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Willingdon Island, Matsyapuri P.O., Cochin - 682 029, Kerala, India
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2019

ICAR-Central Institute of Fisheries Technology

(Indian Council of Agricultural Research)

Willingdon Island, Matsyapuri P. O., Cochin - 682 029

(An ISO/IEC 17025-2017 NABL Accredited & ISO 9001-2015 Certified Institute)

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भाकृअनुप-केमाप्रौसं अपने गौरवशाली अस्तित्व के 63 वर्ष पूर्ण कर रहा है। विश्व 21 वीं सदी में असंख्य संघर्षों से जूझ रहा है, जिसमें कोविड-19 की महामारी का संकट भी परिभाषित है। यह ऐसा समय हैं जब भाकृअनुप-केमाप्रौसं अपने प्रगति की ओर निरंतर उन्मुख, मत्स्य प्रग्रहण और मत्स्य प्रसंस्करण क्षेत्रों को अत्यधिक सहायता प्रदान करने की दिशा में, एक के बाद एक सतर्क कदम उठा रहा है। सदैव देश की सेवा में समर्पित यह संस्थान, मत्स्य प्रग्रहण एवं पश्च प्रग्रहण के क्षेत्रों में अनुसंधान और विकास के प्रयासों से भारत की आर्थिक वृद्धि और पोषण सुरक्षा में महत्वपूर्ण योगदान दे रहा है। मैं संस्थान की इस वार्षिक रिपोर्ट की प्रस्तुति को एक अत्यंत सम्मान एवं प्रतिष्ठाजनक मानता हूं जो कि वर्ष 2019 की अवधि के दौरान अनुसंधान परिणाम और संबंधित उपलब्धियों को इंगित करती है। भाकृअनुप-केमाप्रौसं ने पिछले साल कई महत्वपूर्ण उपलब्धियों की सफलताओं का जश्न मनाया, जो कि इसके वैज्ञानिक कर्मचारियों की प्रतिबद्धता एवं शोध छात्रों, तकनीकी, प्रशासनिक और सहायक कर्मियों द्वारा समर्थित ठोस अनुसंधान प्रयासों के परिणाम है।

भाकृअनुप-केमाप्रौसं का शोध प्रयास ऊर्जा कार्यक्षम एवं अल्प दुष्प्रभावी मत्स्यन जहाजों और गियर पर केंद्रित है। संपोषणीय मत्स्यन के तरीकों के उपयोग को सुनिश्चित करने और संसाधन संरक्षण प्रोद्यौगिकी संबंधी अनुसंधान के प्रति हम प्रतिबद्ध हैं और इसी कड़ी में, स्क्विला उपपकड़ कमी युक्ति (एस-बाई कैच रिडक्शन डिवाइस) का विकास एवं कोचिन से बाहर परिक्षण एवं सकारात्मक परिणाम एक सफल उदाहरण है। यह युक्ति स्क्विला को आनाय जाल से बाहर निकालता है। स्क्विला, झींगा आनाय जाल का एक बड़ा उपपकड़ है जिसका कोई वाणिज्यिक मूल्य नहीं है, इससे छँटाई के समय में अप्रत्याशित रूप में बृद्धि होती है और यह वाणिज्यिक महत्वपूर्ण संसाधनो के लिए स्थान सीमित करता है। वर्तमान में उच्च ईंधन मूल्य और जलीय पारिस्थितिक तंत्रों पर ऊर्जा गहन मत्स्यन प्रयासों के नकारात्मक प्रभावों के बारे में पूरी तरह से अवगत होने के नाते, भाकृअनुप-केमाप्रौसं ने प्रयोग प्राप्त परिणामों के आधार पर यह निर्देशित किया है कि जहाज के इन बोर्ड डीजल इंजन में ईंधन की खपत ओ.बी.एम. की तुलना में एक तिहाई कम होती है। आज के परिदृश्य में हमें इस तथ्य को स्वीकार करना होगा की मत्स्यन फंदा (ट्रेप) का उपयोग कम ऊर्जा गहित है और साथ ही साथ यह कम कार्बन पदचिह्न छोड़ता है। भाकृअनुप-केमाप्रौसं द्वारा विकसित सिमटनेवाले मत्स्यन फंदा (कोलेप्सिबल ट्रेप) एक मुडने वाला फंदा है जो अन्य पारम्परिक फंदो की तुलना मे 40% हल्का होता है और चार गुना तक अधिक टिकाऊ होता है। इस फंदे का सफलतापूर्वक परिक्षण किया गया एवं जिसका परिणाम काफी संतोषजनक रहा।

चारा और फोलियर स्प्रे के उत्पादन के लिए घरेलू मत्स्य अपशिष्ट के उपयोग की दिशा में भाकृअनुप-केमाप्रौसं के अनुसंधान प्रयास फल-फूल रहे हैं। शहरी मत्स्य बाजारों और देश भर के चुनिंदा अवतरण केंद्रों में आयोजित निदर्शनों को खूब सराहा गया है। भाकृअनुप-केमाप्रौसं में अनुसंधान के मजबूत बिंदुओं में से एक है अपरंपरागत संसाधनों का संपोषणीय दोहन एवं इस दिशा में स्क्विला एवं दूसरे क्रस्टेशियन से विकसित किया गया खाद्य प्रोटीन सांद्र एक सफल उदाहरण है, जिसका उपयोग खाद्य पदार्थों को स्वादिष्ट बनाने वाले तत्व के रूप में किया जा सकता है।

भाकृअनुप-केमाप्रौसं, उत्पाद, प्रक्रिया और प्रणाली विकास में हमेशा अग्रसर रहा है और इसलिए भाकृअनुप-केमाप्रौसं

द्वारा विकसित मछलियों में फार्मेल्डिहाइड के निर्धारण के लिए जीसी-एमएस आधारित विश्लेषणात्मक प्रणाली को एक आधिकारिक प्रणाली के रूप में एफ एस एस ए आई (FSSAI) द्वारा मान्यता प्रदान की गयी है। भाकृअनुप-केमाप्रौसं में समुद्री जैव सक्रिय अणुओं के अनुसंधान में एक सतत गतिविधि रही है और पिछले वर्षों की तरह, एंटी ऑक्सिडेंट, इम्यून मॉड्यूलेटरी और हाइपो लिपिडेमिक प्रभाव जैसी विभिन्न गतिविधियों के साथ एस्तेक्सैन्थिन और एसिटिलेटेड उलवन जैसे बायोमोलेक्यूलस को विकसित किया गया और न्यूट्रास्युटिकल/ कार्यात्मक खाद्य में सूत्रबद्ध किया गया।

माननीय प्रधानमंत्री के निर्देशों के अनुसार समुद्री शैवाल खपत पर संस्थान के गहन अनुसंधान प्रयासो से पिछले साल केरल सरकार का उद्यम, मिल्मा डेयरी एरणाकुलम के सहयोग से भूरे समुद्री शैवाल से व्युत्पन्न फूकोयडल पुरक योगहर्ट के पाइलट स्तर परीक्षण के परिणाम सकारात्मक निकले। सुरक्षित आहार हर मनुष्य का अधिकार है और भाकृअनुप-केमाप्रौसं इस क्षेत्र में खाद्य पदार्थों में दूषित कारकों की जाँच द्वारा आहार सुरक्षा सुनिश्चित करती है और इस क्षेत्र में प्रशिक्षण भी देती है। समाज में असुरक्षित आहार का खतरा ज्यादा है, खासकर समुद्री आहार के सूक्ष्म जैविक सुरक्षा का सर्वोच्च महत्व है। इस दिशा में संस्थान सरल, सस्ते दाम और कम समय में रोगजनक इ-कोली और विब्रियो कोलेरो के खोज में महत्वपूर्ण सफ़ल परिणाम की सीमारेखा पर ख़डा है। उसी प्रकार प्रकट होनेवाले और पुनः प्रकट होनेवाले रोगाणु जैसे *लिसियोमोनास शेगेलोयड्स, विब्रियो मिमिकस* और अन्य पर किए गए विशेष अध्ययन आहार सुरक्षा के खतरे के अनुभव को समझने में सहायकर सिद्ध हो रही है। मत्स्य, मात्स्यिकी उत्पाद और उनके पर्यावरण पर AMR (गैर सूक्ष्मजैव प्रतिरोध) अध्ययन को महत्वपूर्ण दर्जा प्राप्त हुआ और बहु दवा प्रतिरोध जीवाणु को नियंत्रित करने के लिए हमने बहुमुखी पहल को विकसित किया है।

अंतर्राष्ट्रीय ऊर्जा एजेंसी के अनुसार 2050 तक अभिनव ईंधन कुशल एवं दक्ष तकनीक के कारण औद्योगिक प्रक्रिया और मात्स्यिकी क्षेत्रों में ऊर्जा की जरूरतों को एक तिहाई तक कम किया जा सकता है। भाकृअनुप-केमाप्रौसं इस प्रयास में मात्स्यिकी क्षेत्र में ऊर्जा क्षम्य उपकरण/मशीनरी जैसे सौर ड्रायर, मत्स्य स्वच्छता जांच सेंसर, सौर आधारित हिमीकृत पद्धति आदि के विकास में अपना योगदान दे रही है। गर्म हवा आधारित आई.आर. पद्धति एवं बिजली और गर्म पानी के सह उत्पादन के लिए फोटोवोल्टानिक तापीय पद्धति का विकास, धारणीय ऊर्जा उपयोग के लिए उठाये गए कुछ महत्वपूर्ण कदम हैं।

अनुसंधान तभी पूरा होता है जब उसे क्षेत्र में वास्तविक लाभार्थिओं तक पहुंचाया जाता है। कौशल विकास की परंपरा को ध्यान में रखते हुए संस्थान द्वारा पिछले साल मात्स्यिकी के क्षेत्र में लाभार्थिओं के फायदे के लिए कई प्रशिक्षण कार्यक्रम आयोजित की गई। स्थानीय संस्थानों/उपक्रमों और मछुआरों की सहभागिता से अनुसंधान परियोजना के तहत सीपी (क्लैम) प्रसंस्करण इकाई स्थापित की गई। उपभोक्ता सर्वेक्षण अध्ययन यह पता चला है कि लोग मछलियों के उपयोग से होने वाले स्वास्थ्य लाभ से जागरूक हैं।

राष्ट्रीय और अंतर्राष्ट्रीय संगठन जैसे CSIR, NFDB, FAO, वर्ल्ड फिश, GESAMP आदि के साथ संपर्क और सहयोग के कारण हमारी सरलता और हमारे वैज्ञानिक रचनात्मकता और सृजनशीलता को बढ़ावा मिला। संस्थान के लिए यह गर्व का विषय था जब FAO ने संस्थान द्वारा गिल जाल मात्स्यिकी में आहार और गिअर क्षय पर किए गए शोध पत्र को प्रकाशित किया, यह भारत में इस प्रकार का पहला शोध पहल था। पिछले वर्ष के अनुसंधान नतीजों को प्रिंट और प्रस्तुतियों द्वारा राष्ट्रीय और अंतर्राष्ट्रीय सम्मेलनों में प्रदर्शित किया गया। स्तरीय पत्रिकाओं में प्रस्तुत गुणात्मक प्रकाशन इसका सबूत है।

जैसे जैसे हम 2020 की ओर आशा और महत्वाकांक्षा से देखते हैं, वैसे वैसे हम अनुसंधान और विकास द्वारा भारतीय मात्स्यिकी क्षेत्र की प्रगति में अधिक सहयोग देने की आशा करते हैं।

जय हिन्द

कोचिन
अगस्त 2020

रविशंकर सी.एन.
(निदेशक)

FROM THE DIRECTOR'S DESK

As ICAR-CIFT cruises into its 63rd year of existence, the world has been thrust into a myriad of struggles by the COVID-19 pandemic, the defining crisis of the 21st century thus far. These are the times ICAR-CIFT is taking one cautious step after another in its march towards providing unstinted support to the fish and fish processing sectors. Having dedicated itself to the service of the nation, research and development efforts of the Institute in fish harvest and post-harvest sectors have gone a long way in contributing to India's economic growth and nutritional security. I deem it a great honour to present the Institute's Annual Report which chronicles the research output and related achievements during the year 2019. CIFT celebrated key accomplishments and witnessed several success stories last year owing to the committed and concerted research efforts of its scientific staff ably supported by the research students, technical, administrative and support personnel.

ICAR-CIFT has been concentrating its research efforts on energy efficient low impact fishing vessels and gears. In our commitment towards ensuring use of sustainable fishing methods and research on resource conservation technologies, a squilla by catch reduction device (S-BRD) was developed and field tested off Cochin. The device excludes squilla, a major bycatch in shrimp trawls which has no commercial value and substantially increases drag, sorting time and limits space for target catch. Being acutely aware of the high energy prices prevailing currently and the negative impacts of energy intensive fishing efforts on aquatic ecosystems, ICAR-CIFT has demonstrated that an inboard diesel engine cuts fuel consumption by one third that of an outboard motor. Recognising the fact that use of fishing traps is low energy intensive that leaves a lesser carbon footprint, a collapsible trap that is 40% lighter in weight and up to four times more durable was designed, fabricated and field tested. We are proud to reveal that our investigation into anti-corrosive and anti-fouling technologies for fishing materials has led us to develop chitosan-derived nano-carbon dots that showed excellent corrosion resistance properties in marine conditions.

CIFT's research efforts towards utilization of domestic fish market waste for production of feed and foliar spray are bearing fruit as demonstrations held in urban fish markets and select landing centres across the country were well-received. One of the strong points of research at ICAR-CIFT is sustainable exploitation of underutilized species. In this direction, an edible protein concentrate that can find use as a flavouring agent in food formulations was developed from the crustacean, squilla.

ICAR-CIFT has been in the forefront of product, process and method development and therefore it doesn't surprise us that a GC-MS based analytical method for determination of formaldehyde

in fish developed by ICAR-CIFT has been corroborated as an official method by the FSSAI. Research into marine derived bioactive molecules has been an ongoing activity at CIFT and as in previous years, biomolecules like astaxanthin and acetylated ulvan with diverse activities such as antioxidant, immunomodulatory and hypolipidemic effects have been elaborated and formulated into nutraceuticals/functional food. The Institute's intensive research efforts for seaweed utilization in response to Prime Minister's call, have borne results with development and pilot scale trials of brown seaweed-derived fucoidan supplemented yoghurt last year in collaboration with Milma Diary, Ernakulam, a State government of Kerala enterprise. Access to safe food is a human right and ICAR-CIFT plays a part in ensuring food safety through testing for contaminants and imparting training in the area. With the constant threat of unsafe food looming large over the society, microbial safety of foods, especially of seafood is of paramount importance. In this direction, the Institute is on the verge of a breakthrough in detection of pathogenic *E. coli* and *Vibrio cholera* in simplest, cost effective and in shortest period of time. Similarly, focused studies on emerging and re-emerging pathogens like *Plesiomonas shigelloides*, *Vibrio mimicus* and others are paying good dividends in understanding the threat perception to seafood safety. Studies on AMR (antimicrobial resistance) in fish, fishery products and their environment gained flagship status and we have evolved a multi-thronged approach to control multidrug resistant bacteria.

According to the International Energy Agency, improved energy efficiency in industrial processes and sectors including fisheries could reduce the world's energy needs in 2050 by one third. ICAR-CIFT is contributing its might to this endeavour by development of energy efficient equipment/machinery for the fisheries sector, like solar dryers, fish freshness detection sensors, solar based chilling system etc. Development of hot-air-assisted IR systems and photovoltaic thermal system for co-generation of electricity and hot water are also steps taken towards sustainable energy use.

Research is complete only when it is taken to the field and benefits the actual stakeholders. Keeping its tradition of capacity building, the Institute organised several training programmes last year for the benefit of stakeholders across the spectrum of fisheries sector. An action research project established a clam processing facility through a participatory approach involving local institutions and the fishers. Consumer studies revealed that people were increasingly being aware of the health benefits of consuming fish.

Establishing linkages and fostering collaborations with national and international organisations like CSIR, NFDB, FAO, WorldFish, GESAMP etc has enhanced our ingenuity and as a consequence improved our scientific output. It was a proud moment for the Institute when the FAO published CIFT's work on food & gear loss in gill net fisheries, the first of its kind initiated in India.The research outcomes in the past year were extensively communicated through both print and through presentations at national and international conferences. The number of quality publications in reputed journals of high impact is witness to this fact.

As we look forward to coming years with hope and ambitions, we aspire to further contribute to India's growth in fisheries sector through research and development.

Jai Hind

Cochin
August 2020

Ravishankar C.N.
(Director)

कार्यकारी सारांश

- इन बोर्ड डीजल इंजन (10.5 hp) का इंधन खपत, समान होर्स पॉवर के OBM का लगभग 1/3 पाया गया।
- 96 घंटों की एक्सपोजर अवधि में पी ए एकल-तंतु और बहु-तंतु फिलेमेंट में औसतन 6.9% और 7.7% ब्रेकिंग स्ट्रेंथ की गिरावट दर्ज़ की गई। एकतंतु और बहु-तंतु ट्वाइन के खिंचाव में कमी क्रमशः 1.3% और 5.7% आंकी गयी।
- पूर्वी तट के प्रचालित गिल नेटर-लोंग लाइनर का LCA आकलित किया गया।
- कैटोसन से संश्लेषित नैनो कार्बन डॉटस द्वारा समुद्री अवस्थाओं में उत्कृष्ठ क्षय प्रतिरोध गुण दर्शाया गया। इसे बोट निर्मित स्टील (BIS 2062) के लिए लेपित सामग्री के रूप में उपयोग किया जाता है।
- तनाव को निर्धारित करने के लिए RAMP तरीके का उपयोग किया गया जिसमें मत्स्य के अनैच्छिक क्रिया के आधार पर भिन्न रैंकों का विकास किया गया। ट्राल सिमुलेशन प्रयोगों के प्रतिक्रिया से यह पता चला कि बेहतर अनैच्छिक क्रिया के बावज़ूद कम समय के हॉल (haul) से मृत्यु दर उच्च होता है।
- सिमटनेवाले फंदे का संशोधित अभिकल्प संविचरित कर प्रायोगिक जांच किया गया। नया अभिकल्प वजन में 40% हल्का है और पारंपरिक फंदों की तुलना में 3-4 गुना टिकाऊ है। भाकृअनुप-केमाप्रौसं का सिमटनेवाले मत्स्य फंदों का दाम पारंपरिक बांस फंदों की तुलना में केवल 50% है।
- कोचिन मत्स्य बंदरगाह से प्रचालन किए जा रहे लोंग लाइनर - गिल नेटर यानों के 20 युनिटों के DEA विश्लेषण से यह पता चला कि ईंधन और अन्य आगत की तुलना में केवल दो युनिट पूरे क्षमता स्कोर (1.0) में प्रचालित किए गए।
- नैनो कॉपर आक्साइड से उपचारित नारियल के लकड़ियों के नमूनों का यांत्रिक गुण बढ़ते सांद्रता के साथ कम होता गया।
- घोस्ट जालों के पकड़ दर की मात्रा का पता लगाने के लिए किए गए सिमुलेशन प्रयोग से यह सिद्ध हुआ कि केरल के बैकवाटर में वर्षा काल के दौरान गिल जालों से 14 दिनों तक और पश्च मॉनसून के दौरान 39 दिनों तक मत्स्य प्रग्रहण की क्रिया निरंतर चली।
- वेरावल में अधिष्ठापित तरंग राइडर बोय द्वारा प्राप्त तरंग ऊँचाई को परखा गया और पाया गया की अनुकरित मापों में महत्वूपर्ण अन्तर नहीं था।
- देश के शहरी मत्स्य बाजार और चयनित अवतरण केंद्रों में "घरेलू बाजार अपशिष्ट से चारा और फोलियर स्प्रे" को तैयार करने की तरीकों को प्रदर्शित किया गया।
- झींगा सिर के निचोड़ से अस्टाजांतिन प्राप्त किया गया और इसे ऐन्टी आक्सीडेंट और यू.वी. सुरक्षात्मक गुणों के लिए लक्षणीकृत किया गया।
- कम उपयोग में आने वाले क्रस्टेशियाई और स्क्विल्ला का फाम मेट शुष्कन तकनीक द्वारा खाद्य प्रोटीन सांद्र तैयार किया गया। इसे सूप, सॉस और नमकीनों जैसे आहार रुपायनों में प्रोटीन/ फ्लेवरिंग पदार्थ के रुप में उपयोग किया जा सकता है।
- जायफल तेल और पी एल ए से तैयार किए गए प्रतिसूक्ष्मजीवी झिल्लियों के द्वारा, ठंडे संचयन के दौरान वन्नेमी झींगों के भंडारण अवधि में बृद्धि दर्ज की गयी।

- पर्ल स्पॉट (*एट्रोप्लस सुरातेनसिस*) के जिंदा परिवहन के लिए प्रोटोकाल बनाया गया।
- स्वच्छता सूचक द्वारा ताज़ी मछलियों और कवच मछलियों के गुणता क्षय के विषय में बेहतर सह संबंध को दर्शाया गया।
- धातु आयन और बयोजेनिक अमाइन की उपस्थिति को जांचने के किए AUNP का उपयोग किया गया।
- भारत में 300 मत्स्य प्रसंकरण इकाइयों में किए गए विस्तृत सर्वेक्षण में यह पता चला कि मूल्यवर्धित उत्पादों के औद्योगिक उत्पादन को शुरू करने के लिए उद्योग को तकनीकी एवं वित्तीय सहायता की ज़रूरत है।
- मछलियों में फोरमाल्डीहाइड जांचने के लिए HPLC-DAD और GC-MS आधारित मात्रा निर्धारण तरीके को विकसित और मान्यीकृत किया गया और इसे औपचारिक तरीके की तरह पुष्टि के लिए FSSAI को प्रस्तुत किया गया।
- जलकृषि योग्य मछलियों में 200 बिभिन्न प्रकार के बहु श्रेणी दूषित कारकों (ओरगानो फोस्फेट, पैरिथ्रोइडस, कारबामेट्स, फंजीसाइड, हेरबिसाइड, अन्य पी ओ पी, पी ए एच और पी सी बी) के तुरंत व सही मात्रा निर्धारण के लिए एक उच्च त्रोपुट विश्लेषणात्मक तरीक़े को विकसित किया गया।
- सूखे मत्स्य उत्पादों से 34 स्टाफलोकोकस ओरियस एकक पाया गया। TSST-1 जो कि tst जीन से एनकोड किया गया, उसमें स्टाफलोकोकस टाक्सिक सॉक संलक्षण पाया गया।
- समुद्री शैवाल पूरित दही विकसित किया गया और एरणाकुलम के मिल्मा डेयरी डयरी साथ मिलकर पायलेट स्केल परीक्षण किया गया।
- इलेक्ट्रान बीम इररेडिएशन के बाद यह देखा गया कि झींगा में ट्रोपोमैसिन की एलर्जी में काफी कमी थी।
- भूरे समुद्री शैवाल (*पाडिना गिमनिस्पोरा*) के मेथोनाल निचोड़ को प्रमुख आहार जनित रोगाणुओं के खिलाफ प्रबल प्रतिजैविक प्रभाव के लिए निर्धारित किया गया।
- लवणीकृत/सूखे मत्स्य उत्पादों में सैपेरमेथ्रिन कीटनाशक का मध्यम से उच्च परिप्रेक्ष्य स्तर (1.97-7.23 mg/g) पाया गया।
- 3.53% फिन मत्स्य और कवच मत्स्य नमूनों में भारी धातुओं की मात्रा FSSR की सीमा से ज्यादा पाया गया।
- नौ रोगजनक जीवाणुओं पर कोलोरिमेट्रिक और काग़ज स्ट्रिपों की चयनात्मकता को इ. *कोली* 0 157:H7 और C मानोसैटोजेन्स को जांचने के लिए मान्यीकृत किया गया, जो परीक्षण के आधार पर X-INP सबस्ट्रेट को, शुद्ध किण्वक फोसफाटिडिलिनोसिटोल विशिष्ट फोस्फोलिपेस के लिए चयनात्मक पाया गया।
- एरणाकुलम के रिटेल बाज़ारों के समुद्री आहार से विब्रियो मिमिक्स को पृथक किया गया। रिटेल समुद्री आहार में इसकी उपस्थिति 5.5% थी। कुल 44 पृथकों में 11 नमूने *वी. मिमिकस* पाजिटिव पाए गए और *वी. मिमिकस* वियुक्तों में हीमोलिसिन Vmh जीन पाए गए।
- 95 इ. *कोली* में 26 प्रतिजैविकों के विरुद्ध बहुदवा प्रतिरोधकता पाई गई। इनमें 14.73% वियुक्तों में एमपिसिलिन और टेट्रासैक्लीन के विरुद्ध फीनौटैपिक प्रतिरोधकता पायी गई। इन विमुक्तों में ampC और TetA जीन की उपस्थिति दर्ज़ की गई। 95 वियुक्तों में 10 इ. *कोली* में H7 ऐंटीजन (625 bp) पाया गया।

- केरल में जलीय कृषि से रोगाणुरोधी प्रतिरोध (एएमआर) रोगजनकों की रूपरेखा का आधारभूत मूल्यांकन की गई और 50 एएमआर रोगजनकों के लिए प्रायोगिक अनुक्रमण (sequencing) किया गया।
- अध्ययनों से पता चला कि जलीय परिवेश में *वी. एल्जीनोलिटीकस* और *वी. पाराहेमोलिटीकस* के समान प्रजाति वाले पृथकों की उपस्थिति है।
- *बेसिलस सबटिलिस* और *एक्सिगुबैक्टेरियम प्रोफंडम* को जलीय परिवेश से पृथक किया गया और देखा गया कि दोनों पृथक संभावित केराटिनोलिटिक सक्रियता वाले हैं। इसलिए इसे एक सुरक्षित पर्यावरण प्रोबायोटिक के रूप में प्रचारित किया जा सकता है।
- जिंक ऑक्साइड नैनो कण (ZnO-NP) सोलजेल विधि के अनुसार तैयार किया गया और नैनो कणों की रोगाणुरोधी सक्रियता की जाँच की गई और देखा गया कि जिंक ऑक्साइड नैनो कण अपने मूल रूप (अधिकांश) की तुलना में कम सांद्रता में *क्रोमोबैक्टीरियम वायलसियम* को नष्ट करने में सक्षम थे।
- कोचिन के ताजे समुद्री खाद्य के नमूनों में *प्लाज़िओमोनस हिगेलोइड्स* का प्रचलन 4% था और इसके द्वारा रक्त अगार पर अल्फा हेमोलिसिस का प्रदर्शन किया गया। एंटीबायोग्राम प्रोफाइलिंग से पता चला कि 100% पृथक एम्पीसिलीन और एनोक्सीक्लेव के प्रतिरोधी थे।
- सुपरक्रिटिकल कार्बन डाइऑक्साइड को एक प्रमुख विलायक के रूप में उपयोग कर भूरे समुद्री शैवाल (*पडिना जिमनोस्पोरा*) से फ्लोरोटनिन्स को पृथक करने का संवहनीय निष्कर्षण प्रोटोकॉल विकसित किया गया।
- स्क्वालीन, विटामिन डी3 और हरी चाय के सार के एक साथ वितरण के लिए सोडियम एल्गिनेट आधारित बहु पायस विकसित किए गए।
- काइटोसन नैनो कण उपरोपित मत्स्य जिलेटिन आधारित जैव-नैनो कंपोसिट झिल्ली के द्वारा उच्च सरंध्रता और सूजन सूचकांक गुण प्रकट किए गए।
- ट्यूना त्वचा अपशिष्ट से प्राप्त जिलेटिन ने विशेष आणविक भार और अपेक्षाकृत उच्च हाइड्रोफोबिक अमीनो अम्ल और इमिनो अम्ल सामग्री को दर्शाया और इससे पूरी तरह से थर्मो-प्रतिवर्ती जेल का निर्माण हुआ।
- अध्ययन से यह सिद्ध हुआ की हरी चाय सार जिसमें उद्धोधक मात्रा के फेनोलिक यौगिक है, लिपिड उपचयन को नियंत्रित करते हैं और स्क्वालीन और विटामिन डी आधारित सूक्ष्म कणों की स्थिरता को बनाए रखते हैं।
- सुपरक्रिटिकल निष्कर्षण द्वारा प्राप्त मोरिंगा छाल के सार और कम आणविक भार काइटोसन का निर्माण प्रतिदाहक पट्टी के विकास के लिए किया गया।
- पुफा-समृद्ध मत्स्य तेल की चिकित्सीय क्षमता रूमाटोइड संधिशोथ से ग्रसित चूहों में प्रायोगिक अध्ययन किया गया।
- रक्तालपिक (एनिमिक) चूहों को स्थानीय लौह स्रोत से पूरित किया गया और पाया गया कि हीमोग्लोबिन की मात्रा में महत्वपूर्ण वृद्धि हुई।
- कार्बन नैनो-डॉट संयोजित उल्वन जेल ने उच्च रोगाणुरोधी सक्रियता का प्रदर्शन किया।
- एफटीआईआर द्वारा एसीटैल उल्वन को संरचनात्मक रूप से लक्षित किया गया और उसके कणीय आकार और जीटा क्षमता का निर्धारण किया गया।

- काइटोसन, वैनिलिक अम्ल और कच्चे समुद्री शैवाल सार के संयोजन ने, रोहू (*लेबियो रोहिता*) के अंगुलिकाओं पर आहार प्रयोग द्वारा बृद्धि दर में सकारात्मक प्रभाव दिखाया।
- कोचिन स्थित चुनिंदा समुद्री खाद्य उद्योगों की ऊर्जा और पानी की खपत का वास्तविक समय आँकड़ों का एकत्रण और विश्लेषण किया गया। इनके लिए मानक प्रोटोकॉल और प्रचालन प्रक्रिया तैयार की गई।
- बाजार से उपलब्ध भारतीय बांग़डों का उपयोग कर वहनीय, गैर-विनाशकारी और ताज़गी निर्धारण के लिए त्वरित सेंसर को विकसित और मान्यीकृत किया गया।
- कम-लागत वाली ऊर्जा कार्यक्षम वॉक-इन किस्म की सोलर टनल शुष्कक का प्रचालन मूल्यांकन पूरा किया गया।
- मत्स्य के लिए कम उत्सर्जन वाले बायोमास शुष्कक का परिकल्पना और विकास किया गया।
- फेस परिवर्तन सामग्री और अवशोषक डीह्युमिडिफ़ायर प्रणाली के साथ एक ट्रॉली आधारित सौर-विद्युत शुष्कक (40 किलोग्राम क्षमता) परिकल्पित किया गया।
- सौर आधारित शीत प्रणाली के लिए सिलिका जेल सोखन सेटअप को परिकल्पित किया गया।
- सौर आधारित जलवाहक और चारा वितरण प्रणाली की परिकल्पना पूरी की गई।
- गर्म हवा के निरंतर आईआर प्रणाली प्रोटोटाइप का निर्माण कार्य प्रगति में है।
- बिजली और गर्म पानी की सह-उत्पादन के लिए एक संकर फोटोवोल्टिक थर्मल प्रणाली (पीवीटी) बनाई गई।
- प्रौद्योगिकी का लाभ लेकर उद्यमों को स्थापित करने वाले हितधारकों की व्यवहार्यता का आकलन करने के लिए विकसित (ओएसएफटी) व्यवहार्यता सूचकांक संतोषजनक रहा।
- अलियार जलाशय में 1715 क्लोम जाल पर किये गए अध्ययन में, मध्यमान अनपेक्ष एरर (एमएई) के संदर्भ में एआर (1) के साथ फॉक्स मॉडल का परिणाम, एआर (1) के साथ शेफर मॉडल की तुलना में बेहतर था और MSY एवं EMSY का अनुमान 35.12 मिलियन टन था।
- अलियार जलाशय में क्लोम जाल (110 मिमी और 140 मिमी) के जाली आकार पर कार्यक्षमता अध्ययन से पता चला कि मत्स्य पकड़ने की दक्षता 140 मिमी जाल आकार की तुलना में 110 मिमी में अधिक थी।
- 2004-05 से 2014-15 के दौरान भारत में मत्स्य उत्पादन के क्षेत्र में संरचनात्मक परिवर्तन में वृद्धि लगभग 55.3 हजार करोड़ रुपए से बढ़कर 106.8 हजार करोड़ रुपए हो गया। इसकी वृद्धि दर (2011-12 की कीमतों पर) लगभग 5.3% प्रति वर्ष आंकी गई, जिसमें अंतर्स्थलीय मात्स्यिकी 6.2% प्रति वर्ष और समुद्री मात्स्यिकी 4.3% प्रति वर्ष की वृद्धि दर से योगदान करता हैं।
- 1971-2013 की अवधि के दौरान, मत्स्य का गैर-खाद्य उपयोग एवं निर्यात क्रमशः 1.6 मिलियन टन से बढ़कर 6.7 मिलियन टन और 0.06 मिलियन टन से बढ़कर 0.95 मिलियन टन हो गया है। मत्स्यों के गैर-खाद्य उपयोग का हिस्सा लगभग 4-10% है।
- मत्स्य और मत्स्य सुरक्षा के स्वास्थ्य संबंधी लाभों के संबंध में मत्स्य उपभोक्ताओं का जागरूकता उच्च पाया गया। गुणवत्ता और आर्थिक पहलुओं के सिवाय मत्स्य उपभोक्ताओं के दृष्टिकोण में महत्वपूर्ण अंतर था।

EXECUTIVE SUMMARY

- It is estimated that fuel consumption of inboard diesel engine (10.5hp) is approximately 1/3 of that off an OBM of similar horse power.
- An average decline in breaking strength by 6.9% and 7.7% was recorded for PA monofilament and multifilament twines respectively at the end of exposure period of 96 hours in daylight. The loss in extension was 1.3% and 5.7% respectively for monofilament and multifilament twine.
- LCA assessment of gillnetter cum longliner of east coast conducted.
- Nano carbon dots synthesized from chitosan, when used as coating material over boat building steel (BIS 2062), showed excellent corrosion resistance properties in marine conditions.
- Rapid Assessment of Mortality Predictor (RAMP) methodology was used to determine the stress, which involved developing different ranks based on the reflex action of fish. The responses showed that short time hauls even though showed better reflex responses, had high mortality rates in trawl simulation experiments.
- A modified collapsible trap was designed, fabricated and field tested. The new design is 40% lighter in weight and is 3-4 times more durable than the conventional traps. Cost of ICAR-CIFT collapsible fish trap is only 50% of the conventional bamboo traps.
- Data envelopment analysis (DEA) of twenty units of longliner cum gillnetter vessels operating from Cochin fishing harbours revealed that only two units operated at the full efficiency score of 1.0, in terms of fuel use and other inputs.
- The mechanical properties of the nano copper oxide treated coconut wood samples showed decreasing pattern of mechanical strength with increasing concentration.
- Simulation experiments to quantify the catch rate of ghost nets, indicated that gillnets continued to catch fish for 14 days during monsoon and 39 days during post-monsoon seasons in the backwaters of Kerala.
- No significant difference in the observed and simulated measurements were noticed in wave height from the data obtained from the wave rider buoy installed at Veraval.
- Demonstrations on preparation of feed and foliar spray form domestic market waste was conducted in the urban fish markets and selected landing centres across the country
- Astaxanthin was extracted from shrimp head extract and characterized for antioxidant and UV protective properties.
- Edible protein concentrate was prepared from the underutilized crustacean, squilla by foam mat drying technique, which can be used as a protein/flavouring agent in food formulations such as soup, sauce or snacks.
- Antimicrobial films made of nutmeg oil and PLA extended the shelf life of Vannamei shrimps during chilled storage.
- Optimised the protocols for live transportation of pearl spot (*Etroplus suratensis*).

- Freshness indicator gave good correlation with quality deterioration for fresh fish and shellfish.
- AuNPs were used to detect the presence of metal ions and biogenic amines visibly
- A detailed survey conducted across India in more than 300 fish processing units showed that for initiating industrial production of value added fish products, the industry requires technical as well as financial support.
- HPLC-DAD and GC-MS based quantification method was developed and validated for determination of formaldehyde in fishes and submitted to FSSAI for conformation as official method.
- A high throughput analytical method was developed for fast and accurate quantitation of 200 multi-class contaminants (organophosphate, pyrethroids, carbamates, fungicides, herbicides, other POPs, PAH and PCBs) in aquacultured fish.
- The toxic shock syndrome toxin-1 (TSST-1) encoded by tst gene that leads to staphylococcal toxic shock syndrome (TSS) was detected in 34 isolates of *Staphylococcus aureus* from dried fish products.
- Seaweed supplemented yoghurt was developed and pilot scale trials were conducted in collaboration with Milma Dairy, Ernakulam.
- Considerable reduction in the allergenicity of tropomyosin in shrimp was observed after electron beam irradiation.
- Methanolic extract of brown seaweed (*Padina gymnospora*) was determined to have strong antimicrobial effect against major foodborne pathogens.
- A moderate to high background level (1.97-7.23 µg/g) of cypermethrin pesticide was observed in salted/dried fish products.
- Violation of FSSR limit for heavy metals was observed in 3.53% of finfish and shellfish samples.
- Selectivity of colororimetric and paper strips was validated against nine pathogenic bacteria for detection of *E. coli* O 157:H7and *L. monocytogenes*. Based on the testing, substrate X-INP was found selective to pure enzyme phosphatidylinositol-specific phospholipase C (PI-PLC).
- *Vibrio mimicus* was isolated from seafood in retail markets of Ernakulam and the prevalence in retail seafood seen at 5.5%. Total 44 isolates from 11 different samples positive for *V. mimicus* and all the *V. mimicus* isolates harbored hemolysin Vmh gene
- The multidrug resistance (MDR) was observed in 95 *E. coliisolates* against 26 antibiotics. Among them 14.73% isolates were exhibiting phenotypic resistance to ampicillin and tetracycline by harboring ampC and TetA genes. Ten *E. coli* out of 95 isolates having of H7 antigen (625 bp).
- Baseline assessment of antimicrobial resistance (AMR) pathogens profile of aquaculture settings in Kerala was established and the pilot sequencing were carried for 50 number of AMR pathogens.
- Studies confirmed existence of phylogenetically similar isolates of *V. alginolyticus* and *V. parahaemolyticus* in the aquatic environments.
- *Bacillus subtilis* and *Exiguobacterium profundum* were isolated from aquatic environment and observed that both isolates are having potential keratinolytic activity. Hence, it can be promoted as a safe environmental pro-biotic.

- Zinc oxide nanoparticle (ZnO-NP) were prepared as per solgel method and antimicrobial activity of nanoparticles were checked and observed that zinc oxide nanoparticles were able to destroy the *Chromobacterium violaceum* at low concentration than its original form (Bulk).
- *Plesiomonas shigelloides* prevalence was 4% in fresh seafood samples of Cochin and they exhibited alpha haemolysis on blood agar. Antibiogram profiling revealed 100% of the isolates were resistant to ampicillin and amoxyclav.
- A sustainable extraction protocol was developed for isolation of phlorotannins from brown seaweed, *Padina gymnospora* using supercritical carbon dioxide as the major solvent.
- Sodium alginate based multiple emulsion was developed for simultaneous delivery of squalene, vitamin D3 and green tea extracts.
- The chitosan nanoparticles-grafted fish gelatin based bio-nanocomposite membranes developed revealed higher porosity and swelling index properties.
- Gelatin obtained from tuna skin waste showed characteristic molecular weight and relatively high hydrophobic amino acids and imino acids contents and formed a completely thermo-reversible gel.
- Green tea extract with a significant content of phenolic compounds effectively controlled lipid oxidation rate and maintained the stability of squalene and vitamin D based microparticles
- Moringa bark extract obtained by supercritical extraction was used for development of anti-inflammatory bandage in combination with low molecular weight chitosan
- Therapeutic potential of PUFA-enriched fish oil was established in an in-vivo rat model of rheumatoid arthritis induced by Complete Freund's Adjuvant.
- Significant rise in the hemoglobin content of anemia-induced rats was observed in rats supplemented with an indigenous iron source.
- Carbon nano-dot incorporated ulvan gel exhibited high antimicrobial activity.
- Acetylated ulvan was developed and structurally characterized by FTIR and particle size and zeta potential determined.
- Feeding trials with combination of chitosan, vanillic acid and crude seaweed extract showed influence on the growth performance of Labeo rohita fingerlings.
- Collected and analyzed real time data of energy and water consumption of selected seafood industries located at Kochi. Standard protocols and operating procedures were prepared with specific suggestions for different seafood plants.
- Portable, non-destructive and rapid fish freshness detection sensor for Indian Mackerel was developed and validated using market samples.
- Performance evaluation of low-cost energy efficient walk-in type solar tunnel dryer was completed
- Designed and developed less emission biomass dryer for fish.
- Designed a trolley based solar-electrical dryer (40 kg) with phase change material and desiccant dehumidifier system.

- Silica gel adsorption setup was designed for solar based chilling system
- Design for solar based aerator and feed dispensing system was completed
- Fabrication work of prototype of hot air assisted continuous IR system is under progress
- Designed a hybrid photovoltaic thermal system (PVT) for co-generation of electricity and hot water.

The customized overall stakeholder feasibility index (OSFI) was found to be satisfactory for establishing fish based enterprises with technology support and extension network found significant in estimating stakeholders' feasibility.

- Analysis of catch-effort data from Aliyar reservoir using modified surplus production model based on Fox (1970) with incorporated autoregressive error term of lag 1 AR (1) showed better performance than Schaefer model with AR (1) in terms of Mean Absolute Error (MAE), and the MSY and E_{MSY} were estimated as 35.12 MT and 1715 gill nets in the study.
- The efficiency studies on mesh size of gillnet (110mm and 140mm) in the Aliyar reservoir revealed that the fish catch efficiency was high in 110mm than 140mm mesh size.
- The structural changes in the fishery sector in India in terms of value of output increased from Rs 55.3 thousand crores to 106.8 thousand crores during 2004-05 to 2014-15, at a growth rate of 5.3% per year (at 2011-12 prices) in which inland fisheries contribute a growth rate of 6.2% per year and marine fisheries 4.3% per year.
- During the period 1971-2013, the non-food use of fish has increased from 1.6 million tonnes to 6.7 million tonnes; and exports from 0.06 million tonnes to 0.95 million tonnes. The share of non-food use of fishes hovers around 4-10%.
- Knowledge of fish consumers was found to be high with respect to health benefits of fish and fish safety. There was significant difference in dimensions of fish consumers' attitude except in quality and economic dimensions.

ICAR-CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY

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 and other Divisions soon followed. The administrative control of the Institute was brought under the Indian Council of Agricultural Research on 01st 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.

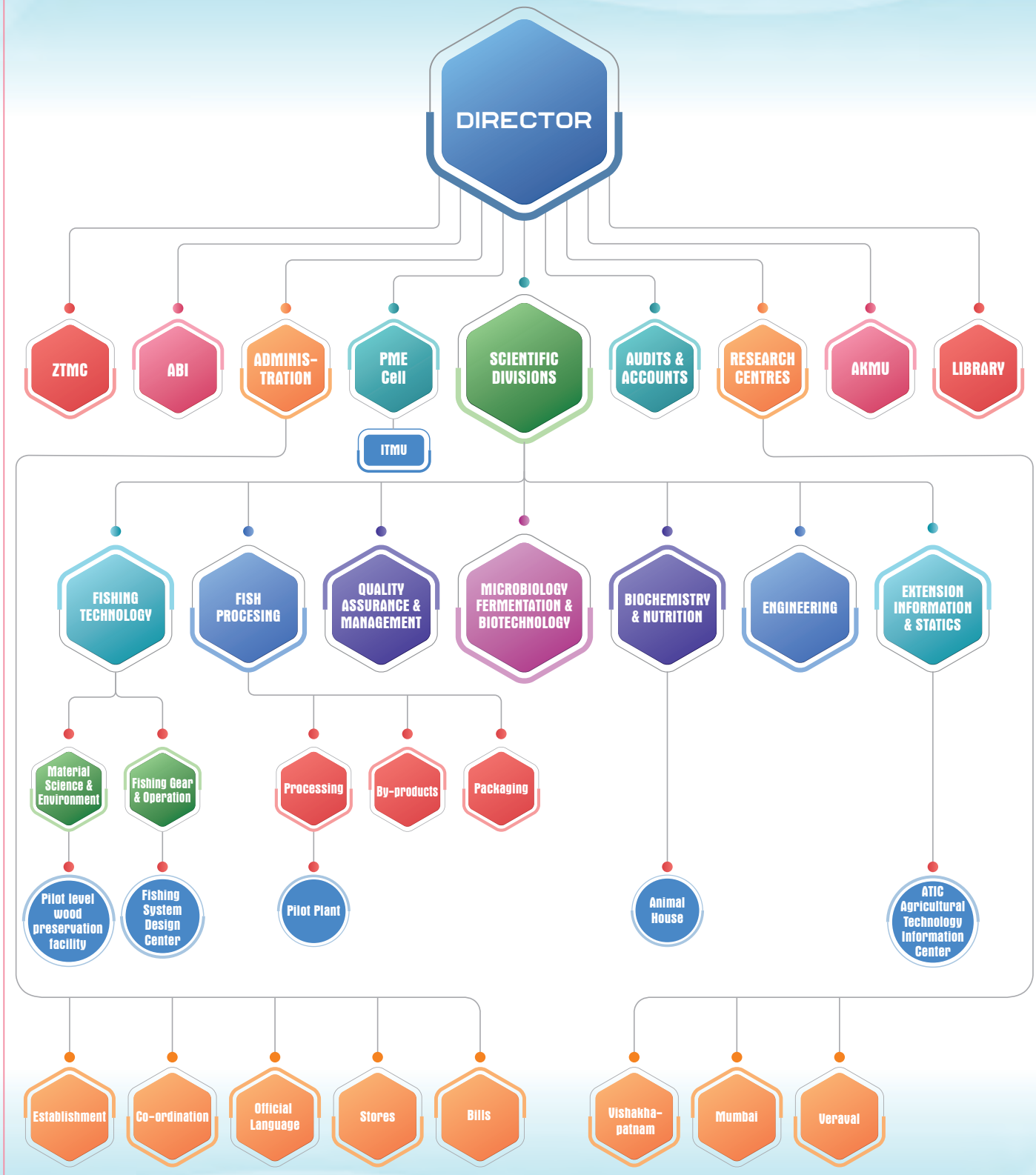
Staff position as on 31 December, 2019

Category	Sanctioned	Filled
RMP/Director	1	1
Scientific	95	84
Technical	127	81
Administrative	81	55
Supporting	38	32
Auxiliary	05	02
Total	**347**	**255**

Budget allocation and expenditure

(For the year 2019-2020 – All values in INR in Lakhs)

Budget Head	Allocation	Expenditure
Establishment charges	3058.32	3058.32
Pension and Retirement Benefits	365.00	365.00
Grants for creation of Capital Assets	357.61	357.47
Traveling allowances	55.00	55.00
Research and Operational Expenses	381.76	381.89
Administrative Expenses	565.00	564.99
Miscellaneous Expenses	21.24	21.24
Tribal Sub Plan	20.00	20.00
North East Hill	6.36	6.36
Total	**4830.29**	**4830.27**


DIRECTOR
ZTMC
ABI
ADMINIS-TRATION
PME Cell
SCIENTIFIC DIVISIONS
AUDITS & ACCOUNTS
RESEARCH CENTRES
AKMU
LIBRARY
ITMU
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
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

Research Achievements

RESEARCH PROJECTS HANDLED

Institute projects

- Studies on fishing operations and energy use for formulation of guidelines for selected small scale marine fisheries of India
- Optimization of harvest and post-harvest techniques for mesopelagics in south western Arabian sea
- Fishing technological interventions for sustainable marine ecosystem services along the east coast of India
- Enhancement of life of fishing materials using nanotechnology
- Studies on fish behaviour as an input for developing responsible fishing systems
- Development of region- and species-specific pots/traps.

Externally funded projects

- Global Warming Potential (GWP) of mechanized fishing methods of India and mitigation strategies: Analysis using Life Cycle Assessment (LCA)- Data Envelopment Analysis (DEA) approach
- Improved coconut wood canoes for small scale fishing sector of southeast coast of India
- Investigations on ghost fishing by derelict traps and gill nets in selected areas of Indian waters and mitigation measures.
- Harvest and post harvest interventions for mainstreaming biodiversity conservation into the fisheries sector of East Godavari riverine and estuarine ecosystem
- Validation and dissemination of ocean state forecast advisories along Gujarat coast

Most significant achievements

- It is estimated that fuel consumption of inboard diesel engine (10.5hp) is approximately 1/3 of that off an OBM of similar horse power.
- An average decline in breaking strength by 6.9% and 7.7% was recorded for PA monofilament and multifilament twines respectively at the end of exposure period of 96 hours in daylight. The loss in extension was 1.3% and 5.7% respectively for monofilament and multifilament twine.
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- No significant difference in the observed and simulated measurements were noticed in wave height from the data obtained from the wave rider buoy installed at Veraval.

CHIEF FINDINGS

Institute projects

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

Documentation of design characteristics, energy use/emission of gears in small scale sector of selected stretches of India

Survey was carried out to document the design, technical details and energy use of gillnets in small scale sector from southern Tamil Nadu. A total of 13 gillnet designs were documented from 5 landing centres (Terespuram, Tharuvaikulam, Chinnapalam, Dhanushkodi, Devipattinam). Documented the design of traditional typical beach seine from Goa (Rampon) and Ratnagiri (Rampani). Compiled the designs of traditional seine nets from the south west coast of India.

Rampon net operation from Goa

Drying of Rampani at Ratnagiri, Maharasthra

Details of seine nets

	Number of sections	Material	Twine Size	Stretched mesh size (mm)	Stretched length (m)	Stretched depth (m)	Hanging coeff. at float line	Hanging coeff. at lead line	Float line rope	Sinker line rope	Hauling rope	Float	Sinkers
Wing	13	PA	4-6 no.	15-30	190*2	4.8-8.4	0.70-0.50	0.70-0.50	PP (2) 8mm & 10mm	PP (2) 10mm & 10mm	16mm	2" PVC 3-6 per meter	150g 3-6 per meter
Bunt	1	PA	2-3 no.	10	36	9	0.45-0.25	0.45-0.25	PP (2) 8mm & 10mm	PP (2) 10mm & 10mm	16 mm	PVC 2" 10 per meter	150g 10 per meter

Catch data from troll line fishery was collected for the months of June, August, September and October from Kalamukku fishing harbor, Ernakulam. Three lines were operated from motorized boats (L_{OA} 25-32ft) with single or double OBM (9.9-25hp) used for propulsion. The fishermen used 'J' hooks of size 9-12. Metal spoons and planar boards were also used for trolling. Major species caught were seer fish (19.82%), carangids (37.84%), barracuda (17.12%), full beak (18.12%) and dolphin fish (2.70%).

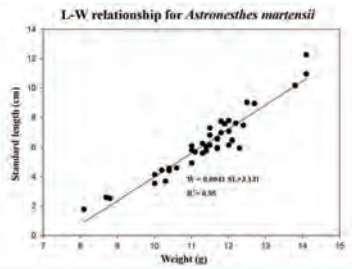
Baseline survey on energy use and comparative study of fuel consumption between inboard and outboard motor in small scale fishing sector from selected centres

The average fuel consumption of inboard and outboard engine of almost similar power were studied. Diesel inboard engine of 10.5 hp and kerosene/petrol operated outboard engine of 9.9 hp were selected for the study. These FRP boats (L_{OA}: 9.5-13 m) operate hand trawls which mainly target shrimps off Alappuzha, Ernakulam and Kollam. Fishing operation is for a day which commences early morning and ends by late noon.

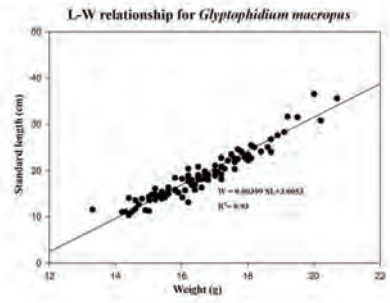
Inboard engine requires only diesel for its operation, but outboard motor requires petrol for starting and kerosene for propulsion. It was observed that the fuel consumption of outboard motor was 2.38±0.31 L of kerosene/hour (for propulsion) and 1.1±0.31 L of petrol/trip (for ignition) whereas inboard engine consumed 0.973±0.28 L of diesel/hour.

Optimization of harvest and post-harvest techniques for mesopelagics in the south western Arabian Sea

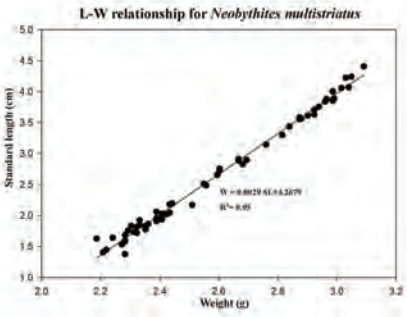
Length–weight relationships were estimated for five deep sea fishes viz. *Astronesthes martensii, Glyptophidium macropus, Neobythites multistriatus, Physiculus roseus, Synagrops japonicus* from Kerala, south west coast of India. Fishes were collected from commercial trawlers operating at depth ranged from 270m (9°29.35'N & 75°44.74'E) to 350m (9°26. 49'N & 75°42.36'E) in the southwest Arabian Sea. Correlation coefficients (r2) were found high for all species, with b value ranging from 2.923 to 3.404. The study gives first record LWRs for *A. martensii, G. macropus* and *N. multistriatus* from Indian waters.



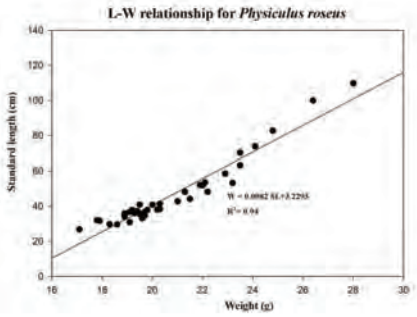
Astronesthes martensii



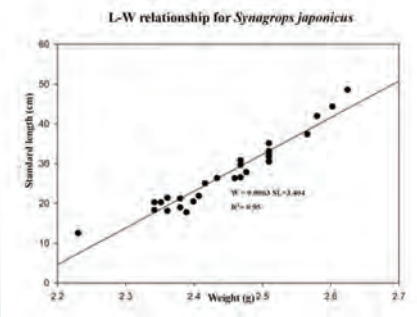
Glyptophidium macropus



Neobythites multistriatus

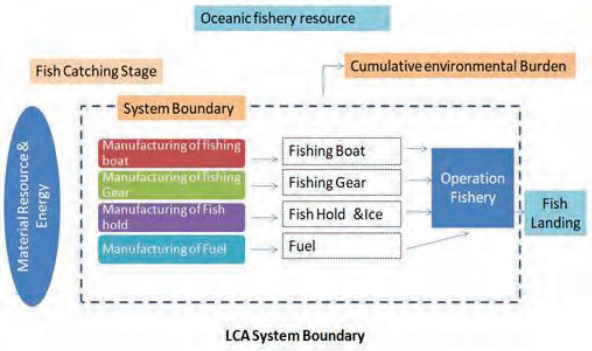


Physiculus roseus



Synagrops japonicus

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



LCA System Boundary

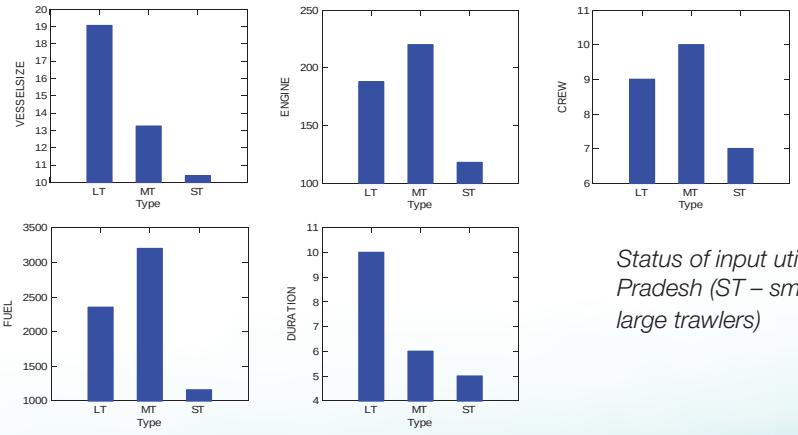
Life cycle analysis of fishing systems: Data was collected from fishing systems of Andhra Pradesh using a tested & validated questionnaire for integration of data with GaBi for life cycle analysis.

The fishing methods studied included, gillnetting, trawling, long lining and combination fishing systems. Data collected on structural details of both craft and gear material, accessories, construction details, operational conditions and trip details such as the number of fishermen, the tonnage of the fishing boats, details of the fishing gear, number of fishing days per year, number of trawls per day, and towing time per trawl, and fish production information such as the species landed, the catch weight, and the value of the catch etc. collected as per standard protocols.

Study on structural changes in craft and gear: Structural and operational changes in fishing systems of Andhra Pradesh from Visakhapatnam, Kakinada, Nizampatnam and Machallipatnam were documented. Design characteristics of gears in marine fishery (trawl nets, gill nets, boat seine nets, shore seine, hook and line) were documented. Operational details of long line gear operated by commercial mechanized and motorised crafts off Andhra coast were studied.

The study indicates drastic changes in the structural and operational aspects of the fishing fleet in terms of size (L_{OA}) and installed engine horsepower, depth of operation, duration of voyage etc. among trawlers, long liners and gillnetters operating from Andhra Pradesh.

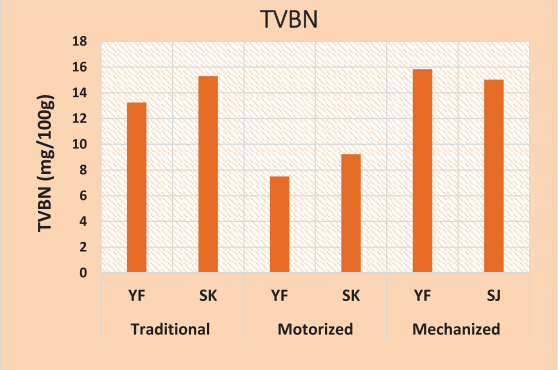
Economic evaluation of fishing systems: Input utilization by the trawlers in Kakinada, Andhra Pradesh was categorized based on the level of exploitation of input usage by the small, medium and large trawlers.



Status of input utilization by trawlers in Kakinada, Andhra Pradesh (ST – small trawlers; MT – medium trawlers; LT – large trawlers)

Quality evaluation of tuna caught by different fishing methods

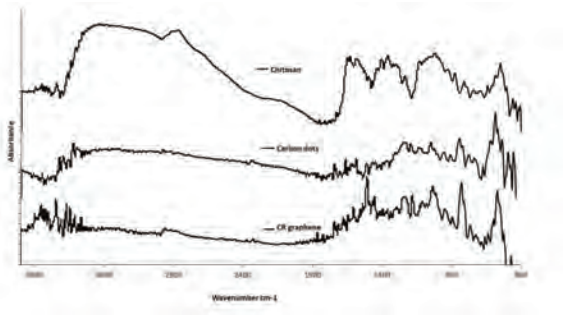
Biochemical quality in yellow fin tuna and skip jack tuna caught by different fishing methods such as long lining and trolling methods operated by traditional, motorized and mechanized fishing vessels from Visakhapatnam fishing village was analyzed. Lowest PV, TBARS and TVBN were found in yellow fin tuna and skipjack tuna caught by motorized fishing craft.



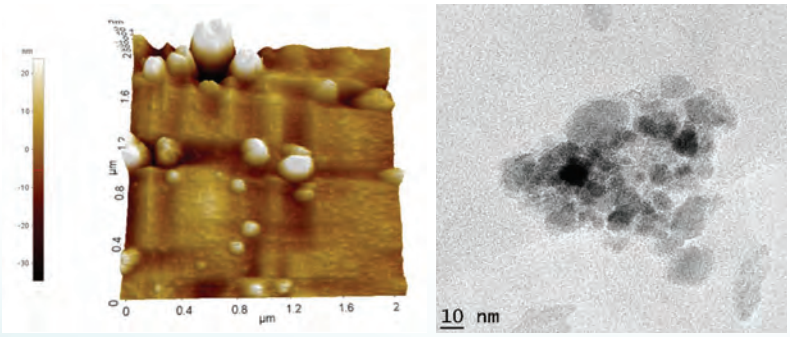
Enhancement of life of fishing materials using nanotechnology

Synthesis of nano carbon dots from chitosan

Nano carbon dots were synthesized from chitosan using hydrothermal method and the SEM, AFM, FTIR confirmed that the characteristics including the two-dimensional structure was similar to nano carbon dots. The synthesized carbon dots when used as coating material over boat building steel (BIS 2062), exhibited corrosion resistance under marine environments, which was confirmed by electrochemical data. Electrochemical evaluation by linear polarization and electrochemical impedance spectral studies showed that 0.05% carbon dot solution coated steel exhibited higher corrosion resistance.



FTIR spectra of nano carbon dots, chitosan and chemically reduced graphene. Noise in the spectra was due to the hygroscopic nature of materials.

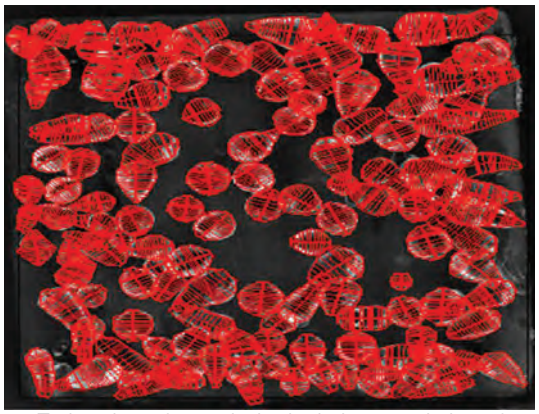


AFM and TEM images of nano carbon dots.

Assessment of degradation pattern of fishing gear materials (polyamide) due to solar radiation

Samples of three PA monofilament twines (0.2mm, 0.4mm and 0.7mm) and three multifilament PA twines of comparable thickness (210x 1x2, 210x 2x3 and 210x 6x3) were exposed to artificial weathering conditions (irradiance 45W/m2, chamber temperature 350C black standard temperature 650C, relative humidity 60%) for a period of 96h (1h Xenon Arc lamp effect equals to 7h exposure in daylight). An average decline in breaking strength by 6.9% and 7.7% was recorded for PA monofilament and multifilament twines respectively at the end of exposure period. The loss in extension was 1.3% and 5.7% respectively for monofilament and multifilament twine.

Degradation pattern of wood, exposed to marine conditions by wood boring bivalve Martesia striata (Pholadidae)



Estimation of morphological characteristics of M. striata by combining X ray and AutoCAD.

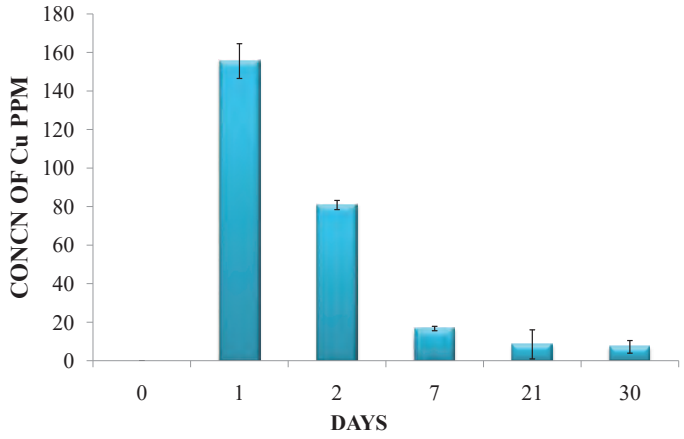
Aini wood panels immersed in the Cochin estuary were monitored every month to study the growth and boring characteristics of *Martesia striata* for a period of two years. The growth was rapid during first three months and then stabilized to 0.56 mm per month. The maximum length of *M. striata* recorded during the study was 3.94cm. The area of the panels, covered by borers were 42%, 48%, 52%, and 62% at the end of 3, 6, 9 and 12 months, respectively. *M. striata* can cause extensive damage but is restricted to the length of adult shell.

Field trial of nano copper oxide – polyaniline treated polyethylene aquaculture cage net

Nano copper oxide – polyethylene coated aquaculture cagenet was fabricated and exposed in the test sites of CMFRI Vizhinjam centre for 7 months. A total of 50 numbers of *Lethrinus lentjan* were stocked in the experimental and control cages. The treated net showed significantly lower fouling biomass with occlusion due to biofouling in lumen recorded as 14 and 25% respectively in treated and control cages. The level of copper in the edible and non-edible parts of fish were below 5 ppm. The fishes in both cages had similar growth rates.

Treated and untereated cage webbings after seven months

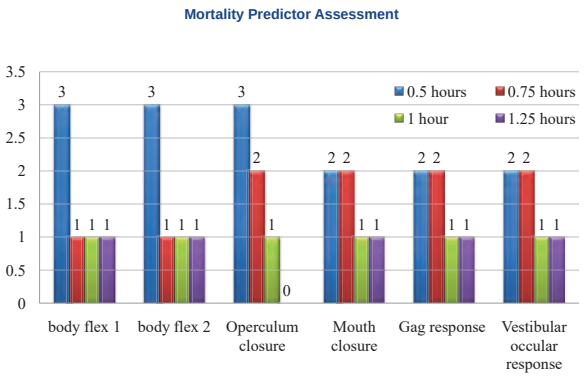
Leaching studies of nano copper oxide from nano copper oxide – polyaniline treated polyethylene cage net



Nano copper oxide – polyaniline treated net were exposed to estuarine water of 12 psu (practical salinity unit) in laboratory. Initial concentration of copper in the treated net was 329 ppm. 24 h exposure in the water leached 155 ppm of copper, which could be due to loosely bound copper. In the later stages, the average leaching of copper was 8 ppm per day.

Studies on Fish Behaviour as an input for Developing Responsible Fishing Systems

Survival of fish in simulated trawling experiments at different time durations

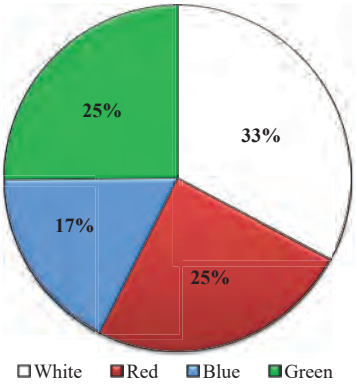


Preliminary trials to determine the stress and mortality associated with simulated trawling was assessed using Tilapia as a model. Experiments were conducted in the moving gantry system installed in the fish behaviour laboratory. The speed of the moving gantry was maintained at 3 knots and fish were checked for stress and mortality at intervals of 0.5, 0.75, 1.0 and 1.25 hours respectively. Rapid Assessment of Mortality Predictor (RAMP) methodology was used to determine the stress, which involved developing different ranks based on the reflex action of fish. The responses showed that short time hauls even though showed better reflex responses, had high mortality rates.

Behavioural responses of Macrobrachium rosenbergii towards different coloured LED

The behavioural responses of post-larvae of *M. rosenbergii* towards different coloured LED lights were studied using Y- maze test. The experiments were carried out to study the light that most attracts the post-larvae, since this can be an input for light-based capture systems that are used widely to catch this species during its migration after breeding in the estuaries. Juveniles of *M. rosenbergii* were used for the experiments.

The results indicated that the species had the most attraction towards white light, followed by green, red and blue lights.



Attraction towards different coloured LED lights by M. rosenbergii larvae (number indicate total approaches to the respective LED light)

Odour preference of fishes using baited gillnets in estuarine and freshwater zones

Effect of attaching baits on trammel was studied using two nets of 80 meter each with whole mackerel as bait attached to one net and deploying them in the same area. The catch composition in terms of quantity and number of species varied. Baited net caught species like *Arius sp., Terapon sp., Lutjanus argentimaculatus* and *Scylla serrata*, whereas these species were not observed in the non-baited net.

Liza parsia (non-baited 3.0kg, baited-2.0kg) formed the major catch, followed by *Caranx sp*. (non-baited 1.9kg, baited 2.2kg). Species like *Liza parsia, Sillago sihama, Etroplus suratensis* were caught more in non-baited net whereas omnivorus species like *Arius maculatus, Terapon jarbua, Lutjanus argentimaculatus* and *Scylla serrata* were caught more in baited net. Total catch from baited and non-baited trammel nets were 6.35kg and 6.75kg respectively. Though significant difference is not evident, it is assumed that baiting on trammel net had attracted more omnivores species.

Development of region and species-specific pots/traps

Survey to collect information on traditional pots/traps

Survey was conducted at Andhra Pradesh, West Bengal, Jharkhand, Gujarat, Tamil Nadu, Goa and Kerala to document various pots and traps designs.

Field trials using optimized traps

A rectangular crab trap made of iron chicken mesh was fabricated with two and four funnel and field trials were conducted. The catch efficiency for the trap was derived as 0.25 kg /trap in terms of weight. Similarly, a conical crab trap with stainless steel rod and PE mesh webbings was also designed and fabricated.

Field demonstrations of ICAR-CIFT collapsible fish trap were carried out in many locations of India. *Etroplus suratensis, Lutjanus argentimaculatus, Lates calcarifer, Epinephelu ssp, Scylla serrata* are the common target species. Average catch/haul is 1.5 kg. Design of the trap is simple and is 40% lighter in weight & durability is 3-4 times more than the conventional traps. Cost of ICAR-CIFT collapsible fish trap is only 50% of the conventional bamboo traps.

A square shape serially foldable trap made of PVC (Poly Vinyl Chloride) frame was designed and fabricated for operating in inland and marine water bodies. It consists of three PVC chambers with a length and breadth of 60 x44cm. Experimental fishing of serially foldable fish trap was conducted at ICAR-CMFRI marine cage site of Visakhapatnam. A total of 33 nos. of *Adubefduf viagiansis* and *Acanthurus mata* formed the main catch. Small sardines, mackerels, cuttle fishes were used as bait.

Serially foldable trap under construction

Fish Processing

RESEARCH PROJECTS HANDLED

Institute projects

- Interventions in processing and preservation of commercial and unconventional fishery resources.
- Development of processing protocols for emerging farmed fishery resources.
- Biodegradable packaging materials for fish and fishery products.
- Development of active and intelligent packaging system for fish and shellfishes
- Technological interventions for enhancing utilization of secondary raw materials of aquatic origin.
- Development of soft computing systems in fisheries technology for technology dissemination and policy formulation
- Specific technological problems and mitigation measures in fish and fishery products of Maharashtra region
- Novel approaches for value addition and safety assessment of fishery resources of East Coast
- Development of seaweed based edible and functional sachet for food packaging applications

Externally Funded Project

- Assessing seafood exporting units' needs for exporting Value added products and capacity building requirements
- Livelihood enhancement of 'Sidi tribal women and Kharwa fisherwomen' of Veraval in Gujarat through the implementation of improved fish post-harvest technologies.

Most Significant Achievements

- Demonstrations on 'preparation of feed and foliar spray from domestic market waste' was conducted in the urban fish markets and selected landing centres across the country
- Astaxanthin was extracted from shrimp head and characterized for antioxidant and UV protective properties.
- Edible protein concentrate was prepared from the underutilized crustacean, squilla by foam mat drying technique.
- Antimicrobial films made of nutmeg oil and PLA extended the shelf life of Vannamei shrimps during chilled storage.

- Optimised the protocols for live transportation of pearl spot (*Etroplus suratensis*).
- Freshness indicator gave good correlation with quality deterioration for fresh fish and shellfishes.
- AuNPs were used to detect the presence of metal ions and biogenic amines visibly
- A detailed survey conducted across India in more than 300 fish processing units showed that for initiating industrial production of value added fish products, the industry requires technical as well as financial support.

CHIEF FINDINGS

Institute Projects

Technological interventions for enhancing utilization of secondary raw materials of aquatic origin

Incorporation of hydrogen peroxide(H_2O_2) & ZnO at various levels into chitosan/nano-chitosan was found to enhance the antibacterial activity. Antibacterial property of chitosan oligo saccharide (COS) was enhanced by addition of zinc oxide. Metal removal efficiency of chitosan for heavy metals was better at higher pH.

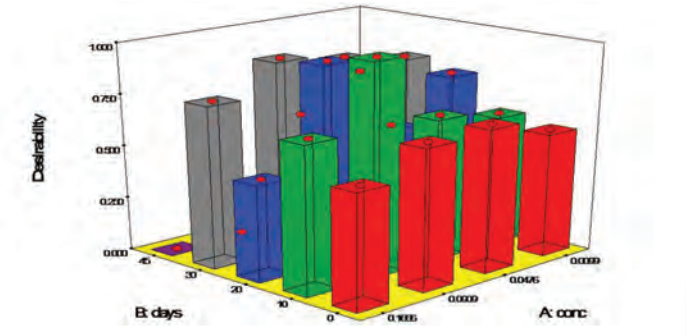
Astaxanthin was extracted from shrimp head waste and characterized for antioxidant and UV protective properties. The extracted astaxanthin was dispersed in virgin coconut oil at a level of 6mg/250 mg virgin coconut oil with suitable stabilizing agent. Chitosan was produced by modified method with mechanically deprotienised shell. The resulted sample exhibited better colour and high viscosity compared to control samples.

Preparation of foliar spray from prawn shell protein was standardised and trials carried out in cardamom plants are showing promising results. The technology has been transferred to M/s Kallar plantations Munnar.

Developed a culture media for *Pseudomonas flourensis* from prawn shell extract and the survival of *Pseudomonas* under different levels of inoculation was carried out. It was observed that the dilution level of 1:100 (prawn shell extract : water) had survival for more than 45 days with a count of 4.3x 10^9cfu.

Spray dried nano fish oil emulsion prepared using fish oil and pomegranate peel extracts with required wall material. Fish oil encapsulates fortified pasta products were prepared and results showed lower PV and TBA values than fish oil added pasta. However, there is no significant change in TVB-N values during storage.

Cuttlefish skin was hydrolysed using papain at optimum conditions. The liquid hydrolysates were characterized for proximate composition, amino acid profile, and fatty acid profile. The liquid hydrolysates obtained were stored at room temperature by pH shifting. The product was found to be stable for more than six months.



Survival of pseudomonas in shrimp shell extract

Variations in the physicochemical characteristics of tuna protein during enzymatic hydrolysis were assessed. Based on RSM the conditions for preparation of tuna protein hydrolysate were optimised for hydrolytic conditions. Enhancement in degree of hydrolysis, proteolytic activity and yield from hydrolysate was noted.

Tilapia hydrolysate agar (THA) was prepared and bacterial growth was compared with commercial media such as nutrient and plate count agar. Fish and shrimp samples were used

for comparison of bacterial growth. THA incorporated media had better bacterial growth compared with PCA and nutrient agar.

Peroxide treatment aided extraction of gelatin was carried out and quality indicated less fat content in peroxide treated skins and extracted gelatin as compared to that of untreated skin samples. Better functional properties and thermal stability were observed.

Skin leather prepared from croaker skin by different methods were assessed for mechanical properties. Evaluation of the biogenic amine formation during preparation of tuna protein hydrolysate was carried at different hydrolysis time using proteolytic enzyme. Studies indicated an increase in formation of amines (histamine, putrescine and cadaverine) with increase in hydrolysis.

Characterization of chitooligosaccharides (COS) prepared using different enzyme was carried out and DSC analysis and flow properties of the product was studied. Thermal stability varied significantly among the COS.

Fish protein hydrolysate (FPH) was prepared from pink perch head waste using papain by following RSM and parameters such enzyme concentration, time of hydrolysis, temperature and pH were optimised.

Fish samples (17) were analysed by ICP-OES for heavy metal contaminants. Cadmium in four samples was detected above the level prescribed by FSSAI (0.3 ppm). Mercury, lead and arsenic were found within the prescribed limit.

Bacteria associated with fermented fish paste (prepared from inland small weed fishes), fermented whole fish (shidal, prepared from *Puntius sp*.), smoked *Labeo rohita* (Rohu) and smoked *Nemipterus japonicas* (pink perch) were identified.

Fish oil microencapsulates prepared by electrospinning and spray drying method was investigated. Chitosan and bovine gelatin were used as a wall materials. Encapsulates had a moisture content between 2.48-3.90%. Encapsulation efficiency ranged from 76.55-82.45%. Morphological characterization of fish oil encapsulates by scanning electron microscopy (SEM) revealed spherical shape of particles without any cracks in encapsulates. Continuous fibers were observed in electrospun encapsulates.

Two types of chitosan beads were prepared in combination with silica and sodium alginate and characterized. Batch adsorption studies were carried out for evaluating removal efficiency of lead from water samples.

Carboxymethyl chitosan

Astaxanthin-virgin coconut oil capsules

Interventions in processing and preservation of commercial and unconventional fishery resources.

Fish protein isolate was prepared from Nile tilapia and Bombay duck fish mince by pH shifting process and its physico-chemical and functional properties were evaluated. A protocol was standardized to get better yield of hyaluronic acid from the umbrella jellyfish available from Indian coast. Protocol for preparation of ready to eat prawn with spice mix that can be stored at room temperature was developed.

Puffer fish *(Lagocephalus guentheri)* fillets has shelf life for 10 days in chilled storage.

Developed edible protein concentrate from Squilla by foam mat drying: The technique indicated very good solubility and can be used as a protein/flavouring agent in food formulations such as soup, sauce or snacks.

An attempt was made to reduce the level of salt and vinegar in pickle by modifying the process. Accordingly, both, the ingredients and final products were subjected to quick-chill after heating to boil. Further, salt and vinegar concentration was reduced to half of conventional pickle. The microbiological parameters indicated 25 weeks shelf life as against 17 weeks for conventional sample, under ambient storage conditions.

Process standardization was carried out for the development of noodles fortified with thelly shrimp *(Metapenaeus dobsonii)*.

A demerit score-based fish quality index (FQI) has been developed to assess the quality/freshness of fresh fish by considering five general characteristics in the demerit score like appearance of eyes, gills, belly and vent. The developed FQI was validated with real time data on milk fish *(Chanos chanos)* stored in chilled condition.

Benefit risk ratio of ready to eat sardine in different oils viz olive oil, rice bran oil and sunflower oil was evaluated with respect to essential fatty acid, calorie value, lipid oxidation and biogenic amines and found that benefits were more compared to risk.The tuna mushroom soup was developed and a number of trials were conducted to standardize the right combination and recipe. Five different recipes were prepared and two were selected for bulk processing based on sensory analysis.

Fish protein isolate was prepared from croaker, rohu, Bombay duck, tilapia and Indian mackerel fish mince and freeze dried and characterized. Yield of isolate obtained was 38.40-42.50%. Protein isolate had moisture content of 2.49-4.62%. Protein content ranged between 88.16- 92.5%. Fat and ash content ranged between 1.5-2.1% and 0.99-3.15%, respectively. Protein isolate from Bombay duck showed highest solubility (43.85%) than others (29.77-35.16%). Water absorption capacity of isolate ranged from 4.26 to 5.29 g water/g sample. Fat absorption capacity of isolate was found be high in tilapia isolate (7.7g oil/g sample).

Effect of beetroot extract (BT) treatment on retarding melanosis in *Litopenaeus vannamei* was studied with sodium metabisulphate (SMS) and control under ice storage condition. Melanosis score of control increased rapidly during storage. Treatment with BT at 4% was observed to be highly efficient in controlling melanosis and had 11 days of shelf life based on microbial count and sensory analysis.

Fresh seer fish, *Pangasius* and lobster were collected from supermarket at Vashi. Microbiological qualities were analyzed. Total plate count, *E. coli* and *Staphylococcus* ranged between $1.8x10^2$cfu/g to $3.2x10^2$cfu/g and 15-58 cfu/g, respectively. Salmonella, *Listeria sp.* were found to be absent in all sample.

Biodegradable packaging materials for fish and fishery products

Thermoplastic trays were developed using different biodegradable polymers like polylactic acid (PLA), polybutylene adipate terephthalate (PBAT) and PLA with calcium carbonate by injection moulding process. Application of polylactic acid coating at 3% increased the physical properties of bagasse trays and decreased the moisture absorptive properties of the trays. Coating of polylactic acid solution on kraft paper and paperboard increased the strength of the paper and decreased the moisture absorptiveness. Antimicrobial films made of nutmeg oil and PLA extended the shelf life of vannamei shrimps during chilled storage in comparison to standard packaging. Chitosan films incorporated with 7.5% halloysite was found suitable for food packaging application.

The mechanical properties of myofibrillar protein films from threadfin bream were enhanced by the addition of transglutaminase enzyme and the same could be used as an edible wrapper.

Edible myofibrillar films

Edible wrappings for spring rolls

Incorporation of tea polyphenols into CMC and sodium alginate films were found effective in improving the film strength and antioxidant activity of the films. Microencapsulated fish protein hydrolysate powder with chitosan and clove oil (FPHCC) improved the shelf life of tuna fillets during the chilled storage. Wrappers made of pink perch myofilbrillar protein extended the shelf life of fish fingers in comparison to sodium alginate film wrappers.

Development of processing protocols for emerging farmed fishery resources

The microbial quality and shelf life of farm reared giant trevally *(Caranx ignobilis)* stored under frozen condition as a function of slaughtering method viz. allowing to struggle till death (normal harvesting procedure at farm) and stunning in ice/ water slurry was assessed. In ice slurry, the fish exhibited significantly shorter period of struggling compared to that of conventionally killed fish samples. Giant trevally slaughtered by conventional method of harvesting indicated poor textural and microbiological quality compared to that of stunned samples, during the entire period of frozen storage.

Freshly harvested Indian pompano (1.1 kg average weight) from sea cage was stored in ice and evaluated its quality changes including pictorial, biochemical (TVB-N, TMA-N, PV, TBARS), physical (moisture and colour)

and microbiological (APC, psychrophilic count and enterobactereaceae) changes during storage. Based on sensory evaluation and microbiological quality, the shelf life of Indian pompano was determined as 21 days under iced storage.

The bacterial flora associated with fermented fish-flavoured marinating mixture was determined. The bacteria found to be associated with marinating mixture were *Sphingomonas paucimobilis, Pantoea sp., Bacillus amyloliquefaciens, B. atrophaeus, B. subtilis, B. cereus and B. mycoides*. Further, the marinating mixture was autoclaved at 121ºC for 15 min and found that bacterial load was reduced to almost nil.

Standardization of protocols (prior to, during and post harvest) for live transportation of pearl spot (*Etroplus suratensis*) was carried out. Studies indicated comparatively high ammonia built up and low dissolved oxygen in water maintained under ambient temperature while low temperatures maintained high dissolved oxygen and lower ammonia in the transported water. Mortality to the extent of 10 % was noted during acclimatization as well as during transportation, higher at ambient condition in comparison to low temperatures.

Quality characteristics of restructured fish product from Nile Tilapia

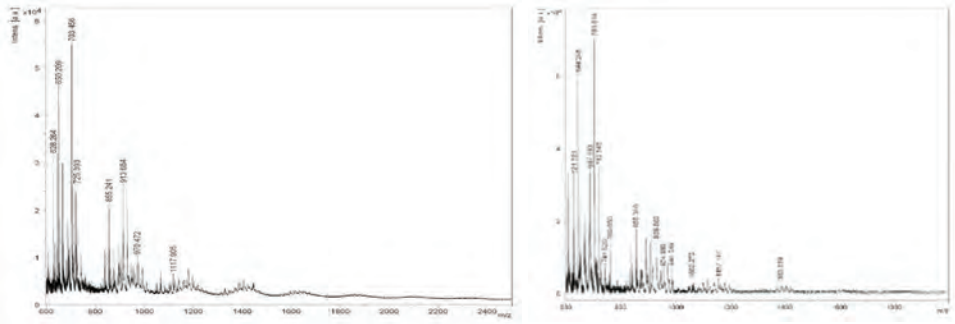
Restructured fish products were prepared from Nile Tilapia fish mince. Restructured products were prepared in three different formulations by incorporating corn starch (4 %), chitosan (0.5 & 0.75 %), STPP (0.25%) and salt (1%) . Restructured products were prepared by steam cooking and stored in chilled condition (2 °C) for further analysis.Restructured fish products had moisture, pH values ranging between 39.2-41.46%, 6.36-6.50. The total volatile base nitrogen (TVB-N) and TBA values showed an increasing trend and it was found to be higher in control than the chitosan incorporated sample. Similar trend also observed for peroxide values (PV). Microbial analysis indicated that control reached 5log cfu/g on 11th day. Further, chitosan incorporated sample had a 3-6 days extended shelf life.

Development of active and intelligent packaging system for fish and shellfish

The freshness indicator was evaluated for its effectiveness in commercially important fishes like white pomfret, seerfish, pink perch, crab, *Lethrinus spp*., Anchovies, Indian white shrimp and clams stored under chilled conditions in retail pack. White pomfret, seerfish, pink perch and Letrinus spp. were used as steaks after proper cleaning, crab was used as cut crabs, shrimps as head less form and clam as cooked form. A shelf life of 5, 9, 10, 10, 12, 12, 14 and 14 days was observed for cooked clam, anchovies, crab, shrimp, pomfret, seerfish, Lethrinus and pink perch, respectively under chilled storage conditions. Freshness indicator showed colour change from bright yellow to slight yellow and finally to purple in all the varieties except for cooked clam.

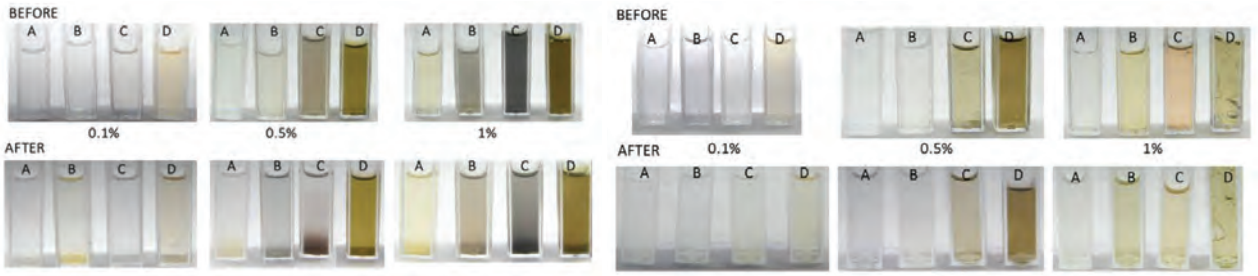
Lethrinus spp. packed under active packs (3:1 ascorbic acid and iron powder) was compared with vacuum, modified atmosphere packaging conditions (60:20:20 and 40:30:30 CO_2:N_2:O_2) and control air packs under chilled conditions for its shelf life. *Lethrinus* spp. packed in control air was acceptable up to 14 days only compared to 16 days for vacuum packs. For active packs, shelf life extended up to 18 days similar to MAP (40:30:30 CO_2:N_2:O_2). Maximum shelf life of 20 days was observed for MAP (60:20:20 CO_2:N_2:O_2) under chilled conditions.

Chitosan used in the synthesis of nanoparticles were characterized for its molecular weight, which is one of the major deciding factor in imparting the properties to NP's. For this, viscosity dependent method and matrix assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI TOF MS) are used to assess molecular weight of 4 different chitosan samples. Molecular weight in the range of 628 to 1384 was observed.

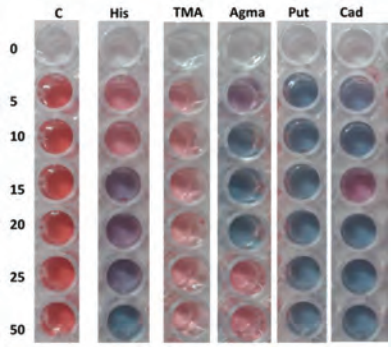


Optimization of silver nanoparticles synthesis using low and high molecular weight chitosan using different concentration of $AgNO_3$ was studied. In both low and high molecular weight chitosan, the colour intensity increased with the increasing concentration of silver nitrate. For both low and high molecular weight chitosan (0.1%), lower concentration of $AgNO_3$ did not result in the formation of silver nanoparticles. As the concentration of chitosan increased, lower concentration of $AgNO_3$ resulted in the formation of Ag nanoparticles. At higher concentration of high molecular weight chitosan, AgNPs with dark yellow colour with very high viscous gel was formed. Although viscosity increased, gel formation was not observed for AgNPs prepared using low molecular weight chitosan.

AgNPs synthesized using low and high molecular weight chitosan were evaluated as frozen storage indicator. Upon exposure to frozen storage, AgNPs prepared using high molecular weight chitosan with low high concenterations of $AgNO_3$ and with low molecular weight chitosan, only higher concenteration of $AgNO_3$ gave colour change indicating its application as smart indicator for frozen fish.

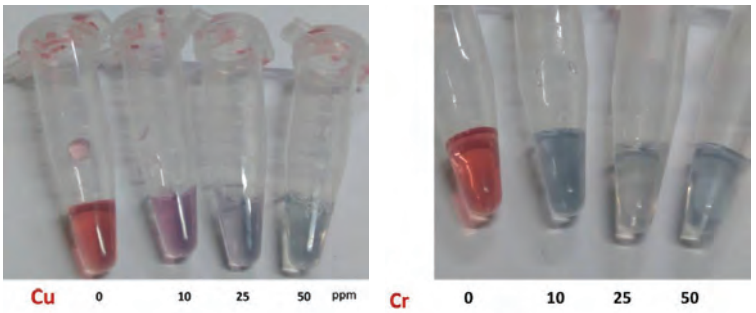


Colour change of silver nanoparticles before and after frozen storage

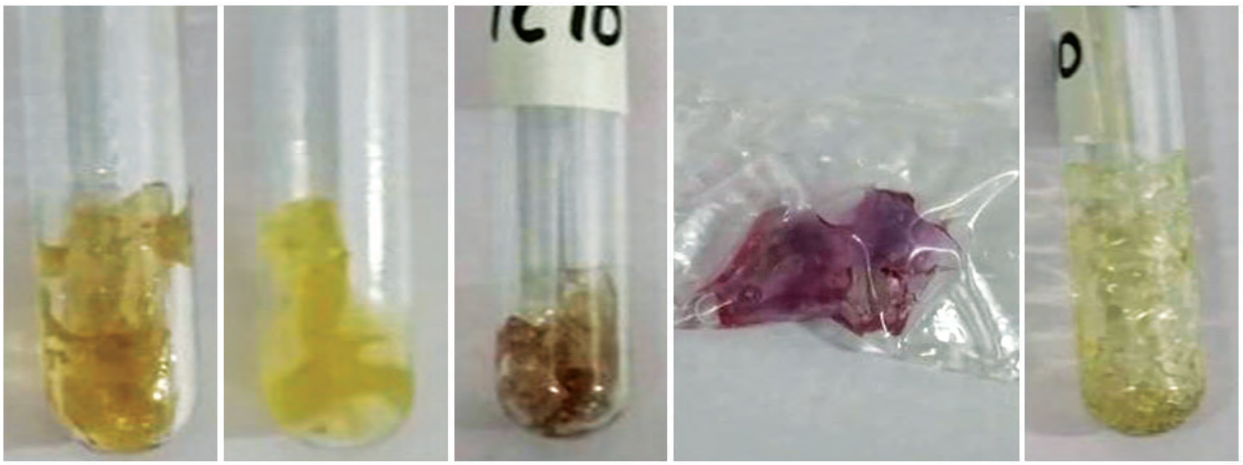


Gold nanoparticles synthesized using chemical method were evaluated for their ability to detect biogenic amines. For this, different amines viz., histamine, trimethylamine, agmatine, putresceine and cadaverine were evaluated at different concentrations. Ruby red colour of AuNPs did not give any colour change up on reacting with TMA, whereas it gave bluish to purple colour with the other amines. For histamine, up to 10ppm it did not change any colour whereas from 15ppm onwards it gave slightly purple colour and at 50 ppm it turned to bluish colour. Colour formation is time dependent.

Gold nanoparticles synthesized using chemical method were evaluated to detect the presence of metal ions in water. For this, metal ions (copper and chromium) at different concentrations were exposed with the AuNPs. At lower concentration of copper, it gave purple colour and as the concentration increased, it turned to slight purple to bluish-grey colour. For chromium, even lower concentration gave bluish colour and it changed to bluish-grey as the concentration increased.



Thermochromic sensor was prepared by using polyvinyl alcohol, borax and hydroxyl ethyl methacrylate. The hydrogel was sensitive from 80 to 120°C and RT to -20°C.



- 20°C 0°C RT 100°C 120°C

Development of Soft Computing Systems in Fisheries Technology for Technology Dissemination and Policy Formulation

A web based interactive information system on ICAR-CIFT value added fish byproducts has been designed and developed. The home page of the information system contains general information about the value added fish byproducts with some potential applications. The information system contains information on chitin, chitosan, glucosamine hydrochloride, fish silage, fish bone calcium, fish protein hydrolysates and collagen. The series of fish byproducts gives an introduction about the products, information about ingredients required and stepwise method of preparation of the product. The information system contains a contact page, for which the computer codes were developed by HTML and PHP. The user can use this contact form through which user can post any query by just mentioning name, e-mail id and content of the query; this would enable the experts from CIFT to give reply to the query immediately.


Indian Council of Agricultural Research - CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
भारतीय कृषि अनुसंधान परिषद - केन्द्रीय मात्स्यिकी प्रौद्योगिकी संस्थान
(ISO/IEC 17025:2005 NABL accredited & ISO 9001:2015 certified)

INFORMATION SYSTEM ON CIFT FISH BYPRODUCTS

HOME ABOUT BYPRODUCTS CONTACT CIFT

CIFT Value Added Fish Byproducts

India is one of the major traders of fish and fishery products. in the world in the year 2017-18, 1.37 million tonnes of fish and fishery products worth Rs.45000 crore has been exported from India. Approximately 0.3 million tonnes of seafood waste are being generated every year including the domestic as well as industrial seafood waste. The aquatic food waste generated can be used as a raw material for many of the production of many compounds which are useful in other industries like agriculture and food industry, chemicals and cosmetics, pharmaceutical and nutraceutical, textile, dye etc. It is highly essential that these wastes should be used to protect the environment, resources and for better economic growth.

The major products which can be derived from aquatic food waste are fish meal and oil, chitin and its derivatives, collagen and collagen derivatives, shrimp meal, squid meal, squid liver paste, protein and their derivatives, fish maw, fish silage, squid and cuttlefish ink, cuttlebone powder, fish skin leather, fish calcium, fish manure and fish waste derived fertilizers, fish soluble etc.

ICAR-Central Institute of Fisheries Technology (CIFT) is working on improving the utilization of Aquatic food waste for more than six decades. Research of ICAR-CIFT focused on developing and optimizing the process for various products from aquatic food waste having utility in nutraceutical and health food formulations, farm inputs for agriculture and aquaculture application of process technology and product application in the relevant field. The ICAR-CIFT offers technologies for the following products.

Specific Technological Problems and Mitigation Measures in Fish and Fishery Products of Maharashtra Region

Visceral proteases from freshwater fish mrigal *(Cirrhinus mrigala)* have been extracted and partially purified using various precipitation techniques such as ammonium sulphate fractional precipitation, acetone precipitation and ethanol precipitation. No significant difference was observed in total protease activity of enzyme purified by ethanol precipitation and acetone precipitation method ($p<0.05$). Ammonium sulfate fractional precipitation at 60% saturation yielded higher activity. Protein recovery in ethanol extraction was 55.41% from the crude enzyme extract.

Ready to eat Acetes cone chat

Innovative ready to eat product “Acetes cone chat” is developed by standardising recipe. The ingredients used were acetes, potato, onion, capsicum, along with spices. Refined wheat flour was used as base material for cone preparation. In sensory evaluation, overall acceptability of the product scored extremely likely score based on nine point hedonic scale.

The effect of electron beam irradiation on the quality of dried Bombay duck, acetes and ready to eat tilapia fingers was studied. Samples were exposed to 2.0, 4.0 and 6 kGy doses of electron beam irradiation. Control had higher TVB-N increased oxidative and reduced microbial counts were observed for irradiated samples compared to control.

Dry fish samples including of shrimp, anchovy, Bombay duck, mackerel, ribbon fish and acetes were collected monthly form different local markets of Mumbai and biochemical quality and microbial safety were evaluated. In 27.7% of samples the aerobic plate count was above the limit of 5 log cfu/g as per IS14950. In 82.75% of samples, yeast and mould count were above 2 log cfu/g. Mercury content was absent in all the samples. Presence of lead was detected in 16.7% of samples in the range of 0.14 to 0.96 ppm in samples of shrimp and acetes. Maximum lead content was observed in Acetes sample.

Effectiveness of trisodium phosphate (TSP) treatment alone and in combination with salt was evaluated in dried mackerel. Total plate count and yeast & mould count in case of TSP alone and TSP+salt treatment is lower than that of salt treated samples. Histamine content in TSP treatment samples didn't show much variation during storage.

Fresh Bombay duck were cleaned and subjected to garlic and ginger extract dip treatment of 1.5% and 3.0% and dried. Moisture content ranged between 10.02-11.43%. TMA content was found to lower in sample treated with tri-sodium phosphate and ginger extract than control. TBA content was found to lower in garlic extract treated samples followed by ginger extract, tri-sodium phosphate dip treated than control.

Fish and fish products were collected from super market, Vashi, Navi Mumbai and screened for seafood authentication. Fish mitochondrial gene were amplified using the primers and PCR products were visualized and positive reactions were purified. The sequences were compared with GenBank and the BOLD databases.

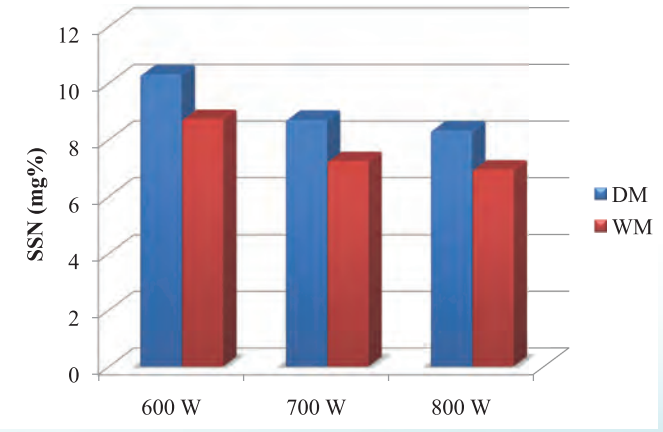
Name of fish sold in market	Identified by database
Basa 1, Basa 2 & Basa 3	*Pangasianodon hypophthalmus*
Salmon norwegian	*Salmo salar*
Salmon fillet	*Salmo salar*

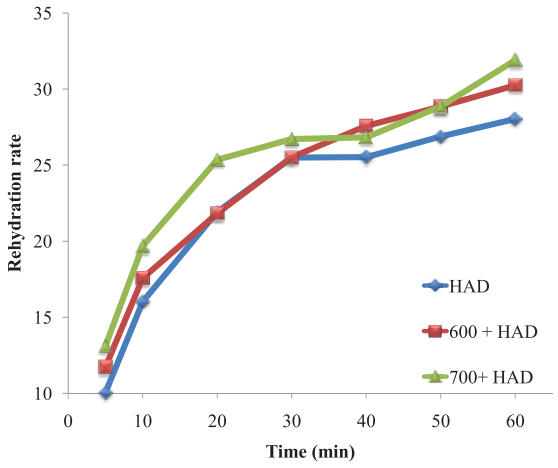
Studies from Versova, Mudh Island, Vasai region Rangaon, Naigaon, Pachubander, Killabander regarding the Dol net fishing and its activities specially on the problems were organised. Some of the problems identified with the help of fishermen includes i) Dolphin attack on dol net which destroys the net and also losing of the catch. To avoid dolphin bite an external bigger size mesh net is covered up near the codend portion. ii) Dol net fishing though said to target Bombay duck it catches everything with landing of different types of species starting from small fishes to big size fishes. iii) Lose of set net when the current is very strong iv) difficulties in net operation due to plastic waste.

Novel approaches for value addition and safety assessment of fishery resources of East Coast

Effect of microwave vacuum drying on the properties of marinated tuna chunks: Boneless tuna chunks were marinated using spices and were dried in microwave vacuum dryer at different power levels (600 W (T1), 650 W (T2) and 700 W (T3)) for 2 h. Increasing microwave power level resulted in reduced moisture but higher hardness in dried tuna chunks. Color and appearance of T3 and T2 was superior to other treatments. Analysis of SEM indicated a tough morphology in T4 and T5 whereas a smooth fibrous morphology in microwave vacuum dried samples.

Boneless tuna chunks were dried in microwave vacuum dryer at different power levels (600 W (T1),700 W (T2) and 800 W (T3)) for 2 h. Moisture content drastically reduced from 76.84% to 60.71, 53.65 and 47.31% in samples dried at 600 W, 700 W and 800 W, respectively. Increase in power significantly affected the solubility of protein as the salt soluble nitrogen (SSN) and water soluble nitrogen (WSN) content of both dark and white muscle decreased with increase in power. SSN of dark muscle was significantly higher to that of white muscle whereas a reverse trend was observed for water soluble nitrogen content. Lightness (L*) of dark muscle and white muscle decreased while redness (a*) values of both increased with increase in microwave power. Lipid oxidation as measured by TBARS also increased with microwave power.





Brine salted goat fish was dried for 30 min at 600 (T1) and 700 W (T2) in microwave vacuum dryer followed by drying in hot air at 55±5^{0}C till the moisture content reduced to nearly 30%. A control sample (T3) was also dried in hot air oven under the similar conditions and compared its properties. The time taken to bring down the moisture content from initial 65.86% (after brine salting) to nearly 30% was 18 h, 15.30 h and 12 h, respectively for control, T1 and T2 samples. Solubility of water soluble and salt soluble nitrogen fraction decreased in microwave assisted hot air dried samples. TMA-N and TVB-N of hot air dried fish was more than (13.6 and 23.6 mg %) T1 (10.54 and 11.84 mg%) and T2 samples (8.4 and 15.9 mg%) where asthe TBARs was higher for microwave assisted hot air dried samples. Color attributes (L*, a* and b*) of all the three samples were comparable. T2 and T3 samples exhibited good rehydration property compared to hot air dried sample.

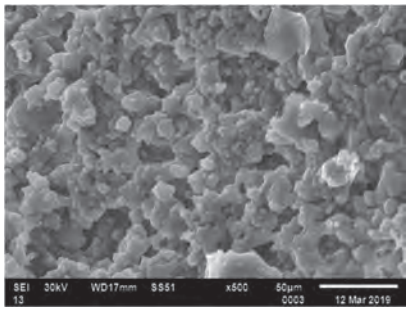
Antioxidant properties of encapsulated seafood flavor SFm (maltodextrin,1% and gum Arabic,1%) and SFNa (maltodextrin, gum arabic and sodium caseinate at the concentration of 1% each) were studied at ambient temperature. ABTS scavenging activity of encapsulated flavor such as SFm and SFNa reduced from 91.21 % to 45.72% and 84.32% to 44.02% at the end of two months storage at room temperature. While ABTS scavenging activity of non encapsulated flavor reduced faster from 86.09% to 40.32% after 4 weeks. All the samples exhibited scavenging ability lower than 30% for DPPH radicals at the end of two months and the sensory analysis showed rancid and bitter taste.

Emulsions were prepared by following core materials, SFm: maltodextrin, gum arabic, and combination of SFNa: maltodextrin, gum arabic and sodium caseinate and dried in dryer. SFm showed a higher antioxidant activity as compared to the non-encapsulated peptides (SF) and encapsulated SFNa. All the sample exhibited scavenging ability lower than 50% for DPPH radicals and also had very low metal ion chelating activity.

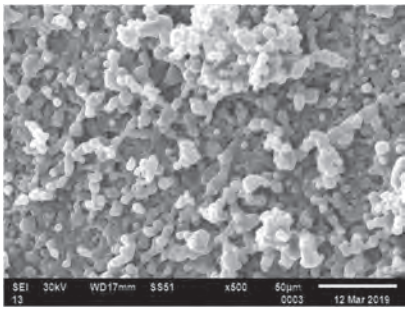
A total of 95 strains of *Escherichia coli* isolated from freshwater fish procured from fish markets, wholesale fish markets and retail fish markets were tested for antibiotic sensitivity against 26 antibiotics. The bacterial isolates showed highest percentages of resistance towards azithromycin (58%), kanamycin (30%,) nitrofurans (27%), cefotoxime (27%) and ampicillin (21%). The commonly found resistance against antibiotic classes among the isolates are cephalosporins (3rd gen), folate pathway inhibitors, penicillins, tetracyclines. The multidrug resistance found in this study was 14.73%.

Ten out of the 95 *E. coli* isolates showed characteristic light pink-mauve colored colonies on chromogenic media (O157 and H7). All these ten *E. coli* showed the presence of H7 antigen (625 bp) & int gene (368 bp) but O157 antigen, SLT-1 and SLT-2 genes were not detected. All the isolates showing phenotypic resistance

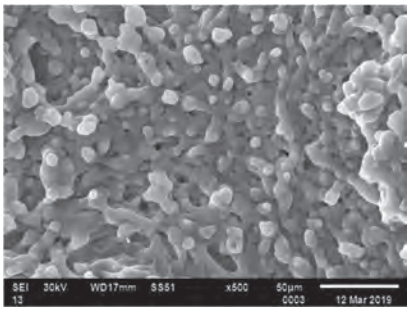
to ampicillin (18/18) and tetracycline (8/8) were harboring the antibiotic resistance genes viz., ampC and TetA genes. However, 25% and 50% of the resistant isolates were carrying tetM and tetL genes.



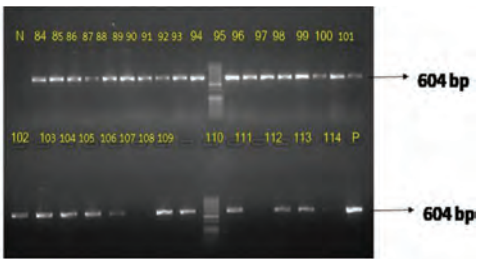
SEM of spray dried SF



SEM of encapsulated SF with maltodextrin

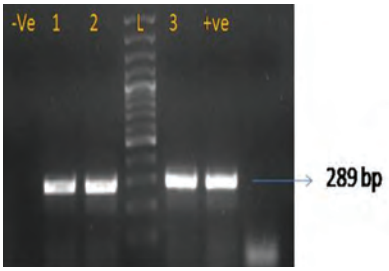


SEM of encapsulated SF with maltodextrin and sodium casienate



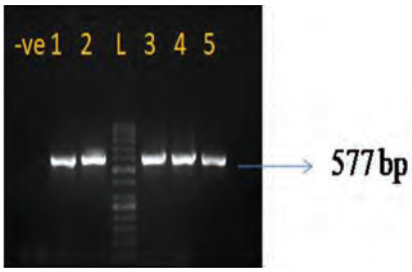
PCR amplification of uidA gene.

Lane1:-ve control, lane 12 and 29: 50bp ladder, lane 2-11: test isolates lane 13- 20:test isolates, lane 21-28: test isolates, lane 30-34: test isolates, lane 35: ATCC

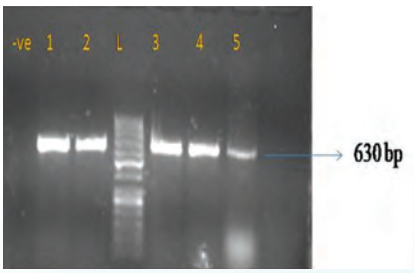


PCR amplification of lacY gene at 289bp.

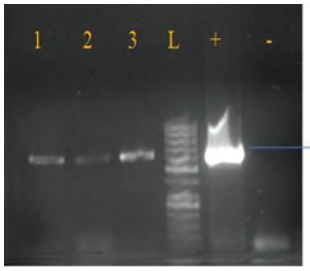
Lane 1:negative control, lane 2,3,5- test isolates, lane 4:100 bp ladder



PCR amplification of tetA gene (577 bp)
Lane 1:negative control, lane 2,3,5,6,7- test isolates, lane 4:50 bp ladder

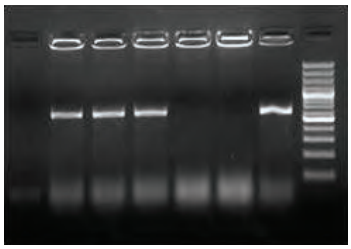


PCR amplification of ampCgene (630 bp)
Lane 1:negative control, lane 2,3,5,6,7- test isolates, lane 4:50 bp ladder

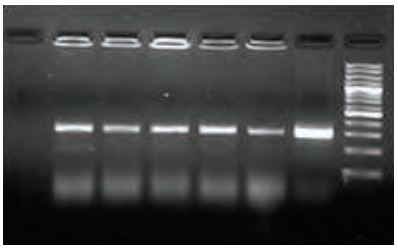


PCR amplification of H7 gene at 625 bp.
Lane, 1,2,3- test isolates, lane 4:50 bp ladder lane 5:positive control, lane6:Negative control

Farmed *Penaeus vannamei* shrimp procured from fish markets (n=6), 2 each in East Godavari (Kakinada), West Godavari (Bhimavaram) and Visakhapatnam (Visakhapatnam) districts were screened for the incidences of *E.coli*, *Staphylococci* (both coagulase positive and negative Staphylococci), *Vibrio spp*. other than *Vibrio parahaemolyticus*. Results indicated 100% incidence of *E.coli*, 83% incidence of coagulase negative Staphylococci, 33% incidence of *Coagulase positive Staphylococcus aureus*, 33% incidence of *Vibrio parahaemolyticus* and 100% of incidence of *Vibrio spp*. in *P. vannamei* procured form retail markets. All the isolates were confirmed by the presence of respective target genes.



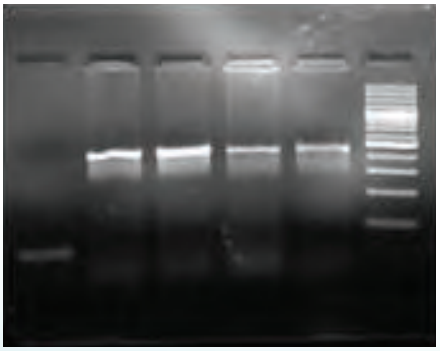
PCR targeting uidA gene (603 bp) for identifying E.coli



PCR tagetinglacY gene (289 bp)for identifying E.coli

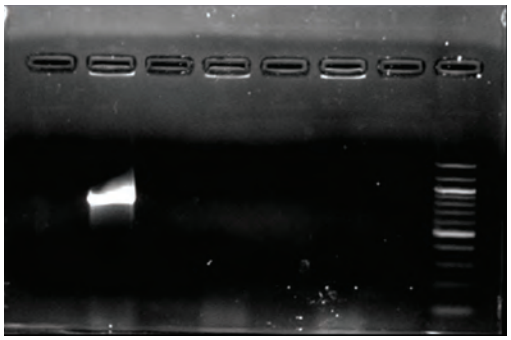
PCR targeting nuc gene (278bp) for identifying Coagulase positive Staphylococcus aureus

PCR targeting sta756 gene (750bp) for identifying Staphylococci

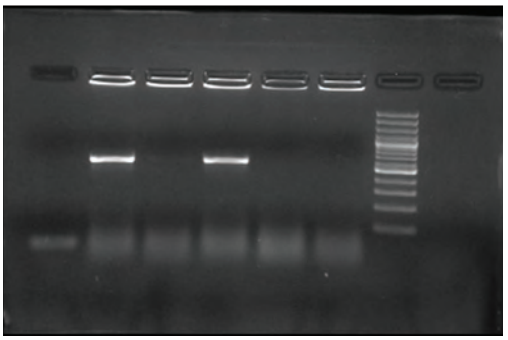


PCR targeting tlh gene (490 bp) for identifying V.parahaemolyticus

Antimicrobial Resistance Pattern (AMR) profiling for these bacteria indicated varied resistance towards major class of antibiotics. Antibiotic resistance gene screening was done for resistant isolates targeting the resistance genes using PCR technique.



FPCR targeting antibiotic resistance genes TEM-1 and TEM-2 genes (800bp)



PCR targeting tetracycline resistance gene tetA (577bp)

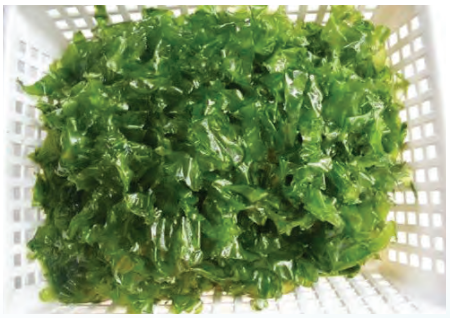
Frozen fish broth cubes from fish/ frame waste

During fillet preparation, fish frames are generated as waste which are rich in calcium and protein. In this study, fish broth was prepared from fish frame of mackerel and rohu by boiling in potable water and cubes were prepared by freezing of broth. Similarly, fish broth was also prepared from meat of Bombay duck. Broth cubes prepared from fish frame waste can be used as protein and calcium source in soups and other food preparations.

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

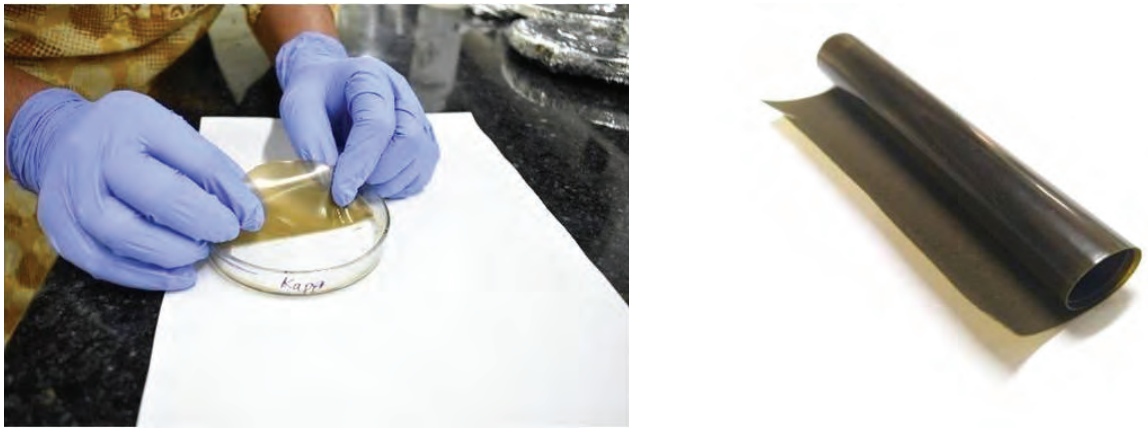
Moisture of *Ulva sp.* and *Kappaphycus alvarezii* are 90.37% and 91.13%, respectively. The results showed that protein of *Ulva sp.* and *K. alvarezii* are 1.85% and 1.72%, respectively and fat content of seaweeds are very low. The analysis of macronutrient shows that seaweeds are rich in sodium, potassium and calcium content. Cadmium and lead were not detected in both the seaweed samples.

Ulva sp.

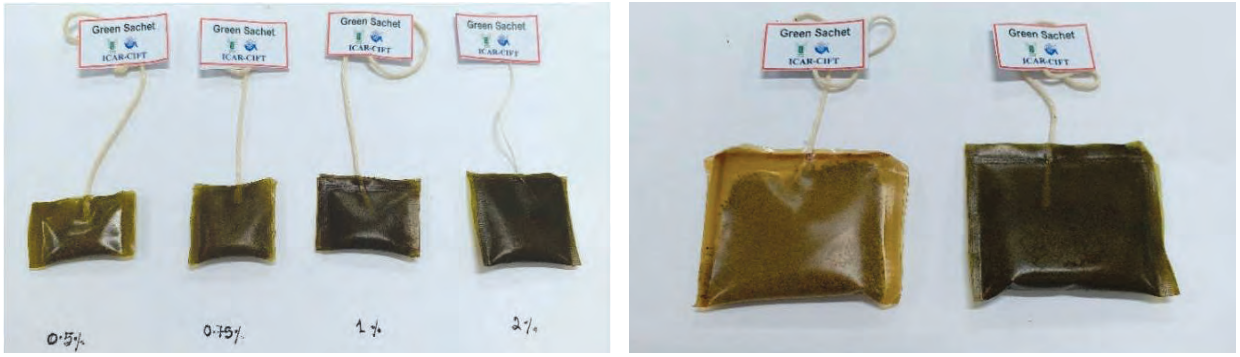


Kappaphycus alvarezii

Film forming solution was obtained by dissolving seaweed powder and sodium alginate in distilled water and castonto glass plates in hot air oven at 50°C for 24 h. Then the dried films were peeled and stored in a desiccator prior to analysis. The films were used to prepare sachet which has very good sealing properties. However, seaweed sachet with *K. alvarezii* need higher temperature for proper sealing as compared with Seaweed sachet with Ulva.



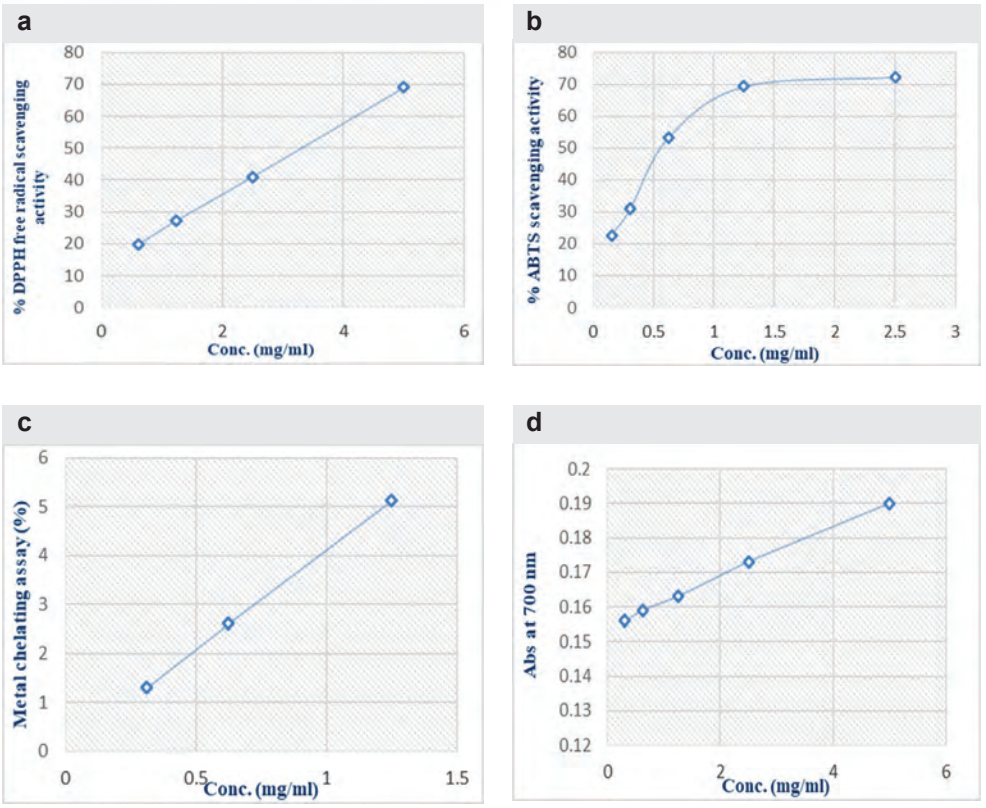
Film prepared from Ulva and K. Alvarezii



Film prepared from Ulva and K. Alvarezii

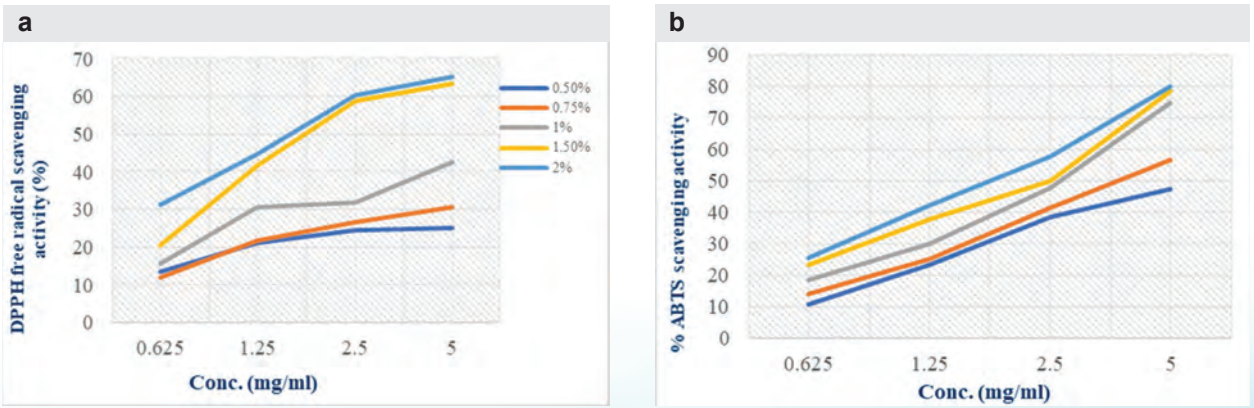
The solubility of the films was determined at 70, 80 and 90°C. Edible seaweed sachet made from 1% *Kappaphycus* completely dissolved within 53.15 sec at 90°C, while edible seaweed sachet made from Ulva took longer time to dissolve.

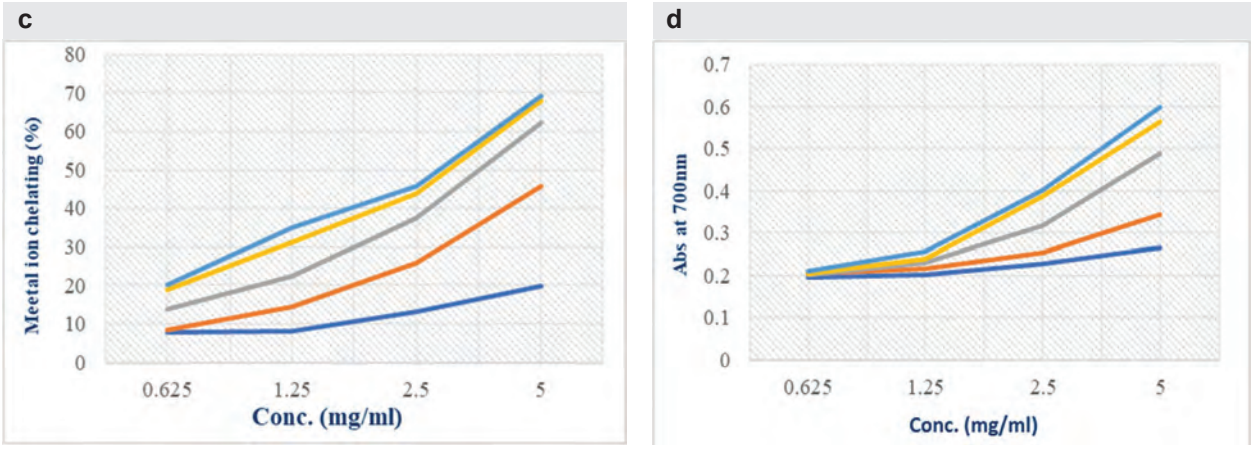
Seaweed film prepared from *Kappaphycus* exhibited more ABTS free radical scavenging activity than DPPH free radical scavenging activity. The *Kappaphycus* film showed scavenging ability higher than 50% for DPPH radicals (69.19%) and the inhibitory activity on ABTS+ reached 72.33% at a concentration of 2.5 mg/ml. Metal chelating activity of the film was comparatively poor.



Antioxidant activity of kappaphycus film a) DPPH radical scavenging activity, b) ABTS scavenging activity, c) Metal chelating assay and d) Reducing power assay

Antioxidant properties of seaweed film using 0.5 to 2% *Ulva sp*. showed increased antioxidant activity of the films at higher levels of seaweed and seaweed film with 2% *Ulva sp*. exhibiting higher antioxidant properties as compared to other seaweed film. The film with 1.5% and 2% *Ulva sp*. showed scavenging ability higher than 50% of DPPH radicals. ABTS scavenging activity, metal chelating assay and reducing power assay of the seaweed film using *Ulva sp*. also followed the same trends as DPPH radical scavenging activity.





Antioxidant activity of Ulva film a) DPPH radical scavenging activity, b) ABTS scavenging activity, c) Metal chelating assay and d) Reducing power assay

RESEARCH PROJECTS HANDLED

Institute projects

- Food safety hazards of fish and fishery products: assessment and mitigation measures
- Development of seaweed supplemented bioactive yoghurt
- Safety and quality aspects of fish and fishery products from Gujarat coast

Externally funded projects

- All India Network Project on Fish Health
- Monitoring of heavy metal in finfish and shellfish species along the Indian coast and possible mitigation measures
- Natural levels of formaldehyde in freshly harvested finfish and shellfish species

Most significant achievements

- HPLC-DAD and GC-MS based quantification method was developed and validated for determination of formaldehyde in fishes and submitted to FSSAI for conformation as official method.
- A high throughput analytical method was developed for fast and accurate quantitation of 200 multi-class contaminants (organophosphate, pyrethroids, carbamates, fungicides, herbicides, other POPs, PAH and PCBs) in aquacultured fish.
- The toxic shock syndrome toxin-1 (TSST-1) encoded by tst gene that leads to staphylococcal toxic shock syndrome (TSS) was detected in 34 isolates of *Staphylococcus aureus* from dried fish products.
- Seaweed supplemented yoghurt was developed and pilot scale trials were conducted in collaboration with Milma Dairy, Ernakulam.
- Considerable reduction in the allergenicity of tropomyosin in shrimp was observed after electron beam irradiation.
- Methanolic extract of brown seaweed (*Padina gymnospora*) was determined to have strong antimicrobial effect against major foodborne pathogens.
- A moderate to high background level (1.97-7.23 µg/g) of cypermethrin pesticide was observed in salted/dried fish products.
- Violation of FSSR limit for heavy metals was observed in 3.53% of finfish and shellfish samples.

CHIEF FINDINGS

Institute Projects

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

Prevalence of enterotoxigenic Staphylococci in RTE/RTC fishery products

About 102 RTC/RTE fishery products were collected from different supermarkets of Cochin and analyzed for the presence of Coagulase positive staphylococci (CPS). Out of 102 samples, 10 (9.8%) samples showed aerobic plate count (APC) above the acceptable limit (5log cfu/g). CPS was confirmed in 4 (3.92%) samples, out of which 3 samples had CPS count above the acceptable limit of 2 log cfu/g. About 20 CPS were isolated from 4 samples and tested for their enterotoxigenicity. Only one sample (0.98%) showed the presence of enterotoxigenic isolates. The isolates were tested for the presence of different enterotoxigenic genes strains and one CPS isolate showed the presence of SEA, two isolates showed the presence of SEB and SEH. Antimicrobial resistance of staphylococcal isolates was studied and 2 samples (1.96%) were found methicillin resistant. Most of the isolates were found to be resistant to ampicillin (7.2%), Cephalothin (7.2%), Trimethoprim (7.8%), Oxacillin (1.96%) and Erythromycin (1.96%). All the isolates were susceptible to tetracycline, gentamycin, chloramphenicol and clindamycin.

Effect of electron beam irradiation on shrimp allergen (tropomyosin)

Effect of electron beam irradiation in combination with thermal and non-thermal processing treatment on shrimp allergen, tropomyosin was evaluated in *Metapenaeus dobsoni*. The treatments (boiling, autoclaving, trypsin and chymotrypsin treatments) and whole peeled raw samples were subjected to electron beam irradiation at 5 kGy on each side of the samples. A considerable reduction was observed in IgE activity in all the samples after electron beam irradiation. Autoclaving in combination with electron beam irradiation has a promising potential to reduce allergenicity. Cooking in pressure cooker of whole peeled shrimp couldnot reduce the allergenicity of shrimp allergen, tropomyosin.

Electron beam irradition of shrimp

Development of multiclass multi-residue method for quantitation of chemical contaminants in aquacultured fish

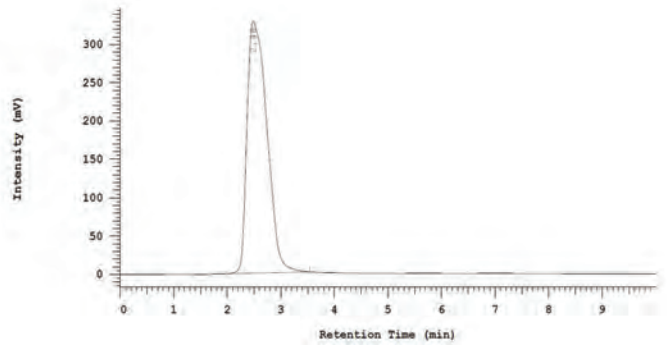
A GC-MS/MS multiclass method of analysis has been developed for fast and accurate quantitation of chemical contaminants in cultured fish. Salmon fillets were used for method development and optimization. A total of 270 contaminants were targeted for optimization, of which 200 compounds satisfied all validation criteria. A Large Volume Injection (LVI) technique was optimized to achieve trace level sensitivity. For PAH, LOD values of most of the target analyte were less than 1 ppb while LOQ values were less than 5 ppb.Recovery of the analytes were in the range of 60-120%. The reproducibility and repeatability values of the analytes satisfied the validation criteria of Thompson Equation.

Determination of food colours in processed fishery products

HPLC based method was standardized for the determination of FSSR approved food colours in various fish and fishery products. The method developed can simultaneously estimate a host of food colours, viz. Ponceau 4R, Sunset yellow FCF, Allura red AC, Brilliant blue FCF, Fast green FCF and Indigotine (Indigo carmine) using a reversed-phase C18 column.

Determination of cypermethrin residue in dried fish samples

Chromatographic separation of cypermethrin was achieved with a reversed phase C18 column. Dried fish samples collected from various markets of Kerala indicated presence of cypermethrin in 73% samples at a level of 1.97-7.23 µg/g. Among the detected positive dried shrimp and shark were found to be having very high level of contamination (7.03-7.23µg/g).



Chromatogram of 40 µg/l matrix matched cypermethrin standard

Development of methods and estimation of adulterants (ammonia, benzoate etc.) in fish and fishery products

Methods were developed for determination of ammonia and TVBN in fish and fishery products as per ISO 17025. The methods developed had good linearity with R^2 0.98 and 0.99, respectively and the average recovery was 80.88%. Similarly, the method verification for TVBN (steam distillation method) was also done. The accuracy and precision were analyzed and the average recovery was 86.77%.

Safety and quality of Ready to Eat fishery products

Fish and squid pickles collected from supermarkets of Ernakulam were analyzed for pH, water activity, acidity and salt content. The pH was in the range of 4.01-4.48, a_w was 0.881-0.904 (for solid pieces alone), acidity between 0.91-1.12%. As per FSSAI vertical standards for fish and fisheries products, the acidity as acetic acid of the fluid portion of fish pickles should be 2.5-3.0% and the analyzed samples were found not complying with the FSSR requirements for acidity of fish pickles.

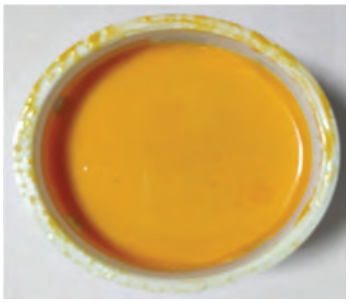
Monitoring of Ciguatoxin in coral reef fishes

During this period, different fish and fishery products procured from Kerala, Karnataka and Gujarat region were tested for presence of ciguatoxin using mouse bioassay. None of the samples were found positive for this significant biotoxin.

Hygiene status of significant contact surfaces in selected retail fresh fish outlets

Mesophilic microbial concentration ranged from 3.01-5.10 log CFU/cm^2. Enterobacteriaceae varied from 1.71-2.9 log CFU/cm^2. This was found to be 46-75% and 53-85% of Mesophilic microbial concentration. Total coliforms varied from 0.60-1.9 log CFU/cm^2. Which was 16-63% of mesophilic microbial concentration. Among the different contact surfaces under study, highest fecal *Streptococci* concentration was found to be on weighing balance. Highest concentration of total coliforms and coagulase positive *Staphylococci* were observed on workers' hands. *L. monocytogenes and Salmonella* could not be detected from any of the surfaces studied. In the supply chain, none of the samples showed the presence of enterotoxigenic *Staphylococcus, Salmonella, V. cholerae and L. monocytogenes*.

Development of seaweed supplemented bioactive yoghurt



Fucoidan was extracted from *Sargassum wightii*, and a comparison was made between hot water extraction (HWE) and ultra-sonication extraction (USE) methods. The USE method gave higher yield and lighter coloured fucoidan than HWE method. The sulphate content was similar in both fucoidans. However, HWE fucoidan had higher content of fucose. The Fourier transform infrared spectroscopy spectra confirmed the presence of sulphate groups in both the fucoidans. Ultra-sonication was found to be an effective alternative for the extraction of sulphated polysaccharide from seaweed, in terms of higher yield.

Yoghurt preparation trials were conducted in collaboration with Milma Products Dairy, Edappally, Ernakulam at pilot scale by incorporating fucoidan extracted from Sargassum at various concentrations. Incorporation of seaweed as such resulted in sediment formation, while fucoidan incorporation did not alter the organoleptic qualities negatively. Combinations of various flavours viz., caramel toffee, banana, mango, blueberry, pineapple, boost, Spanish delight were tried in yoghurt for better sensory acceptability. The yoghurt samples were liked 'very much' on 9-point Hedonic rating. Commercialization formalities of the product have been initiated withMilma Diary, Ernakulam.

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

Heavy metals in fishes and shellfishes along Saurashtra coast

Cadmium content in cuttle fish collected from Okha, Porbandar & Veraval, Gujarat were analysed. Out of seven samples, cadmium content in 5 samples exceeded the maximum permissible levels. As per Europen Union Regulation (EC) 466/2001 and directives 2001/22/EC the maximum permissible level of Cadmium for the bivalve molluscs and cephalopods is 1.00 ppm. The cadmium levels of cuttle fish samples ranged from 0.52 – 2.61 ppm.

LCMS/MS method standardised for detection of Antibiotics

A method was standardized for the quantification of chloramphenicol from shrimp matrix. The mass spectrometer was operated in the negative ion mode SRM (selected reaction monitoring). Dual ion source (DIS) Electrospray ionization (ESI) were opted for ionization. Methanol and water was used as mobile phase and LC time was programmed. Flow rate was maintained at 0.300 ml/min.The precursor ion at m/z 321 yielded four product ions m/z 152.10, 257.10, 176.10 and 194.10. Q1 voltage, Collision energy and Q3 voltage were fixed for each m/z. The peak area of the m/z 152 peak was used for quantification.

CAPD was used as internal standard and calibration curve was made with 6 different concentrations of chloramphenicol (0.01 ppb, 0.02 ppb, 0.05 ppb, 0.1 ppb, 0.5 ppb and 1.0 ppb). Linearity curve was observed with r^2 value of 0.9999. For system suitability, each concentration was run 6 times and the results were validated.

Quality assessment of ice used for fish preservation in Gujarat

A study was carried out to evaluate the quality of ice used for fish processing at different nodal points of Veraval, Gujarat. Samples such as water used for making of ice, ice from ice plant, landing centre and fish hold were collected and microbiological parameters such as APC, psychrophilic bacterial count, total coliforms, fecal coliforms, *E. coli* and *Listeria monocytogenes* were analyzed. APC of water used for ice manufacturing was 3.87 log cfu/ml and that of ice in the ice plant was 2.6 log cfu/ml. It was observed that ice at the landing centre had an APC of 3.68 log cfu/g, while ice in fish hold had an APC of 4 log cfu/ml, which was above the acceptable limit. Total coliform bacteria and faecal coliform bacteria was found in all the ice and water samples. *E. coli* was found in all the samples except the ice from ice plant. *E. coli* O157:H7 was not detected in any of the samples. Physico-chemical analysis of ice samples revealed that total hardness and total alkalinity was 258 and 211mg/l, which were above the acceptable limit of 200 mg/l. Other parameters such as iron (0.3 ppm), chlorides (77.9 mg/l) and total dissolved solids (390mg/l) were within the acceptable limits.

Documentation of different ribbon fish processing methods in Gujarat

Four different size grades, viz., 100-200, 200-300, 300-400 and grater than 400 g of ribbon fish, processed in frozen form, are packaged by individual wrap or bulk packing. 84.2% of whole frozen product is exported to China and 15.4% to Vietnam. The low quality or the ribbon fishes that are rejected were sold for surimi processing or dry fish processing through commission agents.

Drying of ribbon fish

Surimi processing of ribbon fish

Marketing channels of ribbon fish

Ribbon fish is a major finfish commodity in Veraval, Gujarat. The first stage of ribbon fish marketing is in landing centres. The marketing of the landed ribbon fish is done by 150 commission agents/wholesalers/suppliers, who exclusively do trade of only ribbon fish. The wholesaler, who secure fairly large quantities of ribbon fish fix the

price based on the size and quality for seafood processing. The ribbon fish that are weighed in landing centres are transported through chakkada to the seafood factory for freezing or surimi processing. The wholesalers, who secure lesser quantity of fish through auction sell them for dry fish processing and fish meal processing.

The main channel of ribbon fish trade in Gujarat is the landing centre to wholesaler/commission agent/supplier to processor. The internal consumption of ribbon fish in Gujarat is very less.

Virulence Gene Profiling and Pathogenicity Characterization of Non-Typhoidal Salmonella isolated from seafood

The prevalence of 12 virulence genes associated with *Salmonella* (n=94) isolated from seafood were studied. The *Salmonella* isolates were confirmed based on biochemical tests and the presence of *inv*A gene. The prevalence of virulence genes that were associated with Salmonella Pathogenicity Islands (SPIs) in the isolates were *hil*A (*SPI-1*) (98.93%), *marT-SPI-3 (94.68%), mgtC (92.55%), orfL-SPI-4 (97.87%), spiC-SPI-2 (95.74), ttrC-SPI-2 (90.42%), misL-SPI-3 (73.40%), pipD- SPI-5 (58.51%), Bacteriophage sodC (30.85%) and gogB (27.65%) and sopB (15.95%)*.

Antibiotic susceptibility assay of Salmonella isolated from seafood

To determine the antibiotic resistant profile, ninety four isolates of *Salmonella spp.* isolated from seafood were subjected to disc diffusion assay. A total of 19 panel of antibiotics representing 8 different classes of antibiotics including Aztreonam (AT) 30 µg, Ampicilline (AMP) 10 µg, Ceftriaxone (CTR) 30 µg, Ciprofloxacin (CIP) 5 µg, Nalidoxic Acid (NA) 30 µg, Cefuroxime (CXM) 30 µg, Ceftazidime (CAZ) 30 µg, Cefpodoxime (CPD) 10 µg, Cefotaxime (CTX) 30 µg, Cefoxitin (CX) 30 µg, Tetracycline (TE) 30 µg, Trimethoprim (TR) 5 µg, Chloramphenicol (C) 30 µg, Ertapenem (ETP) 10 µg, Imipenem (IPM) 10 µg, Meropenem (MRP) 10 µg, Colistin (CL) 10 µg, Co-Trimoxazole (COT) 25 µg, Piperacillin/tazobactom (PIT) 100/10 µg were tested for antibiotic sensitivity. A total of 56 (59.68%) Salmonella isolates were sensitive to all the antibiotics tested. Out of 38 isolates that were resistant to at least one antibiotic, 7 (18.42%) isolates has shown MDR.

Microbiology, Fermentation and Biotechnology

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.

Externally funded projects

- National surveillance programme for aquatic animal diseases
- Diagnostics for one health and user driven solutions for AMR (DOSA)
- 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 (NEOSTAR)*
- Network programme on assessment of antimicrobial resistance (AMR) in microorganisms associated with fisheries and aquaculture in India (INFAAR)
- Evaluating costs and benefits of prophylactic health products and novel alternatives on smallholder aquaculture farmers in asia and africa (IMAQulate)
- Screening lytic phages from diverse marine and aquatic niche for controlling bacterial pathogens associated with aquaculture and post-harvest fish quality

Most significant achievements

- Selectivity of colororimetric and paper strips was validated against nine pathogenic bacteria for detection of *E. coli* O157:H7and *L. monocytogenes*. Based on the testing, substrate X-INP was found selective to pure enzyme phosphatidylinositol-specific phospholipase C (PI-PLC).
- *Vibrio mimicus* was isolated from seafood in retail markets of Ernakulam and the prevalence in retail seafood seen at 5.5%. Total 44 isolates from 11 different samples positive for *V. mimicus* and all the *V. mimicus* isolates harbored hemolysin *Vmh* gene
- The multidrug resistance (MDR) was observed in 95 *E. coli isolates* against 26 antibiotics. Among them 14.73% isolates were exhibiting phenotypic resistance to ampicillin and tetracycline by harboring *amp*C and *TetA* genes. Ten *E. coli* out of 95 isolates having of H7 antigen (625 bp).
- Baseline assessment of antimicrobial resistant (AMR) pathogens profile of aquaculture settings in Kerala was established and the pilot sequencing was carried for 50 number of AMR pathogens.

- Studies confirmed existence of phylogenetically similar isolates of *V. alginolyticus* and *V. parahaemolyticus* in the aquatic environments.
- *Bacillus subtilis* and *Exiguobacterium profundum* were isolated from aquatic environment and observed that both isolates are have potential keratinolytic activity. Hence, it can be promoted as a safe environmental pro-biotic.
- Zinc oxide nanoparticles (ZnO-NP) were prepared as per solgel method and antimicrobial activity of nanoparticles were checked and observed that zinc oxide nanoparticles are able to destroy the *Chromobacterium violaceum* at low concentration than its original form (Bulk).
- *Plesiomonas shigelloides* prevalence was 4% in fresh seafood samples of Cochin and they exhibited alpha haemolysis on blood agar. Antibiogram profiling revealed100% of the isolates were resistant to ampicillin and amoxyclav.

CHIEF FINDINGS

Institute Projects

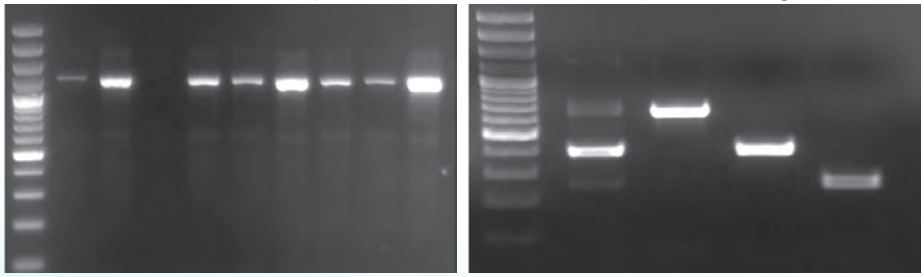
Occurrence, distribution and molecular characteristics of emerging and re-emerging pathogens in seafood and its environment

Characterization of CTX-M group1 resistant ESBL-producing E. coli from Cochin market fish samples:

The present investigations revealed that 69.86% of the samples were positive for ESBL producing *E. coli.* All the strains were multidrug resistance (MDR). These isolates were screened for ESBL genes by multiplex PCR with CTX-M group 1, 2 , 9 & 25, TEM, SHV and OX genes. Out of 220 ESBL producing *E. coli* screened, majority of the strains harbored the CTX-M group 1 gene, 17.27% of them were TEM, and 8.18% were OX gene. These ESBL *E. coli* strains showed a higher level of AMR to cefotaxime, cefpodixime, aztreonam, ceftazidime and ceftriaxone in addition to the penecillin. Whereas, 64.15% and 28.30% of the strains had the combination CTXM-1 with TEM, OX and CTXM-1 with OX genes respectively. Only 3 strains (5.66%) out of 220 harbored all the three genes viz., CTX-M 1, TEM and 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 or animal habitation.

Screening of Arcobacter Species

A total of 52 samples were screened for the presence of Arcobacter sp. Among them 18 numbers were positive for Arcobacter sp. Molecular characterization was carried out by genus specific PCR. Optimization of PCR conditions was carried out for *cadF*, *ciaB*, *cj1349*, *mviN*, *pldA and tlyA* virulence genes of Arcobacter. 13 isolates harbored cadF among 33 isolates of *Arcobacter butzleri*. Similarly, 7 isolates harbored ciaB, 5 isolates harbored cj1349, 8 isolates harbored mviN, 3 isolates harbored pldA and 7 isolates harbored tlyA virulence genes in *Arcobacter butzleri*.



Genus specific PCR for detection of *Arcobacter sp* (1200 bp)	Multiplex PCR for detection of Arcobacter sp *Arcobacter butzleri* (401 bp), A. skirrowii (641 bp) and *A. cryaerophilus* (257 bp)

Detection of Arcobacter by genus and species specific PCR

Screening of antibiotic resistance bacteria from shrimp aquaculture farms:

Antibiotic resistant heterotrophic bacteria were isolated from sixty shrimp *(P. vannamei)* farms located in four districts of Andhra Pradesh. Soil, water and shrimps were aseptically collected and isolation of bacteria was carried by standard microbiological techniques. 208 isolates of Gram positive rod shaped bacteria have screened for the antibiotic resistivity against five antibiotics. Based on conventional biochemical tests 208 isolates were identified as *Bacillus pasteurii, Bacillus sphaericus, Bacillus brevis, Bacillus circulans, Bacillus alcalophilus, Bacillus panthothenticus, Bacillus polymyxa, Bacillus licheniformis, Bacillus alcalophilus, Bacillussubtilis.*

Prevalence of V. alginolyticus:

A total of 92 seafood (comprising fish, shellfish) and water samples from different brackish water farms, and landing centres of Cochin were screened for *V. alginolyticus*. The prevalence of *V. alginolyticus* in the screened samples was around 13.04%.

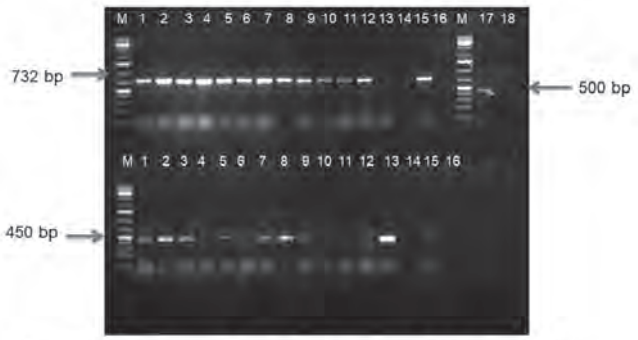


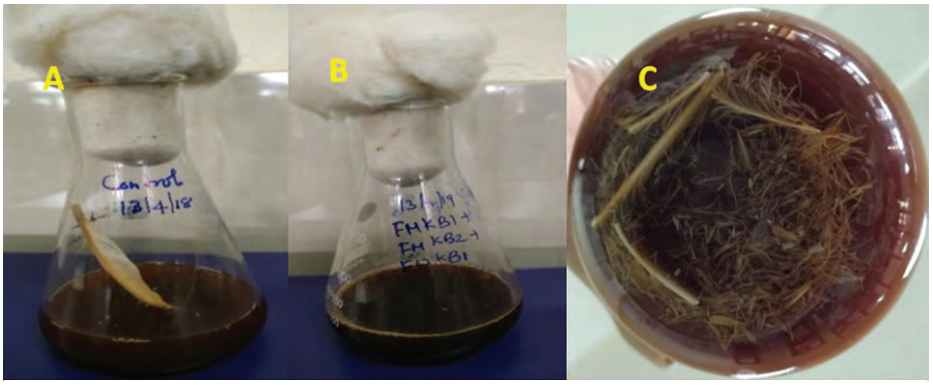
Figure 1: Detection of *collagenase* gene (732 bp), amplification of *trh* gene (500bp), *tlh* gene (450bp) in f *V. alginolyticus* isolates. Lane M: DNA ladder (100 bp plus), Lane1: Positive control; Lane 2-16: *V. alginolyticus* isolates from different samples. Lane 17: Positive control, Lane 18: *V. alginolyticus* isolate (ISL D3)

Molecular Diversity of pathogens associated with aquatic systems and harnessing aquatic niche for beneficial bacteria or products

Assessment of AMR burden in E. coli isolated from Vembanad Lake: Vembanad Lake of Kerala, a biologically diverse and largest lake in India was assessed for *E. coli* prevalence and AMR. Water samples (n=35) were drawn at different geographical locations of the Lake (90 km) and 27 of the locations harboured *E. coli* further confirmed by PCR (*uidA* and *phoA* genes). AST performed on 116 for 14 antibiotics revealed that the probability of getting cefotaxime resistance in Vembanad Lake in *E. coli* was highest. Even though AMR in Vembanad Lake was observed for *E. coli*, estimated Ecoff and MAR index has provided the evidence for more WT strains in the Lake than resistant and "low risk" to the population in the vicinity of the Lake.

Development of mPCR for detection and differentiation of Staphylococci from fishery environment: Seven primer sets were designed and synthesized for developing mPCR assay. The annealing and PCR cycling conditions were optimized for 4- 5 primers in multiplex PCR format for the detection and differentiation of MRSA, MR-CoNS, MR-CoPS from seafood. Standardization is being carried out for 5th & 6th primers.

Isolation of keratinolytic bacteria from aquatic environment: Ten poultry waste fed *Pangasius hypophthalmus* farms from Palakkad and Alappuzha districts of Kerala were screened for the keratinolytic bacteria from the aquatic environment. Among 116 proteolytic colonies obtained only 6.9% has shown keratinolytic activity. Isolates FMKB1 and FMKB2 were identified as *B. subtilis* and FWkb1 as *Exiguobacterium profundum* by 16s rRNA sequencing.



A) Control feather flask, B) Feather degraded in the flask by keratinolytic bacteria, C) Feather degraded in Agar plates

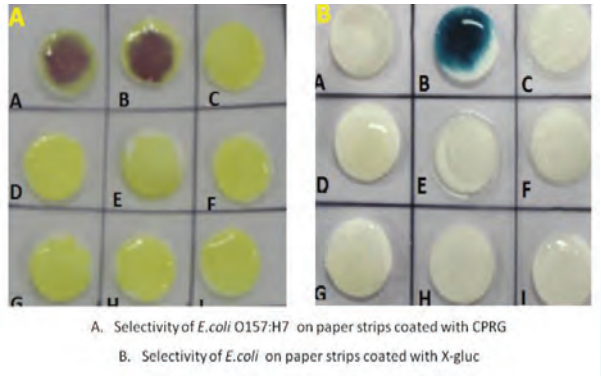
Keratinolytic activity of the isolated bacteria

Protein profile of V. cholerae: The protein profile of tetracycline sensitive *V. cholerae* isolated from cultured *Oreochromis mossambicus* (VC1) was compared with the tetracycline resistant *V. cholerae* isolate recovered from *P. monodon*(VC2) using sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS PAGE). The results from the present study showed comparable difference in the expression of *ompW* protein of sensitive *V. cholerae* isolate under different tetracycline stressed conditions.

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

Optimization of paper strips for detection of E. coli and E. coli O157:H7

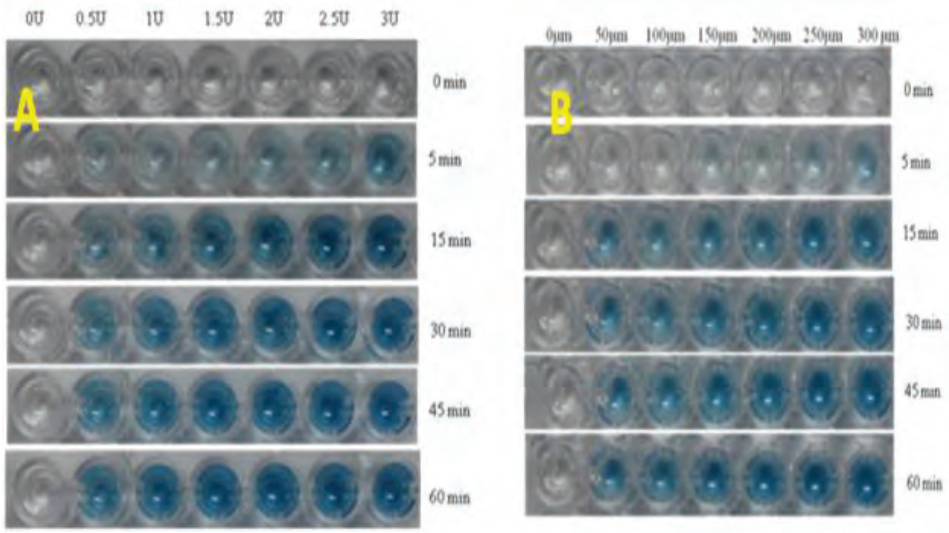
For the colorimetric assay, substrates CPRG & X-gluc were selective to pure enzymes β- galactosidase & β glucoronidase of *E. coli* O157:H7 and *E. coli* respectively. Specificity of paper strips for detection of *E. coli* and *E. coli* O157:H7 was carried out by both plate and paper strip methods. Results indicated that this X-gluc and CPRG had high specificity toward *E. coli* and *E. coli* O157:H7, respectively.



A. Selectivity of *E.coli* O157:H7 on paper strips coated with CPRG
B. Selectivity of *E.coli* on paper strips coated with X-gluc

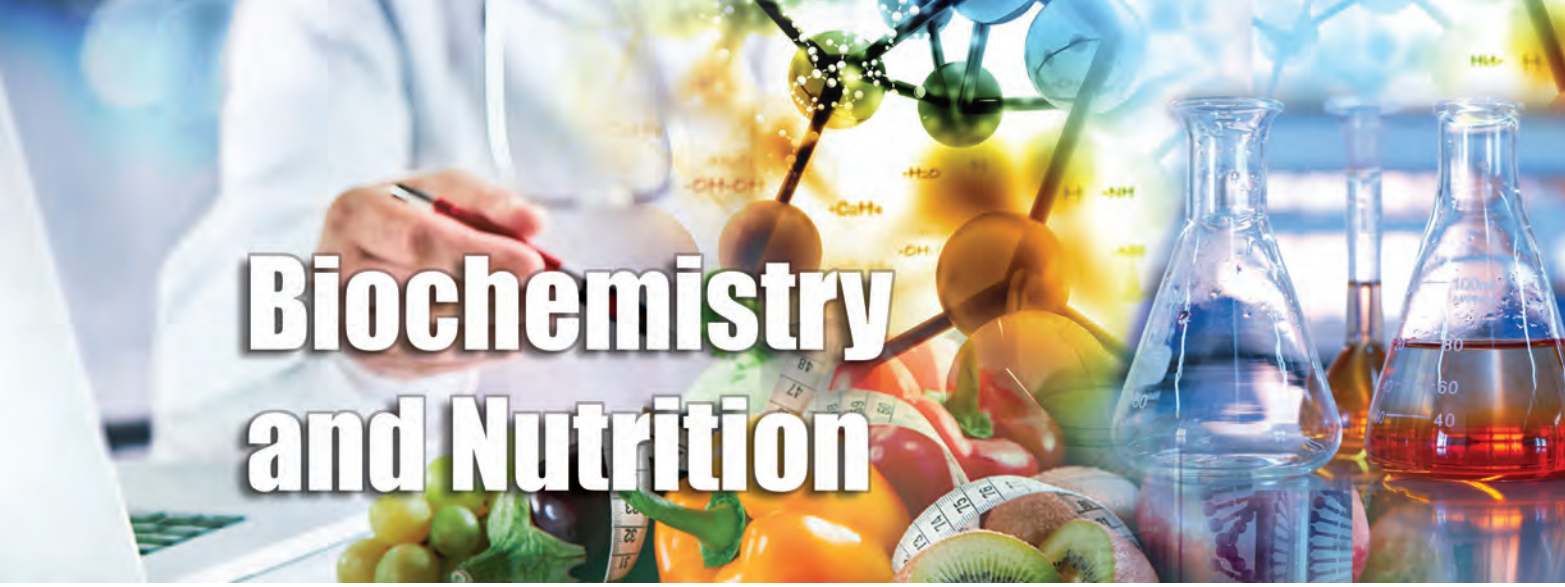
Selectivity of nano-biosensor strips *for E. coli* O157:H7 and *E. coli*

Optimization of pure enzyme, substrate, time interval and nano particles for colorimetric assay for Listeria monocytogenes. Trials on development of rapid colorimetric detection method for *Listeria monocytogenes* was carried out. Initially, the concentration of pure enzyme, substrate and time interval was optimized separately. Prominent colour formation was observed from five min onwards.



A. Selectivity of *E.Coli* O157:H7 and *E.coli* in colorimetic assay coated with CPRG and X-Gluc Optimization
B. Specific volume of pure enzyme (PI-PLC-1.5U)

Specificity of paper strips for detection of E. coli, E. coli O157:H7 and Listeria monocytogenes Specificity of paper strips for detection of *E. coli, E. coli* O157:H7 and *Listeria monocytogenes* was done by both colorimetric and paper strip methods against nine bacterial pathogens. Both *E. coli* O.157 and *E. coli* showed production of β-galactosidase in colorimetric assay as well as on paper strips coated with CPRG, while all other pathogens failed to produce colour. Similarly, *E. coli* showed production of β-glucuronidase in colorimetric assay as well as on paper strips coated with X-gluc, while all other pathogens failed to produce colour. Also, *L. monocytogenes* showed production of PI-PLC in colorimetric assay as well as on paper strips coated with X-INP, while all other pathogens failed to produce colour. These results indicated that this CPRG X-gluc and X-INP had high specificity for detection of *E. coli* O157:H7 *E. coli* and *L. monocytogenes* respectively.



Biochemistry and Nutrition

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
- Evaluating FTIR spectroscopy and chemometric models in high-throughput authentication of species and geographical origin of shrimp

Externally Funded Projects

- Determining seasonal and spatial occurrence of multiclass endocrine disrupting chemicals in the fishes, crustaceans and mollusks of the Vembanad urban estuary: risk assessment by an untargeted metabolomics approach
- Establishing value chain for fish: towards nutritional security for rural population
- Biomodulation of marine biopolymers for the preparation of biomaterials of healthcare importance

Most Significant Achievements

- A sustainable extraction protocol was developed for isolation of phlorotannins from brown seaweed, *Padina gymnospora* using supercritical carbon dioxide as the major solvent.
- Sodium alginate based multiple emulsion was developed for simultaneous delivery of squalene, vitamin D3 and green tea extracts.
- The chitosan nanoparticles-grafted fish gelatin based bio-nanocomposite membranes developed revealed higher porosity and swelling index properties.
- Gelatin obtained from tuna skin waste showed characteristic molecular weight and relatively high hydrophobic amino acids and imino acids contents and formed a completely thermo-reversible gel.
- Green tea extract with a significant content of phenolic compounds effectively controlled lipid oxidation rate and maintained the stability of squalene and vitamin D based microparticles
- Moringa bark extract obtained by supercritical extraction was used for development of anti-inflammatory bandage in combination with low molecular weight chitosan
- Therapeutic potential of PUFA-enriched fish oil was established in an in vivo rat model of rheumatoid arthritis induced by Complete Freund's Adjuvant.

- Significant rise in the hemoglobin content of anemia-induced rats was observed in rats supplemented with an indigenous iron source.
- Carbon nano-dot incorporated ulvan gel exhibited high antimicrobial activity.
- Acetylated ulvan was developed and structurally characterized by FTIR and particle size and zeta potential determined.
- Feeding trials with combination of chitosan, vanillic acid and crude seaweed extract showed influence on the growth performance of Labeo rohita fingerlings.

CHIEF FINDINGS

Institute Projects

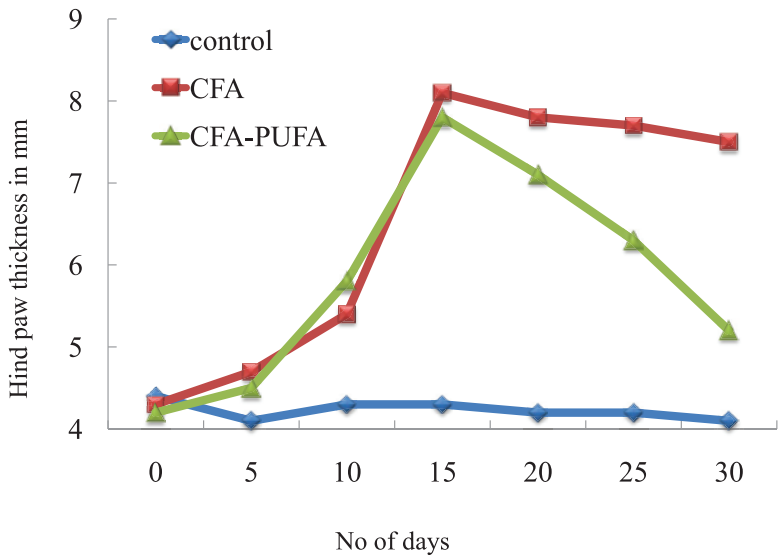
Seaweeds of Indian Coast as Source of Bioactive Compounds for Developing Nutraceuticals/ Functional Foods

Fucoxanthin is a marine carotenoid compound present in brown seaweeds with numerous health care importance. Amount of fucoxanthin in each SFE fraction was in a countable amount when compared to the conventional solvent extracts in the previous studies. The antioxidant analyses through *in vitro* and *in vivo* methods have been done. For the examination of antioxidant activity total phenolic content, total flavonoid content, total antioxidant and radical scavenging analyses such as ABTS and DPPH were also performed. The results show that fucoxanthin is having excellent antioxidant efficacy. Remarkable changes were obtained in the level of antioxidant enzymes in the studied animal model tissue samples. The excellent free radical scavenging ability of fucoxanthin assures effectual protection of living systems from adverse effect of oxidative stress.

Novel Bio-Molecules for Food and Nutraceutical Applications from Marine Resources

PUFA-enriched fish oil demonstrated effective activity in lowering the progress and acuteness of arthritic disease in CFA rats. Following treatment with PUFA-enriched fish oil, plasma levels of the pro-inflammatory cytokines; interleukin -1β, IL-6 and tumor necrosis factor α (TNFα) were markedly lower when compared to CFA-untreated rats. Results also revealed an increase in anti-inflammatory cytokines IL-2 and IL-10 in PUFA-enriched fish oil treated arthritic rats in comparison to untreated arthritic rats. Lowered levels of pro-inflammatory cytokines and raised levels of anti-inflammatory cytokines in arthritis induced rats treated with PUFA-enriched fish oil correlated with a reduced expression of TNFα, Il-1β and IL-6 and enhanced expression of IL-2 and IL-10 in paw and joint homogenates of treated rats.

Control *CFA* *CFA + PUFA rich Fish oil*



Use of biomolecules to enrich foods for addressing malnutrition-Effect of sodium iron EDTA on blood parameters in albino rats induced with anaemia: A significant rise in the hemoglobin content of anemia-induced rats was observed in rats supplemented with SIE with higher level noticed in rats administered higher dose of sodium iron EDTA (SIE).

The efficiency of various solvents, viz, super critical carbon dioxide modified with ethanol and conventional food grade solvents such as absolute ethanol, 60% ethanol and 40% ethanol, in extracting bioactive compounds from Moringa bark (*Moringa oleifera*) was analysed. Bioactivities of Moringa bark extract was assessed in terms of total phenolics, total antioxidant activity, Fe2+ reducing power and DPPH. Among the various solvents used, supercritical carbon dioxide with ethanol was found to be significantly effective in obtaining moringa bark extracts with highest total phenolic, total antioxidant activity, FRAP and DPPH activity. 60% ethanol and absolute ethanol was found to be the superior conventional solvents in extracting bioactive compounds from Moringa bark. If we are considering the combined activities of chitosan and moringa bark extract, it was noticed that the antioxidant and scavenging activities (TPC, TAA, DPPH and FRAP) were very high in low molecular weight chitosan incorporated with the extracts obtained by SFE and 60% ethanol extraction.

The significant findings of the present study showed the promising potential of supercritical carbon dioxide modified with ethanol as an effective solvent for obtaining antioxidant rich moringa bark extracts. The shorter extraction time of SFE (2h) when compared with the conventional methods (72 h) makes it a more sustainable method. Among the conventional solvents, 60% ethanol was found to be the most effective solvent for obtaining *Moringa oleifera* extract in terms of the total antioxidant activity, ferric reducing power and total flavonoid content. If we are considering the combined activities of chitosan and moringa bark extract, it was noticed that the antioxidant and scavenging activities (TPC, TAA, DPPH and FRAP) were very high in low molecular weight chitosan incorporated with the extracts obtained by SFE and 60% ethanol extraction. So the development of anti-inflammatory bandagewas in process by incorporating low molecular weight chitosan and moringa bark extract.

Evaluating FTIR Spectroscopy and Chemometric Models in High-throughput Authentication of Species and Geographical Origin of Shrimp

Seafood fraud is a socially and economically important global problem. Mislabelling of seafood species is ubiquitous in seafood trade. The developed analytical method will be useful in high-throughput screening of shrimp species and origin. This can drastically reduce the number of samples taken forward for further lengthy confirmatory analysis thus saving time and money. Development and validation of FTIR spectroscopy assisted chemometrics models for authentication of species and geographical origin of shrimps, and evaluation of the prediction capability of the developed models using test shrimp samples were attempted.

We have successfully developed FTIR based rapid methods of confirmation of species identity of commercially important shrimps. The methods have been validated with independent test samples, and should be a deterrent for economically motivated mislabelling in shrimp trade. We have also developed a FTIR based rapid method for rapid identification of Methicillin resistant *Staphylococcus aureus* and pathogenic Vibrio species. The methods developed can be used for rapid screening for detection of seafood fraud and safety.

Engineering

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

Externally funded projects

- Design and development of hot air assisted continuous Infrared drying system for high value fish and fishery products
- Green, clean and affordable energy for fishermen community: Development of a multipurpose solar thermal conversion system with gasifier/biomass heater backup

Most significant achievements

- Collected and analyzed real time data of energy and water consumption of selected seafood industries located at Kochi. Standard protocols and operating procedures were prepared with specific suggestions for different seafood plants.
- Portable, non-destructive and rapid fish freshness detection sensor for Indian Mackerel was developed and validated using market samples.
- Performance evaluation of low-cost energy efficient walk-in type solar tunnel dryer was completed.
- Designed and developed less emission biomass dryer for fish.
- Designed a trolley based solar-electrical dryer (40 kg) with phase change material and desiccant dehumidifier system.
- Silica gel adsorption setup was designed for solar based chilling system.
- Design for solar based aerator and feed dispensing system was completed.
- Fabrication work of prototype of hot air assisted continuous IR system is under progress.
- Designed a hybrid photovoltaic thermal system (PVT) for co-generation of electricity and hot water.

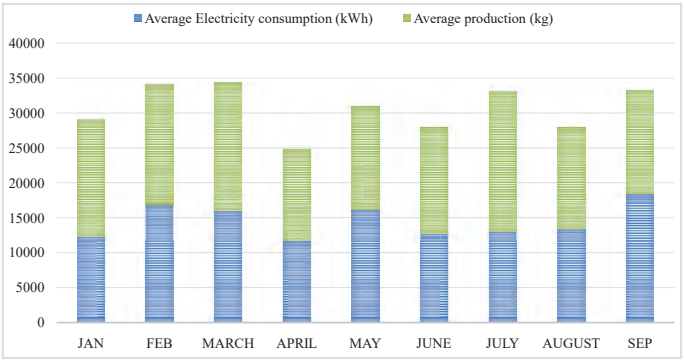
CHIEF FINDINGS

Institute Projects

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

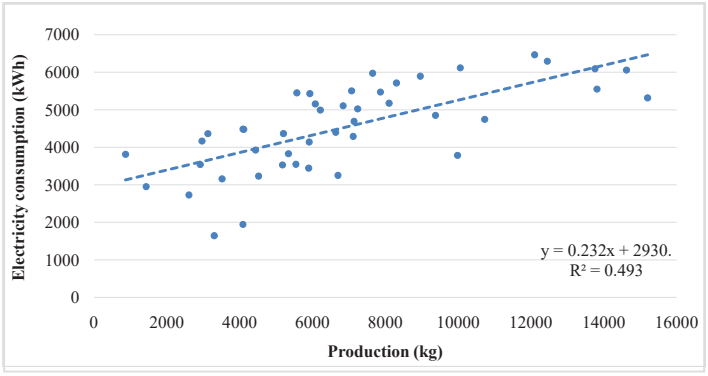
Energy usage - Data collection

Real time energy use data was collected using a customized hardware-software system - Remote Energy Optimization & Sustainability Services (REOSS) developed by the research partner, Datamatrix Pvt Ltd., Pune. The data on production and energy consumption was collected from all three selected seafood processing industries (I, II, III) located at Kochi.



Monthly average energy consumption against production (Industry- II)

Energy usage -Data analysis

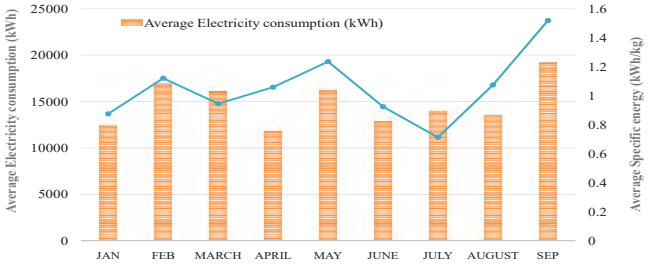


Energy consumption against production (Industry I)

Information on energy usage, production level, and equipment details were collected form the industries. The collected data was analysed to assess the specific energy consumption and then to fix an optimum energy usage level on a monthly basis depending on the type of seafood and process adopted. The fluctuation in specific energy helped in monitoring the unusual practices which result in higher energy consumption in the plant especially in the refrigeration process. The analysis revealed that energy usage with respect to production exhibited significant scattering, hinting huge wastage of energy in these industries. Further, it was observed that the use of blast freezers mainly resulted in higher energy consumption. It is suggested to replace conventional direct contact type condensers with evaporative type condensers.

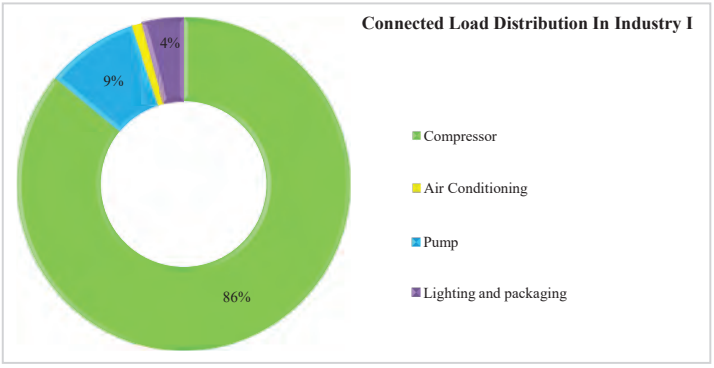
Distribution of connected load in industries

The equipment details were collected from selected seafood industries for the analysis of load distribution and accordingly the distribution



Average specific energy consumption against month of production (Industry III)

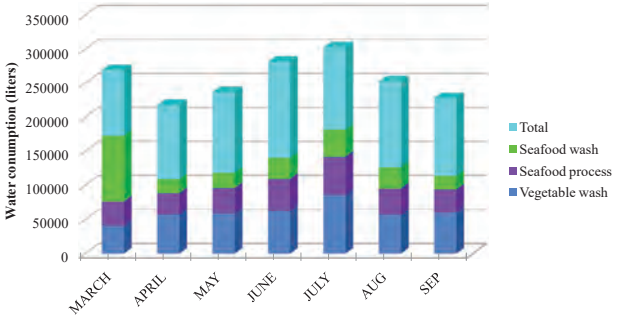
of connected load among various operations were calculated. This will help in designing specific energy saving procedures and monitor the real time energy usage in seafood plants.



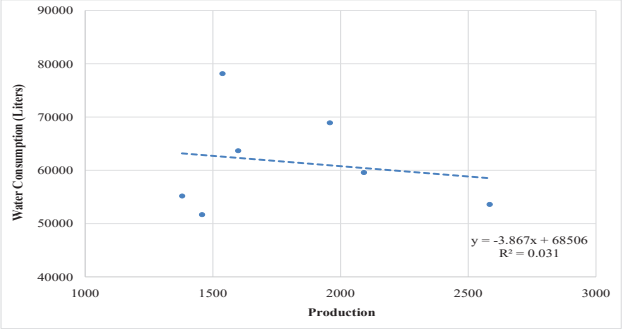
Distribution of connected load (Industry I)

Water use data – Collection and analysis

The real time data on water consumption and corresponding production was collected from Industry III using water meters. The monthly water consumption for seafood wash, seafood process and vegetable wash were plotted. The production versus water consumption graph revealed that there is a high need of optimizing the water consumption since the amount of water consumed was not in consonance with the production level. Also, there was a huge fluctuation in monthly water consumption pattern. Hence it is decided to install solenoid valve which automatically controls the water flow rate based on the loaded capacity of materials and type of process.



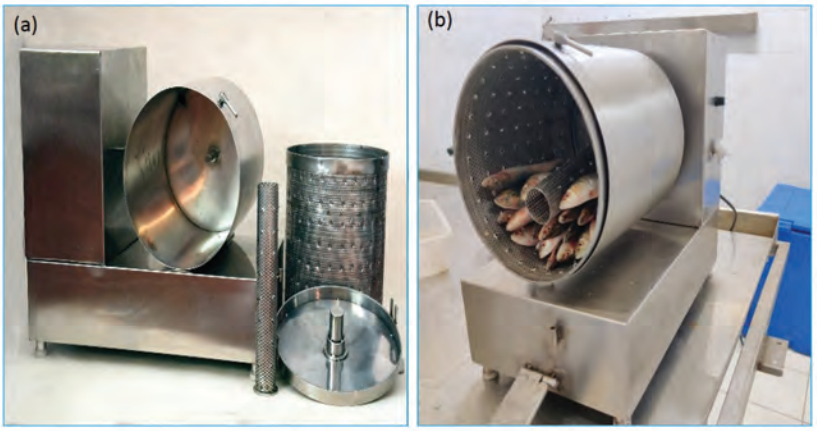
Details of monthly total water use pattern for various purposes (Industry III)



Monthly water consumption against production (Industry III)

Design and 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, motor and frame to support the assembly. One stainless steel mesh of diameter 210 mm and length of 250 mm is placed inside the drum which is detachable. Descaling machine can be loaded with 1 kg of fish per batch for effective removal of scales.The system is ergonomically designed in such a way that even women can work on it without any drudgery. The performance of the machine was evaluated using sardines and the descaling efficiency of 71.4% and 63.15% was obtained for the fish loading of 0.5 kg and 0.75 kg, respectively in 6 min.



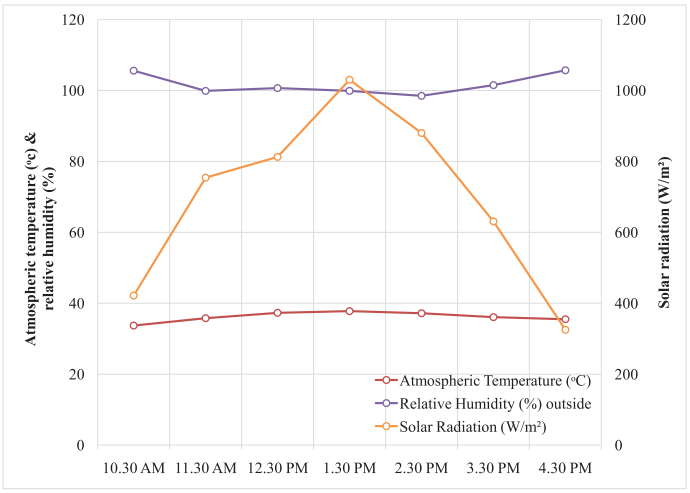
Photograph of mini fish descaling machine (a) and with sardine fish (b)

Fish freshness sensor validation study

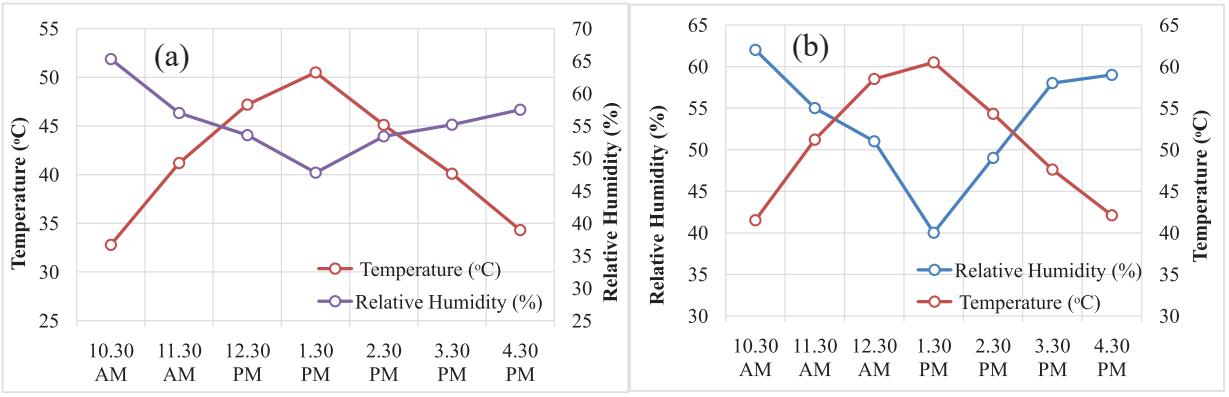
Random samples of Indian mackerel were collected from local fish markets for the validation study of fish freshness sensor. Initially, the quality of the fish was assessed using sensor and the output (extremely fresh, fresh, spoiled) was cross checked with lab analysis (K- value andpsychrophilic count) and sensory assessment. In the sensory evaluation, panel members evaluated the fish for skin and eye appearance, gill colour, texture, blood on gill cover and belly, and odour. It was observed that the sensor device results were precisely matching with the quality analysis results by appropriately categorizing the samples. The sample received sensor output as “Extremely Fresh” recorded K-value of 13.55 – 17.73% and psychrophilic count of 3.56 – 3.69 (Log CFU/g) with the sensory attributes of bright skin colour, transparent eye, bright red gill, firm and elastic flesh, and fresh sea odour.

Performance evaluation of low-cost energy efficient walk-in type solar tunnel dryer

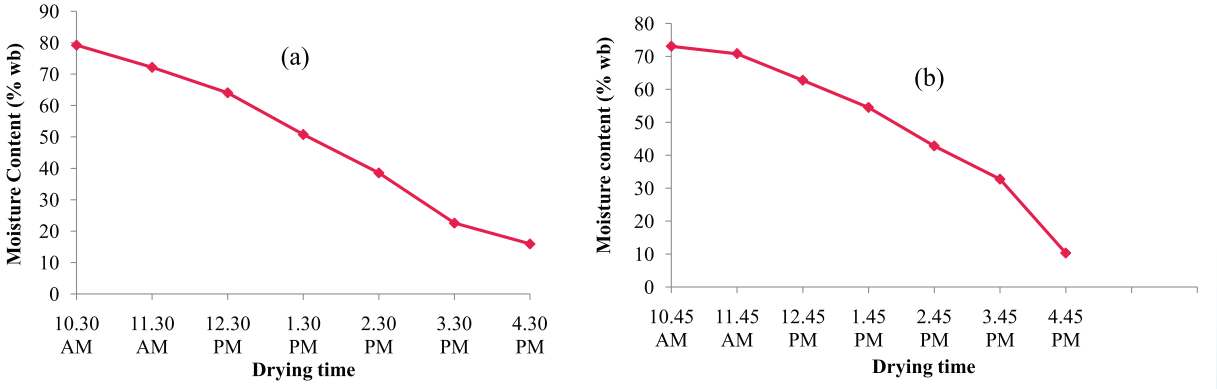
Average solar radiation, atmospheric air temperature and relative humidity were monitored on an hourly basis during the drying experiments and was found to vary from 320-1048 W/m^2, 33.7-37.8°C and 61.3-71.9%, respectively. Under no load conditions, 41.5 - 60°C temperature and 40-62% relative humidity (RH) were attained in the drying chamber. In loaded condition, the temperature and relative humidity in the drying chamber varied between 32.8-50.5°C and 47.8-65.3 %, respectively. The dryer was evaluated using anchovy (*Stolephorus indicus*) (74% MC on wet basis (w.b)) and shrimp (*Metapenaeus dobsoni*) (79% MC (w.b)). The final moisture levels attained were 10.33% and 18.47% for anchovy and shrimp within 6.5 h and 5.5 h, respectively (Figs, 16, 17 and 18). The drying rate curve showed that shrimp drying occurred under falling-rate drying period. Colour and texture of the dried shrimps were highly acceptable.



Atmospheric conditions during drying



Solar tunnel dryer under loaded (a) and no-load conditions (b)



Moisture content against time in solar tunnel dryer for shrimp (a) and anchovy (b)

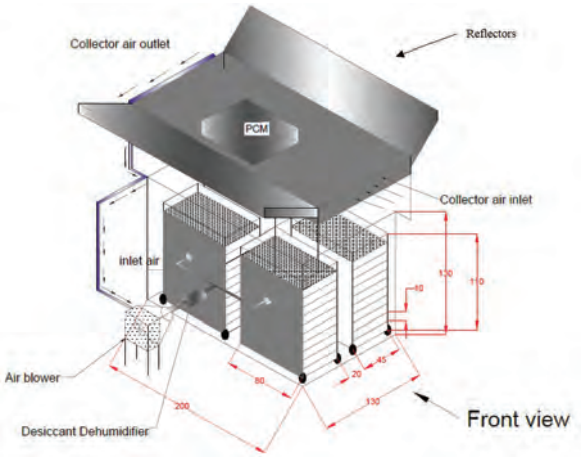
Low emission biomass dryer with drying chamber (a) and Biomass furnace (b)

Design and development of biomass fish dryer

A biomass dryer with low emission was jointly designed and developed by ICAR-CIFT, Kochi and Kuttamthadathil Traders and Manufacturers (Greenguard), Idukki for drying of fish and fishery products. The capacity of the dryer was about 30 to 40 kg depending upon the type of material. The dryer consists of a drying chamber, blower, biomass furnace and hot air recirculatory system. It has ten SS trays in lower bin and one-foot deep upper bin for material loading purpose. The biomass furnace can hold about 25 kg of firewood and is provided with an axial fan of 0.25 hp and temperature sensor for controlling the temperature of drying chamber.

Study on Hybrid PVT system

Hybrid PVT system is a combination of photovoltaic panel (PV) and solar thermal collectors. It is used for the co-generation of electricity and hot water/air heating purposes. It works primarily in the principle that increase in solar intensity decreases electricity generation of PV panel and having water as heat absorbing medium to reduce the heat of PV panel. Literature review was conducted to develop a hybrid PVT system suiting electricity and hot water demands of a small solar hybrid dryer. The design for PVT system is completed and it consists of 100W PV panel, 120 Ah battery and one charge controller, copper tubes, aluminium sheets and temperature sensors.



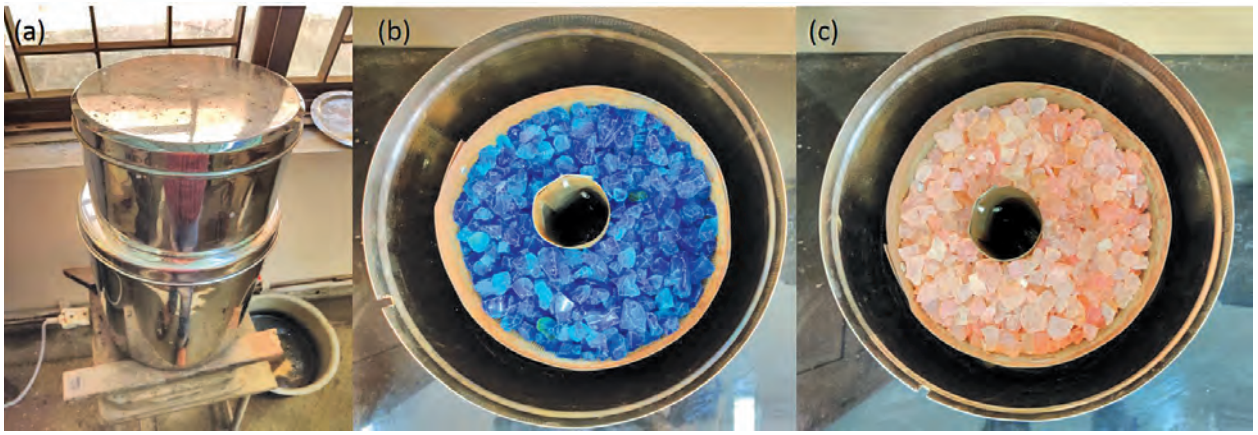
Design diagram of 40 kg solar -electrical hybrid dryer

Design of a trolley based solar-electrical dryer of 40 kg capacity

A trolley mount solar-electrical hybrid dryer of 40 kg capacity was designed. The dryer consists of 40 trays with a tray charge of 1 to 1.5 kg. In this dryer, tray holder (10 trays) can be carried inside the drying chamber with the help of trolleys. Silica gel-based dehumidifier is envisaged in this dryer so as to reduce the relative humidity of the incoming ambient air. Phase change material (PCM) based thermal energy storage also incorporated in this dryer in order to store the excess energy during peak sunshine hours and further use it during low sunshine/ cloudy/rainy days or night. The overall dryer dimension is 130 mm x 200 mm x 130 mm.

Design of silica gel adsorption system

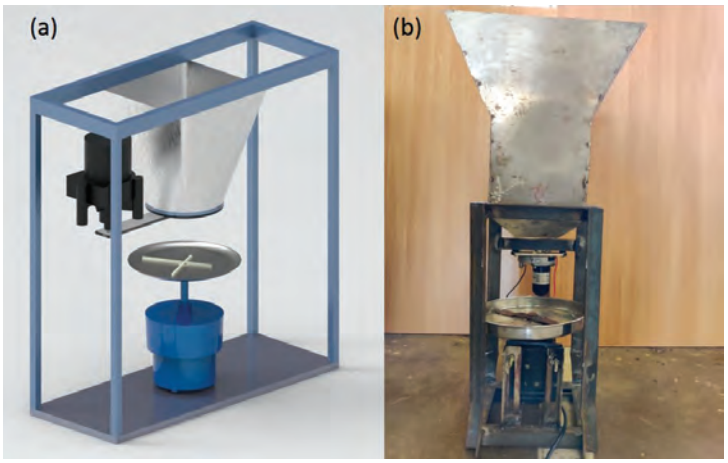
Adsorption refrigeration system coupled with solar system could be an attractive and alternative solution to produce necessary cooling instead of conventional refrigeration system. Preliminary studies on adsorption cooling system were conducted to estimate the water vapor adsorption capacity of silica gel. Solid sorption material such as silica gel and zeolite were used to produce cooling effect. It was found that one kg of silica gel can adsorb water vapor of 16% in its initial weight in 6 h.



Silica gel-based adsorption system (a), silica gel before (b) and after (c) water vapor adsorption

Design of solar based aerator and feed dispensing system

Aquaculture is a growing sector with a great potential towards the contribution of the country's total fish requirement. Serious efforts have been done to develop and improve the production of fish by rearing high value fish in tanks or ponds. The development of an automatic fish feeding machine can be very beneficial to the growth of the aquaculture industry. Design of initial experimental setup of fish feeding system has been done and the fabrication is in progress.



Schematic of fish feeding system (a) and prototype (b)

Extension, Information and Statistics

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
- 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 issues.
- Development and validation of a scale to measure fishers' attitude towards responsible fishing

Externally funded projects

- Development of clam cluster and clam processing facility at Perumbalam Village, Thycatusherry block, Cherthala Taluk, Alappuzha District, Kerala.

Most significant achievements

- The customized overall stakeholder feasibility index (OSFI) was found to be satisfactory for establishing fish based enterprises with technology support and extension network found significant in estimating stakeholders' feasibility.
- Analysis of catch-effort data from Aliyar reservoir using modified surplus production model based on Fox (1970) with incorporated autoregressive error term of lag 1 AR (1) showed better performance than Schaefer model with AR (1) in terms of Mean Absolute Error (MAE), and the MSY and E_{MSY} were estimated as 35.12 MT and 1715 gill nets in the study.
- The efficiency studies on mesh size of gillnet (110mm and 140mm) in the Aliyar reservoir revealed that the fish catch efficiency was high in 110mm than 140mm mesh size.
- The structural changes in the fishery sector in India in terms of value of output increased from Rs 55.3 thousand crores to 106.8 thousand crores during 2004-05 to 2014-15, at a growth rate of 5.3% per year (at 2011-12 prices) in which inland fisheries contribute a growth rate of 6.2% per year and marine fisheries 4.3% per year.
- During the period 1971-2013, the non-food use of fish has increased from 1.6 million tonnes to 6.7 million tonnes; and exports from 0.06 million tonnes to 0.95 million tonnes. The share of non-food use of fishes hovers around 4-10%.
- Knowledge of fish consumers was found to be high with respect to health benefits of fish and fish safety. There was significant difference in dimensions of fish consumers' attitude except in quality and economic dimensions.

CHIEF FINDINGS

Institute Projects

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

Stakeholders' feasibility analysis using Salience model

Stakeholders' feasibility for establishing fish based enterprises was assessed at Kadamakkudy village in Ernakulam, Kerala with emphasis on identification and determination of stakeholders. The stakeholders' viz., end users and service providers were the respondents for the study. The determinants of stakeholders (service providers) was looked into as per Salience model using three attributes viz., power, legitimacy and urgency.

	POWER	LEGITIMACY	URGENCY	TYPOLOGY
Latent Stakeholders				Discretionary stakeholder
				Demanding stakeholder
				Demanding stakeholder
Expectant Stakeholders				Dominant stakeholder
				Dangerous stakeholder
				Dependent stakeholder
Definitive Stakeholders				Definitive stakeholder
				Definitive stakeholder
				Definitive stakeholder
				Definitive stakeholder

For establishing fish based enterprise, end-users (EU) and Self Help Groups (SHGs) were classified as demanding stakeholders. Also, end users, Self Help Groups (SHGs), were the latent stakeholders. While local self-government (village panchayat), activist groups and Co-operative Societies were classified as expectant stakeholders. Four stakeholders viz., Village Higher Secondary School (VHSS), Parents Teachers Association (PTA), Society for Assistance to Fisherwomen (SAF) and ICAR research institute are the definitive stakeholders because of their predominant role in starting and executing the fish based enterprises starting from pre-start up to till implementation and follow-up.

A customized overall stakeholders' feasibility index (OSFI) was developed for assessing the level of stakeholders' feasibility (end users). The end users- stakeholders' feasibility was estimated using five dimensions viz., resource availability, technology support, financial assistance, information source and extension network. Likert scale was followed to measure the attitude or opinions of different stakeholders in a 5-point continuum. The customized overall stakeholders' feasibility index (OSFI) was found to be satisfactory for establishing fish based enterprises. Among other dimensions, technology support, extension network and information source valued high out of which only two dimensions, technology support and extension network were found significant in estimating stakeholders' feasibility.

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

Labour onboard in trawlers and long liners have been surveyed for assessing type and pattern of employment. Aged between 25-50 years in long liners and 35-55 years in trawlers, the crew were from Tamil Nadu, Kerala, Odisha and West Bengal. The number of days of work was 15-30 days for long liners and 5-6 days in trawlers. The wages were 37% of the catch along with Rs 250-Rs.400 as bata in trawlers and in long liners the wage is 40% of the catch along with Rs.250/- as bata. The major reason for migrant fishers working in the sector is the lack of other employment opportunities and for better wages.

Economic evaluation of resource use efficiency and management of reservoir ecosystem

Surplus production models due to Fox (1970) and Schaffer (1954) were used to obtain the maximum sustainable yield (MSY) and optimum fishing effort (E_{MSY}) from Aliyar reservoir fisheries. The catch-effort fisheries data observed over continuous periods of time are often correlated among themselves. The presence of autocorrelation in the observations was tested using Durbin Watson test and the statistic 'd' was estimated. The validity of surplus production models was checked by examining the independency assumption of error term using Durbin-Watson test. The Durbin-Watson statistic was estimated as 1.201 for Schaeffer model and 1.312 for Fox model.

Ten year catch effort data on fish yield collected from Aliyar reservoir was fitted to Fox (1970) model, Schaffer (1954), Fox model with AR(1) term and Schaeffer model with AR(1) term using the Levenberg-Marquardt method. The model adequacy was studied using the Mean Absolute Error (MAE). The MSY and optimum effort E_{MSY} in terms of number of gill nets were estimated as under:

	Schaeffer model	Schaeffer model with AR (1)	Fox model	Fox model with AR(1)
MSY (in tons)	39.02	33.21	41.23	35.12
E_{MSY}	1941	1745	1897	1715
Model Adequacy (MAE)	109.15	79.25	101.23	68.25

The Durbin-Watson statistic 'd' calculated with refitted Fox and Schaeffer models with AR(1) were close to two indicating presence of autocorrelation. Fox model with AR(1) showed better performance than Schaeffer

model with AR (1), when compared with model adequacy statistic MAE. Further when the MSY values are looked into, it is seen that the Fox and Scaheffer models tend to overestimate MSY and E_{MSY}. The fish catch data from Aliyar reservoir had an yield of 32 tonnes during the previous year with average annual effort of 1695 gill nets which is closer to the results of MSY and E_{MSY} obtained through models fitted with autoregressive error term AR(1).

Optimization of gillnets for improved fishing efficiency

A study on the efficiency of various mesh size gillnets (110 and 140 mm) on the fishing of three commercially important Indian major carps species viz. *Catla catla, Labeo rohita* and *Cirrhinus mrigala* was conducted at Aliyar reservoir. The fish landing details were collected from the landing centre between May and June 2019 (species, length and weight with respect to different mesh size) and during the study, fishes of four species comprising 747 individuals were sampled in two months. Fish catching efficiency, based on the number of individual catch per unit effort, was better in case of 110 mm gillnets (695 individuals) as compared to 140 mm gillnets (52 individuals). Appropriate mesh size for maximising fish catch and improving earnings of fishers is recommended as 110 mm based on this study. The fish species contributed to the total catch were *Cirrhinus mrigala* 61.7%, followed by *Oreochromis mossambicus* 23.3%, *Labeo rohita* 10%, and *Catla catla* 5%, respectively. The present investigation also recommended that the use of gillnets with mesh size below 110 mm should be avoided to ensure sustainability of the fishery.

Fish safety and quality surveillance, hazard analysis and alleviation along the selected points of value chain

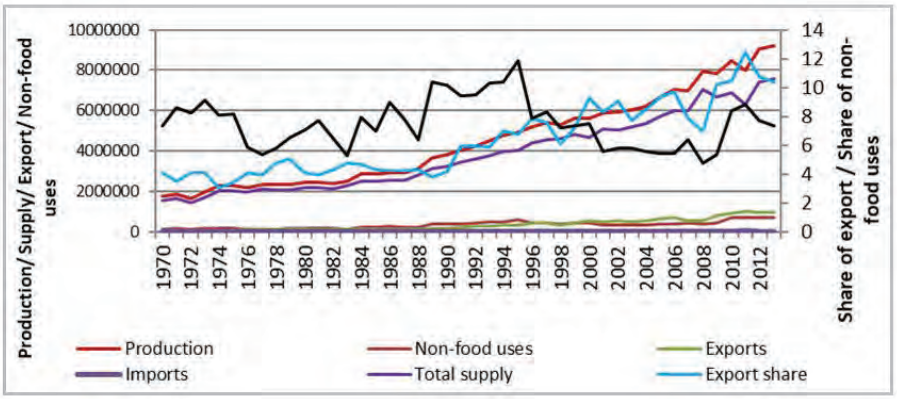
The bioluminescence assay of Adenosine Triphosphate (ATP) of fish contact surfaces at critical points of three value chains of Aliyar Reservoir was done. The contact surfaces of harvesting unit on an average had 2734 Relative Light Units (RLU) of ATP. From there the fish will be brought to the assortment point where ATP bioluminescence assay revealed 205% more RLU. The fish gets channelized from here. In value chain (VC) 1, iced fish were transported in Auto rickshaw to markets of Pollachi, Tiruppur and Coimbatore. The last point was having only 8% rise in ATP, in terms of RLU. At VC 2, fish was brought to local shops where value addition was done and sold to tourists in ready to eat form. The ATP, in terms of RLU was found to be very low on this product. At VC 3, the fish was dressed in a pre-processing shed, the bioluminescence assay of contact surfaces, in terms of RLU showed 28% more ATP. The analysis revealed the importance of adopting sanitary protocols in value chain.

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

The structural changes in the fishery sector in India in terms of value of output were studied in both output and value terms. It was observed that the structural changes happened due to the differential growth of inland and marine fisheries (1.1% per year in marine fisheries and 5.2% per year in case of inland fisheries for the period of 1990-91 to 2017-18). In terms of value, the structural changes were analysed by using the Central Statistical Office (CSO) data. At the national level, the value of output increased from Rs 55.3 thousand crores to 106.8 thousand crores during 2004-05 to 2014-15, at a growth rate of 5.3% per year (at 2011-12 prices), with a growth rate of 6.2% per year for inland fisheries and 4.3%/year for marine fisheries. The highest annual growth among the states was noted in Chhattisgarh (14.5%) followed by Tripura (10.2%), Andhra Pradesh (9.8%) and Haryana (9.5%), all led by the growths in inland fisheries. The growths in marine fisheries ranged from 0.3% per year in Kerala to 7.7% per year in Andhra Pradesh.

Change in composition of value of output from fisheries sector in India (2004-05 to 2015-16)										
Inland (Rscrores)		Marine (Rscrores)		Total		Share of inland		Growth rate (% per year)		
2004-05	2015-16	2004-05	2015-16	2004-05	2015-16	2004-05	2015-16	Inland	Marine	Total
30461	59092	24862	47687	55323	106780	55.1	55.3	6.18	4.28	5.34

A study on domestic availability of fish indicated that total supply of fish in the country has increased from 1.6 million tonnes in 1971 to 7.6 million tonnes in 2013. During this period, the non-food use of fish has increased from 1.6 million tonnes to 6.7 million tonnes; and exports from 0.06 million tonnes to 0.95 million tonnes. The share of non-food use of fishes also hovers around 4-10%.



Trends in domestic availability of fish (1970 -2012)

The study noted that during 2000-01 to 2019-20, the total number of fish processing units has increased from 260 to 460 with an increase in total employment from 27065 to 60227. The annual growth rate of the number of processing units was 3.1% with the number of persons improving at the rate of 4.3%. As per the data of two representative states namely Andhra Pradesh and West Bengal, selected for the study, there are only 850 and 734 fisheries extension personnel in these states respectively, which is quite insufficient to address the needs of vast coastline and fish production in those states. The unequipped manpower was highlighted as one of the major deterrents for leveraging the full potential in harvest and post-harvest fisheries sector, which is highly skill intensive in nature. The study also noted that there is a need to increase the number of graduates, post-graduates and Ph.Ds and para-professionals in the fisheries sector and re-orienting the skill set of the already employed ones to address the emerging research and development needs in marine sector, inland sector and in the entire value chain.

Trend in the growth rate of fish processing sector in India, 2011-2019			
Year	No. of working Factories	Total number of persons	Average no. of persons per unit
2000-01	260	27065	104
2019-20	460	60227	131
Compound annual growth rate	3.1	4.3	1.2

Fisheries export from Kerala

The export of marine products from Kerala increased from 97.2 thousand tonnes in 1995-96 to 238 thousand tonnes in 2018-19 with a corresponding increase in the value from US $ 440 million to 1163 million. However, the share of the state in the export value has declined consistently from 24.5% to 12.9% during this period. Corresponding changes have also been seen in case of quantity as well. A disaggregated analysis indicates that during the recent period (2010-11 to 2018-19), the export performance has bettered over the period of 1995-96 to 2009-10 in the state, as noted at the national level also, albeit at a subdued level. The sharp decline of the share of the state is due to the inability to match with the high growth in shrimp production in other states, notably Andhra Pradesh, primarily due to low pace of aquaculture development in Kerala. Marine exports from Kerala are mainly dependent on capture fisheries of wild caught shrimp and finfishes with minimal level of processing. The south east Asian countries constitute our major export destination.

Growth rate of fisheries export from Kerala (%/year)

	Item	1994-95 to 2009-10	2010-11 to 2018-19	1994-95 to 2018-19
Kerala	Quantity	2.1	3.0	4.1
	Value	3.2	7.0	7.0
	Unit Value	1.0	4.0	2.8
India	Quantity	5.5	6.8	6.7
	Value	4.3	11.4	9.1
	Unit Value	-1.2	4.3	2.2

Analysis of price transmission of wholesale fish prices in domestic markets

The weekly wholesale prices of five states namely Assam, West Bengal, Odisha, Uttarakhand, Tripura were subjected to time series analysis to study price transmission. The time series pertaining to wholesale prices of fish in all states are not stationary at level series with respect to all the three basic models considered, indicating that there may be seasonal trend in data. The time series becomes almost stationary for all in 5th level differencing indicating price data series were integrated at level 5 (of same order) and did not have unit root. Study has indicated that the four markets namely Assam, Odisha, West Bengal and Tripura are co-integrated and price transmission was present among the markets. In a perfectly competitive market, commodity prices should move into unison in response to the forces of demand and supply. The high degree of co-integration also suggests that these markets are competitive and efficient at wholesale levels.

Co-integration analysis between weekly fish prices of four states

Y/X	Assam	Odisha	West Bengal	Tripura
Assam	-	-3.14*(lag 10)	-5.84**(lag 10)	-3.45* (lag 10)
Odisha	-3.908*(lag 10)	-	-1.212***(lag 10)	-8.21**(lag 10)
West Bengal	-7.67** (lag 5)	-2.154*(lag 10)	-	-9.86**(lag 10)
Tripura	-2.727*(lag 10)	-3.098*(lag 10)	-7.992**(lag 6)	-

*Significant at 5%, ** significant at 1% and *** indicates significant at 10%
No. of lags based on Akaike Information Criterion

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

Fish consumption patterns

Analysis of fish consumption patterns in Ernakulam and Kozhikode districts revealed that sardine was the most preferred and consumed fish in both the districts. Majority in Kozhikode reported daily consumption of fish while in Ernakulam majority reported consumption of 2-3 times per week and purchase decision was based on liking of children in Ernakulam and it was based on own choice in Kozhikode. In both the districts, curry and fry were the most preferred mode of fish preparation. In Ernakulam fish once cooked was kept for next day also by majority while in Kozhikode same day consumption was the major choice reported. Preferred time of consumption was found to be lunch followed by dinner in both the districts.

Fish purchasing preference

Willingness to spend on fish/purchase was up to Rs. 100 in Kozhikode while it was upto Rs. 200 for majority in Ernakulam. Average monthly expenditure on fish was reported to be around Rs. 2300 and Rs. 2200 respectively in Ernakulam and Kozhikkode. In both districts, marine fish was found to be most favoured one and majority reported that fish was only somewhat affordable. Average monthly expenditure on high value fish was reported to be around Rs. 764 and Rs. 537 respectively in Ernakulam and Kozhikkode. Consumption of crabs, squids, clams and mussels was reported to be monthly once by majority in both Ernakulam and Kozhikkode with average monthly expenditure of Rs. 189 and 365 respectively. But surprisingly, consumption of dry fishes was found to be in decline in both the districts as compared to fresh fishes in terms of frequency of consumption. Health issues and fear of chemicals used in drying were the major causes for decline with average monthly expenditure of only Rs. 92 and Rs. 170 recorded in Ernakulam and Kozhikkode districts, respectively.

Purchase of fish in comparison with other meat and eggs and milk was studied and results revealed that on an average 13 kg of fish is purchased per family per month followed by other meat. The purchase of fish vs other meat in Ernakulam and Kozhikkode was fish (13.35, 13.38), chicken (4.10, 3.40), mutton (2.12, 2.13), beef (2.70, 2.80), pork (1.43,-), duck (1.90,-), milk (20.0 ltr, 15ltr) and eggs (35 nos, 28 nos). The average monthly family expenditure on above items was found to be Rs. 5097 and Rs. 3685 respectively in Ernakulam and Kozhikode.

Consumers' knowledge and attitude towards fish safety and quality

Knowledge of fish consumers was found to be high for majority with respect to knowledge on health benefits of fish and fish safety while it was medium with respect to fish quality in both districts. Attitude of consumers purchasing fish was studied and Mann Whitney U test revealed significant difference in attitude of fish customers in Ernakulam and Kozhikode with respect to semantic, sensory, health, economic and quality factors with exception of safety factors. Friedman's test and Wilcoxon signed ranks test revealed that both in Ernakulam and Kozhikode, there was significant difference in dimensions of fish consumers' attitude except between quality and economic dimensions. Perception of fish consumers was studied and Mann Whitney U test revealed significant disparity in perception with respect to fish quality and safety between Ernakulam and Kozhikode customers. In Ernakulam, Friedman test showed that there is a statistically significant difference between perception on health benefit, fish quality and fish safety while in kozhikode there is no statistically significant difference between perception on health benefit, fish quality and fish safety.

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

Defining the focus, operationalization of responsible fisheries with respect to study objective and generating attitude statements

Using the attitude statements, a study was conducted to develope a scale to measure fishermen's attitude towards responsible fishing by using the conceptual dimensions of responsible fishing stated in the Code of Conduct for Responsible Fisheries (CCRF). The attitude statements were generated on the basis of certain parameters influencing the responsible fishing, which were decided on the basis of review studies, expert consultations and Focus Group Discussion (FGD) with stakeholders. The selected parameters were safety of human life at sea/safe fishing, compliance with applicable measures/general conservation orientation, regulation on Minimum Legal Size (MLS) of fish, loss of fishing gear and the ghost fishing effects of lost or abandoned fishing gear, fishing gear selectivity, energy optimization, co-management, marine protected areas and training and extension aspects. As per the above conceptual dimensions, a total of 200 statements were developed with equal number of positive and negative statements and with proper representation of affective, behavioral, and cognitive components of attitude. Out of the 200 statements 100 were selected based on Edward's criteria. Data collection on judges rating of attitude statements is under progress.

Survey has been made for measuring fishermen attitude toward the guidelines of Code of Conduct of Responsible Fisheries. An attitude statement with both positive and negative reply were noted with respect to Article 8.4.1 Safety of human life at sea, Article 8.4.2 Destructive fishing practices, Article 8.4.3 Compliance with applicable measures, which includes minimum legal landing size, trade of juveniles and seasonal trawl ban. Article 8.4.4 Adoption of appropriate technology which includes Bycatch reduction devices, Craft designs and size and resource conservation. Article 8.4.5 reduce discards, increase survival rates of escaping fish. Article 8.4.6 Minimize the loss of fishing and the ghost fishing effects of lost or abandoned fishing gear. Article 8.5 fishing gear selectivity, Article 8.6 Energy optimization.

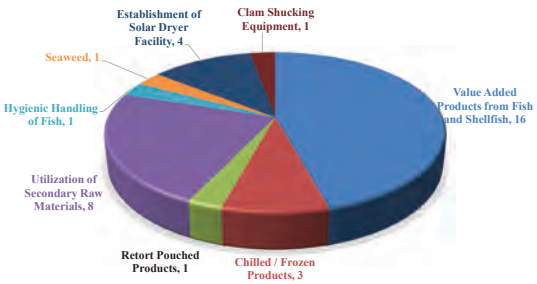
Externally Funded Projects

INDIAN COUNCIL OF AGRICULURAL RESEARCH PROJECTS

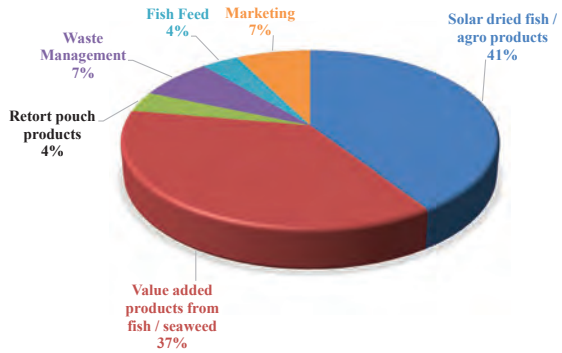
Zonal Technology Management – Agribusiness Incubation Centre

The Zonal Technology Management – Agribusiness Incubation (ZTM-ABI) Centre was established at ICAR-CIFT 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 IPR protection, technology adoption and enables 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. It 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 entreprises 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. Business incubation is a selective, comprehensive service offering that aims to accelerate the growth of SMEs.

Signed 35 technology transfer agreements: Commercially viable technologies related to value added products from fish/seaweed, chilled / frozen fish products,retort pouched products, utilization of secondary raw materials, solar dryers, refrigerated fish vending kiosks were transferred to the private sector and government agencies.



Number of agreements signed in various areas



The clients approached the centre during the period 2019, for various services are classified based on the area of their expertise

26 entrepreneurs registered at ZTM-ABI Centre for business incubation: The fishing industry includes any industry or activity concerned with culturing, harvesting, processing, preserving, storing, transporting, marketing or selling fish or fish products.

Carried 30 professional service functions: ZTM-ABI centre has carried out 30 professional service functions as follows.

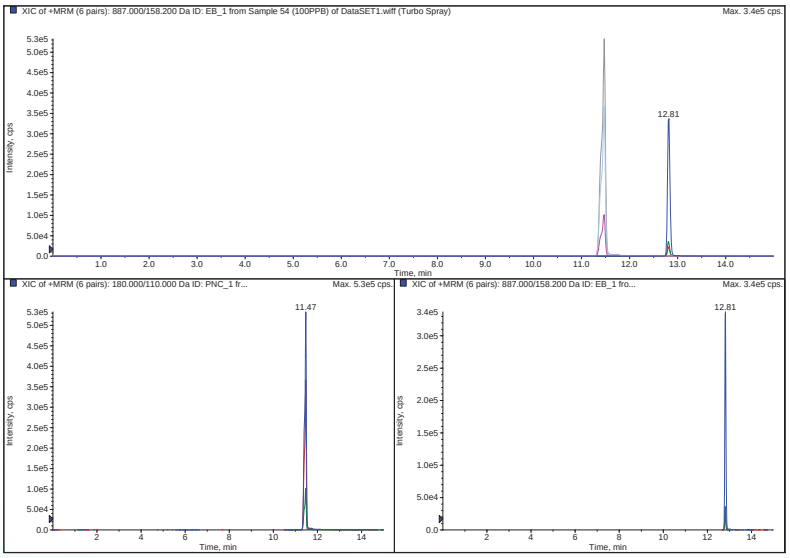
Consultancy Projects	10
Collaborative Research	9
Contract Service	8
Contract Research (Grant-in-Aid)	4
Contract Research (Sponsored)	1

Empanelment of manufacturers: ICAR-CIFT empanelled 6 more external agencies to manufacture and supply ICAR-CIFT dryers, Descaling machine and Mobile fish vending kiosk.

All India Network Project on Fish Health

Emamectin benzoate residues in fish: Validation and quantification using API 4000 QTRAP Mass Spectrometer

Emamectin benzoate is classified as a second generation avermectin group of insecticide used as an anti-parasitic drug in aquaculture. Method for emamectin and ivermectin drugs are commonly used to control sea lice in farmed salmon and trout. Residue analysis of emamectin benzoate in shrimp matrix was developed using a quick, easy, cheap, effective, rugged and safe method (QuEChERS) and AB Sciex 4000 QTRAP Liquid chromatography tandem mass spectrometry (LC/MS/MS). When quantified by the external standard method, the calibration curves showed linearity with correlation coefficient value 0.995. Spiked samples of low, medium and high concentrations were tested in 6 replicates with Phenacetin as an internal standard. LOD and LOQ for the analyte detected as 0.27 & 0.9 ng/mL respectively.

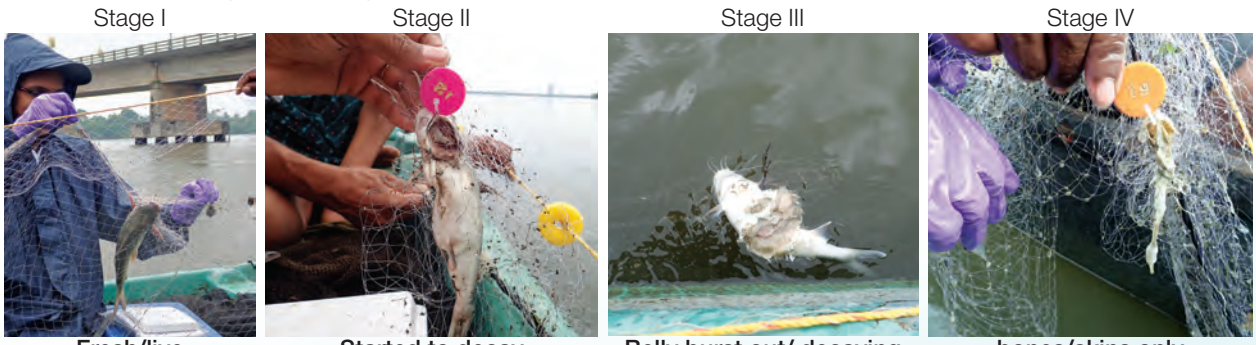


MRM chromatogram of shrimp matrix spike solution with Phenacetin as internal standard (100ng/mL)

Emamectin benzoate and Oxytetracycline residues in fish samples collected from partnering institutes ICAR –Central Inland Fisheries Research Institute (CIFRI), Barrackpore and West Bengal University of Animal and Fishery Sciences (WBUAFS), Kolkata were analysed and quantified using mass spectrometry. From ICAR- CIFRI, catfish species *Pangasianodon hypophthalmus tested* for efficacy and withdrawal period of antibiotic Oxytetracycline (OTC) and antiparasitic drug emamectin benzoate (EB). Following administration of the drugs in recommended dosages, their levels in blood, liver, kidney and muscle were determined using LC-MS/MS. Further, pharmacokinetics of these drugs was also determined following oral and intramuscular administration and measuring their tissue levels at different time intervals. Total of 196 extracted samples were analyzed for Emamectin and 180 samples were analyzed for Oxytetracycline residues in *P. hypophthalmus*. From WBUAFS, the Nile tilapia, *Oreochromis niloticus* has been taken for the study of withdrawal and biosafety of an approved antibiotic oxytetracycline (OTC) and registered and recommended antiparasitic agent emamectin benzoate (EB) as feed additive in fries (± 0.25 g) and juveniles (±13.05 g) in the tropical conditions. An approved dose for OTC is 80 mg per fish biomass per day for ten consecutive days and for EB is 50 µg per kg fish biomass per day for seven consecutive days. Total of 115 extracted samples were analyzed for emamectin and 70 samples were analyzed for oxytetracycline residues in *O. niloticus.*

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

The gillnet and trap loss rate and reasons thereof were assessed along Thoothukudi to Rameswaram coast. Details were collected from 12 fishing villages in Tamil Nadu (Thoothukudi, Vembar, Therespuram, Tharuvaikulam, Ervadi, Kilakarai, Devipattanam, Chinnapalam, Ramanathapuram, Mandapam, Thondi, Dhanushkodi). Conducted lost fishing gear retrieval experiments off Cochin (between 10 00.425 N 076 10.254 E and 10 00.870 N 076 10.260 E) using rod and chain creepers. The catch rate in ghost gillnets were assessed by simulation experiment in monsoon (June-July) and post-monsoon season (September-December) in backwaters at Arookutty, Alappuzha district. Catching capacity and condition of the catch (different stages) were observed periodically. Simulated lost gillnets continued to catch fish for 14 days during monsoon and for 39 days during post-monsoon. The ghost fishing simulation experiment was also conducted in marine water in Arthunkal, Alappuzha using mackerel gillnet and assessed the catching capacity and condition of the catch. The physical and mechanical properties of natural fibers (Hemp, Coir, Jute, Cotton, Raffia, Sea grass and Sisal) in comparison to synthetic fibers (PA monofilament, PA multifilament, PE and PP) were tested in different field exposures such as in soil, sea water and atmospheric conditions for further use in mitigation measures to reduce the effect of ghost fishing in gillnets and traps. Among the natural fibers tested, jute fibre had maximum deterioration, closely followed by cotton.



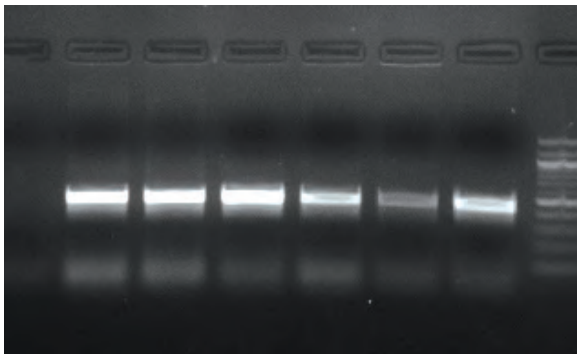
Condition of fishes (different stages) in simulated lost gillnets

Network programme on Assessment of Antimicrobial Resistance (AMR) in microorganisms associated with fisheries and aquaculture in India

AMR in E. coli, Staphylococcus and Vibrio parahaemolyticus isolated from Penaues vannamei shrimp farms of Andhra Pradesh:

Shrimp farm in East Godavari district , Andhra Pradesh

A total of 26 farms from East Godavari and 26 farms from west Godavari district were screened for the incidences of *E.coli*, *Staphylococci* (both Coagulase positive and negative Staphylococci), *Vibrio* spp. other than *Vibrio parahaemolyticus.* Results indicated the incidences of 26.9% of *E.coli* in East Godavari district and 11.5% in West Godavari, 69.2% of *Coagulase negative staphylococci* in East Godavari district and 53.8% in West Godavari district, 7.69% of *Coagulase Positive Staphylococcus aureus* in East Godavari district and 26.9% in West Godavari district, 26.9% of *Vibrio parahaemolyticus* in East Godavari district and 30.7% in West Godavari district and 100% of incidence of *Vibrio* spp. was observed in both East and West Godavari districts.



PCR targeting tlh gene (490bp) for identifying Vibrio parahaemolyticus

The suspected bacterial isolates were confirmed molecularly using PCR. *E. coli* isolates were confirmed by targeting *uid A* and *lacY* genes, *Staphylococci* isolates were confirmed by targeting *sta756* gene, *Coagulase positive Staphylococci* were confirmed by targeting *nuc* gene and *Vibrio parahaemolyticus* isolates were confirmed by targeting *tlh* gene.

AMR profile of *E. coli* (n=10) were screened against 17 different antibiotics belonging to 10 classes, and the results indicated 40% resistance to Amoxicillin/Clavulanic acid, 33.3% to cefotaxime, 33.3% to Trimethoprim, 30% to Ceftazidime, 30% to Aztreonam and 30% to Tetracycline.

AMR profile of *Coagulase Negative Staphylococci* (n=32) were screened against 10 different antibiotics belonging to 9 classes, and results indicated the 87.5% resistance to Penicillin G, 50% to Oxacillin, 50% to Cefoxitin, 43.8% to Erythromycin and 33.3% to Trimethoprim. AMR profile of *Coagulase positive staphylococci* (n=9) were screened against 10 different antibiotics belonging to 9 classes, and results indicated the 88.9% resistance to Penicillin G, 44.4% to Erythromycin, 22.2% to Oxacillin and 22.2% to Cefoxitin. AMR profile of *Vibrio parahaemolyticus*(n=15) were screened against 12 different antibiotics belonging to 8 classes, and results indicated the 46.7% resistance to Ampicillin and 33.3% to Cefoxitin.

Sample Analyses: Samples were collected from 45 shrimp farms (33 from Thrissur and 12 from Alappuzha). Out of 12 farms from Alappuzha, animal samples were tested only from 8 farms. Out of 45 shrimp farms, 09

farms harboured *E. coli*. Out of 27 shrimp farms, all farms harboured *Staphylococcus* spp. Out of 30 shrimp farms, 23 farms harboured green *Vibrio* spp. Assessors Training for PIs of INFAAR was conducted at MFB Division of ICAR-CIFT. *E. coli* (n=9) were tested for antibiotics viz., Cefoxitin, Chloramphenicol, Ciprofloxacin, Gentamicin, Tetracycline, Trimethoprim/ Sulfamethoxazole, Amoxicillin/Clavulanic acid, Ampicillin, Aztreonam, Cefpodoxime, Ceftazidime, Ceftriaxone, Imipenem, Nalidixic acid, Amikacin were tested. Tetracycline (11%) and Amoxycillin and clavulanic acid (22%).

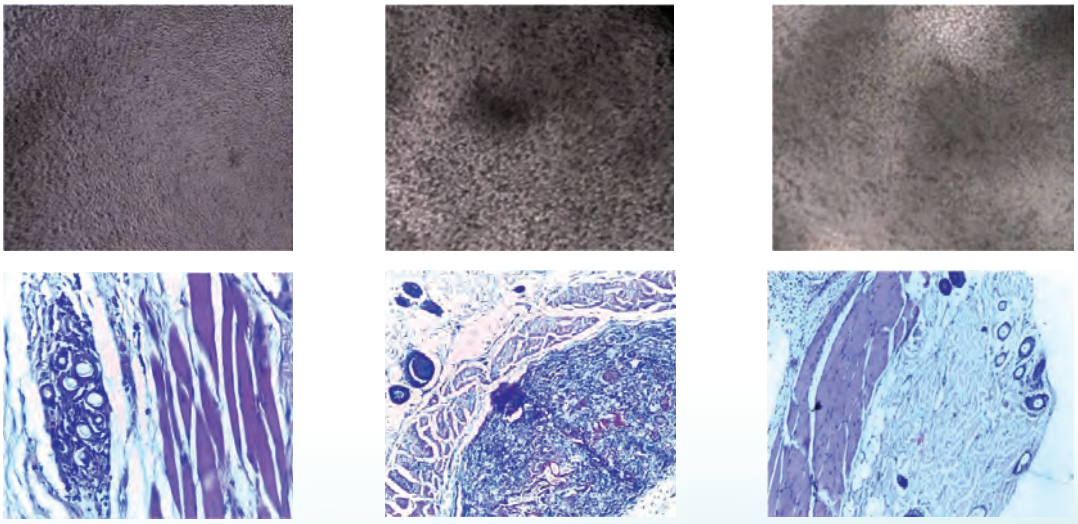
Assessment of *Staphylococci* AMR: For *Staphylococcus sp.* (N=32), Penicillin G, Cefoxitin, Chloramphenicol, Ciprofloxacin, Erythromycin, Gentamicin, Tetracycline, Trimethoprim/ Sulfamethoxazole, Linezolid were tested and the resistance were 81.2, 62.5, 3.1, 6.2, 28, 9.4, 6.2, 3.1, 12.51 %, respectively.

Assessment of *Vibrio* AMR: For *Vibrio sp.* (n=23) Cefoxitin, Chloramphenicol, Ciprofloxacin, Gentamicin, Tetracycline, Trimethoprim/ Sulfamethoxazole, Amoxicillin/Clavulanic acid, Ampicillin, Ceftazidime, Cefepime, Cefotaxime were tested. Cefoxitin, ciprofloxacin, Amoxicillin/Clavulanic acid, ampicillin, ceftazidime, cefepime, cefotaxime resistance were observed in 47.8, 4.3, 26.1, 60.9, 17.4, 34.8, 52.2%, respectively.

ICAR-NATIONAL FELLOW PROJECT

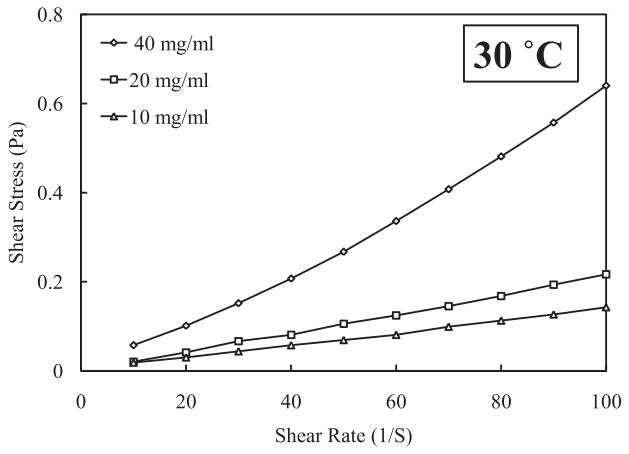
Biomodulation of Marine Biopolymers for the preparation of Biomaterials of Healthcare Importance

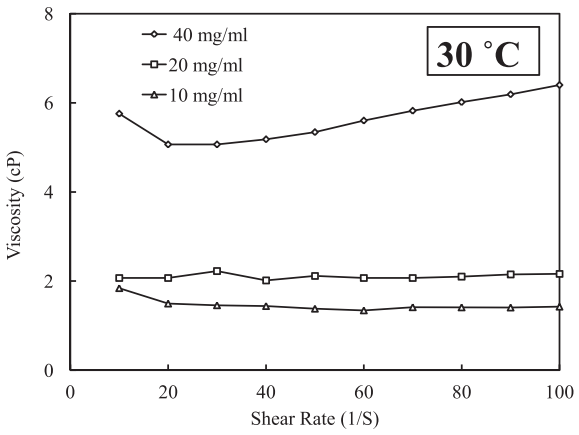
Histopathological and biocompatible evaluation of chitosan nano particles - grafted fish gelatin based bio-nano composite membranes: The chitosan nano particles - grafted fish gelatin based bio nano composite membranes were developed. The study has revealed the cross-linking capability of chitosan nano particles (83 –193 nm range) with tuna skin gelatin for the preparation of chitosan nano particles-grafted gelatin bio-nano composite membranes with higher porosity and swelling index properties. The histo pathological observations in experimental animals and the cytotoxicity studies carried out with L929 cell lines have confirmed its biocompatibility nature for applications in tissue engineering, drug targeted and biomedical fields. However, further experimental studies need to be carried out for the applicability of these bio-composite membranes as supportive biomaterial membrane in the treatment of burn wounds, skin implantations and tissue transplantation.

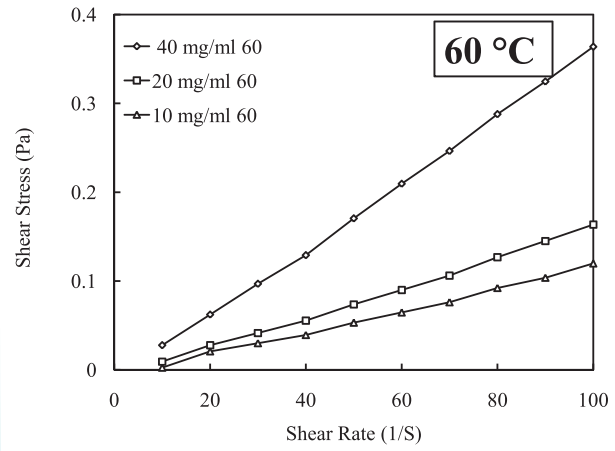


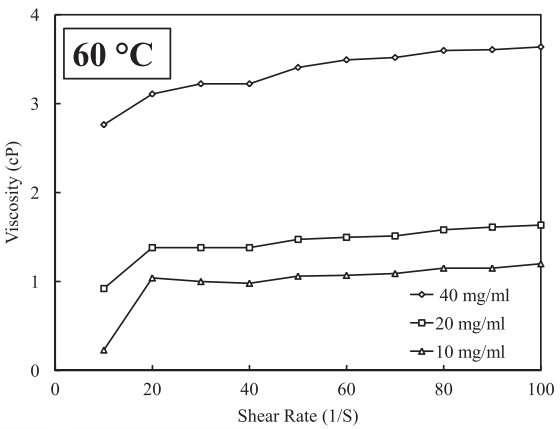
Control | Gelatin | Bio-nanocomposite membrane

Rheological, Physico-chemical and Surface active properties of gelatin extracted from Bigeye tuna (*Thunnus obesus*) skin waste: The physico-chemical, structural and functional properties of tuna skin gelatin are significantly influenced by the extraction conditions. The results of this study demonstrated that tuna skin waste could be used as a desirable raw material for the extraction of gelatine. The yield of gelatin obtained from tuna skin waste was 8.42%. The obtained gelatin showed characteristic molecular weight and relatively high hydrophobic amino acids and iminoacids contents which can form a completely thermo-reversible gel. The Newtonian and shear thickening nature of gelatine was evident from shearrate-stress sweep and viscosity sweep. The flow behaviour studies of obtained gelatin solution could be predicted by the Herschel– Bulkley and Power law models. The obtained gelatin also exhibite dinterfacial functional properties such as foaming, emulsifying and water-holding capacities. The study indicated that gelatin extracted from tuna skin waste has great potential ltobeutilized in different food functional and formulation products, as a biomaterial in biomedical and tissue engineering applications.









DEPARTMENT OF SCIENCE AND TECHNOLOGY (DST) PROJECTS

Development of clam cluster and clam processing facility at Perumbalam Village, Thycatusherry block CherthalaTaluk, Alappuzha District, Kerala

A Clam Processing Facility was set up by ICAR-CIFT at Perumbalam island in Alappuzha district of Kerala for the benefit of clam fisherwomen, the first of its kind in the state. About 250 families dependent on clam fishery for their livelihood in the village will directly benefit from this initiative. The facility was set up under a project funded by SEED Division, Department of Science & Technology, New Delhi. The facility was inaugurated by Hon'ble Minister for Fisheries, Harbour Engineering & Cashew Industry, Government of Kerala, Smt. J. Mercykutty Amma, in the presence of Adv. A. M. Ariff, Hon'ble Member of Parliament, Alappuzha. The project implemented in a participatory mode involved the Perumbalam Grama Panchayat and the Haritha Farmers' Club from the village.

The project has been able to standardize protocols for processing clam; develop and demonstrate value added products; design and fabricate customized machinery required for the processing; build capacities of the local people; and establish the clam processing facility. In total 90 fisherwomen of five clusters formed under the project have been trained and hands-on training on GMP (Good Manufacturing Practices) as well as preparation of value added products.

Inauguration by Hon'ble Minister for Fisheries, Harbour Engineering & Cashew Industry, Government of Kerala, Smt. J. Mercykutty Amma

Unveiling of the inaugural plaque in the presence of Adv. A. M Ariff, Hon'ble MP, Alappuzha

Livelihood enhancement of 'Sidi tribal women and Kharwa fisherwomen' of Veraval in Gujarat through the implementation of improved fish post-harvest technologies

The project titled 'Livelihood enhancement of Sidi tribal women and Kharwa fisherwomen of Veraval in Gujarat through the implementation of improved fish post-harvest technologies' was catalyzed and supported by Department of Science and Technology (DST), New Delhi. It is aimed to transfer improved fish post-harvest technologies to two backward communities, 'the Sidi tribal community and Kharwa fishermen community' of Veraval region in Gujarat for their livelihood enhancement. 'Kharwas', the fishermen community, form a

sizable part of the local population in the coastal regions of Gujarat like Veraval. 'Sidis', or 'Habshis' is a unique tribal group with African ancestry, who have been transported to Gujarat as slaves in an easterly slave trade, controlled mainly by Arabs. The Sidis are considered to be the most backward class in Gujarat and majority of them are living below poverty line.

In the last year, under the project, 8 capacity building/ skill development programmes were conducted at Veraval Research Centre of ICAR-CIFT for Sidi tribal women and Kharwa fisherwomen. The Sidi tribal women and Kharwa fisherwomen were trained on different topics like 'Preparation of value added products from fish', 'Improved packaging and labelling methods for producing better quality fish' and 'Renewable energy based hygienic fish drying methods'. Another training programme was conducted for Kharwa fisherwomen. Shri. Shrimali Vinod Kumar M., Deputy Director, MPEDA and Shri. RajeshbhaiChamadia, leading exporter in Veraval (K.R. Seafoods, Veraval, Gujarat) were the guests in the programme.

A hybrid solar dryer with electricity as alternate back up energy was distributed to the Kharwa fisherwomen group for establishing a hygienic fish drying unit. A field day cum demonstration programme was organized to train them on 'Renewable energy based hygienic fish drying methods'. Both the target groups were trained on improved packaging methods for seafood products and a vacuum packaging unit was also established for the benefit of Kharwa fisherwomen group. Processing aids were also distributed to both the groups for setting up a mini value-added products preparation unit.

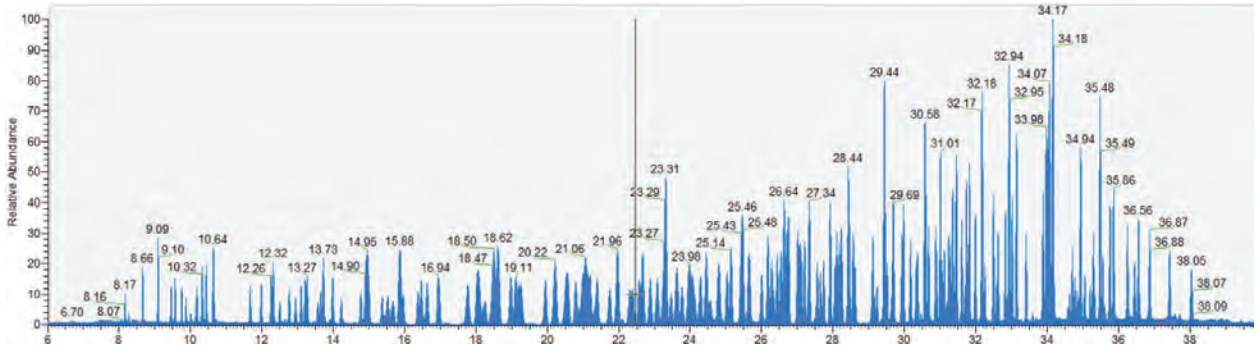
Certificate distribution by Dr. Toms C. Joseph, SIC, Veraval RC of ICAR-CIFT to the trainees of the programme on Improved packaging and labelling methods for producing better quality fish on 14. 10. 2019

Trainees with faculty after the demonstration programme on Renewable energy based hygienic fish drying methods organized on 11. 12. 2019 for Kharwa fisherwomen

Determining seasonal and spatial occurrence of multiclass endocrine disrupting chemicals in the fishes, crustaceans and molluscs of the Vembanad urban estuary: risk assessment by an untargeted metabolomics approach

Endocrine disrupting chemicals (EDCs) are emerging contaminants of global concern in the aquatic environment. EDCs can disrupt the endocrine system of aquatic organisms, mammals, and humans even at a very low concentration. Urban estuaries receive a multitude of EDCs through many anthropogenic sources such as wastewater treatment plants, industrial effluents, and sewage. GC-MS/MS and LC-MS/MS analytical methods are being developed and validated with an aim to analyse multiple EDCs in a single chromatographic run. The analytical methods will be utilized to determine the seasonal and spatial occurrence of the target EDCs in the edible biota of Vembanad estuary. Finally, the risk of exposure to the detected EDCs at environmentally relevant concentrations will be assessed in vivo, assisted by a high-resolution mass spectrometry-based untargeted metabolomics technique. The study might produce new insights on health risk from exposure to EDCs and help device future strategies to protect urban estuaries from exposure to EDCs.

Multi-residue analytical methods are challenging to develop. However, such methods can analyse several hundred contaminants in a single instrument run, thus saving time and money. A GC-MS/MS multi-residue method of analysis was developed for simultaneous quantification of 200 contaminants including endocrine disruptors, PAHs, PCBs and pesticides. The method has been validated as per European Union guidelines and can be used for regulatory analysis of fish before export.



Large scale screening of endocrine disruptors in a single analytical method by GC-MS/MS

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

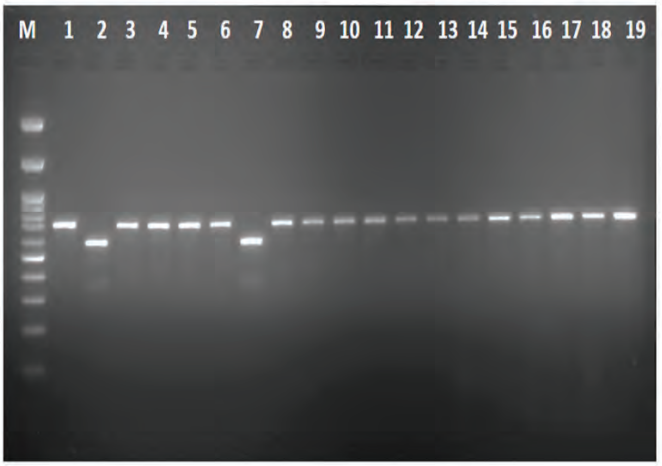
3D diagram of proposed multipurpose solar thermal conversion system with biomass heater backup

A new system has been proposed in this project to completely utilize solar energy by converting it into thermal and electrical energy for multiple uses like drying of fish, domestic hot water generation and solar lighting. The proposed system consists of an overhead tank, evacuated tube/flat plate solar water collector, hot water storage tank, biomass furnace heater/ gasifier, drying chamber, heat exchanger, battery, blower/ fan, solar photovoltaic panel and insulated hot water tubes. The incident solar radiation heats up the water in the evacuated tubes and then stored in hot water storage tank. The hot water from the tank is pumped to the heat exchanger placed in the drying chamber for release of heat and consequently drying of fish and fishery products. If drying is not performed, hot water from storage tank can be directly drawn for domestic use. Photovoltaic panels attached to the drying chamber/solar collector will produce direct current which will be stored in battery to use it for running a small fan/blower inside the drying chamber and it can also be used for street lighting purpose. Generally, solar thermal energy conversion system is proposed as a way of conserving fuel and minimizing cost. However, state like Kerala has long duration of rainy/cloudy days with no solar input. Thus, the combination of a solar heating system with conventional heating supplement is one probable approach for the future. Therefore, in this design, an inexpensive biomass heater backup/gasifier is provided as an alternative heat source.

DEPARTMENT OF BIOTECHNOLOGY (DBT) INDO-UK COLLABORATIVE PROJECTS

Diagnostics for one health and user driven solutions for AMR (DOSA)

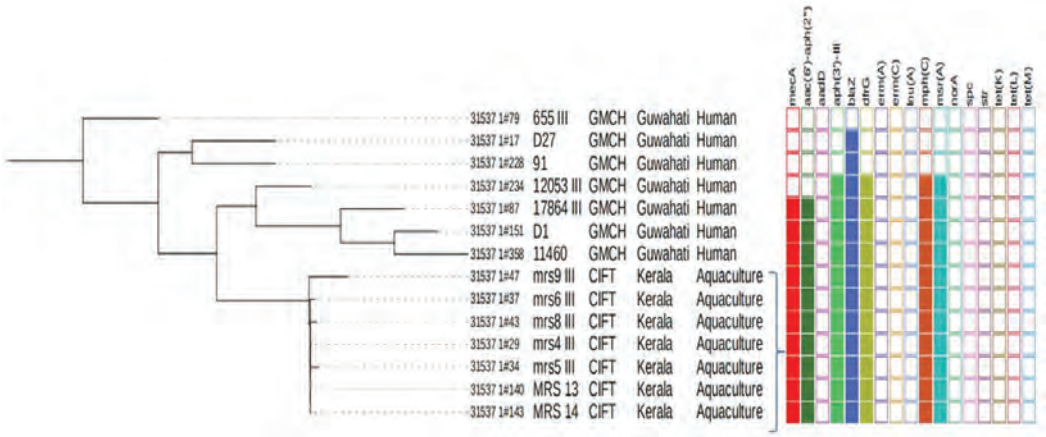
User mapping studies on the use of antibiotics in aquaculture settings were carried from the 10 aquaculture farms in Kakinada, AP (100 samples) and 53 (500 samples) in Kerala. Baseline assessment of AMR pathogen profile in Kerala revealed that 4% of the aquaculture farms are harbored the ESBL producing *E.coli* (CTX-M group1, 2, 9 and 25, TEM, SHV and OXA) and less than 1% of MRSA.



Screening of aquaculture samples for ESBL producing *Enterobacteriaceae*

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

Sampling and data collection from aquaculture farms and market samples for the screening of AMR pathogens in Assam; 79 fish samples were collected from Assam region and 92 Gram negative bacteria (GNB) and 66 Gram positive bacteria (GPB) were isolated from these samples. More than 50% of the GNB were ESBL producers. Out of 59 GPB isolates, 12 *Staphylococcus sciuri*, 10 S. *aureus*, 27 *S. haemolyticus*, 1*S. saprophyticus*, 1*S. lentus* (1.69%), 2 *S. cohnii* and 2 *S. xylosus*. All of *S.haemolyticus* and 20% of the *S.aureus contained mecA gene*. Molecular diversity among *S. haemolyticus were* typed by PFGE and found that at least 3 clonal types.



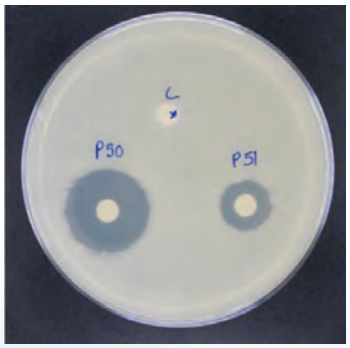
A Comparative antimicrobial resistant gene (ARGs) profiles of Methicillin Resistant Staphylococci based on Whole Genome Sequences

Pilot sequencing of existing isolate collections: A total of 50 numbers of isolates consisting of ESBL producing *E. coli K. pneumoniae*, Methicillin Resistant Staphylococci were confirmed by using BD Phoenix M50 Microbial Identification and AST system. As per approved objectives and plan, 22 numbers of Grams positive and 35 Grams negative AMR bacteria were sequenced by Dr. Mark Holmes, University of Cambridge, UK and data QC checked at Sanger Institute and the results are shown in the above figure.

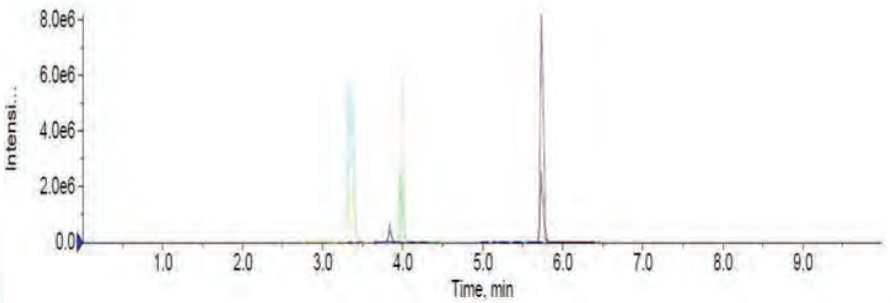
Evaluating Costs and Benefits of Prophylactic Health Products and Novel Alternatives on Smallholder Aquaculture Farmers In Asia and Africa (IMAQulate).

Estimation of Antimicrobial Residue in Probiotics

Out of sixty probiotic products screened for the presence of antimicrobial activity by three plate method, two products were found to have antimicrobial residues. Both products were produced by the same manufacturer and the label on the product claimed that the product contained *Lactobacillus* and yeast. Microbiological analysis revealed the presence of only yeast in both products. LC-MS/MS analysis of the products under ESI+ mode revealed that the products containedmultiple antibiotics; trimethoprim, sulfamethoxazole and ciprofloaxacin and an antiparasitic drug albendazole (Fig.1.b). One of the product is a registered antibiotic-free aquaculture input under CAA.



a) Antimicrobial activity of product extracts against *Bacillus subtilis*.



b) LC-MS chromatogram showing antibiotic residues in commercial aquaculture probiotic

Analysis of microbial community diversity in L. vannamei culture ponds

Water, mud and shrimp samples from aquaculture ponds were collected every two weeks for a culturing period of 150 days from a farm in Kodungallur, Kerala. Culture dependent microbial enumeration, PCR based pathogen detection (YHV, WSSV, IHHNV, TSV, AHPND) and NGS based 16S rRNAamplicon sequencing of V1-V2 and V3-V4 regions analysis were performed for the samples. Low *Vibrio* count was observed in both ponds throughout the culturing period. Presence of WSSV in one pond on 90th day of culture did not affect the final production because of the efficient pond management. The microbiome of animal (intestine and hepatopancreas) and its surrounding environment did not comprise any major foodborne pathogen.

Randomised control trials (RCT) to evaluate efficacy of prophylactic products in shrimp farms

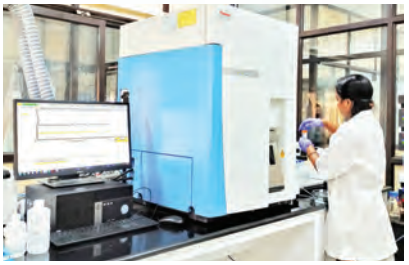
RCT to evaluate efficacy of different prophylactic treatments on *L. vannamei* was performed during nursery phase and grow-out phase, at Ananda laboratory, Bhimavaram, Andhra Pradesh. Foreign partners from University of Sterling, Royal Veterinary college, Bangladesh Agricultural University and World Fish took part in the work along with team from ICAR-CIFT. The following treatments; in-feed probiotic, in-feed prebiotic, in-feed synbiotic, water probiotic and both in-feed prebiotic and water probiotic were evaluated against 'no-treatment' controls and a bio-floc system as a potentially low-cost alternative for *Litopenaeus vannamei*. Commercial probiotics and prebiotics were applied according to the manufacturer instructions. The extended nursery phase was up to 34 days. q-PCR based immune gene expression studies (7 immune genes including LGBP, BGBP, Haemocyanin, Crustin, Penaedin3a, Macrophage migration inhibitory Factor 1and Macrophage migration inhibitory Factor 2) and gut microbiome analysis of shrimp samples collected from RCT were also performed. Preliminary findings indicate significantly enhanced growth outcomes for the biofloc and water probiotic treatments which could significantly reduce grow-out time and disease exposure. Results from the challenge test with *V. harveyi* indicated that, in-feed probiotic and water probiotic have higher survival rate than other treatments and the control. The same treatments were continued to assess the legacy effects in a second post-treatment grow-out phase in earthen ponds. Results obtained were scrutinized to determine low-cost prophylactic options with greatest potential for on-farm adoption by small-scale farmers and improved regulatory advice for policy-makers.

FOOD SAFETY AND STANDARDS AUTHORITY OF INDIA (FSSAI) PROJECTS

Monitoring of heavy metal in finfish & shellfish species along the Indian Coast and possible mitigation measures

Method for the determination of heavy metals (lead, cadmium, mercury, arsenic, selenium, chromium, zinc, nickel) in ICP-MS was standardized, optimized, validated and accredited as per ISO:17025 Requirement.

Method for the determination of methyl mercury by HPLC-ICP MS was developed, validated and accredited as per ISO17025 requirement. Different species of finfish and shellfish were collected from 28 landing centers along the Indian coast and inland water bodies. Until now,1583 samples from Bihar, Karnataka, Kerala and Tamil Nadu, comprising of 164 species of fish (teleost: 160; elasmobranch: 4) and 30 species of shellfish (crustacean: 16; molluscan: 4) have been analyzed. Violation of FSSR limit was observed in 56 samples.



Heavy metal analysis in ICP-MS

Natural levels of formaldehyde in freshly harvested finfish and shellfish species

Formaldehyde analysis in GC-MS/MS

A method for confirmatory determination of formaldehyde in fish and fish products (CIFT/NRL-FORMAL-2019) was developed. The method uses both GC-MS and HPLC based approaches for unequivocal determination of formaldehyde. The method was submitted to FSSAI Scientific Panel on Methods and Sampling for approval as an official method.

To disseminate the newly developed method, a training programme on Method of Analysis of Free Formaldehyde in Fish and Fishery Products was conducted at ICAR-CIFT, Cochin. Representatives from 10 laboratories from Government sector participated in the programme. Training was imparted to officials from Goa, Kerala, Maharashtra and Manipur as well as MPEDA, EIC and CFTRI on the updated method.

Natural levels of formaldehyde was estimated in 116 samples of freshwater and marine aquatic species (31) from Kerala, Karnataka, Tamil Nadu and Goa. The interim findings were submitted to FSSAI for risk assessment.

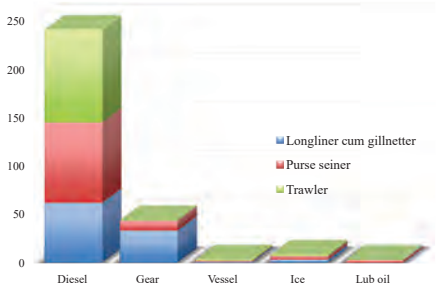
NATIONAL INNOVATIONS ON CLIMATE RESILIENT AGRICULTURE PROJECT

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

Global Warming Potential (GWP) assessment through LCA studies

A comparative energy evaluation expenditure of three fishing system viz. twenty longliner cum gillnetters from Tamil Nadu based at Thengapattanam fishing harbor and Cochin fisheries harbour of Kerala, ten purse seiners from Betul and Vasco of Goa, and twelve trawlers from Veraval of Gujarat were conducted. Primary data was

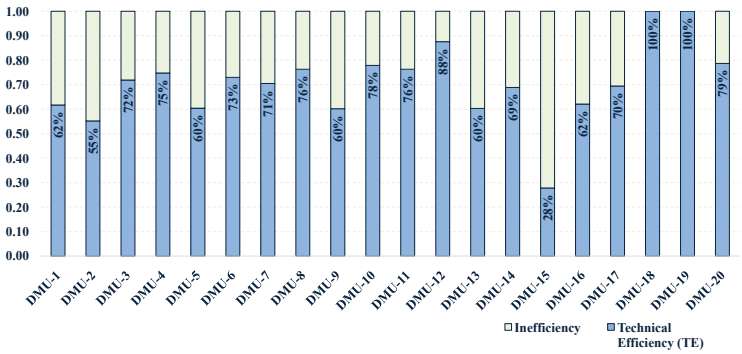
collected from fishers and secondary data were collected from different line departments. The diesel derived emission to GWP is highest in trawlers followed by purse seiners and longliner cum gillnetters.



Hotspot analysis of different fishing systems

Data Envelopment Analysis (DEA) of longliner cum gillnetter

Data from twenty homogeneous units of longliner cum gillnetter fishing vessel with each having 5 continuous fishing trips of time series data were collected. Among the 20 Decision Making Units (DMU) used for the DEA analysis 18th & 19th DMUs operated at full efficiency (score = 1.00) in terms of minimum quantity of diesel and other inputs usage.

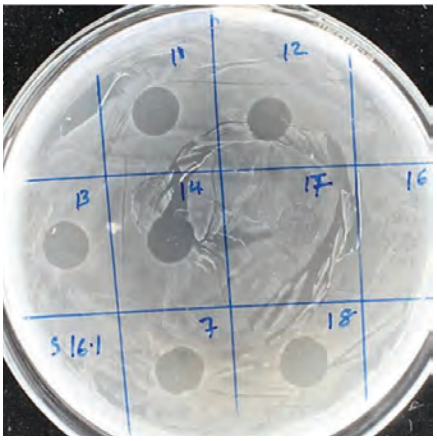


Technical efficiency of the longliner cum gillnetter operated in the Thopumpaddy fishing harbour

DEPARTMENT OF BIOTECHNOLOGY PROJECTS

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

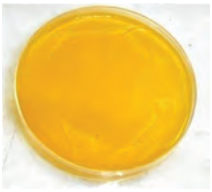
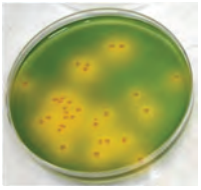
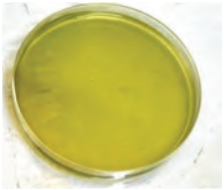
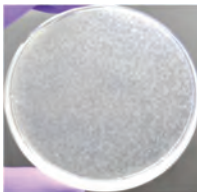
Multiple host enrichment method to isolate broad host range coliphages: A simple method was developed to isolate broad host range coliphages using multiple host enrichment. While most of the phage isolation methods used single host strain. The modified method was optimized for obtaining broad host spectrum lytic phages using multiple hosts in a single enrichment step. The protocol was optimized using 24 strains of antimicrobial resistant (AMR) *E. coli* and a universal host *E. coli* 2089. Phages produced by multiple host enrichment showed lytic activity against higher number of *E. coli* isolates. in addition the multiple host enrichment method was found to be comparatively better in terms of time and cost.



Lytic potential of phages isolated by single host and multiple hosts

PCR method for identifying coliphages: Developed a PCR protocol for classifying bacteriophages into different families. Bacteriophage ΦV, is effective against 19 MDR strains of *E.coli*, yielded amplification with *Podoviridae* specific primers. Bacteriophage ΦY, and ΦS yielded amplification with *Siphoviridae* specific primers.

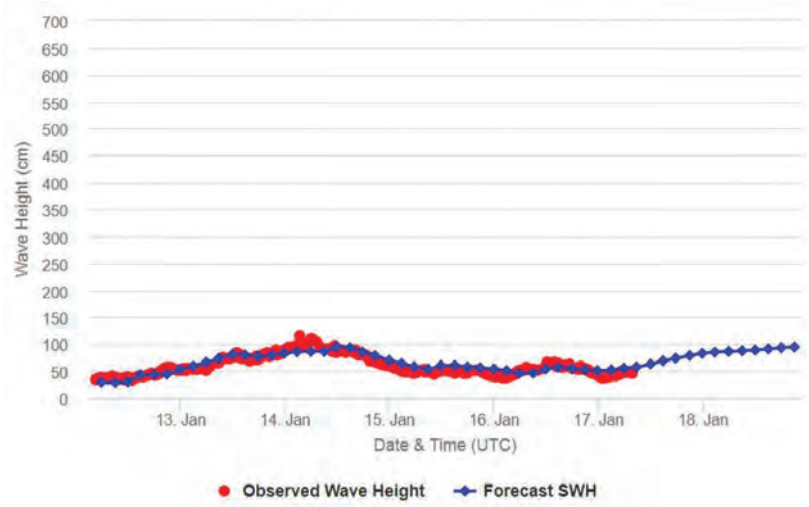
Multiplicity of Infection (MOI) study: *In vitro* MOI study was carried out by testing combinations of lytic coliphage and *E. coli* host strain at different MOI viz., 0.14, 1.42, 14, 142 and 1422 and incubated at 37°C for a period of 6 hours. MOI levels of 14 produced a 5 log reduction in *E. coli* counts after 6 h of incubation.

MOI Level	*E.coli* on T-7 agar (after 2h incubation)	*E.coli* on T-7 agar (after 6h incubation)	Coliphage count (after 6h incubation)
Control (No phage)			
Treatment (MOI :14)			

Reduction in E. coli counts and increase in coliphage counts during in vitro phage treatment

INDIAN NATIONAL CENTRE FOR OCEAN INFORMATION PROJECT

Validation and Dissemination of Ocean State Forecasts Advisories along Gujarat Coast



Forecasted and observed wave heights at Veraval

The Wave Rider Buoy installed at Veraval has been transmitting data and the quality of the forecasts has been very good. There have been two instances of the buoy drifting; butit was successfully retrieved and brought back to the Veraval and re-installed.

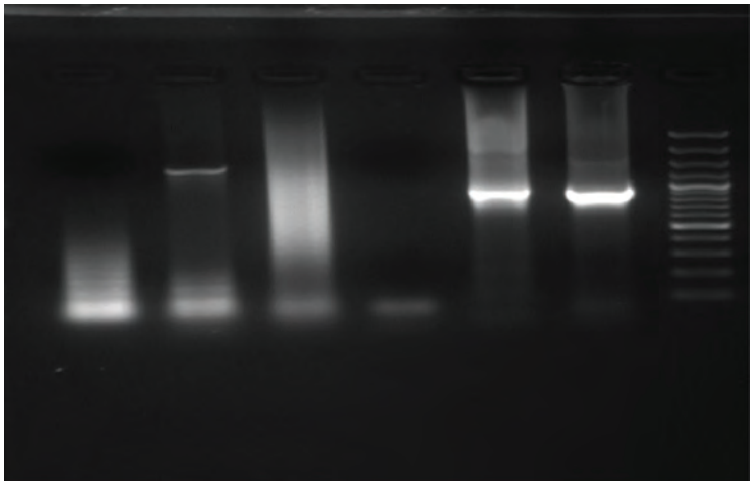
Two training programmes were conducted, one at Vanakbara, Diu and another at Veraval on 11th November and 13th November 2019 respectively. More than 40 fishers participated in each program. Demonstrated the use of GEMINI-Gagan enabled marine instrument developed by INCOIS for navigation by the fishers. The other products developed by INCOIS and the activities of ICAR-CIFT were also demonstrated during the programmes.

Participants of the training program with the faculty at ICAR-CIFT Veraval Research Centre

NATIONAL FISHERIES DEVELOPMENT BOARD PROJECT

National Surveillance Program for aquatic animal diseases

Baseline data collected and active disease surveillance were carried out in 31 freshwater finfish farms and 18 brackish water shrimp farms. 138 pooled finfish and 127 pooled brackish water shrimp samples were collected from the farms and tested for pathogens such as SVCV and KHV from freshwater finfish; TiLV from Tialpia farms and WSSV, HPV, MBV, IHHNV, YHV, TSV, EHP, AHND and IMNV from brackish water shellfish farm. WSSV was detected from 4 farms, EHP in one farm and IHHNV in one farm. The remaining tested pathogens could not be detected from any of the shrimp samples collected. The fresh water finfish samples were found to be negative for the tested viral pathogens KHV, SVCV and TiLV. Six disease outbreak cases were investigated in shrimp farms in Thrissur and Ernakulam Districts of Kerala during the year and the cause of the disease were detected using microbiological and molecular biological techniques and also by testing the water quality parameters of the farms. The major problem observed in the disease outbreak was infection with WSSV and EHP. Twenty six imported shrimp samples were tested for OIE listed pathogens and among these 16 samples were positive for WSSV and 1 sample was positive for MBV.



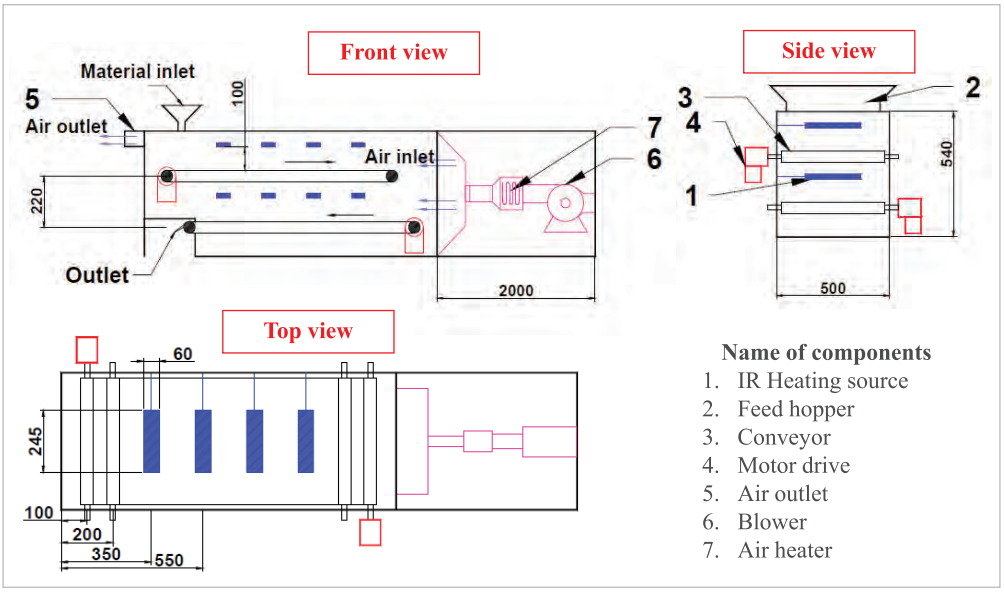
Nested PCR for WSSV detection

Lane 1 Negative control. Lane 2 1st step PCR positive control, Lane 3 1st step negative sample, Lane 4 negative control, Lane 5 nested positive control, Lane 6 nested positive sample, Lane 7 100bp marker

MINISTRY OF FOOD PROCESSING INDUSTRIES PROJECT

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

Infrared offers faster drying of food materials with minimum energy consumption and nutrient losses than the conventional dryers. Thus, a hot air assisted continuous infrared dryer is aimed to be fabricated which finds multitude of application in food processing. Collection of related literature has been done with respect to design of hot air assisted IR dryer, combined effect of IR and hot air on drying, advantages and difficulties involving in hot air assisted IR drying of fish, important design considerations and through review of existing hot air assisted IR drying systems etc. Design of hot air assisted continuous infrared drying system was prepared based on through literature review. Preliminary experiment was carried out using ceramic infrared heater (1000 W) to know the temperature profile in drying chamber. Results obtained from this study were utilized for design of prototype hot air assisted continuous Infrared dryer for high value fish and fishery products.



Schematic of prototype hot air assisted continuous infrared dryer

WORLDFISH PROJECT

Establishing value chain for fish: Towards nutritional security for rural population

In Worldfish project, the objectives were: Study of fish consumption patterns of rural consumers in Meghalaya, Odisha, Karnataka and Kerala, to develop fish products for pregnant/lactating women and children for first 1000 days, nutritional profiling and shelf life studies of novel fish based products developed, to study consumer acceptance for CIFT products and its determinants. The activities taken up in the current year were: Study on fish consumption pattern in selected four sates of India, Development of fish products and Standardization of protocols, Product intervention studies. Indicators for fish consumption study were identified as purchase and consumption behavior, consumption pattern, health profile with reference to iron deficiency anemia, malnutrition, willingness to consume fish based products, knowledge of fish consumers on health benefits of fish, perception of fish consumers and drivers and barriers to fish consumption.

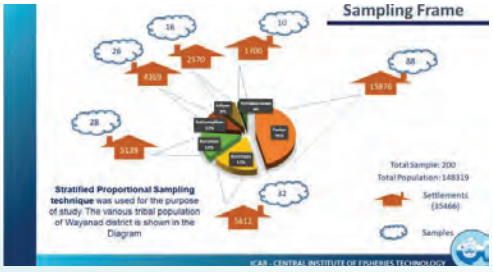
Study was taken up in Kerala and Karnataka in first phase covering two malnourished districts from each state. Questionnaire was prepared in English, Malayalam and Kannada languages. Pre-testing of questionnaire was done at Ernakulam, Wayanad and Malappuram districts of Kerala and Dakshina Kannada and Chamrajnagar districts of Karnataka. Stakeholder meetings were conducted with KVKs, ICDS, FHC, ITDP, Special Cell District Collectorate, NNM, for identification of sample groups for the survey.

Two hundred households covering entire district were identified as sample for the study though stratified proportionate random sampling. Enumerators were identified for conducting the survey. More than 100 households were surveyed in Wayanad and Dakshina Kannada covering tribal settlements.

Before initiating the project interventions as a part of entry point activity (EPA), solar power operated fish drier with electric back up (20Kg) and mobile fish vending kiosk attached with descaling machine were installed among the community in Wayanad (Kerala) and Dakshin Kannada(Karnataka) keeping eye on their problem of hygienic fish drying and fish contamination due to open selling.

Fish products targeting malnourished children, pregnant and lactating women were prepared viz fish soup powder, fish pappad, fish chatney and vacuum packed fried anchovies. Nutrient profiling including macro and micro nutrients, packing and storage studies were completed.

Training and demonstration studies on the preparation of these products were done at Cherai (Kerara), Odisha and Manipur. Intervention studies conducted at Odisha and Manipur on iron fortified soup powder proved that the level of hemoglobin could be increased in malnourished anemic adolescent girls. The iron source used was cheap bringing down the cost of soup powder drastically. Vacuum packed fried anchovies were transported to Odisha for distribution among tribal malnourished population through Worldfish Centre.



Interaction at alternate school, Wayanad

COCONUT DEVELOPMENT BOARD PROJECT

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

Eco toxicity of biocides used for preservation of coconut wood on the aquatic environment

As a prelude to the work on ecotoxicity of biocides used for the preservation of coconut wood, two biocides including Chromated Copper Boron (CCB) and Nano copper oxide was identified for the study.

Preparation of coconut wood samples


Wood seasoning after machining

Three concentrations of nano copper oxide (0.02%, 0.05% and 0.1%) were selected and treated over coconut wood. The mechanical properties of the treated wooden samples were evaluated along with the control samples. The results showed that with increasing concentration of nano copper oxide, modulus of rupture (MoR) was decreasing.

Small scale fishing vessel for traditional fishermen of southeast coast of India

A preliminary survey was conducted along Tamil Nadu coast including Colachel, Inayam, Kadiyapattanam and Thengapattanam of Kanyakumari district for selection of the most popular design of Catamaram/canoe. Stakeholder meeting was held at Kurumpanai village in Colachel, where 50 local fishermen attended. This was organized with the help of South Asian Fishermen Fraternity (SAFF), a Fishermen Society, Colachel. Inputs/ suggestions regarding the type of canoe needed for use were obtained through discussion.


Meeting with fishers


Boat yard visit

Harvest & Post harvest interventions for mainstreaming biodiversity conservation into the fisheries sector of East Godavari riverine and estuarine ecosystem

Visakhapatnam Research Centre of ICAR-Central Institute of Fisheries Technology (ICAR-CIFT) has conducted an awareness workshop and three training-cum-demonstration programmes in the UNDP-EGREE funded project "Harvest and post harvest interventions for mainstreaming biodiversity conservation into the fisheries sector of East Godavari riverine and estuarine ecosystem" at Kakinada, Andhra Pradesh. The project was envisaged under 4 components.

Component I: Awareness workshop on harvest and post harvest interventions in EGREE region

Releasing the workshop proceedings -Sustain 2019

A workshop on "Harvest and post harvest interventions for mainstreaming biodiversity conservation into fisheries sector of East Godavari riverine and estuarine ecosystems" was organized at Kakinada. Stakeholders from mechanized, motorized and traditional fishing sector, entrepreneurs, women from SHG groups etc. participated in the workshop. Govt. agencies including MPEDA, NETFISH-(NACSA), ICAR-CMFRI, ICAR-CIFE, SIFT, Kakinada also participated in the workshop. Dr. Shanti Priya Pandey, IFS, Chief Conservator of Forests, & CEO, EGREE Foundation inaugurated the workshop and also released the workshop proceedings Sustain- 2019 on the occasion The inaugural session was followed by talks by scientists of ICAR-CIFT and ICAR-CMFRI.

Onboard demonstration of square mesh cod end

Component II: Demonstration of sustainable trawl fishing with square mesh cod ends

A demonstration cum training programmme on fabrication and operation of square mesh cods was conducted for 50 fishermen. The field operations demonstrated the advantage of square mesh cod end over the conventionally used diamond mesh cod end, in facilitating the escapement of juveniles. 25 standards size square mesh cod ends were distributed to 25 trawl owners Dr. R. Raghu Prakash, Principal Scientist, Dr. U. Sreedhar, Principal Scientist and Shri. G. Kamei, Scientist were the resource persons for demonstration.

Demonstration of hygienic fish filleting

Component III: Skill development programme on value added fish products

Training on value added fish products and hygienic handling of fish was imparted to 10 fisherwomen from the EGREE region. The participants were trained on hygienic fish handling, preparation of various value added products including packaging and labeling of fishery products.Ten insulated fish bags, 10 sealing machines and 10 meat mincers were distributed to the trainees. Dr. B. Madhusudana Rao, Principal Scientist, Dr. Viji P., Scientist and Dr. Jesmi Debbarma and G. Bhushanam, were the resource persons for the training programme.

Component IV: Capacity building and establishment of hygienic smoking kilns

Ten trainees from the EGREE fishermen community were trained on various aspects of hygienic fish smoking using community fish smoking kiln (COFISKI). Trainees were given hands on training on hygienic handling and preparation of fish for smoking, curing of fish and smoking hygienically dressed fish using COFISKI and packaging and labeling of different smoked products. Dr. B. Madhusudana Rao, Principal Scientist, Dr. Viji P., Scientist and Dr. Jesmi Debbarma and G. Bhushanam, were the resource persons, for the capacity building programme. Fish Smoking Kilns (COFISKI) of 20 kg capacity designed by ICAR-CIFT were distributed to the trainees.

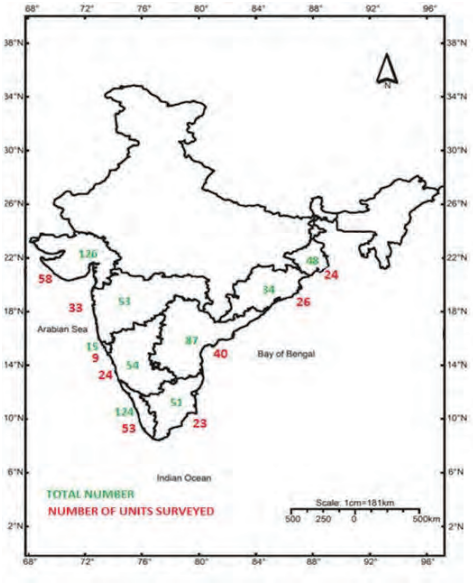
Three training manuals (in local language, Telugu) on value added fish products, hygienic smoking of fish and sustainable trawl fishing using square mesh cod end were prepared and distributed to the trainees.

MARINE PRODUCT EXPORT DEVELOPMENT AUTHORITY PROJECT

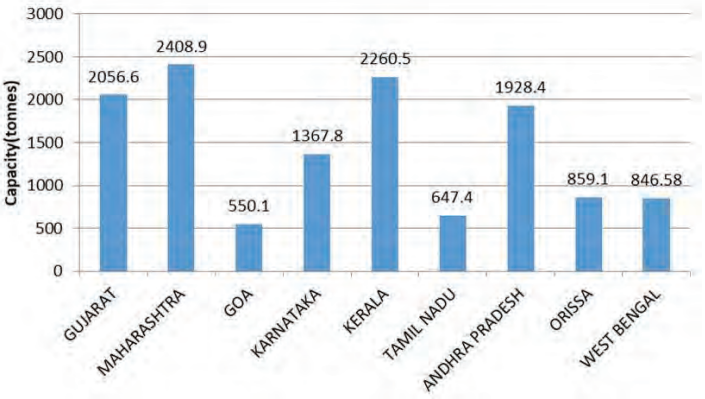
Assessing Seafood Exporting Units' needs for exporting value added products and capacity building requirements

A total of 326 units representing 55% of total units were chosen for the survey. Maximum percentage of units surveyed was in the state Odisha with 76.47% of total units followed by Maharashtra (62.26%), Goa (60%), West Bengal (50%), Gujarat (46.03%), Andhra Pradesh (45.97%), Tamil Nadu (45.09%), Karnataka (44.44%) and Kerala (42.74%). Among the units surveyed, nearly 8% of units own fishing vessels and 42 fish processing units own aquafarms. Total capacity of ice production in processing units surveyed is 10,601.5 tons and 12,925.38 tons is the freezing capacity and Maharashtra has the maximum freezing capacity. The study

indicated value added fish products processing and export is not practiced as expected. Very limited value-added products listed in HS code are currently produced in the units studied. Difficulties and problems faced by seafood industry to initiate value added fish products is studied and documented.



State-wise number of seafood processing units surveyed in India



State-wise freezing capacity in India

General Information

(01 January, 2019 to 31 December, 2019)

Collaboration with other Institutes

Local Institutions in the area other than ICAR Institutes

- Board of Radiation and Isotope Technology, BAARC, Mumbai
- Cochin University of Science and Technology, Kochi
- District Fisherman Youth Welfare Association (DFYWA), Visakhapatnam
- Kerala Biotechnology Commission, Thiruvananthapuram
- Kerala Fishermen's Co-operative Federation (MATSYAFED), Thiuvananthapuram
- Kerala State Pollution Control Board, Kochi
- Network for Scientific Co-Operation for Food Safety and Applied Nutrition (NetSCoFAN)
- PETRONET LNG Division, Cochin
- Seafood Exporters Association of India (SEAI)
- Society for Assistance to Fisherwomen (SAF)
- State Institute of Fisheries Technology, Govt. of Andhra Pradesh
- State Fisheries Departments of Kerala, Karnataka, Tamil Nadu, Gujarat, Telangana Andhra Pradesh, Odisha, West Bengal, Jharkhand, Biohar, Manipur, Tripura, Meghalaya and Arunachal Pradesh

National Institutes and Agricultural Universities

- Amity University, Noida, Uttar Pradesh
- Andhra University, Visakhapatnam
- Annamalai University, Tamil Nadu
- Bharathiar University, Coimbatore, Tamil Nadu
- Bureau of Indian Standards, Old Delhi
- Central Institute of Fisheries Nautical and Engineering Training (CIFNET), Kochi, Kerala
- Christ College, Rajkot, Gujarat
- College of Fisheries, Mangalore, Karnataka
- College of Fisheries, Veraval, Gujarat
- College of Veterinary Science, Gannavaram, Andhra Pradesh
- Confederation of Indian Industries (CII), New Delhi
- Department of Forestry, Tamil Nadu
- Dr. V.S. Krishna Govt. PG college, Visakhapatnam

- Export Inspection Agency (EIA), Kochi
- Fishery Survey of India (FSI), Mumbai
- Food Safety and Standards Authority of India (FSSAI), New Delhi
- GITAM Deemed to be University, Andhra Pradesh
- Goa Shipyard Ltd., Goa
- ICAR -Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha
- ICAR-Central Inland Fisheries Research Institute, Kolkata, West Bengal
- ICAR-Central Institute of Brackish water Aquaculture, Chennai, Tamil Nadu
- ICAR-Central Institute of Fisheries Education, Mumbai, Maharashtra
- ICAR-Central Marine Fisheries Research Institute, Kochi, Kerala
- ICAR-Central Tobacco Research Institute, Rajamundry, Andhra Pradesh
- ICAR-National Bureau of Fish Genetic Resources Research Centre, Kochi, Kerala
- Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, Telangana
- Indian Institute of Technology (IIT), Chennai, Tamil Nadu
- Indian Institute of Technology(IIT), Kharagpur, West Bengal
- Indian Institute of Technology(IIT), Gandhinagar, Gujarat
- Industries Department, Andaman & Nicobar Administration
- Institute of Microbial Technology, Chandigarh
- Jawaharlal Nehru Technological University (JNTU), Hyderabad, Telangana
- Junagadh Agricultural University, Junagadh, Gujarat
- Kamadhenu University, Gandhi Nagar, Gujarat
- Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi, Kerala
- Kerala Water Authority
- M.V.K.R. Fisheries Polytechnic, Bhavadevarapalli, Andhra Pradesh
- Marine Products Export Development Authority (MPEDA), Kochi, Kerala
- National Fisheries Development Board (NFDB), Hyderabad, Telangana
- National Institute of Cholera and Enteric Diseases (NICED), Kolkata, West Bengal
- National Institute of Fisheries Post Harvest Technology and Training (NIFPHATT), Kochi, Kerala
- National Institute of Oceanography, Goa
- National Institute of Oceanography, Kochi, Kerala
- National Research Centre on Plant Biotechnology, Thiruvananthapuram, Kerala
- Naval Physical and Oceanographic Laboratory, Kochi, Kerala
- P.S.G. College of Arts and Science, Coimbatore, Tamil Nadu
- Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram, , Kerala
- Science and Technology Entrepreneurship Development project (STED), NSTEDB, New Delhi
- Shri M.N. Virani Science College, Rajkot, Gujarat

- Sidhartha Mahila College, Vijayawada, Andhra Pradesh
- Sri Venkateswara Veterinary University, Tirupati, Andhra Pradesh

Private Sector

- Action Aid Association, Visakhapatnam, Andhra Pradesh
- Amalgam Seafoods, Ezhupunna, Alapuzha, Kerala
- Ekalavya Pvt Ltd., Mumbai, Maharashtra
- Garware Wall Ropes Ltd., Pune, Maharashtra
- Green Guard Dryers, Idukki, Kerala
- Hi-Media, Mumbai, Maharashtra
- ISHKA Renewable Farms Pvt Ltd., Cochin, Kerala
- Samudra Shipyard, Aroor, Kerala
- Seafood Industries

International Institutions

- Asia Pacific Fisheries Commission (APFC), Bangkok, Thailand
- Bay of Bengal Programme (BOBP)
- Food and Agriculture Organization (FAO), Rome, Italy
- GESAMP of United Nations, London, United Kingdom
- INFOFISH, Malaysia
- WorldFish, Penang, Malaysia
- World Wide Fund (WWF), Gland, Switzerland

Extension and Development Agencies

- AFPRD, Hyderabad, Telangana
- Agency for Development of Aquaculture in Kerala (ADAK), Kochi, Kerala
- Alleppey Diocesan Charitable and Social Welfare Society, Alappuzha, Kerala
- Bharat Sevak Samaj, Thiruvananthapuram, Kerala
- Chellanam Panchayat SC/ST Co-operative Society Ltd., Kochi, Kerala
- Chellanam-Kandakadavu Fishermen Development and Welfare Co-operative Society, Kochi, Kerala
- Development Action through Self Help Network (DARSHN), Kerala
- District Youth Fisheries Welfare Association, Visakhapatnam, Andhra Pradesh
- EGREE Foundation, Visakhapatnam, Andhra Pradesh
- Gandhi Smaraka Seva Kendram, Alappuzha, Kerala
- Kanyakumari District Fishermen Sangam's Federation, Nagercoil, Tamil Nadu

- Karnataka Fisheries Development Corporation, Bengaluru, Karnataka
- Kerala Industrial and Technical Consultancy Organization (KITCO), Kochi, Kerala
- Kottappuram Integrated Development Society (KIDS), Kodungalloor, Kerala
- Matsya Mahila Vedi, Chellanam, Kerala
- MS Swaminathan Research Foundation, Chennai, Tamil Nadu
- Small Industries Development Bank of India (SIDBI), Lucknow, Uttar Pradesh
- South Indian Federation of Fishermen Societies (SIFFS), Thiruvananthapuram, Kerala
- Triptisagar Society for Fishermen Ltd., Jafarabad, Gujarat
- Vanitha Matsya Thozilali Bank, Neendakara, Kerala

TECHNOLOGY TRANSFER/PROFESSIONAL SERVICE FUNCTIONS

S. No:	Technology	Date of Agreement signing	Name of the Client
COLLABORATIVE RESEARCH			
1	Technical know-how for the development of seaweed based organic cookies, spirulina nutri-drink and organic toothpaste	8 January 2019	ZCorp Organic Pvt. Ltd, Kanjikode, Palakkad
2	Development of energy efficient eco-friendly dryers for fish and fishery products	8 March 2019	Greenguard, Anakkara P.O, Kumily, Idukki
3	Foliar spray samples from fish / shellfish waste incorporated with chitosan for three trials. Conduct trials of growth promoter on cardamom plants	13 March 2019	Dr. Thomas K Sebastian, Kanjirappally, Kottayam
4	Study on the Development of profitable and efficient fish and bio-waste management system using larvae of Black Soldier Fly	15 March 2019	Nehru College of Engineering & Research Centre, Pambadi
5	To develop feed from fish discards	27 March 2019	Mr. Yeju K.S., Manaloor P.O., Thrissur
6	Department of Science & Technology under Effective utilization of wasted by-catch of fish for reclamation of soil fertility in barren land, an employment opportunity for coastal population of Tamil Nadu	02 July 2019	Loyola College, Nungambakkam, Chennai
7	Technical guidance and infrastructure facilities to develop algal based cakes, biscuits, rusk, water and puffs.	26 July 2019	Zaara Biotech, TBI Sahrdaya, Kodakara, Thrissur

8	Business development of smoked and dried fish products	16 August 2019	Lemlei Enterprise, Mr. Khumanthem Rakesh Singh, Manipur
9	Manufacture of fish meal-based feed	26 November 2019	Mr. Sabu John, Kanjiramattom, Ernakulam
CONSULTANCY			
10	Deep Sea Fishing Vessels - Detailed design and feasibility report of 20-24m L_{OA} fishing vessel under Blue Revolution Scheme for Lakshadweep	1 February 2019	Directorate of Fisheries, Kavaratti, Lakshadweep
11	Cold storage unit for cardamom, vegetables and other agricultural products for KSWC, Vandanmedu	11 February 2019	ICAR-Indian Institute of Spices Research, IISR & Kerala State Warehouse Corporation, KSWC
12	Providing DPR for establishing of export-oriented tuna loin freezing plant (fish processing unit) at Lakshadweep	8 March 2019	Al-Badr Seafoods Pvt Ltd, Cochin Special Economic Zone, Kakkanad, Cochin
13	Consultancy for building sail powered fishing craft	8 August 2019	Kerala Watersports& Sailing Organization (KWSO), Parry Jn, Ernakulam
14	Technical guidance for spray drying facility	1 November 2019	Avisa Biotech Pvt Ltd, Kalamassery, Kochi
15	Technical approval of 22.7 m L_{OA} FRP Long Liner cum Gillnetter and 22.0 m L_{OA} steel boat under Blue Revolution scheme	2 December 2019	S.M. Engineering Works Thovalai, Kanyakumari
16	Setting up of Central Lab with NABL accreditation status for dairy products	4 December 2019	MILMA, Ernakulam Regional Co-operative Milk Producer's Union Ltd (ERCMPU), Edappally
17	Setting up of Aquatic Health Laboratory (AAHL) by ADAK at Odayam, Kerala	7 December 2019	Agency for Development of Aquaculture Kerala (ADAK) & Dept. of Fisheries, Govt. of Kerala, Trivandrum
18	Technical guidance and training on Quality Assurance & Seafood Microbiology aspects	9 December 2019	Castlerock Fisheries Pvt Ltd, Raigad, Maharashtra
CONTRACT SERVICE			
19	To analyse fatty acid profile, amino acids and mineral elements (K, Na, Ca, Mg, Fe and Zn) content of two samples namely squilla and silver belly	April 2019	Douglas Shandi LaminShillong, Meghalaya

20	To conduct product efficacy study of Safe Oxy-Aqueous chlorine dioxide for below usages in seafood processing-fish and fish products including White leg shrimp (Litopenaeusvannamei), squids.	April 2019	Crest Aquatech, Coimbatore, Tamil Nadu
21	Training and biochemical analysis by using analytical instruments.	April 2019	Eastern Condiments Pvt Ltd, Adimali, Idukki
22	Analytical testing/validation of five marine diesel engines	June - December 2019	Topland Engines Pvt Ltd., Rajkot, Gujarat
23	To establish Good Manufacturing Practices (GMP) & Good Laboratory Practices (GLP) in European Union approved sea-food processing plant	August 2019 - February 2020	Jeelani Marine Products, Mandavi, Ratnagiri
24	Validation of four anti-microbial resistance PCR kits developed by Hi-Media Labs	July 2019	Hi-Media Laboratories Pvt Ltd., Mumbai
25	Lyophilization of melanin sample	September - March 2019	Avisa Biotech Pvt Ltd., Kalamassery, Kochi
26	Nutritional profiling of dietary product	October - March 2019	M/s Arecia Life Sciences Pvt Ltd., Panampilly Nagar, Ernakulam
CONTRACT RESEARCH (GRANT-IN-AID / SPONSORED)			
27	Study on Assessing seafood exporting units needs for exporting value-added products & capacity building measures	1 August 2019	The Marine Products Export Development Authority – MPEDA, Kochi
28	Providing 20 units of Hygienic Refrigerated Mobile Fish Vending Kiosk to Fisherwomen Community	30 September 2019	Society for Assistance to Fisherwomen (SAF), Aluva
29	Biochemical characterization of different parts of Caper (*Capparis spinosa*) and Moringa (*Moringa oleifera*)	28 October 2019	Ishka Renewable Farms Pvt Ltd., Tuticorin, Tamil Nadu
30	Human resource development in Harvest and Post-harvest interventions for mainstreaming biodiversity conservation into the fisheries sector of East Godavari Riverine and Estuarine Ecosystem through 4 components	1 November 2019	EGREE (East Godavari Riverine Estuarine Ecosystem) Foundation, East Godavari, Andhra Pradesh

Inauguration of MATSYA Fish Feed Unit, Thrissur

Signing of Collaborative Research Agreement with Lemlei Enterprise, Manipur

Signing of MoU for collaborative research

Exchange of MoU for refrigerated kiosks to SAF

Ten solar dyers of different capacities, 23 mobile fish vending kiosks and three descaling machines were sold to needy entrepreneurs/clients through CIFT empanelled agencies eight more dryers are under manufacturing for various stakeholders such as AAU, WorldFish project and private ventures.

Handing over of MoA to P.Rambabu for transfer of technology of CIFT Insulated Fish Bag

Handing over the MoA to Dr. Neena Singh, Advik Dhanyati Enterprises, Balasore, Odisha

Commissioning of solar-LPG hybrid dryer at Peringala by Shri. Benny Behanan, MP

COMMERCIALISATION OF TECHNOLOGIES

S.No.	Technology	Date of Agreement signing	Name of the Client
VALUE ADDED PRODUCTS FROM FISH AND SHELLFISH			
1	Fish pickle	11 January 2019	Chellanam Seafish, Mrs. Mary Sunitha, Kochi
2	Value added products from fish	25 January 2019	Nanma Foods, Mr. Johnson K. Chennithala P.O., Mavelikkara, Kerala
3	Fish pickle	31 January 2019	Travancore Pickles, Mrs. Beena J.T., Nedumangad, Thiruvananthapuram
4	Fish pickle	04 February 2019	Mrs. Shahina Nishad, Changanassery, Kerala
5	Fish cutlet and fish pickle	27 March 2019	Ponnoos Fish Feed, Mrs. Akhila Mole M.A, Kodungallur, Thrissur
6	Fish pickle and masala fried clam	10 April 2019	Vedika Food Industrial, Mr.Saneesh K.S., Vaikom, Kottayam, Kerala
7	Fish and prawn pickle	10 May 2019	Mr. Dasan K.K., Balussery, Kozhikode, Kerala
8	Fish and prawn pickles	18 June 2019	Herbs & Spices, Mrs.Prasanthi S., Bhoothakulam, Kollam, Kerala
9	Fish and prawn pickles	26 July 2019	Mr. Seby Cherian, Omanapuzha, Alappuzha, Kerala
10	Fish/prawn pickles and chutney powder	27 August 2019	Mr. Basil Thankachen, Kothamangalam, Kerala
11	Fish and prawn pickles	27 August 2019	Sahalas fish pickles, Mr.Faisal M.P., Malappuram, Kerala
12	Value-added products from dried fish	21 August 2019	Mr. Bharat V. Kamaliya, Sankhada, Gujarat
13	Fish/prawn pickles	19 September 2019	Mr. M. Assu, Thazthekandy Paramba, Calicut
14	Value-added products like fish wafers, fish soup powder, fish/shrimp pickle, fish finger and fish cutlets	30 September 2019	Advik Dhanyati Enterprises, Dr. Nina Singh, Balasore, Odisha
15	Value-added products like fish fingers, fish cutlets, fish burgers, fish samosa, fish balls, stretched shrimp & fish pickle	25 November 2019	Manasa Fish Con, West Godavari District, Andhra Pradesh
16	Marinated fishery products	25 November 2019	Mr. Ramees C.P.M., Kuttichira, Calicut

CHILLED / FROZEN PRODUCTS			
17	Pre-processing and packaging of fresh fish	27 February 2019	Green Marine, Mrs. Rejitha T.K., Thevara, Kochi
18	Frozen stuffed mussel recipes	27 February 2019	Mejillon Foods, Mr. Mansoor O. P., Kozhikode, Kerala
19	Pre-processing of selected marine and inland fish and prawns, its chilling and freezing technology	25 November 2019	Manasa Fish Con, West Godavari District, Andhra Pradesh
RETORT POUCHED PRODUCTS			
20	Production of retort processed ready to cook/fry stuffed mussels and mussel meats	14 May 2019	Foo Foods, Mr. Mohammed Fawaz T.C., Chaliyam P.O., Kozhikode, Kerala
UTILIZATION OF SECONDARY RAW MATERIALS			
21	Technology on enzyme based de-proteinization of shrimp shell waste and hydrolysate production	11 January 2019	Mr. Koshy Thomas Fab Dye Kem, Aroor, Alleppey
22	Feed from fish waste	11 January 2019	Mrs. Akhila Mole, Kodungallur, Thrissur
23	Fish silage	11 January 2019	Chellanam Seafish, Mrs. Mary Sunitha, Kochi
24	Production of fish collagen peptide and hydroxyapatite	15 March 2019	Eklavya Biotech Pvt. Ltd, Ghatkopar (E), Mumbai
25	Production of foliar spray from fish waste	06 May 2019	Kallar Plantation, Kallar, Vattiyar P.O.
26	Fishery waste utilization	26 July 2019	Mr. Seby Cherian, Omanapuzha, Alappuzha, Kerala
27	For the production of multipurpose fertilizers from fish hydrolysate (Soluble)	04 September 2019	Sandesh K. Salian, Udupi, Karnataka
28	Collagen concentrated fish skin for collagen/gelatin/collagen-peptide extraction	26 November 2019	Sulchem Industries, Muvattupuzha, Kerala

HYGIENIC HANDLING OF FISH			
29	Insulated fish bag	11 March 2019	Mr. Pentapalli Rambabu, Vishakapatnam
SEAWEED			
30	Extraction protocol of seaweed sulphated polysaccharide and fucoxanthin from seaweed	27 March 2019	Accelerated Freeze Drying Co. Ltd - AFDC (Amalgam Group), Ezhupunna, Alappuzha, Kerala
ESTABLISHMENT OF SOLAR DRYER FACILITY			
31	Production of dry fish and for the establishment of hybrid solar dryer	07 February 2019	Vaikans Fisheries, Moolamkuzhy, Kochi
32	Design and fabrication of electrical dryer of 400 kg capacity for drying vegetables	01 July 2019	Mrs. Ann Mary Abraham, Manarcad, Kottayam
33	Design and technical know-how of solar electrical fish dryer (100 kg capacity) for hygienic drying of fish	21 November 2019	Chellanam Sea Fish, Kochi
34	Design and technical know-how of Solar electrical fish dryer (2 units with 300 kg capacity each) for hygienic drying of fish	06 December 2019	God'N Foods, Kannamaly P.O., Kochi
CLAM SHUCKING EQUIPMENT			
35	Design for clam shucking equipment	10 June 2019	Britto seafoods exports Pvt. Ltd, Tuticorin

Official launch of products developed for Foo Foods, Kozhikode by Secretary DARE and Director General, ICAR

Agreement signing with Ponnoos Fish Feed, Kodungallur, Thrissur for transfer on technology for the preparation of feed from fish waste

ICAR-CIFT empanelled six more external agencies to manufacture and supply ICAR-CIFT dryers, descaling machine and mobile fish vending kiosk. The firms are,

1) M/s Endorse associates, Manarcad, Kottayam
2) M/s Dellmarc, Vallapady, Thrissur
3) M/s Jeyasorna AgroTech, Dindigul, Tamil Nadu
4) M/s Techno consultancy services – Sarah's Techno, Vellanchira, Thrissur
5) M/s Delbert industries (P) Ltd, Kizhakkambalam, Ernakulam
6) M/s. Sreehari fabricator, Port Blair

Agreement signing with empanelled firm, M/s. Jeyasorna AgroTech, Dindigul

Solar dryer facility established by Chef N Kitchen, ZTM-ABI Incubatee

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

Solar Dryer established at ICAR-CIWA, Bhubaneswar, Odisha

INCUBATEES REGISTERED FOR AGRIBUSINESS INCUBATION

SNo:	Area of activity	No. of registered incubatees
1	Dried fish products	11
2	Value added products from fish / seaweed	10
3	Retort pouch products	1
4	Waste Management	2
5	Fish Feed	1
6	Marketing	2
	TOTAL	27

Retort product launched by Foo Foods, Kozhikode

Cookies launched by ZCorp Pvt Ltd., under the brand name Smile N Take

INTELLECTUAL PROPERTY RIGHTS

a. Copyright has been granted for CIFTFISHPRO mobile application
b. Filed Copyright for FishQCheQ - A System to Assess the Quality of Fish
c. Filed Design application for Modern and Hygienic Mobile Fish Vending Kiosk
d. Filed Trademark application for 'CIFTEQ'
e. Filed Copyright application for computer software titled Mobile Alert System for Dryer Users

Apart from these incubation support has been provided to 26 persons and nine dryfish brands using CIFT support are available in the market

CIFT supported incubatee products

ANALYTICAL SERVICES

The Headquarters and research centres of the Institute undertook testing samples of different types of raw materials and products received from various organizations, State and Central Government departments and entrepreneurs and issued reports on their quality. The samples tested included fresh and frozen fish and shellfish products, byproducts, prawn larvae from hatcheries, swabs from processing tables and workers' hands, chemicals, salt, water, ice, packaging materials etc. Type testing of marine diesel engines was also carried out and performance certificates were issued to the concerned manufacturers in addition to calibration of mercury, alcohol and digital thermometers received from different fish processing plants and the industry. Samples were tested in different laboratories at Headquarters and research centers of ICAR-CIFT and test reports were sent to the concerned.

Communicating Research Outcomes

Participation in Symposia/Seminars/Workshops etc.

Scientists from the Headquarters and Research Centres participated in several national and international symposia, seminar and workshops. Some of the notable events were World Brackishwater Aquaculture Conference (BraqCon -2019), Chennai (23 - 25 Jan, 2019); National Seminar on Food Sovereignty: Innovations at intersection of technology, Quality & production Gannavaram, Andhra Pradesh (06 Feb,2019); National seminar on emerging solutions in medical and environmental biotechnology (ESMEB) , Visakhapatnam (23Feb, 2019); Hindi Workshop on *bharat ke dakshin rajyo ki matsyaki sanwardhanke naye aayam*, Kakinada (15 March, 19); One day seminar organized by GEA and Kochi branch of Seafood Exporters Association of India, Cochin (16 May 2019); National seminar on FISHTECH-19, Mumbai (11 June, 2019); International conference on Asian - Pacific Aquaculture 2019, Chennai (June 18-21, 2019); Asian-Pacific Aquaculture 2019, Chennai (19 -21 June, 2019); National Scientific Hindi seminar-Techfish 2019 on Technological advancements in fisheries sector with special reference to Gujarat Veraval, Gujarat (25 June, 2019); National Seminar in Hindi Harith Matsyaki 2019, Visakhapatnam (30 July, 2019); Industry-R&D interaction on large scale deployment of radiation processing of food commodities (TMRPFC-2019), Mumbai (17 Aug, 2019); National seminar "AMR on Indian Fisheries: Measures of mitigation, Kochi (7-8 Nov, 2019); Workshop on Third short term mission on risk assessment Sonipat, Haryana (11-15 Nov, 2019); Workshop on Sustain Fish 2019, Andhra Pradesh (21 Nov - 11 Dec 2019); International Conference on Aquatic Resources and Blue Economy (AQUABE-2019), KUFOS, Kochi (28-30 Nov, 2019); Conference on New Frontiers in Material and Environmental Sciences, Cochin (28-29 January 2020)

TRAINING/AWARENESS IMPARTED

Sl. No.	Subject	No. of beneficiaries	Venue and date
1	Characterization of Heterotrophic bacteria isolated from shrimp culture environs for AMR genes	1	Kochi (05 Nov 2018 to 04 Feb 2019)
2	Characterization and antimicrobial susceptibility patterns of Arcobacter sp. isolated from seafood	1	Kochi (15 Nov 2018 to 15 Feb 2019)
3	Isolation & characterization of bio-film farming *Escherichia coli* & *Chromobacterium violaceum* from retail fish market	1	Kochi (15 Nov 2018 to 15 Feb 2019)
4	Prevalence and characterization of *Escherichia coli* from Vembanad lake	1	Kochi (15 Nov 2018 to 15 Feb 2019)
5	Incidence of *Plesiomonas shigelloides* from seafood	1	Kochi (15 Nov 2018 to 15 Feb 2019)
6	Isolation and characterization of exo polysaccharide bacteria from seaweed *Sargassum wightii*	1	Kochi (01-31 Jan, 2019)

7	Microbial analysis of seafood and screening of aquatic bacteria for antibiotic resistance	1	Kochi (01-31 Jan, 2019)
8	Isolation of bio-film farming *Escherichia coli* from retail fish market	1	Kochi (01-31 Jan, 2019)
9	Sample of fish for microbial quality and antibiotic resistance of heterotrophic marine bacteria	1	Kochi (01-31 Jan, 2019)
10	Characterization of photobacterium deiseal isolated from shell fish	1	Kochi (01-31 Jan, 2019)
11	Characterization of *Vibrio mimics* isolated from seafood	1	Kochi (01-31 Jan, 2019)
12	Microbial examination of seafood and antibacterial resistance of bacteria isolated from shrimp aquaculture	1	Kochi (01-31 Jan, 2019)
13	Extraction and biochemical characterization of seed extracts and its antibiofilm activity	1	Kochi (14 Jan 2019 to 16 April 2019)
14	Programme on 'distribution of community fish smoking kilns and demonstration of smoke curing of fish in hygienic conditions'	30	Kakinada, Andhra Pradesh 27 Jan, 2019
15	Seafood processing of Gujarat (In-plant training Programme)	5	Veraval (25 Jan - 24 May 2019)
16	Smoke curing fish in hygienic condition	7	Kakinada, Andhra Pradesh (27-29 Jan, 2019)
17	A study on standardization and storage life evaluation of Kerala style fish curry powder mixes in laminated flexible pouches	1	Kochi (01 Feb –30 April, 2019)
18	Development of ready-to-eat white sardine and anchovies in reportable pouches using conventional and step-up processing methods	1	Kochi (01 Feb –30 April, 2019)
19	Development and standardization of ready-to-serve tuna-mushroom keto soup in retortable pouches	1	Kochi (01 Feb –30 April, 2019)
20	Quality changes in fish packed under reduced oxygen atmosphere	1	Kochi (01 Feb –30 April, 2019)
21	Demonstrations conducted on feed preparation from market waste at Champakkara fish market	5	Kochi (04 Feb, 2019)

22	Leaching of copper in the aquatic environment from nano copper oxide treated cage nets	2	Kochi (04 Feb - 03 May, 2019)
23	Assessment characteristics of nano copper oxide treated cage nets	1	Kochi (04 Feb - 03 May 2019)
24	Assessment of bioaccumulation and toxic effect of copper on *Oreochromic mossambicus*	1	Kochi (04 Feb - 03 May 2019)
25	Formaldehyde determination in fish by HPLC and GC-MS /MS	2	Kochi (04 Feb - 04 May 2019)
26	Square mesh cod end fabrication	50	Mangrol (5 February 2019)
27	Fish processing and value addition	3	Kochi (06 Feb – 06 May, 2019)
28	Smoke curing fish in hygienic conditions	30	Lower Dibang Valley, Arunachal Pradesh (10-12Feb, 2019)
29	HACCP concepts	24	Kochi (11-15 Feb, 2019)
30	Awareness programme on 'Harvest and post-harvest fishery technologies' under scheduled tribe component programme.	60	Koyyuru Mandal, Visakhapatnam 12Feb 2019
31	In-plant training to B.Tech food engineering students of KAU	19	Kochi (13-22 Feb, 2019)
32	Demonstrations conducted on feed preparation from market waste at Munambam fishing harbor	10	Kochi (15 Feb, 2019)
33	Demonstrations conducted on feed preparation from market waste at Varappuzha Fish market	15	Kochi (16 Feb, 2019)
34	Ethnography and development of user mapping on antimicrobial usage in aquaculture setting	22	Kochi (18-25 Feb, 2019)
35	Square mesh codend fabrication	50	Porbandar, Gujarat (18 Feb, 2019)
36	Square mesh codend fabrication	50	Porbandar , Gujarat (18 Feb, 2019)
37	Awareness programme on antibiotic usage and its impact with aquaculture farmers	5	Kochi (19-23 Feb, 2019)
38	Fishing harbor demonstrations conducted on feed preparation from market waste at Shaktikulangara	10	Kollam (21 Feb, 2019)
39	Demonstrations conducted on feed preparation from market waste at Kollam fish market	20	Kollam (21 Feb, 2019)
40	Preparation of value added products from fish	20	Veraval (22-24 Feb, 2019)

41	Brainstorming session under DOSA Project	12	Kochi (23 Feb, 2019)
42	Renewable energy based hygienic fish drying methods	20	Veraval (26-27 Feb, 2019)
43	Scientific fish drying'	11	Kochi (26-28 Feb, 2019)
44	Extraction and characterization of Ulvan and development of curcumin incorporated Ulvan gel	1	Kochi (01 March - 31 May 2019)
45	Purification of chondroitin sulphate shark cartilage and synthesis of acetylated chondroitin sulphate	1	Kochi (01 March - 31 May 2019)
46	Extraction of seaweed phytochemicals with deep eutectic solvents and characterization	1	Kochi (01 March - 31 May 2019)
47	Utilization of the seaweed of Indian-coast *Ulva lactuca* for bioremediation of contaminated water	1	Kochi (01 March - 31 May 2019)
48	Influence of sardine whole fish protein hydrolysate on growth, metabolic immune response and resistance to *Aeromonas hydrophilia* tilapia fingerlings	1	Kochi (01 March - 31 May 2019)
49	Influence of cuttle fish protein hydrolysate on growth, metabolic, immune response and resistance to *Aeromonas hydrophila* in Tilapia fingerlings	1	Kochi (01 March - 31 May 2019)
50	Seafood processing value addition	23	Kochi (01 March - 31 May 2019)
51	Value addition of fish & fishery products	20	Veraval (8 March 2019)
52	Demonstrations conducted on feed preparation from market waste at Lakshadweep fish harbor/ market	10	Lakshadweep (10 March, 2019)
53	Value addition of fish & fishery products	20	Veraval (14 March 2019)
54	Improved packaging and labelling methods for producing better quality fish	20	Veraval (18 March 2019)
55	Renewable energy based hygienic fish drying methods	20	Veraval (19-20 March 2019)
56	Training-cum-demonstration programme on harvest technologies and value addition of fish and fish products	50	Munchingpattu and Paderu, Visakhapatnam (21-23 March, 2019)

57	Demonstrations conducted on feed preparation from market waste at Ukkadam fish market	20	Coimbatore, Tamil Nadu (26 March, 2019)
58	Training-cum-demonstration programme on Fishing gear engineering for increasing inland fishing efficiency and improved smoking process for quality smoked fish product	50	Imphal, Manipur (27-29 March, 2019)
59	Demonstration on feed preparation from market waste	20	Hyderabad, Andhra Pradesh (28 March 2019)
60	Input training on fish process engineering	11	Kochi (01-08 April, 2019)
61	Variations in physicochemical attributes of tuna red meat protein during enzymatic hydrolysis	1	Kochi (01 April - 31 May, 2019)
62	Prevalence of *Staphylococcus aureus* in fishery products and effect of storage temperature on its survival and toxin production	1	Kochi (01 April - 29 June, 2019)
63	Isolation and characterisation of *Enterococcus faecium* from seafoods	1	Kochi (01 April - 29 June, 2019)
64	Determination of histamine forming ability of bacteria isolated from tuna	1	Kochi (01 April - 29 June, 2019)
65	Prevalence of shiga toxin producing *Escherichia coli* from seafoods	1	Kochi (01 April - 29 June, 2019)
66	Assessment of antimicrobial resistance of *Vibrio parahaemolyticus* isolated from aquaculture ponds, Kerala	1	Kochi (01 April - 31 June 2019)
67	Training on fish processing technology	3	Kochi (01 April - 29 June, 2019)
68	Efficacy of two different otter boards (Slotted 'V' form and subercrub) on board commercial fishing vessel to group of deep sea going fishermen at off Munambam	15	Kochi (2 April, 2019)
69	Advanced analytical techniques in monitoring and evaluation of chemical contaminants of food and water using GC-MS etc	5	Kochi (02-12 April, 2019)
70	Preparation and characterization of fish bone oil encapsulate	1	Kochi (03 April-03 July, 2019)
71	Production of chitin and chitosan	1	Kochi (08-09 April, 2019)
72	Input training on fish process engineering	7	Kochi (10-20 April, 2019)

73	Method of analysis of formaldehyde in fish and fishery products	11	Kochi (22-25 April, 2019)
74	In-plant training on fish-process engineering	11	Kochi (22 April- 01 May 2019)
75	Advances in fishing technology	30	Kochi (25-27 April, 2019)
76	Internship programme in laboratory practice	2	Kochi (06-31 May, 2019)
77	Training programme on value added fish products	73	Vijayapura, Karnataka (8-10 May, 2019)
78	Instrumentation in food processing, packaging and seafood quality evaluation	2	Kochi (08 May - 07 June, 2019)
79	Laboratory techniques in microbiology and biotechnology	2	Kochi (09 May – 06 July, 2019)
80	Studies on occurrence of *Vibrio alginolyticus* in seafoods	1	Kochi (14 May-13 July, 2019)
81	Post-harvest fisheries engineering	1	Kochi (15 May-15 June, 2019)
82	Advances in seafood processing and quality assurance	30	Kochi (14-21 May, 2019)
83	Training on post harvest quality management	20	Kochi (14-21 May, 2019)
84	Modern analytical techniques in nutritional biochemistry	1	Kochi (17-31 May, 2019)
85	Laboratory technologies in molecular biology	2	Kochi (20-25 May, 2019)
86	Comparative profile on fatty acid composition of hen and duck eggs using gas chromatography-FID	1	Kochi (20-30 May, 2019)
87	Biochemical analysis and instrumentation	1	Kochi (20-30 May, 2019)
88	Skill development training programme on value added fish products	1	Visakhapatnam (23-25May, 2019)
89	Ad-hoc training programme on heavy metals analysis and nutritional profiling of mud crab	1	Visakhapatnam (23 May-08 June, 2019)
90	Development of risk assessment procedures and practices in India	32	Kochi (27-31 May, 2019)
91	Advances in microbial examination of fish and fishery products	14	Kochi (10-14 June, 2019)

92	Responsible reservoir fisheries and improved gear fabrication in association with KVK, Natmada, Dediapada, Gujarat	16	Gujarat (11 June,2019)
93	Demonstration of feed preparation from fishery waste	28	Vashi, Mumbai (12June, 2019)
94	Demonstration on feed preparation from market waste	10	Mumbai, Maharashtra (12 June, 2019)
95	Ad-hoc training programme on Biochemical analysis of fish	2	Visakhapatnam (12-22June, 2019)
96	Validation of ICP-MS for determination of heavy metals in fish	1	Kochi (15 June-30 July, 2018)
97	HACCP Concepts	35	Kochi (18- 22 June, 2019)
98	HACCP Concepts	35	Kochi (18-22 June, 2019)
99	Solar powered refrigerator (part time)	4	Kochi (18-22 June, 2019)
100	Internship on fish processing	10	Kochi (24 June -15 July 2019)
101	Advanced analytical techniques in biochemistry and nutrition (HPLC, GC, Rheometer, Zeta sizer, AAS, Elisa, Fluorescent Microscope)	6	Kochi (01 July 19 - 31 July 19)
102	Demonstration on feed preparation from market waste	15	Veraval, Gujarat (11 July, 2019)
103	Microbiological examination of seafood pathogens (ISO method)	9	Mumbai (16-20 July, 2019)
104	Hygienic handling and value addition in fisheries	50	Devgad, Sindhdurg, Maharashtra (17-18 July, 2019)
105	Hygienic handling and value addition in fisheries	50	Hindale, Sindhdurg, Maharashtra (19-20 July, 2019)
106	Training on fishing gear materials	2	Kochi (23-27 July,2019)
107	Hindi - Harith Matsyaki 2019, opportunities and challenges for sustainable development of indian fisheries	40	Kochi (30 July, 2019)
108	Model Training Course (MTC) on Advanced fish drying and chilling technology	20	Kochi (19-26 Aug, 2019)
109	Biochemical characterization of seed extracts and its antibiofilm activity	1	Kochi (19 Aug - 26 Oct, 2019)

110	Advanced fish drying and chilling technology	20	Kochi (19-26 Aug, 2019)
111	Microbiological Quality Analysis of Seafood	16	Veraval (26-31August 2019
112	Skill development programme on pre-processing and drying of fish	25	Kochi (27 - 29 Aug, 2019)
113	Isolation and identification of seafood pathogens by biochemical and molecular techniques	1	Kochi (01-30 Sep, 2019)
114	Advanced analytical techniques in nutrient composition and chemical contaminant residue analyses of Indian seafood	1	Kochi (03 Sept -16 Nov 2019)
115	Advanced analytical techniques in nutritional biochemistry and molecular biology	11	Kochi (16 Sep - 24 Oct,19)
116	Awareness–cum-demonstration programme on value added fish products	500	Nizampatnam, Andhra Pradesh(16-17Sept, 2019)
117	Demonstration and fabrication of collapsible fish trap	20	Goa (20 - 26 Sept, 2019)
118	Collapsible fish trap fabrication in association with Krishi Vigyan Kendra (KVK), South Goa	25	South Goa (22 - 24Sept, 2019)
119	Collapsible fish trap fabrication in association with ICAR-CCARI, North Goa	25	North Goa (22 – 24Sept, 2019)
120	Advances in seafood processing technology	3	(23 -24 Sept, 2019)
121	Preparation of value-added products from fish	20	Veraval (24 Sept, 2019)
122	Advanced analytical techniques in the analysis of nutrients and contaminates in food chemistry	1	Kochi (27 Sept - 02 Oct, 2019)
123	Fish processing and value addition		Kochi (28 Sept - 03 Oct, 2019)
124	Improved packaging and labelling methods for producing better quality fish	20	Veraval (14 Oct, 2019)
125	Preparation of value added products from fish	20	Veraval (15-17 Oct, 2019)
126	Advanced analytical techniques in nutritional biochemistry & molecular biology	3	Kochi (16-14 Oct, 2019)
127	Training cum demonstration on value addition of fish and fishery products and recent advances in fishing technology under Tribal Sub-Plan (TSP)	91	Singhbhum, Jharkhand (16-18 Oct, 2019)

128	Seafood processing value addition	2	Kochi (22 - 23 Oct, 2019)
129	Value added fishery products	20	Veraval (7 Nov, 2019)
130	National seminar on AMR in Indian fisheries: measures of mitigation	50	Kochi (7-8 Nov, 2019)
131	Renewable energy based hygienic fish drying methods	20	Veraval (11 Nov, 2019)
132	Applied analytical techniques in food chemistry	1	Kochi (11 Nov-13 Dec, 2019)
133	Biochemical analyses of seafood	6	Kochi (11 - 16 Nov, 2019)
134	Recent advances in post-harvest fisheries engineering	14	Kochi (13 – 22 Nov, 2019)
135	ICAR sponsored short course on recent advances in post-harvest fisheries engineering'	14	Kochi (13-22 Nov, 2019)
136	Recent advances in post-harvest fisheries engineering	14	Kochi (13- 22 Nov, 2019)
137	HACCP for fish processing establishments	11	Kochi (15-27 Nov, 2019)
138	Recent advances in resource & energy conservation responsible fishing	20	Kochi, (21Nov - 11 Dec, 2019)
139	Chemical composition of seafood (moisture, crude fat, protein, ash, cholesterol)	1	Kochi (25 Nov-04 Dec, 2019)
140	Training programme on seafood quality and antimicrobial resistant	5	Visakhapatnam (26 Nov- 06Dec, 2019)
141	Training on heavy metals and biochemical analysis of crabs	2	Visakhapatnam (27 Nov- 04 Dec 2019)
142	Training-cum-demonstration programme on value added fish products	4	Visakhapatnam 03-05 Dec, 2019
143	Training cum demonstration programme on value addition of fish and fishery products under scheduled caste sub plan (SCSP) at Old Goa, Goa	23	Goa (9-11 Dec, 2019)
144	Hands on training on advanced microbiological technique	15	Kochi (9-13 Dec, 2019)

145	Survival of coliforms in modified atmosphere packaged freeze-dried shrimps	1	Kochi (10 Dec - 31 March 2019)
146	A training programme on transfer of technologies in the field of harvest and post harvest technologies under SCSP programme	42	Belgaum, Karnataka (11-13 Dec, 2019)
147	Pre-processing and drying of fishconducted	22	Kochi (12-13 Dec 2019)
148	Renewable energy based hygienic fish drying methods	20	Veraval (12-13 Dec 2019)
149	Seafood quality and antimicrobial resistance	3	Kochi (1Feb - 31 March 2019)
150	Antibiotics in aquaculture: adverse effects and alternatives	40	Kochi (1Feb - 31 March 2019)
151	Advanced analytical and cell culture techniques in biochemistry and nutrition	6	Kochi (1Feb - 31 March 2019)
152	Modern analytical techniques in nutrient and chemical contaminant profiling of seafood	15	Kochi (1Feb - 31 March 2019)
153	Advanced analytical techniques in nutritional biochemistry and molecular biology	7	Kochi (1Feb - 31 March 2019)
154	Influence of sardine whole fish protein hydrolysate on growth, metabolic, immune response and resistance to *Aeromonas hydrophila* in tilapia fingerlings	1	Kochi (1Feb - 31 March 2019)
155	Hibiscus extract: a potent natural antioxidant for stabilization of squalene based emulsions.	1	Kochi (1Feb - 31 March 2019)
156	Incorporation of moringa (*Moringa oleifera*) bark extract in chitosan for improved bioactivity and development of anti-inflammatory bandage.	1	Kochi (1Feb - 31 March 2019)
157	Nano carbon dot incorporated ulvan gel-its extraction, characterization and microbial property.	1	Kochi (1Feb - 31 March 2019)

158	Rheological, physiochemical and functional properties of gelatin extracted from bigeye tuna (*Thunnus obesus*) skin waste.	1	Kochi (1Feb - 31 March 2019)
159	Developing seaweed infused reconstituable green tea:-evaluating antioxidant activity and biochemical profile.	1	Kochi (1Feb - 31 March 2019)
160	Influence of chitosan on formulation of stable vitamin C	1	Kochi (1Feb - 31 March 2019)
161	Extraction and characterization of sodium alginate from different seaweeds	1	Kochi (1Feb - 31 March 2019)
162	Development of multi-residue method for pesticides in seaweed using GC-MS/MS	1	Kochi (1Feb - 31 March 2019)
163	Isolation, characterization and biocompatibility evaluation of collagen from the skin of *Anguilla bicolorbicolor*.	1	Kochi (1Feb - 31 March 2019)
164	B. Tech students project work on portable refrigeration system	2	Kochi (1Feb - 31 March 2019)
165	In-plant training to B.Tech students	3	Kochi (1Feb - 31 March 2019)

Sri Mopidevi Venkata Ramana Rao, Honourable Minsiter of Animal Husbandry, Fisheries & Marketing, Government of Andhra Pradesh interacting with CIFT staff

Staff of ICAR-VRC with the trainees of in-plant training programme

Feed preparation from market waste demonstration at Lakshdweep

Participants of training on risk assessment of fish and fishery products

Training on HACCP concepts from 18 to 22 June 2019

Dr. Kostas Koutsoumanis, Chair Panel on Biological Hazards, EFSA explaining microbiological risk assessment

Training programme on ISO 22000/HACCP for fish processing establishments (under ITEC, Ministry of External Affairs, Govt. of India)

Participants of Training on Advances in Microbial Examination of Fish and Fishery Products

Participants of training on advanced analytical techniques in nutritional biochemistry & molecular biology

Training programme on pre-processing and drying of fish

Particiapants and Faculty of training programme on microbiological examination of seafood pathogens by ISO method

Participants and faculty of training programme on hygienic handling and value addition in fisheries at Devgad

Awareness programme on harvest and post-harvest fishery technologie under scheduled tribe component programme at Paderu, Viskhapatnam District

Smt. M. Jayashree, deputy project manager-livelihood, ITDA-Velugu, Paderu distributing inputs to members of tribal self help group

Practical session of hands-on training on microbiological quality analysis of seafood held at Veraval Research Centre of ICAR-CIFT

Exhibitions organised

Sl. No.	Name of the Exhibition	Organizers	Date (Duration)
1	31st All India Congress of Zoology	CAU, Imphal, Manipur	15-16 Jan, 2019
2	BRAQCON-2019	ICAR-CIBA	23-25 Jan, 2019
3	Food tech exhibition Kerala 2019	Cruz Expos, Kadavanthara	23-25 Jan, 2019
4	Aquex India 2019	SIFA, Hyderabad	31Jan to 2 Feb, 2019
5	Agri-summit 2019	ICAR-RCER, Motihari Patna	10-12 Feb, 2019
6	Agriculture technology and farm machinery demonstration mela	RARS, Anakapalle, AP	15Feb, 2019
7	ATMA Dist. Tech Meet	ATMA, Nayarambalam, Ernakulam	15-16 Feb, 2019
8	National workshop on aquaculture	ICAR-CIFA, Bhubaneshwar	18-19 Feb, 2019
9	XIV National agri science congress	IARI, New Delhi	20-23 Feb, 2019
10	World ocean science congress-2019	Andhra University, Visakhapatnam	25-27 Feb, 2019
11	Costal agri expo-2019	ICAR-CCARI, Old Goa	2-4 March, 2019
12	ICB-19 & Marine expo	CUSAT, Kochi	6-8 March, 2019
13	Assisi organic-2019	Chembumukku, Palarivattom	4 -7 April, 2019
14	NFDB-National fish festival	Necklace Road, Hyderabad	7-9 June, 2019
15	APA- World aquaculture society	Chennai Trade Centre, Chennai	19-21 June, 2019
16	Efficient value chain in fisheries and aquaculture	Smart Agri Post, Vijayawada	27July, 2019
17	Aqua Aquaria India 5th edition	MPEDA, Hyderabad	30 Aug-1 Sept, 2019
18	Palluruthy regional co-operative bank celebration	Veli Ground Palluruthy	7-10 Sept, 2019
19	Cold water fisheries development in India	ICAR-DCFR,Bhimtal	24-25 Sept, 2019
20	Mathrubhumi karshikamela	Edathavalam ground, Pathanamthitta	02-08 Oct, 2019
21	Exhibition on world fisheries day	Mummidivaram, East Godavari District	21 Nov, 2019
22	61st Kisan mela	Anakapalle, Visakhapatnam	23 Nov, 2019
23	Swasraya Bharath	Marine Drive, Kochi	23-26 Nov, 2019

24	Conference on one health & ecosystem science	ICAR-NBFGR, Lucknow	29-30 Nov, 2019
25	One health & ecosystem service (OHES-2019)	Lucknow, UP	29-30 Nov, 2019
26	Smart aqua india 2019	Digha, West Bengal	13-15 Dec, 2019
27	Seafood show	CII Lulu Convention Centre, Bolgatty	17-18 Dec, 2019
28	MARICON 2019	Marine Campus, CUSAT, Ernakulam	17-19 Dec, 2019
29	Kerala Agro. Food Pro-2019	Jawaharlal Nehru Stadium, Kaloor	20-23 Dec, 2019

Hon'ble Chief Minister of Andhra pradesh Shri. Y. S. Jaganmohan Reddy visiting the ICAR-CIFT stall at exhibition on world fisheries day at Mummidivaram, East Godavari District

Mr. Dola Sankar, Director, MPEDA at ICAR-CIFT stall at exhibition on efficient value chain in fisheries and Aquaculture organized by Smart Agri Post at Vijayawada

Students visiting the stall at 61st Kisan Mela at Anakapalle, Visakhapatnam

Radio talks

Scientists and Technical Staff of the Institute gave the following radio talks during the period under report:

- Dr. Manoj P. Samuel, Principal Scientist and HOD, Engg. - Talk on rainwater harvesting was broadcast on Red FM 93.5 at 9:00 a.m. on 20.05.2019.
- Dr. B. Madhusudana Rao, Principal Scientist gave an interview on 'Livelihood opportunities through value added fish products. Interview (in Telugu) broadcast by All India Radio, Visakhapatnam on 10-03-2019.
- Dr. Santosh Alex, ACTO, ICAR-CIFT, Cochin delivered a radio talk as part of the Swachhata Pakhwada in Malayalam at AIR, Kochi radio on wastewater utilization and importance of water harvesting on 13.12.2019.

Invited Talks

- Dr. Ravishankar C. N., Director, ICAR-CIFT, Cochin delivered an invited talk on Recent advances in harvest and post harvest technologies of fish in 31st All India Congress of Zoology (31st AICZ) and National Seminar on Climate Smart Aquaculture and Fisheries (CSAF) at Agartala on 15.01.19.
- Dr. Ravishankar C. N. delivered a lead talk on advances in processing and packaging of fish and fishery products during International conference on challenges and opportunities for sustainable fisheries and aquaculture development organized by College of Fisheries, Ratnagiri, during 17.01.19 to 18.01.19.
- Dr. Ravishankar C. N., delivered an invited talk on Development of an entrepreneurial support system in an R & D Institute – A case study of ICAR-CIFT in 3rd student convention on Next generation aquaculture: panacea to employment challenges on the theme Start up in fisheries for promoting entrepreneurship among the students held at CIFE, Mumbai 25.03.2019
- Dr. Ravishankar C. N., delivered an invited talk on recent advances in food packaging in Sri. G. C. P. Rangarao Memoraial Lecture organised by Association of Food Scientists and Technologist (India) in association with AFST(I) Thrissur and KVASU at Dr. Varghese Kurian Institute of Dairy and Food Technology, Mannuthy, Thrissur on 19.07.2019.
- Dr. Leela Edwin, Principal Scientist and Head Fishing Technology Division delivered a lecture for officers of the DoF organised by FIRMA on ring seine fishing in Kerala, on 25.04.2019.
- Dr. Leela Edwin, delivered lecture in present status of Indian fishing industry at the Department of aquaculture, sacred heart college, Cochin on 21.11.2019.
- Dr. Leela Edwin, delivered an invited talk on techniques to augment blue economy and ocean health at international conference on aquatic resources and blue economy-AQUABE 2019 on 28.11.2019.
- Dr. Suseela Mathew, Principal Scientist and Head Biochemistry and Nutrition Division delivered an invited talk on Nutritional and pharmaceutical application of marine biomolecules at 5th IUPHAR World Conference on the Pharmacology (WCP) on natural product, 2019 India conducted by IUPHAR, ICMR and NIN on 06 December 2019
- Dr. Suseela Mathew delivered scientific talk on Seaweeds – an untapped repository of biomolecules at International conference on aquatic resources and blue economy AQUABE 2019 arranged by KUFOS on 28 November 2019.

- Dr. Manoj P. Samuel, Principal Scientist and Head Engineering Division delivered a talk on Retail cold chain and energy management in the Indo- Norway meeting held at ICAR-CIFT Kochi on 07 Dec 2019.
- Dr. Manoj P. Samuel delivered an invited talk on Technological and entrepreneurial innovations in post-harvest fisheries with focus on drying, dehydration and chilling technologies in REFCOLD International Conference at HitexExhibion centre, Hyderabad organised by the Indian Society of Heating, Refrigeration and Air-conditioning Engineers (ISHRAE).
- Dr. Manoj P.Samuel delivered a talk on Technology valuation in the one day Workshop on Intellectual Property Valuation of Agricultural Technologies at ICAR- CTCRI, Thiruvananthapuram on 22 March 2019.
- Dr. Manoj P Samuel delivered an invited talk on IPR and Technology Management in Start-up Ecosystem in the National seminar on Intellectual Property Rights at St. Theresa's College Ernakulam on 22 February 2019.
- Dr. Manoj P. Samuel delivered an invited talk on solar drying technology in the Karshika Mela organized by Gandhiji Study Circle at Thodupuzha on 04.01.2019.
- Dr Manoj P Samuel delivered a lecture on Innovative engineering technologies for fish processing in the national seminar FISHTECH 19 organised by Mumbai Research Centre of CIFT sponsored by SOFT(I).
- Dr. Madhusudana Rao B., Principal Scientist delivered an invited talk on Antibiotic use in livestock and fish production systems: implications for food safety & antimicrobial resistance'. World Veterinary Day, organized by the Department of Animal Husbandry, Vizianagaram district of Andhra Pradesh on 27.04.2019.
- Dr. Madhusudana Rao, B. delivered an invited talk on Cold chain in Fisheries: Status and requirements with special focus on Andhra Pradesh. In: REFCON National conference on cold chain and refrigeration, organized by ISHRAE at Visakhapatnam on 03 August 2019.
- Dr. Madhusudana Rao, B. delivered an invited talk on Confluence of Biology and Engineering: cross learning to create bio-viable technologies to improve quality of human life. In: Biofest GENRECON-2K19 -Era for recombination of Biology and Engineering, at MVP Campus, Visakhapatnam on 16 Sep 2019.
- Dr. Madhusudana Rao, B. delivered an invited talk on Fish meat as vehicle for transmission of antimicrobial resistance: overview of the drivers and mitigation measures in National Seminar on 'AMR in Indian Fisheries: Measures of Mitigation' at ICAR-CIFT on 07-08 Nov, 2019.
- Dr. Toms C.Joseph delivered a talk on Fishery industry waste: a resource to be valorised in the National Seminar, FishTech-19 on 10th July, 2019.
- Dr. Toms C. Joseph, Principal Scientist delivered an invited talk on strategies to reduce the risk of antimicrobial resistance in aquaculture at the National Seminar on AMR in Indian Fisheries: Measures of Mitigation jointly organised by Society of Fisheries Technologists (India), ICAR- CIFT and MPEDA at Cochin from 7-8 November 2019.
- Dr. L. Narasimha Murthy, Principal Scientist delivered invited talk on Value addition in fisheries and marketing opportunities / transfer of technology through business incubation with reference to freshwater fisheries sector" at College of Fisheries, Mangalore (KVAFSU, Bidar) on 6th May, 2019.

- Dr. L. Narasimha Murthy delivered invited talk on the topic Start-ups and marketing opportunities in fisheries at A conference on Efficient value chain in fisheries and aquaculture organized by Smart Agri Post, New Delhi in collaboration with ICAR- Central Institute of Fisheries Education on 15 June, 2019.
- Dr. L. Narasimha Murthy delivered a talk on Research advances in fish processing and Business options for small scale Entrepreneurs in the national seminar FishTech 19 - Utilization of secondary raw materials: Challenges and marketing opportunities for seafood industry on 11 June, 2019.
- Dr. G. K. Sivaraman, Principal Scientist delivered an invited talk on The one health perspective of fighting antimicrobial resistance. In: IMSACON- 2019, organized at DGCN College of Veterinary and Animal sciences, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, HP.
- Dr. K. K. Asha, Principal Scientist delivered a talk on National Symposium on bio-prospecting from marine resources for biotechnological applications: opportunities and challenges on 24-25 July 2019 at Sathyabama Institute of Science and Technology.
- Dr. Mohan, C. O., Senior Scientist delivered an invited talk on processing and value addition of fish for domestic market at AquaEx 2019 a knowledge conclave during AquaexIndia 2019 at Hitex, Hyderabad on 31 Jan to 02 Feb 2019.
- Dr. Mohan, C. O. delivered invited talk on packaging and labeling to 40 participants of Agripreneurship Development Programme organized by RAFTAAR Agri Business Incubation (RABI) center of Kerala Agricultural University on 24 July 2019.
- Dr. Mohan, C. O. delivered invited talk on Understanding the global fisheries industries & seafood supply chain at Food Summit - Kochi 2019 (food & hospitality expo & summit) at hotel grand hyatt, lulu international convention centre, Kochi, Kerala organized by CII during on 17 - 18 Dec 2019.
- Dr. Mohan, C. O. delivered invited talk on Packaging technologies for food sector during Kerala Agro Food Pro 2019 organized by district industries centre, Govt of Kerala at Jawaharlal Nehru International Stadium, Kaloor, Kochi on 20-23 Dec 2019.
- Dr. Binsi P. K., Senior Scientist delivered an invited talk on Fish: for health and wealth -approaches in post-harvest management in a programme organised by NFDB and Cental Ministry of Fisheries, Animal Husbandry and Dairying in connection with celebration of world fisheries day at A.P. Sinde Symposium Hall, NASC Complexon 21 November, 2019.
- Dr. Binsi P. K. delivered an invited talk on Role of S & T institutions in the promotion of entrepreneurship and sustainable livelihood in the rural areas through fisheries sector at NIRDPR, Hyderabad on 14 May 2019.
- Dr. Binsi P.K. delivered an invited talk on toxins and allergens from marine sources: Recent dimensions and research arenas at Pushpagiri Institute of Medical Sciences & Research Centre, Thiruvalla in the national conference on Toxicity the current perspectives- Bioradiance-19 on 06 July 2019.
- Dr. Murugadas V., Scientist delivered a talk on Mycotoxins: origin, chemical structure, classification, significance of analysis in the FSSAI sponsored trainers training program on "Mycotoxins analysis" at EIC, Cochin on 10-13 December 2019.

- Dr. Murugadas V. delivered a talk on antimicrobial resistance and fishery waste management: risks and safety concerns in the international training programme on protocols for the production of high value secondary products from industrial fish and shellfish processing held during 25 Nov. to 21 Dec. 2019 at F.P. Division, ICAR-CIFT, Kochi.

- Dr. Niladri Sekhar Chatterjee, Scientist delivered an invited talk on Metabolomic fingerprinting and chemometrics for food authentication, food forensics, prevention of food fraud and biomarker discovery in Expert consultation on Metabolomics: Exploring the system biology approach in agricultural science on 08 July 2019 at NASC Complex, New Delhi.

- Dr. Ashish Kumar Jha, Scientist has delivered a lecture on recent advances in aquafeed Technology in a five days vocational training programme on Skill development in aquaculture related technologies and its applications. The programme was conducted by College of Fisheries, Veraval under the ageis of National Agriculture Higher Education Programme (NAHEP) and World Bank.

- Dr. N. Rajendra Naik, Scientist delivered lecture on Diversity of trawl catch in India in ICAR sponsored winter school on Responsible fishing: recent advances in resource & energy conservation at ICAR-CIFT, Cochin on 21 Nov-11 Dec 2019.

- Dr. Prajith K. K., Scientist delivered lecture on Design, construction and operation of fishing pots and traps in ICAR sponsored winter school on Responsible fishing: recent advances in resource & energy conservation at ICAR- CIFT, Cochin on 21st Nov-11th Dec 2019.

- Dr. Prajith K. K. delivered a lecture on Introduction to fishing technology, recent advancement and technological development with special reference to responsible fishing" under the training programme for the fishery officers of Government of Gujarat at Udaybhabsinhi Regional Institute of cooperative management.

- Dr. Murali S., Scientist delivered an invited talk on Engineering interventions in post-harvest fisheries sector with special emphasis on design and development of solar dryers at Amal Jyoti College of Engineering, Kottayam, Kerala on 7th Nov 2019.

- Dr. Renuka. V., Scientist delivered a talk on HACCP Concept in the training programme on Skill enhancement in the marine sector organized by EIA,Veraval for Gujarat & Diu Fisheries Departments officials from 04 to 08 March 2019.

- Dr. Renuka V. delivered a talk on Biodegradable polymers from fish waste in the programme on Student Project Fair-2019 organized by CIPET, Ahmedabad on 29 March 2019.

- Dr. J. Renuka, Deputy Director (Official Language) delivered a talk on Rules and regulation of official language policy of Govt.of India in a five-day refresher course on Administrative and finance management for section officers/AAO/AFAOs & JAOs/assistants of ICAR Headquarters and different ICAR Institutes on 14 June, 2019 at ICAR-CIFT, Cochin.

TRAINING AND CAPACITY BUILDING

Human Resource Development activities

During the period under report, the Human Resources Development Cell of the Institute met many times as recommended by the HRD Cell, 52 staff of the Institute participated in training programmes during the period (Scientific – 52, Technical – 28 and Administrative & Finance – 32).

Participation in Trainings (Category-wise)

Sl. No.	Name(s) of participant(s)	Training attended	Venue and date
		Category – Scientific	
1	Dr. Prasad M. M. Dr. Zynudheen A. A. Dr. Femeena Hassan Dr. Sivaraman G. K. Dr. Panda S. K. Dr. Joshy C. G. Dr. Murugadas V. Dr. Visnuvinayagam S. Dr. Niladri S Chatterjee Dr. Pankaj Kishore Dr. Anupama T. K. Shri. Ranjith Kumar Nadella Dr. Anuj Kumar Smt. Greeshma S. S. Smt. Muthulakshmi T. Smt. Priya E. R. Dr. DevandaUchoi Dr. Minimol V. A. Shri. Ezhil Nilavan S.	Short term mission on risk assessment under the Better Training for Safer Food Initiative (BTSF)	ICAR-CIFT, Cochin (27 - 31 May, 2019)
2	Dr. Rejula K.	Scale development in social sciences	ICAR-NDRI, Bengaluru (10-14 June, 2019)
3	Smt. Priya E. R.	Method validation in pesticide residue analysis and measurement of uncertainty	NIPHM, Hyderabad (19-23 August, 2019)
4	Shri. Sajesh V. K.	Model training course on advanced fish drying and chilling technology	ICAR-CIFT, Kochi (19-26 August,2019)
4	Smt. Laly S. J.	Advances in application nanotechnology	CIRCOT, Mumbai (23-24 September 2019)
6	Dr. Femeena Hassan	Internal training as per NABL requirement on performance testing of culture media, reagents and reference cultures on at	ICAR-CIFT, Kochi (10 October, 2019)

7	Dr. Ashok Kumar K. Dr. Prasad M. M. Dr. Panda S. K. Dr. Mohan C. O. Dr. Joshy C. G. Dr. Murugadas V. Shri. Ranjith Kumar Nadella Dr. Anuj Kumar Smt. Priya E. R.	Quality system as per requirements of ISO/ IEC 17043: 2010 for proficiency Testing providers & PT statistics as per ISO 13528: 2015	ICAR-CIFT, Kochi (14-17 October, 2019)
8	Dr. George Ninan	Intellectual property valuation and technology management	NAARM, Hyderabad (15-19 October, 2019)
9	Dr. Panda S. K. Smt. Priya E. R.	Chemical risk analysis framework for food safety	CSIR-IITR, Lucknow (21-24 October, 2019)
10	Dr. Suresh A.	Statistical data analysis, experimental design & related aspects-multivariate data analysis	IIM, Kozhikode (18-22 November, 2019)
11	Dr. Murugadas V.	ASCI Skill Training of Trainers (TOT) programme	GKVK Campus, UAS, Bengaluru, (20-22 November, 2019)
12	Dr. Pankaj Kishore Shri. Ranjith Kumar Nadella	Third short term mission on risk assessment under BTSF initiative of EU sponsored by FSSAI	NIFTEM, Haryana (11-15 November, 2019)
13	Smt. Muthulakshmi T.	Short Course on Recent advances in post-harvest fisheries engineering	ICAR-CIFT, Kochi (13-22 November, 2019)
14	Dr. Visnuvinayagam S. Dr. Pankaj Kishore Shri. Ranjith Kumar Nadella Shri. Ezhil Nilavan S.	Hands on training on Advanced Microbiological Techniques, organized by FSSAI and ICAR-CIFT	ICAR-CIFT, Kochi (9-13 December, 2019)
15	Dr. Pankaj Kishore	ICAR sponsored short term course on DNA techniques in forensic food analysis	14-23 December 2019
16	Dr. Mohanty A. K.	Management development programme	NAARM, Hyderabad (02-13 December, 2019)
17	Shri. Chandrasekhar V.	Animal diseases economics conducted by ILRI at	ICAR-IVRI, Uttar Pradesh (8-10 January, 2020)
18	Dr. Pe. Jeyya Jeyanthi	FDP on basics of structural equation modelling	IIM, Kozhikode (17-21 February, 2020)
19	Dr. Manju Lekshmi N.	Two day training programme on testing of FRP	CIPET, (04-05 February, 2020)

20	Dr. Remya S.	Quality system as per requirements of ISO/IEC 17043:2010 for proficiency testing providers and PT statistics as per ISO 13528:2015	ICAR-CIFT, Kochi (09-10 March, 2020)
21	Dr. Remya S.	Training on international standard ISO/ IEC 17025 general requirements for the competence of testing and calibration laboratories	ICAR-CIFT, Kochi (11-12 March, 2020)
22	Dr. Ashok Kumar K. Dr. Bindu J. Dr. Muhamed Ashraf P. Dr. George Ninan Dr. Femeena Hassan Dr. Asha K. K. 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. Monalisha Devi S Dr. Remya S. Dr. ManjuLekshmi N. Dr. Parvathy U. Dr. Pankaj Kishore Shri. Ranjith Kumar Nadella Shri. Sreejith S. Dr. Mandakini Devi H Dr. Anuj Kumar Shri. Tejpal C. S. Dr. Elavarasan K. Smt. Greeshma S. S. Shri. Chinnadurai S. Shri. Paras Nath Jha Smt. Muthulakshmi T. Dr. Renjith R. K. Dr. Sarika K. Dr. Sreelakshmi K. R. Smt. Priya E. R. Smt. Lekshmi R. G. Kumar Shri. Sathish Kumar K. Dr. Minimol V. A. Shri. Anas K. K. Shri. Ezhil Nilavan S. Dr. Rehana Raj	Laboratory quality management system & internal audit as per the revised standard ISO/IEC 17025:2017	ICAR-CIFT, Kochi (11-12 March, 2020)

Category - Technical			
23	Shri. Aneesh P. A. Shri. Suresh P.	Pesticide residual analysis during	NIPHM, Hyderabad (1-21 May, 2019)
24	Smt. Jaya P. A.	Method of analysis for the fortificants in wheat flour, maida and rice during	CSIR-CFTRI, Mysuru (19-21 June, 2019)
25	Smt. Anu Mary Jose Smt. Mary P. J.	Short term course on chromatographic techniques and their analytical approaches in food analysis	CSIR-CFTRI, Mysore (5-9 August, 2019)
26	Mrs. Priyanka Nakhawa	Hindi workshop on translation	Belapur (01 July -9 August, 2019)
27	Smt. Shyma P. K. Shri. Babu P. S. Shri. Aneesh P. A. Shri. Noby Varghese K. A. Smt. Vineetha Das Shri. Jijoy T. Smt. Susmitha V. Smt. Prinetha U. P. Shri. Vinod G. Shri. Ajith V. Chellappan Smt. Mary P. J. Smt. Reshmi K. Shri. Sreejith V. N.	Quality system as per requirements of ISO/IEC 17043: 2010 for proficiency Testing providers& PT statistics as per ISO 13528: 2015	ICAR-CIFT, Kochi (14-17 October, 2019)
28	Shri. Omanakuttan Nair G.	Capacity building programme on towards a secure and resilient work place at ICAR	ICAR-CPRI, Shimla (25-27 November, 2019)
29	Smt. Bindu Joseph Shri. Padmaraj P. D.	Advanced analytical tools in microbiology	CSIR-CFTRI, Mysore (2-6 December, 2019)
30	Dr. Baiju M. Shri. Jos K. D. Shri. Sunil N. Shri. Suresh C. K. Smt. Sruthi P. Shri. Rakesh M. Raghavan	Model training course on Pluralistic Extension for upscaling Secondary Fisheries	ICAR-CIFT, Kochi (17-21 January, 2020)
31	Shri. Nobi P. S.	Capacity building programme for IJSC members	NAARM, Hyderabad (27-31 January, 2020)
32	Shri. Mohanan K. V.	Automobile maintenance, road safety and behavioural skills for regular drivers, Batch-VII	ICAR-CIAE, Bhopal (16-22 January, 2020)

33	Smt. Shyma P. K. Smt. Kala K. K. Shri. Babu P. S. Smt. Lekha N. Smt. Bindu Joseph Smt. Shyla N. C. Shri. Aneesh P. A. Shri. Noby Varghese K. A. Smt. Vineetha Das Shri. Jijoy T. Smt. Susmitha V. Shri. Rahul Ravindran Shri. Anish Kumar K. C. Shri. Vinod G. Shri. Ajith V. Chellappan Shri. Ajeesh K. Smt. Anu Mary Jose Smt. Archana G. Smt. Mary P. J. Shri. Suresh P. Smt. Reshmi K. Shri. Sreejith V. N.	Laboratory quality management system & internal audit as per the revised standard ISO/IEC 17025:2017	ICAR-CIFT, Kochi (11-12 March, 2020)
Category - Adminsitrative			
34	Administrative Staff of ICAR-CIFT	Implementation of official language	ICAR-CIFT, Kochi 14 June 2019
35	Shri A.N. Agawane	Training for filling of GSTR	ICAR-CIFT, Kochi (21-22 Aug, 2019)
36	Shri. Amit Vengraj, UDC	Training programme on payment and filing of GST returns	ICAR-CIFT, Kochi (21-22 Aug, 2019)
37	LDC & UDC's	Use of hindi in administrative work	ICAR-CIFT, Kochi 28 Sep. 2019
38	Shri A.N. Agawane	Hindi basic computer typing	Belapur (09-13 Dec, 2019)
39	Administrative staff of CIFT	Training programme on e-office	ICAR-CIFT, Kochi (14 Nov- 07 Dec, 2019)
40	Administrative Staff of CIFT	Communicative Hindi	ICAR-CIFT, Kochi 17 Dec 2019

VISITS ABROAD

Dr. P. Muhamed Ashraf, Principal Scientist, Fishing Technology Division, ICAR-CIFT, Kochi visited Lisbon, Portugal during 18-20 April, 2018 to attend the Global project workshop on In situ observation of the coastal productivity deoxygenation and acidification.

Dr. P. Muhamed Ashraf, Principal Scientist, Fishing Technology Division, ICAR-CIFT, Kochi visited Japan to attend the NACE East Asia and Pacific Area conference at Japan.

Dr. Zynudheen A. A., Principal Scientist and Head (i/c), Quality Assurance and Management Division, ICAR-CIFT, Kochi visited various institutes in Brest viz., Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER), ENSTA-B, EN, ENIB, IMTA, UBO-IUEM, and ISEN as part of Thematic visit in and knowledge summit held at Lyon France from 14-19 Oct, 2019.

Dr. M. M. Prasad, Principal Scientist and Head Microbiology, Fermentation and Biotechnology Division, ICAR-CIFT, Kochi attended FAO International Symposium on Fisheries Sustainability: Strengthening the Science Policy Nexus organized by Food and Agriculture of United Nations, Rome, Italy from 18-21 Nov, 2019.

Dr. G. K. Sivaraman, Principal Scientist, Microbiology, Fermentation and Biotechnology Division, ICAR-CIFT, Kochi visited the University of Edinburgh as part of the Indo-UK DOSA project Diagnostics for One heath and user Driven Solutions for AMR (DOSA) the visit to project partner's lab, discussion on annual progress of work done in the form of Workshop and stakeholders meeting was made during 19-27 Oct, 2019 at the University of Edinburgh, Scotland.

Indian delegation visiting University of Bordeaux, France

Dr. Manoj P. Samuel, Principal Scientist and Head Engineering Division, ICAR-CIFT, Kochi visited France during 15-19 Oct, 2019 to attend the high-level Franco-Indian summit held on 17-18 Oct, 2019 in University de Lyon and Pre-summit thematic visit to University de Bordeaux, France during 15-16 Oct, 2019 on invitation of the French Embassy in India.

Dr. Manoj P. Samuel, Principal Scientist and Head Engineering Division, ICAR-CIFT, Kochi attended Seafood and Fisheries Emerging Technologies- SAFET 2019 Conference at Bangkok during 13-16 Feb, 2019 and delivered a speech on development of a fish freshness sensor based on digital image processing.

Dr. Saly N.Thomas, Principal Scientist took part in the 2nd meeting of the (GESAMP WG 43) on Sea-based sources of marine litter including fishing gear held during 28-30 October, 2019 at FAO, Rome, as working group member of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection of the United Nations (GESAMP) 43,

Dr. Saly N. Thomas with other members of GESAMP Working Group 43 at FAO, Rome

Dr. Pe. Jeyya Jeyanthi, Senior Scientist, Extension Information & Statistics Division, ICAR-CIFT, Kochi visited Kuala Lumpur, Malaysia for oral presentation of the paper titled Estimation of input utilization and efficiency of trawl fishery in Southern Bay of Bengal at International Fisheries Symposium (IFS 2019) in Kuala Lumpur, Malaysia during 18-21 November, 2019.

Oral presentation IFS 2019, Kuala Lumpur, Malaysia

Dr. L. Narasimha Murthy, Principal Scientist and SIC, ICAR-CIFT Mumabi Research Centre visited Russia as delegate from India during 05-07 Nov, 2019 to explore electron beam irradiation facilities at Tecleor e Beam irradiation plant, Kaluga, Russia.

L.Narasimmha Muthy in a Meeting with Ministry of Economic Development of the Russian Federation at Russia

Dr. Jesmi Debbarma, Scientist, ICAR-CIFT Visakhapatnam Research Centre attended the 23rd International Seaweed Symposium (ISS 2019) held at International Convention Center, Jeju Island, South Korea during 28 April –03 May, 2019.

Dr. Jesmi Debbarma giving her presentation at International Seaweed Symposium, South Korea

Dr Raghu Prakash at International Fisheries Symposium, Malaysia

Dr. R. Raghu Prakash, Principal Scientist and SIC, ICAR-CIFT Visakhapatnam Research Centre attended the International Fisheries Symposium (IFS-2019) at Kuala Lumpur Malaysia from 18-21 November, 2019 and presented a paper entitled Structural and operational changes in mechanized fishing fleet along the east coast of India by Sreedhar U., Kamei G.

AWARDS AND RECOGNITION

The ICAR- Central Institute of Fisheries Technology, Kochi has won the Kerala State Renewable Energy (Akshaya Oorja) Award and commendation certificate in appreciation of the achievements towards research and innovation initiatives on renewable energy resources. The Award was distributed by Shri. Pinarayi Vijayan, Hon'ble Chief Minister, Govt. of Kerala in presence of Shri. Kadakampally Surendran, Hon'ble Minister of Tourism, Cooperation and Devswam at a function organised by the Agency for Non-Conventional Energy and Rural Technology (ANERT) at Thiruvananthapuram on 11 November 2019. Dr. Ravishankar C.N, Director, ICAR- CIFT has received the Award from the Chief Minister along with Dr. Manoj P. Samuel, Principal Scientist & Head, Engineering Division, ICAR-CIFT Kochi.

Director, ICAR-CIFT receiving Renewable Energy (Akshaya Oorja) Award and commendation certificate from Honourable Chief Minister.

Prasad, M. M., Principal Scientist and Head MFB Division, ICAR-CIFT, Kochi received best oral presentation award in National Seminar on AMR in Indian Fisheries: Measures of Mitigation held during 7 - 8 November 2019 at ICAR-CIFT, Kochi for the research paper titled AMR: Ways and means for public awareness authored by Prasad, M. M., Murugadas. V, Abhay Kumar, Muthulakshmi. T, Ezhil Nilavan. Radhakrishnan Nair. V, Visnuvinayagam. S, Ranjith Kumar Nadella, Greeshma. S. S, Minimol. V.A., Ahamed Basha, K., Sivaraman, G.K, Madhusudana Rao, B., Toms C Joseph and Ravishankar, C.N.

Dr. Sivaraman G. K. Principal Scientist, ICAR-CIFT Cochin received best oral presentation award in the 9th Indian Meat Science Association Conference (IMSACON) & International Symposium held during 6-8 Nov, 2019 at DGCN College of Veterinary and Animal Sciences, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh for the research paper titled Incidence of antibiotic resistance among ESKAPE pathogens from shrimp aquaculture farms in Kerala authored by G.K.Sivaraman, Ravi Krishnan Elangovan, Till Bachmann, Alison Prendivillie, Vineeth Rajan and Ardhra Vijayan.

Dr. Sivaraman G. K. Principal Scientist, ICAR-CIFT Cochin received best poster presentation award in the 9th Indian Meat Science Association Conference (IMSACON) & International Symposium held during 6-8 Nov,

2019 at DGCN College of Veterinary and Animal Sciences, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh for the research paper titled' Prevalence and molecular detection of Tetracycline resistant ESBL producing strain from shrimp aquaculture farm' authored by G.K.Sivaraman, Ravi Krishnan Elangovan, Till Bachmann, Alison Prendivillie, Vineeth Rajan and Ardhra Vijayan.

Dr. Sivaraman, G.K., Principal Scientist, ICAR-CIFT, Kochi received best poster presentation award in National Seminar on AMR in Indian Fisheries: Measures of Mitigation held during 7 - 8 November 2019 at ICAR-CIFT, Kochi for the research paper titled Epidemiology and its antimicrobial resistance of *Staphylococci* and *E. coli* in fish and fishery products from Veraval, Gujarat authored by Sivaraman, G.K., Prasad, M.M., Visnuvinayagam, S., Ashish Kumar Jha, Remya, S., Renuka, V. and Deesha Vanik.

Dr. Nikita Gopal, Principal Scientist, ICAR-CIFT Cochin received the Asian Fisheries Society Gold Medal Award presented during the 12th Asian Fisheries and Aquaculture Forum held in Iloilo, Philippines on 10 April 2019

Dr. Nikita Gopal, Principal Scientist, ICAR-CIFT Cochin awarded the Life Fellow of the Society of Fisheries Technologists (India), on 02 August 2019

Dr. Nikita Gopal, Principal Scientist, ICAR-CIFT Cochin received the Certificate of Appreciation for the paper "Does Trade Endanger Nutritional Security? Evidence from Seafood Trade between India and China" Gomathy V, P.S. Ananthan, Renuka Devi, Amod Salgaonkar and Nikita Gopal, presented during 12th Asian Fisheries and Aquaculture Forum, 8-12 April 2019, Iloilo, Philippines

Dr. Satyen Kumar Panda, Principal Scientist, ICAR-CIFT Cochin received the NetSCoFAN (Network for Scientific Co-operation for Food Safety and Applied Nutrition) co-lead Institute certificate for ICAR-CIFT from Dr Harsh Vardhan, Hon'ble Union Minister for Health & Family Welfare, Science & Technology and Earth Sciences, Govt. of India.

Dr. C. O. Mohan, Senior Scientist, ICAR-CIFT Cochin awarded Associateship of National Academy of Agricultural Sciences on 5th June 2019 by Dr. Punjab Singh, President NAAS during the 26th AGM and Foundation day of NAAS

Dr. Binsi P.K., Senior Scientist, ICAR-CIFT Cochin received best oral presentation award in the Aquabe-2019 International Conference of Aquatic resources and Blue economy organized by KUFOS, Kochi held during 28-30 Novemer 2019 at Le Meridien Kochi for the paper titled 'Assessment of in-vitro and in-vivo biocompatibility of fish scale derived hydroxyapatite for bone regeneration 'authored by Binsi P. K., Ajmi S., Nebu Thomas, Zynudheen A.A.

Dr. Murugadas V., Scientist, ICAR-CIFT, Kochi received best poster presentation award in National Seminar on AMR in Indian Fisheries: Measures of Mitigation held during 7 - 8 November 2019 at ICAR-CIFT, Kochi for

the research paper titled 'Isolation of coliphages from water samples for biocontrol of antibiotic resistant strains of Escherichia coli' authored by Iris George, Murugadas V., Karthika R., Visnuvinayagam S., Madhusudhana Rao B., Prasad M.M.

Dr. Murugadas V., Scientist, ICAR-CIFT, Kochi received best oral presentation award in National Seminar on AMR in Indian Fisheries: Measures of Mitigation held during 07 - 08 November 2019 at ICAR-CIFT, Kochi for the research paper titled 'Genetically distinct ESBL producing *E. coli* were identified in water of Vembanad Lake, Kerala, India' authored by Murugadas, V., Anna Sherin, P.S., Sandhya, S.V., Radhakrishnan Nair, V., Sivaraman, G.K., Madhusudana Rao, B., Ravishankar, C.N., and Prasad, M.M.

Dr. Manju Lekshmi N., Scientist, ICAR-CIFT Cochin received best oral presentation award in Aquabe-2019 International Conference of Aquatic resources and Blue economy organized by KUFOS, Kochi held during 28-30Novemer 2019 at Le Meridien Kochi for the paper titled Nanobiocides as antifouling agent in aquaculture cage nets: Bioaccumulation and toxicity studies in *Oreochromis mossambicus* authored by Manju Lekshmi N., Vineeth Kumar C.M., Athira N., Leela Edwin and Ashraf P.

Dr. S. Remya, Scientist, Veraval Research Centre of ICAR-CIFT recived best oral presentation award in the National Scientific Hindi Seminar-Techfish 2019 on Technological Advancements in Fisheries Sector with special reference to Gujarat held during 25 June 2019 at VRC of ICAR-CIFT, Veraval for the research paper titled 'मछली की पैकेजिंग के लिए पॉलीलैक्टिक एसिड (पीएलए) आधारित तथा एसेंशियल तेल से समृद्ध रोगाणुरोधी फिल्मों का विकास' authored by S. Remya, J. Bindu, C. O. Mohan, V. Renuka, Ashish Kumar Jha, Toms C. Joseph, and C. N. Ravishankar.

Dr. S. Remya, Scientist, Veraval Research Centre of ICAR-CIFT recived best poster presentation award in the National Scientific Hindi Seminar-Techfish 2019 on Technological Advancements in Fisheries Sector with special reference to Gujarat held during 25 June 2019 at VRC of ICAR-CIFT,Veraval for the research paper titled 'जैव निम्नीारण एवं सूक्ष जीवरेधी द्विक्रियात्मक पैकेजिंग सिस्टम का शीत भंडारण में मछली के संचयन पर प्रभाव' authored by S. Remya, J. Bindu, C. O. Mohan, V. Renuka, Ashish Kumar Jha, Toms C. Joseph, and C. N. Ravishankar.

Smt. Renuka V., Scientist, Veraval Research Centre of ICAR-CIFT received best poster presentation (runner-up) awardin the National Scientific Hindi Seminar-Techfish 2019 on 'Technological Advancements in Fisheries Sector with special reference to Gujarat' held during 25 June 2019 at VRC of ICAR-CIFT,Veraval for the research paper titled आर एस एम का उपयोग कर के नॉनवपनेडझीगं के प्रटीन हाइडरलाइजेट के उत्पादन का अनुकूलन authored by Renuka.V., Remya,S., A.K.Jha., Zynudeen, A.A., Toms C. Joseph and Ravishankar C.N.

Dr. Minimol V. A., Scientist, ICAR-CIFT, Kochi received best oral presentation award in Hindi Seminar Haritha Matsyaki -2019 held druring 30 July 2019 at VRC of ICAR-CIFT, Visakhapatnamfor the research paper titled 'जलिये क्षेत्रों में एंटी बायोटिक प्रतिरोधी रोग जन ई एस्चेरीचिअकी का व्यापकता' authored by Pankaj Kishore, J. Parvathi, Anila George, Minimol V. A., Devanada Uchoi, Anuj Kumar A., Zynudheeen A.,C.N. Ravishakar and Satyen K. Panda

Razia Mohamed A., Research Associate, ZTM-ABI project received best poster presentation award in Innovation and Technology Management Conference 2019 held during 22- 23 September 2019 at Universiti Tun Hussein Onn Malaysia (UTHM), Batu Pahat-Johor, Malaysia for the research paper titled 'Institutional innovations for management and commercialization of fishery technologies in India – a case study' authored by Razia Mohamed A., Manoj P. Samuel, George Ninan and Ravishankar C.N.

POST GRADUATE STUDIES

Mr. Nenavath Rajendra Naik, Scientist, Fishing Technology Division, ICAR-CIFT, Kochi was awarded PhD. Degree for his thesis entitled, GIS based management of trawl fishery along Visakhapatnam coast, Andhra Pradesh from ICAR-CIFE Mumbai, Under the guidance of Dr. Latha Shenoy, Principal Scientist, ICAR-CIFE.

Ms. Rehana Raj, Scientist, Biochemisty and Nutrition Division, ICAR-CIFT, Kochi was awarded PhD. Degree for her thesis entitled, Utilization of fish processing waste for the preparation of dried fish silage and its fortification for poultry feed from College of Fisheries, Mangalore, Under the guidance of Dr. C.V. Raju, Comptroller, Karnataka Veterinary, Animal and Fisheries Sciences University, (KVAFSU) Bidar, Karnataka.

Mr. T.V. Bhaskaran, Assistant Chief Technical Officer, Fish Processing Division/ PME Cell of ICAR-CIFT, Kochi was awarded PhD. Degree for his thesis entitled, Semiochemical mediated management of blow fly *Chrysomya megacephala* (F.) (Diptera: Calliphoridae) in sun drying of fish from Faculty of Marine Sciences, Cochin University of Science & Technology (CUSAT), Kochi, Under the guidance of Dr. T.K. Srinivasa Gopal, Former Director of ICAR-CIFT. Dr. Bindu.J, Principal Scientist, Fish Processing Division of ICAR-CIFT was the Co-Guide.

Ms. Leena Raphael, Research Fellow, Fishing Technology Division, ICAR-CIFT, Kochi was awarded PhD. Degree for her thesis entitled "Temporal changes in species diversity in landings and emerging concerns in ring seine sector of Kerala" from Faculty of Marine Sciences, Cochin University of Science & Technology (CUSAT), Kochi, Under the guidance of Dr. Leela Edwin, Principal Scientist and Head Fishing Technology Division ICAR-CIFT, Kochi

AGRICULTURAL TECHNOLOGY INFORMATION CENTRE

Different stakeholders namely students (1770), faculty (137), technologists (24), fisheries officials (36), entrepreneurs (11), farmers (45) and fishermen and general public visited the institute during the period to get themselves acquainted with various technologies and activities of the institute. Arrangements were made for the visitors to expose them to various activities of ICAR-CIFT through video film show; visits to NABL accredited sophisticated laboratories, national level referral food laboratories, pilot processing plant, ABI unit, Engg. workshop and different divisions of the institute followed by interaction with scientists. Priced publications were sold through ATIC. Various technical queries received regarding training and other extension activities were replied.

ADMINISTRATION

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

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

1. Departmental Promotion Committee : 2 times
2. Career Advancement Committee : 4 times

Cases considered by the Departmental Promotion Committee

Category	Promotion	Declaration of probation & Confirmation	Granting of MACP
Scientific	16	-	-
Technical	6	-	-
Administrative	7	1	2
Supporting	2	-	-
Auxiliary	-	-	-

PRIORITY SETTING, MONITORING AND EVALUATION CELL

The Priority setting, Monitoring and Evaluation (PME) Cell during the year 2019 primarily looked into the following.

Priority setting, Monitoring and Evaluation of Institute Research Projects.

PME Cell monitored and evaluated the research projects in the identified research priorities of the Institute and evaluated the projects half yearly through conduct of meetings of Project Monitoring and Evaluation Committee of the Institute. The projects initiated during April 2019 and those completed by March 2019 were evaluated and graded. RPP I, RPP II and RPP III of 32 Institute projects were processed.

Externally funded projects

A total of 17 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 aspects were regularly furnished to the Council. Inputs requested from the council on various points are collected, processed as per the formats given 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 like DARE Report, ICAR Reporter, ICAR News etc. were also furnished.

Institute Research Council: The Institute Research Council meeting was convened during 02-04 May 2019 to review the progress achieved in the ongoing research projects of the Institute during 2018-19 and to discuss the research project proposals for the year 2019-20. The Institute Research Project Document for the year 2019-20 was compiled and brought out for discussion at the meeting. The House discussed in detail the 25 ongoing research projects, besides 6 completed projects and 7 new projects apart from the various ad hoc projects.

Verification of CAS Reports of Scientists: The PME Cell verified Career Assessment Reports submitted by 14 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.

Publication of the Scientific Papers and maintenance of database: Facilitated processing and approval for 119 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 and for plagiarism clearance and recommended for decision/approval by Director.

Parliament/Lok Sabha questions/Requests: Cell arranged to give replies to the Parliament/ LokSabha 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.

Maintained 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: Facilitated the Knowledge Management activities of the Institute. Publications, technologies, data etc were uploaded in the KRISHI portal of ICAR. Received Appreciation Certificate for uploading all publications of last six years (2013-14 to 2019-2020) in the KRISHI portal. The certificate was received by Nodal Officer, KRISHI, CIFT from Dr. Trilochan Mohapatra, DG, ICAR & Secretary, DARE on 10 December 2019 during the 4th National workshop on ICAR Research Data Repository for Knowledge Management at New Delhi.

Other Technical Matters: The Cell continued to answer 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.

OFFICIAL LANGUAGE IMPLEMENTATION

National Scientific Seminar in Hindi on Contribution of Fisheries to India Economy

Presidential Address by Dr. Ravishankar C.N., Director, ICAR-CIFT

National scientific seminar in Hindi on Contribution of fisheries to India economy organized on 11 July 2019 at ICAR-Central Institute of Fisheries Technology, Cochin. Dr. Ravishankar C.N. Director, in his presidential address highlighted the achievements of the official language implementation along with the achievements of the Institute. Chief Guest Dr.T.K.Srinivas Gopal, Former Director, ICAR-CIFT, Cochin in his address presented fisheries role in employment generation along with the contribution to the economy and congratulated the Director and Deputy Director (Official Language) of the institute for organizing the national scientific seminar in hindi language. The abstract booklet published on the occasion was released by the Chief Guest.

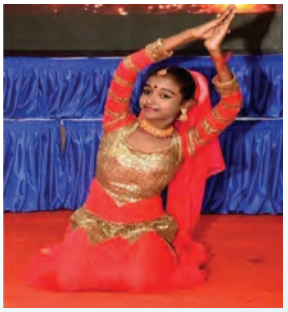
Jaladhi 2018 released

Chetna Mas Valediction Ceremony

Chetna Mas Valediction Ceremony was organized on 21 September 2019 at ICAR-CIFT, Cochin. During Chethna Maas, ten competitions were organized for the staff members of all categories of the Institute. The chief guest of this function was Mr. Pullela Nageswara Rao, IRS, Principal Chief Commissioner, Customs, Central GST and Central Excise, Kochi. Chief Guest released the science house magazine Jaladhi 2018.

The Chetan Mas Awards were distributed by the Chief Guest Mr. Pullela Nageswara Rao. The cash award under the incentive scheme awarded to Mrs. K. Reshmi, Senior Technician and Rajbhasha Pratibha to Mr. P. Krishna Kumar, Assistant Administrative Officer. On this occasion, the educational excellence awards of ICAR-CIFT and ICAR-CIFT Recreation Club were also presented to the wards of staff members of the institute by the Chief Guest and Director. Cultural program was also organized during Chetna Mas Valediction Ceremony.

Rajbhasha Pratibha Shri P. Krishna Kumar



Dance by Kumari Ashritha

Dr. Renuka, Deputy Director (OL) delivering lecture at SNC Headquarters

Hindi Workshop on official language implementation: progressive efforts

Official Language Implementation Section of ICAR-CIFT conducted workshop on topic of Official Language Implementation: progressive efforts at Headquarters of Southern Naval Command, Cochin on 17 September 2019. Naval officers of SNC attended the workshop.

Basic training program for working in Hindi on computers

Shri Gauri Shankar Sahu and Shri Dev Umesh Aroskar, the Lower Grade clerks were nominated for "Basic Training Program for working in Hindi on computer" from 22.07.2019 to 26.07.2019 in Hindi Typing and Stenography Training Center, Hindi Teaching Scheme, Department of Official Language, Ministry of Home Affairs, Government of India, Kakkanad, Cochin.

Competitions of Kochi Town Official Language Implementation Committee

Staff of ICAR-CIFT, Cochin have participated in all the competitions of Kochi TOLIC organized during 25 to 29 November 2019 as part of Joint Hindi Week Celebrations and Official Language staff of the Institute has coordinated the competitions at various venues.

LIBRARY

Library is playing a vital role in providing services to support the information needs of the scientific community of the Institute. The 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 18 books and 186 issues of journals .Online databases viz., ASFA (Aquatic Science and Fisheries Abstracts) and Indian Standards on DVD 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.

Digital Repository of CIFT

Digitization of CIFT publications and putting them in open digital repository is an important activity of the library. During the period 133 documents have been digitized and added to the repository. At present CIFT Digital Repository holds 3958 digital documents.

Remote access to e-resources

Remote access to subscribed e-resources has been provided to the users. The 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 journals are available online through CeRA (Consortium of e-Resources on Agriculture). Library has supplied copies of 98 articles under DDR (Document Delivery Request) facility of CeRA (Consortium of e-Resources on Aquaculture).

Institutional membership

CIFT library is a 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.

Wiley Library Award

CIFT library bagged Wiley Library Award for highest usage of journals in 2019 within CeRA Consortium (Fish & Aquaculture Institutes).

National Digital Library of India (NDLI) Partner

CIFT is designated as a content partner of National Digital Library of India for its generous contribution of contents.

AGRICULTURAL KNOWLEDGE MANAGEMENT UNIT

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 also periodically updates Institute Website and Personnel Management Information System Network (PERMISnet) of the employees of the institute. AKMU provides internet connectivity to nearly 250 systems through LAN and wifi connectivity to nearly 250 users. ICAR-CIFT is presently connected with 1000 mbps lease line under National Knowledge Network (NKN) provided by Govt. of India and 20 mbps MPLS from BSNL to provide all the ICT services around the clock for the employees of the Institute.

AKMU provides server security for protecting from malware threats and other external sources of threats, thus improving the ICT efficiency. It also act as a gateway to protect from intrusion attacks to prevent the leakage of confidential data by adding 250 clients in the system.

AKMU properly manages ICAR-CIFT website and it is available in the url www.cift.res.in. It highlights overall research activities and achievements of the institute and act as an interface between institute and end users. The contents of the Institute Website are periodically updating. 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. ICAR-CIFT has IP based video conferencing facility. It is being operated and maintained effectively by AKMU. This facility is being used for monitoring and evaluating research programmes in the Research Centres of the institute and also other organizations.

AKMU is Maintaining and updating of Personnel Management Information System Network (PERMISnet-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. The information on institute cadre strength and details of individual employees in PERMISnet is periodically updated. As per the provision given, CIFT provided user name and password to the Regional Centres to update the information in PERMISnet on periodical basis and also maintaining social accounts.

AKMU gives 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 provides input to KM Portal developed by ICAR by updating details of institute higher authorities contact information, sophisticated analytical instrumentation facility and online transaction details of the institute.

NABL ACTIVITIES

ICAR- CIFT laboratories are accredited to ISO/IEC 17025: 2005 by NABL in the areas of Chemical, Mechanical and Biological testing since the year 2005. Dr. A. A. Zynudheen, Principal Scientist and HOD-in-Charge, Quality Assurance and Management Division serves as the Quality Manager and Dr. Satyen Kumar Panda, Principal Scientist serves as the Technical Manager of NABL cell in the institute. NABL Cell with Smt. P.K. Shyma (ACTO, Engineering Division), Smt. N.C. Shyla (Technical Officer, AKMU), Shri. Rahul Ravindran (Technical Assistant, FP Division), Shri. G. Vinod (Sr. Technician, FP Division) and Shri. Ajith Chellappan (Sr. Technician, QAM Division) as members is constituted for the smooth functioning of the NABL activities in the institute.

Transition Audit of the testing laboratories of ICAR-CIFT as per ISO/IEC 17025: 2017 was conducted by NABL cell during 21st December 2019 and the validity of accreditation was renewed up to 14/12/2020. Total recommended scope of accreditation for testing is 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 six Proficiency Test programmes in this 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.

PAST YEAR IN THE LIFE OF ICAR-CIFT

Workshops/Short Courses/Seminars etc. conducted

Winter school: A winter school on Responsible fishing: Recent advances in resource and energy conservation was conducted from 21st November to11th December, 2019. Dr. Leela Edwin, Principal Scientist & Head, Fishing Technology Division was the Course Director and Shri. M.V. Baiju, Senior Scientist and Dr. Manju Lekshmi N., Scientist were the Coordinators. Twenty participants from 12 different organisations comprising of Assistant Professors, Fisheries Department officials and research scholars from six states (Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra, Tamil Nadu, Kerala) and three Union Territories (Andaman & Nicobar, Lakshadweep and Kashmir) attended the programme. The winter school was inaugurated by Shri. Madhu S. Nair, Chairman, Cochin Shipyard Limited. Dr. B. Meenakumari and Dr. V.V Sugunan were the guests of honour.

Inauguration of ICAR sponsored Winter School Course by Chief Guest Shri. Madhu, S. Nair, CMD, Cochin Shipyard Limited.

Release of training manual

Inaugural address by Chief Guest Shri. Madhu, S. Nair, CMD, Cochin Shipyard Limited Kerala

Felicitation address by Guest of Honour Dr. B. Meenakumari, Former Chairperson, National Biodiversity Authority (NBA) and Ex-DDG (Fisheries), ICAR, New Delhi.

Participants and faculty

Expert Consultation on Metabolomics: Exploring the System Biology Approach in Agricultural Sciences

The Indian Council of Agricultural Research (ICAR), New Delhi along with ICAR-National Research Centre for Grapes (NRCG), Pune and ICAR-Central Institute of Fisheries Technology (CIFT), Cochin organised an one day Expert consultation meeting on "Metabolomics: Exploring the System Biology Approach in Agricultural Science" with an aim to identify a framework on metabolomics research in agricultural sciences on 8th July, 2019 at NASC Complex, New Delhi. Dr. Trilochan Mohapatra, Secretary DARE and DG, ICAR presided over the meeting in presence of Dr. J.K. Jena, DDG (Fisheries & Animal Science), Dr. A.K. Singh, DDG (Crop & Horticultural Science) and Dr. K. Alagusundaram, DDG (Agricultural Engineering & NRM).

DG, ICAR inaugurating the Expert Consultation Workshop on Metabolomics: exploring the system biology approach in agricultural sciences

National Seminar on AMR in Indian Fisheries: Measures and Mitigation

A two-day national seminar on "AMR in Indian Fisheries: Measures of Mitigation" was held at ICAR-CIFT, Cochin during 07-08 November, 2019. The program was jointly organized by ICAR, New Delhi, SOFT (I) Cochin, ICAR-CIFT, Cochin and MPEDA, Cochin. The seminar was inaugurated by Shri. K.S. Srinivas. IAS, Chairman, MPEDA, Cochin and in his inaugural speech he underscored the need for zero tolerance towards antibiotic residues in fish and 61 research papers were presented of which 16 were posters and 45 were oral presentations.

National Seminar 'Fish Tech-19' on Fishery Waste Management: Challenges and Business Opportunities in Gujarat

A one-day National Seminar, FishTech-19 on 'Fishery waste management: Challenges and business opportunities in Gujarat' has been jointly organized by Veraval Research Centre of ICAR-CIFT and SOFT(I), Kochi at The Imperial Hotel, Somnath, Veraval on 10th July, 2019. The seminar was organized as a series of lectures from experienced experts in the relevant areas.The national seminar brought different stakeholders including scientists, academicians, seafood exporters, quality managers, technologists, entrepreneurs and students on one platform and enabled them to share the recent technological interventions in the area of fishery waste utilization. More than 100 delegates representing various organizations participated in the seminar.

Inauguration of FishTech-19 by Dr. Radhakrishnan.T, Director, ICAR-Directorate of Groundnut Research, Junagadh

Shri. Dominique Gillet from France delivering a talk on applications of chitin, chitosan and its derivatives

Veraval RC of ICAR-CIFT conducted workshop in association with INCOIS Hyderabad at Diu

One day workshop was conducted by Veraval RC of ICAR-CIFT conducted in association with INCOIS Hyderabad at Diu on 11th November 2019. The workshop was arranged to have a better understanding on the fishermen's attitude, approach and acceptance on the services provided by INCOIS & ICAR-CIFT and about 75 fishermen attended the programme.

National Scientific Hindi Seminar – Techfish 2019 on Technological Advancements in Fisheries Sector with Special Reference to Gujarat

As part of implementation and promotion of Official Language, a one day National Scientific Hindi Seminar – Tech fish 2019 on 'Technological Advancements in Fisheries Sector with special reference to Gujarat' was conducted on 25.06.2019 by Veraval Research Centre of ICAR-CIFT. The Chief Guest, Shri. Ajay Prakash, IAS, Collector & District Magistrate, Gir-Somnath applauded the effort taken by ICAR-CIFT for conducting a national level scientific seminar in Hindi for promoting the official language and disseminating the research information to the stake holders, who are conversant in Hindi. The sessions were, Fish and Fisheries Science & Fish Processing Technology. There were 13 oral presentations and 19 poster presentations in the field of fish & fishery science and 11 oral presentations and 11 poster presentations in fish processing technology. Around 100 delegates including scientists, academicians and students representing various organizations participated in the seminar.

Release of abstract book of Techfish 2019

Prize distribution to the winners

National Hindi Seminar Haritha Matsyaki-2019, at Visakhapatnam Centre of ICAR-CIFT

Visakhapatnam Research Centre of ICAR-Central Institute of Fisheries Technology (ICAR-CIFT), has organized Haritha Matsyaki-2019, a National seminar in Hindi Harith Matsyaki 2019- Opportunities and challenges for sustainable development of Indian fisheries on 30th July 2019 at ICAR-CIFT, Pandurangapuram, Visakhapatnam.

Dr. Raghu Prakash, Principal Scientist and Convener of Haritha Matsyaki-2019. Dr. C.N.Ravishankar, Director, ICAR-CIFT, Kochi delivered the presidential address. Dr. Ravishankar stated that Andhra Pradesh is the right place for any seminar on Aquaculture or Fisheries owing to its vast contribution to the fishery sector.

Dr. Pravin Puthra, ADG (MF), ICAR, New Delhi inaugurated the seminar which was attended by Shri. V. Padmanabhan as guest of honour along with Dr. CN. Ravishankar, Dr. Raghu Prakash and Dr.S. Gosh

The seminar was attended by delegates from different parts of India representing central research institutes such as ICAR-CMFRI (Cochin), ICAR-CIFT (Cochin), ICAR-CIFA (Bhubaneswar), CCARI-Goa, Central government organizations such as FSI, CIFNET, academic institutes, members of the boat operators associations, processing, and research scholars. 21 oral and 23 poster presentations were made during the seminar.

Lighting of the lamp by Dr. Pravin Puthra, ADG (Marine Fisheries) ICAR and Dr. Ravisankar Director ICAR-CIFT

Dr. Pravin Puthra, ADG (Marine Fisheries), ICAR, New Delhi delivering inaugural address

ICAR Short Course on Recent advances in post-harvest fisheries engineering

Release of ICAR Short Course Compendium

A 10-days short course on 'Recent advances in post-harvest fisheries engineering' was inaugurated at ICAR-Central Institute of Fisheries Technology (ICAR-CIFT) on Wednesday (13.11.2019). The training program was sponsored by Indian Council of Agricultural Research, New Delhi. Fifteen faculty/ scientists from various ICAR institutes and SAUs attended the Short Course.

Hindi workshops on Official Langugae Policy & Noting and Drafting in Hindi at VRC of ICAR – CIFT

As part of implementation and promotion of Official Language in Veraval Research Centre of ICAR-CIFT a one day workshop on Official Langugae Policy & Noting and Drafting in Hindi was conducted on 18.03.2019 by Dr. D.D. Goud, Hindi Officer, Office of the Principal Accountant General (G&SSA), Rajkot. The workshop was inaugurated by Dr. Toms C Joseph, Principal Scientist & Scientist-In-Charge, VRC of CIFT.

Another one day workshop on Official Language Policy & Use of Unicode in Hindi was conducted on 20.07.2019 by Shri Mukesh Solanki, Junior Translation Officer, Office of the Principal Chief Commissioner of Income Tax, Tamil Nadu. The workshop was inaugurated by Dr. Toms C Joseph, Principal Scientist & Scientist-In-Charge, VRC of CIFT.

Talk on AMR by Dr. Toms C. Joseph at Aditya Birla Higher Secondary School, Veraval

Important Training Programmes

One day stakeholder's meeting was held at Munambam for the trawl fishermen on 20.12.2019. About 25 trawl owners, operators, engine and spare parts dealers, net makers, etc. were the participants.

Two users interaction workshop conducted in association with INCOIS, Hyderabad at Diu and Veraval on 11th and 13th November 2019. The workshops were arranged to have a better understanding on the fishermen's attitude, approach and acceptance on the services provided by INCOIS & ICAR-CIFT and about 75 fishermen attended the programme.

Inauguration of MTC

Model Training Course (MTC)

On *advanced fish drying and chilling technology* sponsored by Directorate of Extension (GOI), New Delhi was held at CIFT, Kochi during 19-26 August 2019 with participation of 20 officers/faculty/scientists from line departments/SAUs/ICAR institutes (Fig.25). 20 participants including officers from various State departments of Andhra Pradesh, Kerala, Tamil Nadu and Karnataka and faculty of SAUs/ICAR institutions attended. The training was organized in 7 modules including exposure visits.

Participants and faculty of international training on ISO 22000/ HACCP for Fish Processing Establishments

International Training Programmes organized

An international training on *ISO 22000/ HACCP for Fish Processing Establishments* sponsored by Indian Technical and Economic Cooperation (ITEC) under Ministry of External Affairs, Govt. of India was conducted from 15 -27 Nov., 2019 at ICAR-CIFT, Kochi; which was attended by 11 officials from 7 different ITEC countries namely Sudan, Zambia, Nigeria, Ethiopia, Mauritius, Bhutan and Madagascar.

ICAR-CIFT, Kochi conducted an international training programme on *Protocols for the production of high value secondary products from industrial fish and shellfish processing* from 25th November to 21st December, 2019 under the sponsorship of ITEC, Ministry of External Affairs, Govt. of India. Eighteen participants from 11 different ITEC partner countries namely, Sudan, Ethiopia, Tanzania, Argentina, Sri Lanka, Afghanistan, Oman, Botswana, Zimbabwe, Guatemala and Egypt participated in the programme.

Participants and faculty of "Protocols for the production of high value secondary products from industrial fish and shellfish processing"

Mumbai research center of ICAR-CIFT conducted four training programmes during 2019, hands on training on Seafood Microbiology Techniques in association with MPEDA, Goa at Albys Agro Private Ltd., Goa from 25th to 29th June, 2019; Training programme on "Quality assurance and estimation of biochemical quality of fish meal at M/s. Gadre Marine Exports Pvt. Ltd., Ratnagiri during 20-24th August, 2019; Five days training programme on Quality Assurance and Seafood Microbiology on consultancy Basis at M/s Jeelani Marine Products, Ratnagiri, Maharashtra from 22nd July to 26th July, 2019; Training programme on Quality Assurance and Seafood Microbiology at M/s Castelrock fisheries Pvt. Ltd., Taloja during 20-25 December, 2019 for the technologist from seafood industry.

Consultancy training programme on Seafood Microbiology Techniques at Albys Agro Private Ltd, Goa

Consultancy training programme on Quality assurance and estimation of biochemical quality of fish meal at Gadre Marine Exports, Ratnagiri

Consultancy training programme on Quality Assurance and Seafood Microbiology at Ratnagiri

Consultancy training programme on Quality Assurance and Seafood Microbiology at Castelrock Fisheries, Taloja

EVENTS

Director General (ICAR) along with DDG (Fisheries Sciences) visits ICAR-CIFT, Cochin

Dr. Trilochan Mohapatra, Secretary (DARE) & DG (ICAR) along with Dr. J.K. Jena, DDG (Fisheries Science) and Dr. P. Pravin, ADG (Marine fisheries) visited ICAR-CIFT, Cochin on (25 May, 2019) and inaugurated the newly established National Referral Laboratory. The Director General also inaugurated the Fish Behaviour Laboratory and CIFT Solar Boat II developed by CIFT.

In his address, the Director General applauded the great work done by ICAR-CIFT and emphasized on perfection in work. He appreciated CIFT as an institute which takes highest level of initiative and technologies from CIFT have provided great visibility to ICAR. He called for better communication of salient achievement to stakeholders and asked for preparation of brief flyers on all available technologies.

Inauguration of ICAR-CIFT Sun Boat II

DG and dignitaries in ICAR-CIFT Sun Boat II

Inaugurating the fish behaviour lab

DG being explained about fish behaviour lab

Inauguration of National Referral Lab

Diginitaries visiting National Referral Lab

DG addressing the gathering

Director General released six new technologies developed by CIFT namely; Squalene powder, Fish Soup Powder, ChitoPro, Tunnel Dryer, Table Top Fish Descaling Machine and Fish Freshness Sensor. The DG officially released three new mobile apps *CIFT FISHPRO, CIFT LABTEST* and *CIFTraining* during the function.

Release of incubatee products

The event also witnessed release of ICAR-CIFT training calendar and eight other publications. The DG also launched products developed by Incubatees of ICAR-CIFT namely Cashew Oats Cookies by Smile and Take, Ready to Eat Mussel by Foo Foods, Dry fish products by Emma Foods, Chef n Kitchen, Mr. Fish.

Visit of DG to ICAR-CIFT ATIC

Dr. J.K. Jena, DDG (Fisheries Science) and Dr. P. Pravin, ADG (Marine Fisheries) also marked their presence during the occasion and felicitated the good work done by ICAR-CIFT and offered suggestions for further research. DDG (Fisheries Science) lauded the contributions of CIFT and called for more focus on blue economy and increased collaborative work between fisheries institutes.

Diginitaries also visited the Agricultural Technology Information Centre at CIFT renovated with latest digital display boards, interactive presentation system and back-lit posters for enhanced technology communication. Visit to different divisions and laboratories were also made and offered suggestions for future research. Directors of ICAR-CMFRI, Cochin, ICAR-CTCRI, Thiruvananthapuram, ICAR-IISR, Calicut and Head of Station, ICAR-CPCRI, Kayamkulam and HoDs of ICAR-CIFT and ICAR-CMFRI, several fisheries incubates and other fishery stakeholders also graced the event.

ICAR-CIFT handholds fishery entrepreneurs by inaugurating mini fish processing unit and custom hiring centre at Kadamakkudy village, Kochi

In an attempt to bring cheer to the fishery entrepreneurs, ICAR-CIFT inaugurated a Mini Fish Processing Unit and Custom Hiring Centre at Kadamakkudy village, near Varappuzha, Ernakulam on 13-02-2019. The function was attended by budding entrepreneurs, people's representatives, Kudumbasree members, teachers and students of VHSC, Kadamakkudy and scientists from ICAR-CIFT. On this occasion, two fish dryers of 10 kg capacity each and two sets of mini fish processing units consisting of 21 implements each were handed over to the PTA of VHSC, Kadamakkudy.

Smt. Sona Jayaraj, Member, Zilla Panchayat inaugurated the programme and Dr. C.N. Ravishankar, Director, ICAR-CIFT chaired the programme.

Inauguration of training programme by Zilla Panchayat Member

Handing over of Mini Processing Units by Director, ICAR-CIFT

Training on Fish Drying using CIFT Dryer

ICAR-CIFT conducts demonstration on fish waste utilization – an initiative under Swachhata Action Plan

As an initiative under Swachhta Action Plan, on 30th January, 2019, ICAR- CIFT conducted a public demonstration programme on Fish waste conversion to poultry and fish feed at Cochin Fisheries Harbour in Ernakulam, Kerala. This programme was organized under special sanction from ICAR for implementing the Management and commercial utilization of waste in 20 fish markets (10/Year) in urban locations. Under the programme, it has been envisaged to cover 20 fish markets/fish landing centres located in six states namely; Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra and Gujarat along with two markets at Delhi.

The Chief Guest Shri K.K. Kunjachan, Councilor, Kochi Corporation inaugurated and Shri Sudhir, Administrator & Chief Engineer, Cochin Fisheries Harbour, Dr. C N. Ravishankar, Director, CIFT and Dr V. Geethalakshmi, Principal Scientist and Nodal Officer, Swachh Bharat Mission, ICAR-CIFT, Cochin, Shri Noushad, President and Shri Majeed, Secretary, Harbour Management Committee, Dr. Saju, Joint Director (Fisheries), Kerala; Smt Daisy, Manager, MATSYAFED, fishermen, market vendors, representatives from fish processing industry and staff of ICAR-CIFT were present.

Dr. Zynudheen A.A., Principal Scientist & I/c QAM Division and Dr. Binsi P.K., Scientist demonstrated conversion of fish waste to feed.

Presidential address by Director, ICAR-CIFT

A section of audience

Demonstration of Fish waste conversion to feed

Secretary, DADF applauds the accomplishments of ICAR-CIFT during his visit

Dr Ravishankar C.N. briefing DADF Secretary Shri Tarun Shridhar during his lab visit at ICAR-CIFT

Shri Tarun Shridhar, IAS, Secretary, Department of Animal Husbandry, Dairy and Fisheries (DADF) under Ministry of Agriculture and Farmers' Welfare, Government of India visited ICAR-CIFT on 11 January 2019 along with Shri K S Srinivas, IAS, Chairman MPEDA, Cochin. Reminiscing his long association with fisheries sector, the Secretary, DADF lauded the research accomplishments of ICAR-CIFT for its outstanding research in harvest and post-harvest sectors in fisheries and suggested for pluralistic convergence of different agencies working in the same line to bring more visibility in the fisheries sector and to check unnecessary wastage of resources due to duplication of work. He urged the stakeholders from both central and state governments for greater collaboration to strengthen the blue economy initiative of the government. He advised that MPEDA should take a lead to bring together all the stakeholders in the sector on quarterly basis to discuss about the strategic research developments in fisheries matching with need of the hour. Shri. K S Srinivas, IAS, Chairman MPEDA in his remarks appreciated the contributions of ICAR-CIFT and ICAR-CMFRI and assured all possible support for the growth of the fisheries sector. Dr. T V Sathianandan, Director i/c. ICAR-CMFRI and Shri. A K Chaudhary, Director CIFNET were also attended the programme.

ICAR-CIFT organizes industry interface programme at Cochin

An Industry Interface Programme was organized by the Zonal Technology Management - Agribusiness Incubation (ZTM-ABI) Centre, ICAR-CIFT on 27th March, 2019 at Cochin, Kerala. This was organized for showcasing the innovations in fisheries which was attended by In Charge (ITMU) of all the eight fisheries

research institutions under Indian Council of Agricultural Research (ICAR). The programme was organized as part of the business promotion drive designed for the fisheries sector to promote entrepreneurs with the help of latest R&D facilities and vast knowledge available with ICAR. The event brought together innovators and entrepreneurs from the field of fisheries on the same platform. Around 70 participants representing fisheries industry, processors, exporters, brackishwater / freshwater aquaculture / fish farmers, ornamental fish breeders, cage culturists, startups, entrepreneurs, private investors and Govt. agencies, participated in the programme.

Shri Alex Ninan, President, Seafood Exporters Association of India (Kerala Region), the Chief Guest of the programme lauded the role of ICAR-CIFT in Indian fish export since last six decades and sought the technological cooperation from other research organizations for holistic development of the sector. Shri Abraham J. Tharakan, Chairman, Amalgam Group of Companies was the Guest of Honour. Dr. Vikram Singh, Principal Scientist, IP&TM Division, ICAR, New Delhi in his felicitation address highlighted the importance of organising such programme at state/regional level to explore the hidden talents and encourage the budding entreprenuers to grab the opportunities for developing a start-up. Dr. George Ninan, Principal Investigator, ZTM-ABI Centre gave the opening remarks and welcomed the gathering.

During the technical session, each institute presented their complete spectrum of potential technologies and explained about the technical and commercial aspects of various technologies to the entrepreneurs and about various schemes offered by Micro, Small & Medium Enterprises (MSME), Marine Products Export Development Authority (MPEDA) and Kerala State Industrial Development Corporation (KSIDC).

ICAR-CIFT designed fishing vessels constructed by Cochin Shipyard Limited flagged off

As a harbinger of a new revolution in deep-sea fishing in India, ICAR-CIFT, Cochin created an impact in Indian fishing sector by signing an MoU with Cochin Shipyard Limited, Cochin for providing technical consultancy in the design of 22.50 m long liner cum gillnetter.

On 19 Feb., 2019; the first batch of four vessels designed by ICAR-CIFT, Cochin and constructed by Cochin Shipyard Limited was flagged off by the Honorable Chief Minister of Tamil Nadu Shri. Edappadi K. Palaniswami through video conferencing in a function organized at Cochin Shipyard Limited, which was attended by an array of dignitaries namely Mr. Madhu S. Nair, Chairman, Cochin Shipyard Limited; Shri Johny Tom, IAS, Additional Director, Tamil Nadu Fisheries; Shri. K.S. Srinivas IAS, Chairman MPEDA, Cochin; Dr. A. Ramachandran, Vice Chancellor, KUFOS; Dr. C.N. Ravishankar, Director, ICAR-CIFT; Dr. A. Gopalakrishnan, Director, ICAR-CMFRI;

Dr. Leela Edwin, Head, Fishing Technology Division and Mr. M.V. Baiju, Senior Scientist and Naval Architect, ICAR-CIFT along with representatives from different Institutions, representatives of fishermen associations.

Under the initiative of ICAR- NASF project on "Green Fishing System for Tropical Seas", ICAR-CIFT evolved a new-generation energy efficient, combination vessel envisaged as a standard model for replication in the tropical waters and developed design of the IRS class model-fishing vessel, F.V Sagar Harita, which was constructed at Goa Shipyard, Goa. Field trials for deep sea fishing were carried out by ICAR-CIFT for multiday fishing operations and the results showed a saving of 15-20 % in different fishing conditions, when compared to similar class of fishing vessels in the region. Based on the success achieved in fuel conservation, the Department of Animal Husbandry Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India, entrusted ICAR-CIFT to make the technical specifications of a 22-23 m long liner cum gillnetter for the blue revolution scheme on all India basis.

Thus the MoU signed between ICAR-CIFT and Cochin Shipyard Limited, finally led to construction of sixteen sophisticated fishing vessels by Cochin Shipyard Limited by incorporating advanced navigational, fire-fighting and live saving appliances, which would help in a big way to harvest the deep-sea resources along the Indian EEZ and beyond which is in line with the "Make in India" concept of Hon'ble Prime Minister of India.

Inauguration of the craft and gear laboratory cum fish behavior laboratory complex by Dr. C. N Ravishanker

Dr. C. N. Ravishankar, Director, ICAR-CIFT, Cochin inaugurated Fish behaviour laboratory and craft and gear workshop at Veraval RC

A new craft and gear lab and a lab for studying the fish behavior lab was inaugurated at Veraval research Centre of ICAR-CIFT by Dr. C. N. Ravishankar, Director, ICAR-CIFT, Cochin at Veraval in May, 2019.

Dr. Toms C. Joseph, SIC, Veraval RC of ICAR-CIFT, Shri. Jitendra Singh, In-charge, KVK, Kodinar, Dr. Divu. D, SIC, Veraval RC of ICAR-CMFRI and scientists and staff of Veraval RC of ICAR-CIFT were present on the occasion.

Fish behaviour laboratory at Veraval RC

Secretary, Department of Fisheries, Govt. of India visits ICAR-CIFT, Cochin

Smt. Rajni Sekhari Sibal, IAS, Secretary, Department of Fisheries, Govt. of India visited ICAR-CIFT, Cochin on 4th April 2019 during her three days' official visit to Cochin.

During the visit, Dr. Ravishankar, C.N., Director, ICAR-CIFT gave a brief report about the role and accomplishments of the institute in the harvest and post-harvest research in fisheries.

Smt. Rajni Sekhari Sibal visited divisions, National Referral/Reference Laboratory, ZTM-ABI centre and was highly impressed with the technologies of the institute. She showed interest in organising exclusive workshops on harvest and post-harvest for wide scale dissemination of technologies to the various fisheries stakeholders across the country. Later, the Secretary, Dept. of Fisheries, GOI had a discussion with members of Seafood Exporter Association (SEA) of Kerala to understand the status of the seafood trade, its problems and opportunities. This meeting was also attended by Shri. K.S. Srinivas IAS, Chairman MPEDA; Shri Alex Ninan, President, SEA, Kerala Region along with more than 30 seafood exporters from Kerala.

AARDO Secretary General visits ICAR-CIFT

As part of seeking cooperation on building and developing harvest and post-harvest fisheries sectors in both developing and underdeveloped African and Asian countries, Secretary General of Afro Asian Rural Development Organization, Dr. Manoj Nardeosingh visited the ICAR-CIFT, Cochin on 29th October 2019. The African-Asian Rural Development Organization (AARDO) is a thirty one member strong inter governmental organization with seventeen and fourteen countries from Africa and Asia respectively, that works for the cooperation among member countries for agriculture and rural development.

ICAR-NAARM conducts refresher course for administrative staff at ICAR-CIFT, Cochin

A five-day refresher course during 13-17 June, 2019 on "Administrative and Finance Management" for Section Officers/AAO/AFAOs & JAOs/Assistants of ICAR Headquarters and different ICAR Institutes was conducted at CIFT, Cochin. The programme is conducted by ICAR-National Academy of Agricultural Research Management (NAARM), Hyderabad as an off-campus training programme to invigorate and inculcate the rules and regulations about complete official procedures, so that the staff of ICAR institutes will be equipped with latest trends in office management.

The programme was attended by about 50 participants from 16 different ICAR Institutes. Inaugurating the program, Director, ICAR- CIFT Dr. C.N. Ravishankar urged the trainees to keep abreast with the revised rules, regulations and develop the skill on information technology systems for better facilitation of research and developments in NARS, which may bring more transparency and better output. Course Directors of the programme Shri S. George, chief finance & accounts officer and shri srinivas bhatt, administrative officer from ICAR-NAARM, Hyderabad also spoke on the occasion. The training programme was coordinated by Shri Sreekumaran K S, F&AO, ICAR-CIFT.

Model training course on Advanced Fish Drying and Chilling Technology

Dr. P. Sudheer Babu, Dean, College of Dairy Science and Technology inaugurating the training course

An eight days model training course on "Advanced Fish Drying and Chilling Technology" sponsored by Directorate of Extension, Ministry of Agriculture & Farmers' Welfare, Govt. of India, was inaugurated at ICAR--CIFT, Cochin, on 19.08.2019. The partcicipants from Andhra Pradesh, Karnataka, Tamil Nadu and Kerala attended the programme. The program was formally inaugurated by lighting the lamp by the Cheif Guest Dr. P. Sudheer Babu, Dean, College of Dairy Science and Technology, Thrissur. Dr. Ashok Kumar, Course Director and HOD, Fish Processing Division, Dr. Manoj P Samuel, Course Director & HOD (Engg) and Dr. J.Bindu, Principal Scientist, Fish Processing Division & Course Coordinator and all the HOD, Senior officers and staff of ICAR-CIFT were present during the function.

Veraval Research Centre of ICAR-CIFT has conducted a public demonstration programme on Fishery Waste Utilization.Conversion of fish waste into fish and poultry feed was demonstrated during the programme by

Shri. Ajeesh.K, Senior Technician, ICAR-CIFT, Cochin and Sunil.N, Senior Technical Assistant, ICAR-CIFT, Cochin. A demonstration programme on Fishery Waste Utilization was organized by Veraval research centre of ICAR-CIFT in the Seafood Exporters Association Hall at GIDC, Bhidia, Veraval on 16.07.2019.

Veraval Research Centre of ICAR-CIFT conducted a demonstration programme on fishery waste utilization at kharakhowa fish market, Veraval, Gujarat on 15.07.2019 and at Seafood Exporters Association, Bhida, Gujarat on 16.07.2019.

Shri. Lakham Bhai Bhensla, Patel, kharwa fishermen community was the chief guest of the inaugural ceremony at Kharakhowa Fish Market, Veraval. He expressed his happiness in the interventions made by ICAR-CIFT for finding out solutions for challenges facing by fishers in the harvest and post harvest sectors. Shri.Tulsi Bhai Gohel, President, Boat Owner's Association and Shri. Rafeek Bhai Maulana, President, The Veraval Fish Merchant Association also graced the occasion. In his felicitation speech, Shri. Tulsi Bhai Gohel complimented VRC of ICAR-CIFT for conducting a programme, which has connection with Swachh Bharat Mission, the flagship scheme of Government of India. Shri. Rafeek Bhai Maulana lauded ICAR-CIFT for inventing a proper method for utilization of fishery waste, which everyday gets piled up in the fish markets and landing centres of Veraval.

Dr. Ashish Kumar Jha, Scientist, Veraval Research Centre of ICAR-CIFT welcomed the gathering and Dr. Remya. S, Scientist, Veraval Research Centre of ICAR-CIFT and In-Charge, Swachh Bharat Abhiyan, VRC of ICAR-CIFT proposed voted of thanks.

Later, 'Conversion of fish waste into fish/poultry feed' was demonstrated during the programme by Shri. Ajeesh.K, Senior Technician, ICAR-CIFT, Cochin, Sunil.N, Senior Technical Assistant, ICAR-CIFT, Cochin and Shri. Yogesh D. Kriplani, senior technician, VRC of ICAR-CIFT.

The programme attracted a huge public including fishermen, fisherwomen, fish vendors, representatives of Veraval Fish Merchant Association and fish suppliers.

On the second day, the programme at Seafood Exporters Association Hall was inaugurated by Shri. Piyush Bhai Fofandi, President, Seafood Exporters Association, Gujarat Chapter. He highlighted that fish processing generates waste that can be as high as 50-80 % of the original raw material and an important waste reduction strategy for the industry is the recovery of marketable byproducts from fish wastes. He thanked ICAR-CIFT for arranging the demonstration programme on fishery waste utilization as it can potentially generate additional revenue as well as reduce disposal costs for these materials. The programme started with a welcome address by Smt. Renuka V., Scientist, Veraval Research Centre of ICAR-CIFT. Dr. Ashish Kumar Jha, Scientist, Veraval Research Centre of ICAR-CIFT explained the possibilities of utilization of fishery waste into high value products. Smt. Renuka. V elaborated the method of converting the fishery waste into fish/poultry feed. A formal vote of thanks was offered by Dr. Remya S., Scientist, Veraval Research Centre of ICAR-CIFT.

As on the previous day, the inaugural function was followed by the demonstration programme on conversion of fish waste to feed. The programme was attended by all the leading seafood exporters, fish suppliers, fish farmers and fish meal manufacturers of Veraval, Gujarat.

Inaugural session of the Demonstration programme on fishery waste utilization at Kharakhowa Fish Market, Veraval, Gujarat

Demonstration of conversion of fish waste into feed is in progress at Kharakhowa Fish Market, Veraval, Gujarat

Mrs. Renuka. V, Scientist, VRC of ICAR-CIFT talking on fishery waste management during the demonstration programme at Seafood Exporters Association Hall, Bhidia, Veraval, Gujarat

Fishpreneur promotion programme-2019 under DST project was organized at Veraval Research Centre of ICAR-CIFT for promoting entrepreneurship among fishers. During the programme, equipments were distributed to the beneficiaries and MoUs were exchanged between Dr. C. N. Ravishankar, Director, ICAR-CIFT and two prospective entrepreneurs (Mr. Shailesh Hari Suyani, Sagar Manthan Machhimar Uthaan Mandal, Veraval & Mr. Bharat V. Kamaliya, saiyad rajpara bandar, Una) from fishermen community in Veraval, Gujarat.

Exchange of MoU for technology transfer during Fishpreneur promotion programme-2019

Director, ICAR-CIFT, Kochi interacting with the Kharwa fisherwomen of Veraval, Gujarat during Fishpreneur promotion programme-2019

CIFT Lab Test - An information system on sample testing and analysis

"CIFT Lab Test" an innovative Mobile Application intended for providing information related to different categories of sample testing and analysis available in the laboratories at ICAR-CIFT, Kochi, Kerala as well as all three research centre labs such as Veraval (Gujarat), Visakapatnam (Andhra Pradesh) and Mumbai (Maharastra). Application includes details on various sample categories such as fish and fish based products, fishing gear materials, packaging materials, microbiological parameters, quality parameters of ice and water samples etc. quantity of sample required, NABL scope or not, duration required, charges and tax (Rs), total charges (Rs) along with payment gateway facility.

App may be downloaded from following links

https://icar.org.in/mobileapp
https://play.google.com/store/apps/details?id=com.vcsecon.CIFT_Lab_Test

CIFTraining- An information system on ICAR-CIFT training programme

The "CIFTraining" Mobile App is embedded with a total list of 68 types of clientele based trainings programmes available in ICAR-CIFT, which contain 60 regular training courses along with two comprehensives, three specialized and three certified courses. This online app includes payment gateway as well and links are given below.

https://icar.org.in/mobileapp
https://play.google.com/store/apps/details?id=com.vcsecon.CIFT_Training_new

CELEBRATIONS

ICAR-CIFT celebrated National Productivity Day

The ICAR-CIFT celebrated the National Productivity Week on 18th February 2019. The programme included a talk on Science- Technology- Society- Environment: Evolving Interfaces for Achieving Sustainability in Agricultural Sector, by Dr. Jiju P Alex, Director (Extension), Kerala Agricultural University.

The focal theme of this year's national productivity week celebrations was circular economy for productivity and sustainability.

Dr. Jiju P. Alex highlighted the need to develop society centric strategies in improving the productivity of agricultural sector, which internalizes the long term sustainability concerns. People's participation at every phase of technology assessment and refinement is the key. Dr. Ravishankar C.N, Director, ICAR-CIFT presided over the function.

Presentation by Dr. Jiju P Alex

Post-presentation discussion section

Institute Foundation Day

ICAR-CIFT, Cochin commemorated its 62nd Foundation Day at its main campus in Willingdon Island, Kochi on 29th April, 2019. The function was graced by Dr. B Meenakumari, former Chairperson of National Biodiversity Board, Chennai and former Deputy Director General (Fy) ICAR and also the former Director, ICAR-CIFT as the Chief Guest. At the outset, Dr. C N Ravishankar, Director, ICAR-CIFT; while presiding over the function highlighted the prominent contributions of the institute during the last year (2018-19), which includes the release of path breaking rapid test kit aptly named as 'CIFTest Kit' for detecting fish contamination by spurious chemicals like formaldehyde and ammonia in the fish market and its national level tremendous impact in controlling the adulteration in fish preservation, CIFT's recognition by FSSAI as a National Reference Laboratory for fish and fish products as an additional feather to its status, collaborating with Cochin Shipyard Limited (CSL) for designing deep sea fishing vessels being built at Cochin Shipyard at Kochi for various coastal states and Lakshadweep, global accreditation as a major research partnership with FAO on anti-microbial resistance (AMR) mitigation linking more than 20 institutions across the country, active participation in formulation of KMFRA guidelines for the state of Kerala, major role in preparation of national blue economy policy document and in addition also playing an active role in the recent flood relief measures during the massive flood havoc in Kerala during 2018 and conducting a post flood damage assessment in the fisheries sector as an aftermath of the flood.

The Chief Guest Dr. B. Meenakumari applauded the accomplishments of the institute during its sixty-two years of fruitful existence during which the institute has catered the requirement of harvest and post-harvest sectors in fisheries immensely, that has been affirmed by the growth in fishery exports and trade. As part of the function, continuing its long tradition of honouring Institute's retired staff on the foundation day, ICAR-CIFT honoured representatives of the different categories of the retired staff of the Institute, namely Dr. T K Shivadas (Scientific), Dr. Sicily (Technical), Shri. Raveendran Nair (Administrative) and Shri CA Krishnan (Skilled Support) on this occasion. Dr. Suseela Mathew, HOD, Biochemistry and Nutrition Division welcomed the gathering and Shri K S Sreekumaran, Finance and Accounts Officer, CIFT proposed the vote of thanks. The function ended with a variety of entertainment programme performed by the staff and their wards.

Chief Guest Dr. Meenakumari delivering inaugural address


Felicitation of retired staff


Cultural performance by CIFT staff

Similar events were organized at Veraval, Mumbai and Vishakhapattanam RC, in connection with 62nd foundation day.

ICAR-CIFT Celebrates 'World Food Safety Day' at Kochi

ICAR-Central Institute of Fisheries Technology, Cochin, which is notified as 'National Referral Laboratory on Fish and Fishery Products' by FSSAI, celebrated the World Food Safety Day on 07 June 2019. The theme for this years' World Food Safety Day was Food Safety, everyone's business.

At the out set, Dr. Ravishankar C. N, Director, ICAR-CIFT administered pledge to all staff members of the institute for promoting safe food and prevent food borne risks and exhorted the audience for upholding the tenets of food safety in daily life. He further stressed that food security cannot exist without food safety. Consumers should be made aware about the healthy food choices and apprehensions of unsafe food.

Later, video films on DART (Detecting Adulterants with Rapid Testing) developed by FSSAI for rapid detection of adulterants in household food items were screened for creating awareness about the methods to detect the

food contamination in our daily life. The program was followed by an informative talk by Dr. M. M. Prasad, Head, Microbiology, Fermentation & Biotechnology Division on Advances in Microbial Safety of Foods. Scientists and other staff of the institute participated in the programme.

World Antibiotic Awareness week -2019

As part of observance of antibiotic awareness week, Veraval Research Centre of ICAR-CIFT conducted awareness programmes on "One health approach for the control and prevention of antimicrobial resistance" at Aditya Birla Higher Secondary School, Veraval (21 Nov 2019) and St. Mary's High school, Veraval (25 Nov 2019) to improve the understanding of antimicrobial resistance among school children. Dr. Toms C. Joseph, Principal Scientist and Scientist-in-Charge of VRC of ICAR-CIFT delivered talk on various aspects of antibiotics including their discovery, uses and misuse, antimicrobial resistance; their control and spread, preventive measures and challenges for the future.

Sri. B. Mohandoss, Principal, Aditya Birla Public School highlighted the need to create awareness on the use of antibiotics among school children. He thanked VRC of ICAR-CIFT for taking the initiative for spreading the information about antibiotic use. The session was attended by around 200 students.

The Principal ofSt. Mary's High school, Veraval, Fr. Josy Joseph commented on the role played by the health sector in improving the lifespan of Indian population. There was a question-answer session on use of antibiotics after the talk led by Dr. Toms C. Joseph. Around 1200 students from class V to X attended the meeting. All the scientists of VRC of ICAR-CIFT also participated in the programme.

Talk by Dr. Toms C. Joseph on AMR at St. Mary's High School, Veraval

Hindi Day & Hindi Week

As part of implementation and promotion of Official Language in Veraval Research Centre of ICAR-Central Institute of Fisheries Technology, Hindi Week Celebrations were organized during 16 to 21 September 2019. The programme was inaugurated by Dr. Toms C Joseph, Principal Scientist & Scientist-In-Charge, VRC of ICAR-CIFT and awareness was created about the importance of Official Language in our official work and also spoke on Official Language as a link language which connects the whole nation. Shri. M. M. Damodara, Assistant Administrative Officer, VRC of ICAR-CIFT gave the felicitation speech.


Cultural programme by the employees

Various competitions were conducted during the period which included dictation, elocution, antakshari and hindi song competition. Prizes were distributed during valedictory function on 21 Sept 2019 in the presence of Shri Vinaykumar Vase, Scientist-in-Charge, Central Marine Fisheries Research Institute was the Guest of honour.

ICAR - CIFT hosts ICAR Southern Zonal Tournament 2019 at Cochin

The ICAR-Central Institute of Fisheries Technology, Cochin hosted the ICAR-Southern Zonal Tournament, 2019 at Cochin from 4-8 November 2019, for the fifth time. ICAR-CIFT hosted this event earlier during 1985, 2001, 2010 and 2015. About 700 participants representing 23 ICAR Research Institutes from the southern states of India namely Karnataka, Kerala, Tamil Nadu, Telangana and Andhra Pradesh participated in the tournament.

The event was inaugurated by Shri. Suhas S., IAS, District Collector, Ernakulam on 4th of November at Maharaja College Ground of Cochin. In his inaugural address the Chief Guest Shri Suhas S., IAS stated that the event creates a nostalgic feeling within himself reminding his student life and encouraged the participants from different institutes to play the game with a true sportsman spirit and develop a fraternity among the organizations. Presiding over the function, Dr. Ravishankar C N, Director, ICAR-CIFT and the Chairman of the Organising Committee appreciated the efforts made by different institutes including the host to make this event a grand success and strongly advocated the importance of sports in ICAR that builds a platform for the employees not only to showcase their talents but nurture a spirit of oneness among them, which later helps in their work front. Later, Dr. A. Gopalakrishnan, Director, ICAR-CMFRI, Cochin and Co-Chairman, Organising Committee applauded the zeal and enthusiasm of the participant employees of ICAR institutes to join a common platform through this tournament irrespective of their age, cadre, religion and culture; with a goal to develop friendship amidst a competitive atmosphere. Lastly Dr. J. Bindu, Principal Scientist and Organising Secretary offered vote of thanks.

The event was officiated and managed by the Officials from the Ernakulam District and State Association of Athletics and Games Associations.



ICAR-CMFRI bagged overall championship and ICAR-IIHR was the runner up.

Overall individual athletic champions were Dr. Pe. Jeyya Jeyanthi, Scientist, ICAR-CIFT (Women) and Shri. Aneesh E. M of ICAR-CPCRI (Men).

Dr. Pe. Jeyya Jeyanthi receiving overall atheletics championship (women) from Smt. Valsamma, Asian Games Gold medalist

International Yoga Day Celebrations 2019

As per the directives of the Govt. of India and the Indian Council of Agricultural Research, ICAR- CIFT celebrated the International Day of Yoga on the 21st of June 2019 at its headquarters in Cochin and all its research centers at Veraval, Visakhapatnam and Mumbai. The yoga celebrations at the ICAR-CIFT headquarters commenced on the 19th June 2019 with a lecture cum demonstration by Smt. Girija B Nair, Founder, Prajapathi Yoga and Therapy Institute. Kadavanthara, Kochi.

Speech by Smt. Girija B Nair, Prajapathi Yoga and Therapy Centre, Kochi

A yoga dance based on the different asanas and Surya namaskar was performed by the staff on the occasion of the International day of yoga

Yoga dance by the staff of CIFT

Mumbai Research Centre of CIFT celebrated fifth international yoga, Day. Smt. Sujatakishan and Shri. Madhu Nair Yoga trainers were the guests for the day.

Visakhapatnam Research Centre of CIFT celebrated yoga day, Mr. Deepak B. and Mr. Satyanarayana, certified Yoga trainers from yoga village, Andhra University started the yoga session with a prayer followed by the demonstration of yoga asanas as per the common yoga protocol

Veraval Research Centre of CIFT Celebrated International Yoga on 21st June, a theory and practical session on yoga was arranged with Sri. Thakar Abhay Kumar M, (M.A Yoga) Shree Somanth Sanskrit University, Veraval as the resource person for the session.

Swachhata Hi Seva Campaign 2019

The theme of Swachhata Hi Seva Campaign 2019 was "Beat Plastic pollution" and ICAR-CIFT, Cochin being a premier research organization in the area of harvest and post-harvest technology had organized several activities with involvement of scientists and staff of the Institute during 11September to 1October 2019.

Talk on plastic pollution: On 18th September 2019,a talk on "Plastic pollution" by Dr. Bijoy Nandan, Head & Professor, Department of Marine Biology, CUSAT was arranged for the benefit for the staff of the Institute at CIFT, Cochin. The speaker outlined the varied aspects of plastic menace especially how the oceans are becoming plastic soup of late.

Awareness programmes for reservoir fishermen: An awareness programme on "Plastic pollution" was conducted at Meenkara and Chuliyar dams during 25-26 October 2019. Around 30 fishermen from each reservoir participated in the programme. Later pamphlets on "hygienic fish handling" printed in local language were distributed among the fishers. Shri Sajan, SI, Fisheries spoke on the occasion and stressed the need to keep the water bodies and surroundings clear of plastic. Dr V. Geethalakshmi, Principal Scientist and Shri K.D. Santosh, Technical Officer coordinated the programme.

Coastal cleanup activity: In connection with the Swachhta Hi Seva Campaign, on 21st September 2019, staff of the Institute participated in the International Coastal Cleanup day 2019. More than 100 countries come together each year and join the coastal cleanup which is a global movement for the benefit of our entire planet. This year on 21st September, 2019, ICAR-CIFT joined the cause by picking up trash and spreading awareness along the Fort Kochi beach of Ernakulam district. The programme was coordinated by School of Marine Sciences, CUSAT along with many other organizations working in ocean science and fisheries.

The coastal cleanup programme was followed by a rally by the team along the streets of Fort Kochi for creating awareness on coastal cleanliness and ill-effects of polluting the seas and water bodies.

Coastal clean up at Fort Kochi beach by staff of ICAR-CIFT, Cochin on 21st September, 2019

Staff planting seedlings in grow bags

Demonstration on fish waste utilization: A demonstration of "Conversion of fish waste to feed" was conducted at Thevara fish market, Ernakulam which generates waste of about 100 kg/day on 24 September, 2019. ICAR-CIFT, Cochin in association with Cochin Corporation and Health Department, Govt. of Kerala conducted the programme. The Institute's technology for converting fish waste to feed which can be used for poultry, duckery and piggery was demonstrated by Dr. A.A. Zynudheen , I/c Head, QAM Division, along with Dr. Binsi P.K., Scientist, Fish Processing Division. Around 100 people including fish traders, contractors, cleaners, fish consumers, local politicians and health inspectors of the area participated which was coordinated by Dr. Sajeev M.V. Senior Scientist, EIS Division.

Utilising domestic waste for homestead farming: A homestead farming drive was organized at CIFT residential complex, Thevara, Cochin at 3.30 pm on 22nd September 2019. Around 30 inmates of the residential complex participated in the programme. An orientation was given to the residents about the importance of cleanliness in the surrounding environments and how the homesteads can be better used for growing vegetables. Inputs for homestead vegetable cultivation were procured from the agency, Vegetable and Fruit Promotion Council Kerala (VFPCK). Seedlings of cowpea, bhendi, chilly, brinjal and tomato were distributed along with the grow bags filled with potting mixture. Planting was done by each participant in the grow bag and the filled bags were kept in the homesteads wherever good sunlight is available. The programme ended with vote of thanks from the liaison officer Shri Omanakuttan Nair, Asst. Chief Technical Officer, ICAR-CIFT of the residential complex. The programme was coordinated by Dr. K. Rejula, Scientist of the Institute.

Kisan Diwas Celebration: On the occasion of Kisan Diwas twenty-five fish farmers were invited for sharing their experience on Swachhta initiatives at Kodungallur. Dr. Greeshma, Scientist, ICAR-CIFT gave a talk on benefits of organic fish farming and created awareness on antibiotic usage and its ill-effects.

Dr. Santosh Alex delivering the talk

Fish farmers sharing their experience

Quiz programme at ICAR CIFT, Kochi : Quiz was conducted at ICAR-CIFT, Cochin for the staff of the Institute. Eight teams participated in the event and the quiz master was Dr. Santosh Alex, ACTO. The programme was coordinated by Smt. Silaja, ACTO and Smt P. Sruthi, Technical Assistant. Main theme was "Water & its conservation". All the staff enthusiastically participated in the programme. The Fish Processing Division won the first prize followed by the QAM Division team and Administration team in the contest. Prizes were distributed by Dr Ashok Kumar, Director I/c of the Institute.

Drawing, Essay and painting competitions to students: As part of instilling awareness among children and youth, drawing and painting competitions were conducted for children at Thevara, Cochin which was coordinated by Dr. Pe. Jeyya Jeyanthi, Scientist, ICAR-CIFT. The topic of the competitions were "Plastic pollution" and "Water management". The children enthusiastically participated in the drawing/painting competition and put their creative ideas in picture. Later Dr. Amulya Kumar Mohanty, HOD (EIS), ICAR-CIFT, Cochin distributed the prizes to the winners of the competition.

Quiz programme being conducted by Dr. Santosh Alex, ACTO

Prizes given by Dr. Mohanty to the winners

Veraval research Centre of ICAR-CIFT observed 'Swacchata Pakhwada', a cleanliness drive under Swachh Bharat Abhiyan from 15th September to 02nd October, 2019. Dr. Divu D. SIC, Veraval RC of ICAR-CMFRI inaugurated the Swachhta campaign.

Dr. Divu D. SIC, Veraval RC of ICAR-CMFRI inaugurating the 'Swacchata Pakhwada at Veraval RC of ICAR-CIFT

Students of Podar International School, Veraval and St. Marys school Veraval were briefed by scientists of VRC CIFT with various activities and presentations to create awareness on Health, Hygiene and Cleanliness. The students also took part in drawing competition and were awarded with certificates.

Prime Minister, Shri Narendra Modi's live webcast programme on International Women's Day

ICAR-CIFT arranged live webcast of the Hon'ble Prime Minister, Shri Narendra Modi's address to the nation on the occasion of International Women's Day - 2019. The staff of ICAR-CIFT actively participated and witnessed the success stories of women Self Help Groups (SHGs). Almost, 187 staff members attended the programme. The programme was co-ordinated by Dr. Pe. Jeyya Jeyanthi, Liaison Officer, Institute Women's Cell, ICAR-CIFT, Cochin.

International Women's Day Celebration at ICAR-CIFT, Cochin

ICAR-CIFT celebrated International Women's Day (IWD) on 8 March, 2019. To emphasize on the gender parity, the theme of this year's IWD was selected by the United Nation as Think equal, build smart and innovate for change with the campaign theme of Balance for Better.

Dr. Ravishankar C.N, Director, ICAR – Central Institute of Fisheries Technology presided over the function. Dr. Pe. Jeyya Jeyanthi, Liaison Officer, Institute Women's Cell and Scientist, Extension, Information and Statistics Division, delivered the welcome address. Mrs. Lakshmi Atul, Vice-president of Aries Group of Companies and Mrs. India Face of South - Queen of Substance and Mrs. India – Intelligent (2017), Mrs. United Nation Grand Prix (2018), Vice president of the prestigious Indy Wood Film Carnival, Head of the Oscar Awards Consultancy and the film festival promotion divisions was the chief guest for the day. Smt. Mini. P.R., Member, Institute Women Cell proposed the vote of thanks.

The 'Women Icons of ICAR-CIFT 2019' (both winner and runners up) selected through opinion poll were honored during the function. The function came to an end with a classical performance of staff of ICAR-CIFT, paying tribute to the tireless efforts by fishermen during the flood rescue and rehabilitation.

Dr. Ravishankar. C.N. Director, ICAR-CIFT delivered the presidential address

Dr. Leela Edwin, winner Woman Icon of ICAR-CIFT 2019 & runners-up with the chief guest

Constitution day celebration at ICAR–CIFT

Mass reading of preamble at ICAR-CIFT, Cochin (Headquarters): The mass reading of Preamble was arranged at ICAR-CIFT, Cochin. The staff of ICAR-CIFT took part in the mass reading of Preamble on the occasion of Constitution Day celebration on 26 November, 2019. Dr. C.N. Ravishankar, Director, ICAR-CIFT read out the Preamble that was repeated by the staff members. The same was also arranged in ICAR-CIFT Research Centres.

Mass reading of Preamble by staff of ICAR-CIFT

Mass reading of Preamble by staff of Vizag ICAR-CIFT Research Centre

Expert talk organized at ICAR-CIFT, Cochin: ICAR-CIFT celebrated Constitution Day on 26 November, 2019. As part of the celebration, an expert talk was organised. Dr. Ravishankar C.N., Director, ICAR – Central Institute of Fisheries Technology presided over the function. He highlighted the significance of constitution in performing duties and stressed on the need to be aware of the rights and responsibilities of citizens. Dr. Pe. Jeyya Jeyanthi, Nodal Officer, Constitution Day celebration and Scientist, Extension, Information and Statistics Division, ICAR-CIFT delivered the welcome address. Dr. Aneesh V. Pillai, Assistant Professor, School of Legal Studies, Cochin University of Science and Technology (CUSAT), Cochin, Kerala was the chief guest. He delivered a talk on 'Duties and Responsibilities of Citizens under Indian Constitution'. He emphasized on the citizens' awareness about fundamental rights and duties while performing day-to-day activities. Shri. Sreenivasa Bhatt, Senior Administrative Officer, ICAR-CIFT proposed the vote of thanks. The function came to end with National Anthem.

Talk by Dr. Aneesh.V. Pillai, Assistant Professor, SLS, CUSAT

Expert and staff of ICAR-CIFT on 26 November, 2019

In continuation of the Constitution day celebration, an essay writing competition was conducted for school students at CIFT Residential Complex on 21 December, 2019. The competition was held for two categories viz., Junior level (VI class) and Senior level (VII to IX classes). The topics for the competition were 'Citizens responsibility on Fundamental Duties' for the Junior category and 'Citizens Responsibilities on Fundamental Rights' for the Senior level category. The prizes were distributed to the winners of the competition. Dr. A. K. Mohanty, Principal Scientist & Head of Division, EIS Division, ICAR- CIFT, Cochin presided over the programme and distributed the prizes to the winners. The programme was organized by Dr. Pe. Jeyya Jeyanthi, Scientist and Nodal Officer, Constitution day celebration, ICAR –CIFT, Cochin.

Prize winner at Junior category

Prize winner at Senior category

Institute Joint Staff Council (IJSC)

Shri. P. S. Nobi, Secretary IJSC at Annual General Meeting of ICAR

During the period under report, the Institute Joint Staff Council (IJSC) of the Institute conducted four meeting. IJSC has completed its 100th meetings in the month of April 2019 and the institute decided to celebrate it in a befitting manner. The secretary IJSC and member CJSC Shri. P.S. Nobi has attended 38th 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.

Recreation Club Activities

New Year 2020 was celebrated by welcoming the staff with a cake. Recreation club designed and printed a wall calendar 2020 which was distributed to all the staff members of CIFT.

CIFT Recreation club actively took part in Kerala flood relief activities during August 2019. The Club took efforts to mobilise funds from generous & willing hands and distributed them to the needy. The Club handed over 500 food & provision packets to District Collector, Ernakulam for distribution in flood affected areas of Wayanad District and 200 floor mattresses were given to the needy in Alappuzha District.

Mr. Francis Perera during the session on 'Cyber Crime'

Cyber crime is an emerging menace in the society and to create awareness among the staff on aspects of phishing, cyberstalking, internet fraud and hacking of personal accounts, a talk on Misuse of Social Media - Cyber Crime by Mr. Francis Perera, Inspector of Police (Rtd.), Cyber Crime Investigation Cell, was organized. Mr. Francis Perera is a proud recipient of Indian President Police Medal for meritorious service and Chief Minister's Police Medal for distinguished service. The talk was held on 7th Aug 2019 at ICAR-CIFT Conference Hall.

Recreation Club held an All Staff General Body meeting on 19th August 2019 under the chairmanship of Director, ICAR-CIFT. Secretary of the Club presented the report of the activities carried out during 2018-19 and the Treasurer presented the audited statement of accounts.

Every year International Coastal Clean-up Day is observed during September. The ICAR-CIFT Recreation Club actively participated in the joint "Plastic Collection" drive held at Fort Kochi Beach area on 21st Sept 2019,organised by many organisations like CUSAT, NIO, and other Govt. agencies.

Blood Donation Camp was organised in collaboration with Indian Medical Association, Blood Bank, Ernakulum at ICAR-CIFT office premises on 30th August 2019 (out of 46 willing staff, 26 members could donate blood).

Blood Donation Camp in progress

The Recreation Club felt that interpersonal relationship skills among the staff should be enhanced for the overall development of the Institute and a talk on Interpersonal Relations by Dr. Vineeta Aravind, Soft Skills Trainer & Consulting Psychologist was organised by the Club on 10th October 2019.

Dr. Vineeta Arvind during the session on 'Interpersonal Relations'

Recreation Club arranged the distribution of awards for academic excellence to wards of staff on 16th September 2019 at the Institute. 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

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

Dr. Ravishankar C.N., Director, ICAR-CIFT

As Chairman

- DPC for considering the promotion of ARS Scientists, IISRI Calicut

As Member

- Working Group Committee on formaldehyde at FSSAI, New Delhi
- Institute Management Committee, ICAR- NRC on Meat, Hyderabad
- FSSAI Reference Laboratories of Trilogy and Vimta at Hyderabad
- Advisory Board Committee Meeting of INFAAR, Kolkata
- Member Authority of MPEDA
- Food Safety and Applied Nutrition Network at FSSAI, Delhi
- Executive Committee, KAU, Vellanikkara, Thrissur
- Food Safety Training and Certification-FSSAI, New Delhi
- Board of Management, CIFE, Mumbai
- Panel on Fish and Fish Products, FSSAI
- Board of Directors, Lakshdweep Development Board
- Joint Working Group, DBT Proposal

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)
- Board of studies, Cochin University of Science and Technology(CUSAT), Kochi
- Board of studies, Kerala University of Fisheries and Ocean Studies, Panangad, Kochi
- Board of studies, Mahatma Gandhi Unversity, Kottayam
- Board of studies, Calicut University, Thenhipalam, Kerala
- Board of studies, Sacred Heart College, Kochi; St Albert's College, Ernakulam
- 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, Kochi

Dr. M.M. Prasad, Principal Scientist and Head, Microbiology, Fermentation and Biotechnology Division

As Member

- Executive Committee and General Body of Rajiv Gandhi Centre for Aquaculture.
- Core Committee for drafting the rules for the Aquatic Animal Disease and Health Management Bill, 2019.
- Selection Committee Meeting for the Post of Assistant Professor at KUFOS, Kochi, Kerala.
- Centralized Evaluation of Dissertations of M.F.Sc. (2017-19 Batch) in the discipline of Post-Harvest Technology at ICAR-CIFE, Mumbai.
- Expert member in scrutinizing application for the post of Assisatnt Professor in Kerala University of Fisheries & Ocean Studies (KUFOS), Panangad, Kerala.
- Expert member in Life Science Cluster-Kochi, Kerala State Industrial Development Corporation (KSIDC).

Dr. Leela Edwin, Principal Scientist and Head, Fishing Technology Division

As Member

- Technical Committee to legalise the conversion of registered trawl boats into purse-seine boats of Karnataka
- Technical committee, Dept. of Fisheries, Govt. of Kerala to evaluate the technical bids for LSA and electronic equipments
- Technical Committee for reconsidering the duration of the Fishing Ban period and to suggest further measures to strengthen the Conservation and management aspects reg. set up by the Ministry of fisheries, New Delhi.
- Tender Evaluation Committee Dept. of Fisheries, Govt. of Kerala for procurement of marine electronic and sea safety equipment
- Board of studies for M.F.Sc Fisheries Engineering and Technology, Faculty of Fisheries, KUFOS, Panangad.
- Tender committees for purchase of life jacket, GPS, Echosounder for Dept. of Fisheries, Kerala
- Board of UG Studies in Marine Sciences, Cochin University of Science & Technology, Cochin
- Board of studies in Industrial Fisheries, Faculty of Marine Sciences, Cochin University of Science & Technology, Cochin
- Committee member, TED 18 Sectional committee, BIS

Dr. A.K. Mohanty, Principal Scientist and Head, Extension, Information and Statistics Division

As Member

- Extension Education Council, KUFOS, Kochi
- External Examiner for Post Graduate students of Agricultural Extension of Department of Agricultural Extension, College of Agriculture (KAU), Vellayani

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 member, NIT, Pondicherry
- Technical team constituted by KFDC, Dept. of Fisheries, Govt. of Karnataka for studying Chilling Plant under KFDC.
- External examiner of PG and PhD students of Faculty of Agricultural Engineering, Kerala Agricultural University
- Member, Consultative committee on National Food Processing Policy (NFPP), IIFPT, Thanjavur
- Evaluator, Young Innovators Program of K-DISC, Govt. of Kerala
- Expert Reviewer for the Biotechnology Ignition Grant (BIG) Scheme launched by Department of Biotechnology (DBT) and Biotechnology Industrial Research and Assistance Council (BIRAC) facilitated by ICAR- NAARM, Hyderabad .
- Expert Reviewer for the Biotechnology Ignition Grant (BIG) Scheme launched by Department of Biotechnology (DBT) and Biotechnology Industrial Research and Assistance Council (BIRAC) facilitated by BIRAC BioNEST Incubator and SIDBI Startup Incubation & Innovation Centre (SIIC) IIT, Kanpur .
- Selection committee member of Asst. Professor in KUFOS, Kochi.
- Member of the multi-disciplinary expert team constituted by Kerala Sastra Sahithya Parishad for studying the environmental issues at Chengottumala, Kozhikode district.
- Jury member for selecting the best residential association in Kerala organized by Chuttuvattom program, Malayala Manorama.

Dr. Suseela Mathew, Principal Scientist and Head, Biochemistry & Nutrition Division

As Member

- Functioned as Scientific expert, MPEDA Selection Board.
- NABL lead assessor.
- Subject expert for review of projects DBT, KSCSTE
- Academic Council, Kerala University of Fisheries and Ocean Studies, Kochi
- External examiner, CUSAT, Kochi, KUFOS, Kochi, Sri Venkateswara Veterinary University, Tirupathi, College of Fisheries, Thoothukkudi and Mar Athanasius College, Kothamangalam

Dr. A.A. Zynudheen, Principal Scientist Head-in-charge, Quality Assurance and Management Division

As Member

- APE member for approving the seafood processing units for export
- Technical committee on SIP for import of fish and fishery products, DAHDF, Krishi Bhavan, Delhi.
- Technical consultancy meeting on finalization of bids for membrane bio filter for Arattupuzha plant of Matsyafed
- External expert member for Interview for Assistant professor on 12.09.2019 at Tamil Nadu Fisheries University.

Dr. R. Raghu Prakash, Principal Scientist and Scientist-in-charge, Visakhapatnam Research Centre

As Member

- Board of Studies, Dept. of Marine Living Resource, Andhra University.

Dr. Toms C. Joseph, Principal Scientist Scientist-in-charge, Veraval Research Centre

As Chairman

- Town Official Language Implementation Committee, Veraval
- Institute Bioethics Committee of Malabar Dental College and Research Centre, Manoor, Kerala

As Member

- Board of Studies of the Faculty of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University
- Institutional Biosafety committee (IBSC) of Cochin University of Science and Technology (CUSAT)
- Institutional Biosafety Committee (IBSC), College of Veterinary and Animal Sciences, Pookode
- Assessment panel of experts for approval of seafood processing plants for EU
- Physical Verification Committee of MPEDA
- Technologist assessment committee of EIA, Veraval
- Inspection committee of EIA, Veraval pertaining to RASFF

Dr. L.N. Murthy, Principal Scientist and Scientist-in-charge, Mumbai Research Centre

As Member

- Assessment panel of experts for approval of seafood processing units located in Maharashtra, Gujarat and Goa.
- Evaluation session of ''Training Programme on Seafood Value Addition'' organized by MPEDA.
- Setting question paper for University of Agricultural Sciences, Dharwad, Karnataka.
- Advisory Committee member of PhD students from ICAR-Central Institute of Fisheries Education.
- External examiner for PhD thesis viva-voce of student from College of Fisheries, Mangalore (KVAFSU, Bidar).
- External examiner for evaluation of MFSc and PhD thesis of students from College of Fisheries, Ratnagiri, CUSAT, Kerala and College of Fisheries, Mangalore.
- Selection committee for Central Institute of Fisheries Education by DDG, Fisheries

Dr. Saly N. Thomas, Principal Scientist

As Chairman

- Chairperson, Textile Materials for Marine/Fishing Purposes Sectional Committee, TXD 18 of Bureau of Indian Standards, New Delhi.

As Member

- 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.
- Member, Technical Committee constituted by Matsyafed, Government of Kerala for the implementation of Twine factory at Alapuzha District, Kerala.
- Member, Technical Committee constituted by Matsyafed, Government of Kerala for implementation of RKVY RAFTAR assisted Modernization of Matsyafed Net Factories at Ernakulam and Kannur.
- Member, Institute Management Committee, ICAR-CMFRI, Cochin
- External Examiner, M. Sc. Degree Programme of Kerala Agricultural University, Thrissur.

Dr. M.P. Remesan, Principal Scientist

As Member

- Member, Board of Studies in the Department of M.F.Sc Fisheries Engineering & Technology under the Faculty of Fisheries, KUFOS
- Advisory Committee Member for M.FSc Students (Fisheries Engineering and Technology) from KUFOS
- Functioned as Member in DPC held at Coir Board and MPEDA

Dr. Nikita Gopal, Principal Scientist

As Vice Chairperson

- Gender in Aquaculture & Fisheries Section (GAFS) of the Asian Fisheries Society, Malaysia

As Member

- ISO 9001:2015:Project Team Leader
- Convener, SFC of ICAR-CIFT
- Member Secretary, IRC of ICAR-CIFT
- Paper Setter and Evaluator: KUFOS, CIFE

Dr. V. Geethalakshmi, Principal Scientist

As Member

- Reviewer for 'Indian Journal of Fisheries' Journal
- Reviewer for 'Journal of Indian Society of Agricultural Statistics'
- Reviewer for 'Fishery Technology' Journal
- External Examiner/Question paper setter for UG and PG Statistics courses at KUFOS, CIFNET & CUSAT
- Evaluator of IGNOU (REC, Bhubaneswar) BCS Course

Dr. J. Bindu, Principal Scientist

As Member

- Advisory Board member, PhD student of KCAET, Tavannur, CVAS, Pookode, Wyanad, CIFE Mumbai, KUFOS
- External expert for setting up of question papers for the MSc students of KUFOS
- Question paper setter and evaluator for PhD students of KUFOS
- Examiner and evaluator for MFSc program of CIFE, Mumbai
- Question paper setter for BFSc. students of KUFOS
- PhD examiner for Bharathiar University, Coimbatore

Dr. P. Muhamed Ashraf, Principal Scientist

As Member

- Expert member (Chancellor's nominee) in the Statutory Selection Committee of Orissa Agricultural University and Technology, Bhuvaneswar.
- Member in ISO17025, ISO9000

Dr. George Ninan, Principal Scientist

As Member

- Member, Committee of the State Level Agency for Export Development of Aquaculture & Fisheries (SAEDAF).
- Member, MPEDA Subsidy Committees on assistance for large cold storages/conveyance , TUSMP & TIUSMP schemes, setting up new ice plant / renovation existing ice plant and chilled fish handling centres.
- Agrinnovate India Limited empaneled commercial expert for techno economic assessment committee in commercializing technologies of NARS
- Board of examiners, Calicut University, Calicut/CUSAT, Kochi/MG University, Kottayam

Dr. S. Ashaletha, Principal Scientist

As Member

- Member, HRD committee of National Policy on 'Post Harvest processing and marketing of fish and fishery products.

Dr. Femeena Hassan, Principal Scientist

As Member

Assessment panel of experts for approval of seafood processing plants for EU

Dr. U. Sreedhar, Principal Scientist

As Member

- Examiner for CIFNET, Visakhapatnam

Dr. B. Madhusudana Rao, Principal Scientist

As Member

- External examiner GITAM deemed to be University, Visakhapatnam
- Interview panel for selection of staff at BCT-KVK, Rambilli, Visakhapatanm
- Interview board for recruitment of SMS and Agromet Observers at KVKs of Acharya N.G.Ranga Agricultural University (ANGRAU) Anakapalle, Andhra Pradesh.
- Task Force Committee for preparation of Fish Feed Act of Andhra Pradesh at the Commissioner of Fisheries Office, Vijayawada
- Technical expert for evaluation of laboratory equipment of AAH & QT laboratory of National Fisheries development Board (NFDB), Hyderabad

Dr. A. Suresh, Principal Scientist

As Member

- Departmental Promotion Committee in National Research Centre- Meat, Hyderabad
- Executive Committee, Agricultural Economics Research Association (India)
- Outside expert for the selection of research assistant at Central Marine Fishery Research Institute, Kochi.
- External member for viva-voce examination of one student of M.Sc (Ag Economics) at College of Agriculture, Vellayani, Kerala Agricultural University, Trivandrum
- Member in the core group of economist identified by National Institute of Agricultural Economics, New Delhi to estimate the impact of agricultural technologies.
- Member of the committee to formulate the national blue economy policy with respect to fisheries and aquaculture

Dr. G.K. Sivaraman, Principal Scientist

As Member

- Assessment Panel of Experts for approval of seafood processing plants for EU
- Member of Kerala Antimicrobial Resistance State Action Plan

Dr. V.R. Madhu, Principal Scientist

As Member

- Represent India on issues related to BRD and bycatch by Department of Fisheries, BRDS by the Dept. Fisheries, Govt. of India.
- Committee formed for fishery improvement plan of 8 species of harvested resources along Kerala coast.

- Seafood sustainability Network India (SSNI), group formed to investigate the sustainability issue of marine resources in India.

Dr. K.K. Asha, Principal Scientist

As Member

- NFDB Post-Harvest Processing and Marketing : Draft Policy
- NFDB Post-Harvest Processing and Marketing: National Policy on 'Post Harvest processing and marketing of fish and fishery products'

Dr. S.K. Panda, Principal Scientist

As Member

- FSSAI Scientific Panel on Fish and Fisheries Products
- Method Review Group, FSSAI
- FSSAI Working Group on Formaldehyde in Fish and Fish Products
- Assessment Panel of Experts, Export Inspection Council
- FAD 12 (Fish and Fisheries Products), Bureau of Indian Standards
- FAD 15 (Food Hygiene, Safety Management and Other Systems), Bureau of Indian Standards
- ISO Ad-hoc Working Group "SC9 Public Website"

Shri M.V. Baiju, Senior Scientist

As Chairperson

- DPC for the promotion of Technical staff of ICAR-CMFRI

As member

- Tender committee for procurement of electronic navigational and fishing equipment for the Dept. of Fisheries, Govt. of Kerala.
- Expert committee for the subsidy scheme for insulated fish hold in commercial fishing vessels by MPEDA.
- Technical committee of ICAR-CMFRI for tender of repair works of research vessel Silver Pompano.
- State Level Technical Committee for providing subsidy by Department of Fisheries, Tamil Nadu
- Technical committee constituted by KDISC, of KIFB to evaluate the technical matters related to dual fuel propulsion and use of alternate fuel for fishing vessels.

Dr. M.V. Sajeev, Senior Scientist

As Member

- Scientific Advisory Committee, KVK, Kumarakom
- Internal Quality Assurance Committee for IGNOU DFPT programmet

Dr. C.O. Mohan, Senior Scientist

As Member

- Assessment panel of experts for approval of seafood processing plants for EU
- MPEDA subsidy committee on assistance to seafood industry
- Faculty of Marine Science, CUSAT
- Academic councellor, IGNOU

Dr. Binsi P.K., Senior Scientist

- External advisor to MFSc and M.Sc Food Science programme Students, KUFOS, Cochin
- Panel member in Expert level committee meeting held by KVK, Lakshdweep for prioritising the R&D activities of KVK in UT.

Dr. P. Viji, Scientist

As Member

- Assessment panel of experts for approval of seafood processing plants for EU

Dr.Niladri. S. Chatterjee, Senior Scientist

As Member

- Co-lead faculty for FSSAI NetScoFAN initiative in “Food Testing Group”

Dr. Sandhya K.M, Scientist

As Member

- 14th BIS Meeting of Textile Materials for Marine/Fishing Purposes Sectional Committee, TXD 18
- 15th BIS Meeting of Textile Materials for Marine/Fishing Purposes Sectional Committee, TXD 18

Shri. Chinnadurai S., Scientist

- FIP implementation for MSC certification of Kerala shrimp & cephalopod trawl fishery

Dr. Jesmi Debbarma, Scientist

As Member

- Assessment panel of experts for approval of seafood processing plants for EU

Dr. S. Remya, Scientist

As Member

- Assessment panel of experts for approval of seafood processing plants for EU.
- Physical Verification Committee of MPEDA.
- Technologist assessment committee of EIA, Veraval.
- External examiner in the panel for viva-voce/synopsis presentation of M.F.Sc and Ph.D. students of College of Fisheries, Veraval, Junagadh Agricultural University.
- External expert in the Advisory Committee for M.F.Sc. and Ph.D. students of Kamdhenu University, Gandhinagar.
- External expert in the advisory committee for M.F.Sc. and Ph.D. students of College of Fisheries, Veraval, Junagadh Agricultural University.
- Member in the inspection committee of EIA, Veraval pertaining to Rapid Alert System for Food and Feed.

Smt. V. Renuka, Scientist

As Member

- Assessment panel of experts for approval of seafood processing plants for EU.
- Physical Verification Committee of MPEDA.
- Technologist assessment committee of EIA, Veraval.
- External expert in the advisory committee for M.F.Sc and PhD students of College of Fisheries, Veraval, Junagadh Agricultural University.
- Evaluation panel member for International training of MPEDA for value addition of fish and fishery products
- Member in the inspection committee of EIA, Veraval pertaining to RASFF (Rapid Alert System for Food and Feed).

Shri. K.A. Basha, Scientist

As Member

- Assessment panel of experts for approval of seafood processing plants for EU

Dr. A. Jeyakumari, Scientist

As Member

- Assessment panel of experts for approval of seafood processing units located in Maharashtra
- External member for Evaluation session of ''Training Programme on Seafood Value Addition'' organized by MPEDA.
- External member for setting question paper for M.F.Sc and PhD programme for TNJFU.
- Advisory member for one Ph.D student from CIFE, Mumbai

Dr. V. Murugadas, Scientist

As Member

- Technical Committee for setting up/ upgradation of referral laboratories for NFDB

Smt. S.J. Laly, Scientist

As Member

- Assessment panel of experts for approval of seafood processing located in Maharashtra.
- Evaluation session of training programme on seafood value addition organized by MPEDA.
- Working group to study and review formaldehyde related issue in fish and fisheries products of Food Safety and Standard Authority of India

Dr. Manju Lakhmi, Scientist

As Member

- External Examiner, KUFOS, Kochi

Dr. Ashish Kumar Jha, Scientist

As Member

- Assessment panel of experts for approval of seafood processing plants for EU.
- Physical Verification Committee of MPEDA.
- Technologist assessment committee of EIA, Veraval.
- External examiner in the panel for viva-voce/synopsis presentation of M.F.Sc and PhD students of College of Fisheries, Veraval, Junagadh Agricultural University.
- External expert in the advisory committee for M.F.Sc and PhD students of Kamdhenu University, Gandhinagar.
- External expert in the advisory committee for M.F.Sc and PhD students of College of Fisheries, Veraval, Junagadh Agricultural University.
- Inspection committee of EIA, Veraval pertaining to RASFF (Rapid Alert System for Food and Feed).

Dr. Anuj Kumar, Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Pankaj Kishore, Scientist

As Member

- External Examiner for BASU, Bihar and KUFOS, Kerala
- Assessment Panel of Experts, Export Inspection Council

Dr. T.K. Anupama, Scientist

As Member

- Assessment panel of experts for approval of seafood processing plants for EU.
- Physical Verification Committee of MPEDA.
- Technologist assessment committee of EIA, Veraval.
- Member for external examiner for TNFU for B.F.Sc and M.F.Sc students
- Member in the inspection committee of EIA, Veraval pertaining to RASFF (Rapid Alert System for Food and Feed)

Shri. P. N. Jha, Scientist

As Member

- ISO Core Committee to update Quality Manual and risk assessment for upgradation to ISO 9001: 2015 from ISO 9001:2008

Dr. Devananda Uchoi, Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Anupama T.K., Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Prajith K.K, Scientist

As Member

- Regional and state level meetings for the deep sea fishing vessel subsidy programme of Government of India.
- External export member for interview board for the selection of young professional in ICAR-CMFRI
- Served as examiner for setting up of question paper for Kerala University of Fisheries and Ocean Studies, Kochi, Kerala
- Deep sea fishing vessel subsidy programme of Government of India, Gujarat
- Examiner, KUFOS, Kochi

Dr. R.K. Renjith, Scientist

As Member

- Expert committee of MPEDA scheme, Certification of fishery and chain of custody

Dr. Murali S, Scientist

As Member

- Physical verification committee of seafood processing units, MPEDA, Kochi

Dr. D.S. Aniesrani Delfiya, Scientist

As Member

- Physical verification committee of seafood processing units, MPEDA, Kochi

Smt. P.V. Alfiya, Scientist

As Member

- Physical verification committee of seafood processing units, MPEDA, Kochi

Dr. J. Renuka, Deputy Director (OL)

As Chairperson

- Assessment Committee of Technical Personnel Category III Functional Group VII (Press & Editorial Staff) of ICAR-IISR, Kozhikode, Kerala

As Member

- Evaluation Committee, Kochi TOLIC

Dr. B. Ganesan, Chief Technical Officer

As Member

- Animal Ethics Committee in the following Institutions
  - MET'S School of Engineering, Kuruvilassery Thrissur
  - Jubilee Mission Medical College & Research Institute, Thrissur
  - Nirmala College of Pharmacy, Muvattupuzha
  - Nehru College Pharmacy, Thiruvilwamala, Thrissur
  - Pushpagiri College of Pharmacy, Tiruvalla
  - Arjuna Natural Extracts LTD, Edayar; Govt. Medical Collage, Kottayam
  - CARe KERAKLAM, Thrissur
  - Amrita Institute of Mediacl Sciences and Research Centre, Kochi
  - M.G. University, Kottayam
  - St: Joseph's College of Pharmacy, Allappuzha

Dr. Santosh Alex, Asst. Chief Technical Officer

As Member

- Evaluation Committee, Kochi TOLIC

Dr. P. Shankar, Sr. Technical Officer

As Member

- Evaluation Committee, Kochi TOLIC

Shri P.S. Nobi, Technical Officer

As Member

- ICAR- Central Joint Staff Council
- ICAR- Technical Anomaly Committee
- ICAR- Fishing Vessel Crew Recruitment Rule Amendment Committee

COMMITTEES

Quinqennial Review Team (QRT)

Chairman: Dr. K.S.M.S. Raghava Rao, Director, CSIR-CFTRI.

Members:

- Dr. B. Sundaramoorthy, Dean (I/c), Prof. & Head, Dr. MGR Fisheries College & Research Centre, TNJFU, Nagapattinam
- Dr. K. C. Dora, Former Dean, Dept. of Fish Processing Technology, KBAFS, Kolkatha (WB)
- Dr. Udey S. Annapure, Prof. & Head, Institute of Chemical Technology, Mumbai
- Dr. V. R. Joshi, Former Prof . & Head, College of Fisheries, Ratnagiri
- Dr. N. Bhaskar, Advisor, FSSAI

Member Secretary:

- Dr. Satyen Kumar Panda, Pr. Scientist, QAM Division, CIFT, Cochin

Research Advisory Committee (RAC)

Chairman: Dr. S. D. Tripathi, Former Director, CIFE, Mumbai

Members:

- Dr. A. K. Upadhyay, Prof. & HOD, College of Fisheries, Pantnagar
- Dr. K. Rathnakumar, Dean, College of Fisheries Engineering, TNJFU, Nagapattinam
- Dr. K. N. Gurudutt, Former Head, CFTRI, Mysore
- Dr. M. N. Venugopal, Former Prof., College of Fisheries, Mangalore
- Prof. Biswanth Sadangi, Former Head, ICAR-CIWA & Emeritus Scientist, ICAR-NRRI
- Asst. Director General (M.Fy), ICAR, New Delhi
- Director, CIFT, Cochin

Member Secretary: Dr. V. R. Madhu, Principal Scientist, CIFT, Cochin

Institute Management Committee (IMC)

Chairman: Dr. Ravishankar C. N., Director, ICAR-CIFT

Members:

- Sh. P. Sahadevan, Additional Director of Fisheries, Directorate of Fisheries, Kerala
- Mr. H.S Veerappa Gowda, Director, Directorate of Fisheries, Bangalore - 56001
- Dr. G. Sugumar, Director(I/c), DIVF, TNJFU, Tamil Nadu
- Shri K. S. Shaiju, R/o Kalathil House, Edavanakkad, Ernakulam
- Ms. Samyuktharani K., R/o Kayakkalath Sivasthuthi Bhavan, Puthiyappa, Kozhikode
- Dr. Rani Palaniswami, Officer-in-charge, Research Centre of CIFRI, Cochin.
- Dr. Alavandi S. V., HOD, CIBA, Chennai.
- Dr. S. Kalavathi, Principal Scientist, CPCRI, Kayamkulam.
- Dr. K. V. Rajendran, HOD, CIFE, Mumbai.
- Assistant Director General (M. Fy.), ICAR, New Delhi - 12.
- FAO, ICAR-CTCRI, Trivandrum.

Member Secretary: Sr. Administrative Officer, CIFT, Cochin

Grievance Cell

Chairman: Dr. Ravishankar C. N., ICAR-CIFT

Members:

- Dr. K. Asok Kumar, Principal Scientist & HOD, FP Dvn., ICAR-CIFT.
- Shri W. Sreenivasa Bhat, Sr. Admn. Officer, ICAR-CIFT
- Shri K. S. Sreekumaran, Fin. & Accts. Officer, ICAR-CIFT
- Dr. Pankaj Kishore, Scientist, ICAR-CIFT
- Shri P. V. Sajeevan, Tech. Officer., ICAR-CIFT
- Shri M. Arokya Shaji, Asst., ICAR-CIFT, Veraval
- Shri A. Vinod, SSS, ICAR-CIFT.

Member Secretary: Shri M. N. Vinodh Kumar, Asst. Admn. Officer (Cdn.), ICAR-CIFT, Cochin

Institute Joint Staff Council (IJSC)

Chairman: Dr. Ravishankar C. N., Director, ICAR-CIFT

Members (Official Side):
- Dr. K. Asok Kumar, PS & HOD, FP Dvn., ICAR-CIFT
- Dr. Leela Edwin, PS & HOD, FT. Dvn., ICAR-CIFT
- Dr. Amulya Kumar Mohanty, PS & HOD EIS Dvn., ICAR-CIFT
- Dr. Manoj P. Samuel, PS & HOD Engg. Dvn., ICAR-CIFT
- Shri K. S. Sreekumaran, FAO, ICAR-CIFT

Secretary (Official Side): Shri W. Sreenivasa Bhat,, Sr. Admn. Officer, ICAR-CIFt

Members (Staff Side):
- Shri K. B. Sabukuttan, Asst. Admn. Officer, ICAR-CIFT
- Shri K. Das., Assistant, ICAR-CIFT
- Shri Vipin Kumar V., Sr. Tech. Assistant, ICAR-CIFT
- Shri A. Vinod, SSS, ICAR-CIFT
- 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, CIFT, Cochin.

Members:
- Dr. K. Asok Kumar, PS & HOD, FP Dvn., ICAR-CIFT
- Dr. M.M. Prasad, PS & HOD, MFB Dvn., ICAR-CIFT
- Dr. Leela Edwin, PS & HOD, FT. Dvn., ICAR-CIFT
- Dr. Amulya Kumar Mohanty, PS & HOD EIS Dvn., ICAR-CIFT
- Dr. Manoj P. Samuel, PS & HOD Engg. Dvn., ICAR-CIFT
- Dr. Suseela Mathew, PS & HOD B&N Dvn., ICAR-CIFT
- Dr. A.A. Zynudheen, PS & HOD QAM Dvn., ICAR-CIFT

Member Secretary: Dr. Saly N. Thomas, PS & In-Charge, PME Cell

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. N. Manju Lekshmi Shri. P.N. Jha
2	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
3	Fishing technological interventions for sustainable marine ecosystem services along the east coast of India	Dr. R. Raghu Prakash	Kochi Visakhapatnam	Dr. U. Sreedhar Shri. M.V. Baiju Dr. V.R. Madhu Smt. P. Jeyanthi Dr. Jesmi Debbarma
4	Enhancement of life of fishing materials using nanotechnology	Dr. P. Muhamed Ashraf	Kochi	Dr. Leela Edwin Dr. Saly N. Thomas Shri. S.Chinnadurai Dr. N. Manju Lekshmi
5	Studies on fish behaviour as an input for developing responsible fis`hing systems	Dr. Madhu V.R.	Kochi Veraval	Dr. Prajith K.K. Dr. Monalisha Devi Dr. Renjith R.K. Mr. Paras Nath Jha
6	Development of region- and species-specific pots/traps	Dr. K.K. Prajith	Kochi Veraval Visakhapatnam Mumbai	Dr. M.P. Remesan Dr. U. Sreedhar Dr. D. Divu (CMFRI) Dr. S. Remya Shri. G. Kamei Shri. S.Chinnadurai Dr. N. Manju Lekshmi
7	Technological interventions for enhancing utilization of secondary raw materials of aquatic origin.	Dr. A.A Zynudheen	Kochi Veraval Mumbai	Dr. Binsi P. K. Dr. K. Elavarasan Dr. Jeyakumari A. Smt. Parvathy U. Smt. Renuka V. Smt. Sreelakshmi K.R. Shri Devananda Uchoi Shri Satishkumar K. Smt. Priya E. R. Dr. Joshy C. G. Dr. Femeena Hassan Dr. Visnuvinayagam S. Dr. H. Mandakini Devi

8	Interventions in processing and preservation of commercial and unconventional fishery resources.	Dr. George Ninan	Kochi Visakhapatnam Mumbai	Dr. Zynudheen .A. A. Dr. Bindu, J. Dr. C. O. Mohan Dr. Binsi P.K. Dr. H. Mandakini Devi Dr. Rehana raj Smt. Sreelakshmi K.R. Dr. Jeyakumari A. Dr. Parvathy U. Dr. Viji. P. Dr. Laly S. J. Smt. Greeshma. S.S. Dr. Joshy C.G.
9	Biodegradable packaging materials for fish and fishery products.	Dr. J. Bindu	Kochi Veraval Visakhapatnam	Dr. Zynudheen .A. A Dr. Bindu, J. Mr. Sreejith S. Ms. Sarika K. Mr. Satishkumar K. Ms. Priya E.R. Dr. AnupamaT.K. Dr. Jesmi Debbarma Dr. Remya S. Ms. Renuka V. Dr. Ashish Kumar Jha
10	Development of processing protocols for emerging farmed fishery resources.	Dr. Binsi P.K.	Kochi Veraval Visakhapatnam Mumbai	Dr.Viji P. Dr. Jeyakumari A. Smt. Parvathy U. Shri. Devananda Uchoi Smt.Sarika K. Shri Satishkumar K. Dr. Rehana Raj Dr. Anupama T.K. Dr. Murali S.
11	Development of active and intelligent packaging system for fish and shellfishes	Dr. C. O. Mohan	Kochi Veraval	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 Mrs. Sreelakshmi, K. R.
12	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. ElavarasanK. Dr. Suresh A. Mr. Premdev

13	Specific technological problems and mitigation measures in fish and fishery products of Maharashtra region (Mumbai)	Dr. L.N. Murthy	Mumbai	Dr. A. Jeyakumari Mrs. Laly, S. J. Dr. Abhay Kumar Dr. S. Monalisha Devi
14	Novel approaches for value addition and safety assessment of fishery resources of East Coast (Vizag)	Dr. B. Madusudana Rao	Visakhapatnam Mumbai	Dr. P. Viji Dr. Jesmi Debbarma Shri. K. Ahamed Basha Dr. L.N. Murthy
15	Development of seaweed based edible and functional sachet for food packaging applications	Dr. Jesmi Debbarma	Kochi Visakhapatnam	Dr. B. Madusudana Rao Dr. P. Viji, Shri. S. Sreejith
16	Food safety hazards of fish and fishery products: assessment and mitigation measures	Dr. Satyen Kumar Panda	Kochi Veraval Mumbai	Dr. Ashok Kumar K. Dr. Femeena Hasan Dr. C. O. Mohan Ms. S. J. Laly Dr. G. K. Sivaraman Dr. Pankaj Kishore Dr. Anupama T. K. Dr. Bindu J. Dr. Niladri Sekhar Chatterjee Ms. Priya E. R. Dr. Devananda Uchoi Dr. Minimol V. Ms. Muthulakshmi T. Dr. Anuj Kumar
17	Safety and quality aspects of fish and fishery products from Gujarat coast	Dr. A. K. Jha	Veraval	Dr. Toms C. Joseph Smt. Renuka V. Dr. Remya S. Dr. Anupama T. K.
18	Development of seaweed supplemented bioactive yoghurt	Dr. Anuj Kumar	Kochi	Dr. H. Mandakini Devi Dr. Pankaj Kishore
19	Occurrence, distribution and molecular characteristics of emerging and re-emerging pathogens in seafood and its environment	Dr. M. M. Prasad	Kochi Veraval Visakhapatnam Mumbai	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. R.K. Nadella Shri K.A. Basha Smt. Greeshma S.S. Smt. T. Muthulakshmi Shri. Abhay Kumar Shri. S. Ezhil Nilavan Dr. Minimol V.

20	Molecular diversity of pathogens associated with aquatic systems and harnessing aquatic niche for beneficial bacteria or products	Dr. V. Murugadas	Kochi Veraval Visakhapatnam Mumbai	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. R.K. Nadella Shri. K.A. Basha Smt. Greeshma.S.S. Smt. T. Muthulakshmi Shri. Abhay Kumar Shri. S. Ezhil Nilavan Dr. Minimol V.
21	Development of colorimetric nano-biosensor strips for detection of food borne pathogens	Shri. R.K. Nadella	Kochi	Dr. M.M Prasad Dr. C. O. Mohan Shri. Ezhil Nilavan
22	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. Shri. Anas K. K. Ms. Lekshmi R.G.K. Dr. T.K. Anupama Dr. Ashish Kumar Jha Dr. V. Geethalakshmi
23	Novel Bio-molecules forfood and nutraceuticalapplications frommarine resources	Dr. K. K. Asha	Kochi	Dr. Suseela Mathew Dr. R. Anandan Dr. Niladri S. C. Shri Tejpal C. S. Shri Anas K. K. Ms. Lekshmi R.G.K.
24	Evaluating FTIR spectroscopy and chemometric models in high-throughput authentication of species and geographical origin of shrimp	Dr. Niladri Sekhar Chatterjee	Kochi	Dr. Toms C Joseph Dr. Minomol V. A. Ms. Lekhshmi R.G.K.
25	Design and development of tools and technologies for energy and water use optimization in fish processing industries	Dr. Manoj P Samuel	Kochi	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. Ms. Jesmi Debbarma Ms. Soumya Krishnan Smt. Lekshmi R. G. K.

26	Evolving SMART EDP module for livelihood security of small scale fisherfolk through fish-preneurship	Dr. A. K. Mohanty	Kochi Visakhapatnam Veraval	Dr. George Ninan Dr. Ashaletha Dr. Sajeev M.V. Dr. Pe. Jeyya Jeyanthi Dr. Sajesh V. K. Dr. Remya S. Dr. Viji P. Dr. Rejula K.
27	Occupational structure, labour productivity and labour migration in the fisheries sector	Dr. Nikita Gopal	Kochi	Dr. V. Geethalakshmi Dr. Pe. Jeyya Jeyanthi Shri. V. Chandrasekar
28	Economic evaluation of resource use efficiency and management of reservoir ecosystem	Dr. V. Geethalakshmi	Kochi	Dr. Nikita Gopal Dr. Pe. Jeyya Jeyanthi Dr. Femeena Hassan Shri V. Chandrasekar
29	Assessing the input and service delivery system for marine fisheries in Kerala	Dr. A. Suresh	Kochi	Dr. A. K. Mohanty Dr. V. Geethalakshmi Dr. Sajeev M. V. Dr. Sajesh V. K. Dr. Rejula K. Shri V. Chandrasekar
30	A study of dynamics of fish consumption in Kerala with reference to emerging health, safety and quality issues.	Dr. Sajeev. M.V.	Kochi	Dr. A K. Mohanty Dr. A. Suresh Dr. Sajesh V. K. Dr. Rejula K. Dr. Delfiya A. R.
31	Development and validation of a scale to measure fishermen's attitude towards responsible fishing	Dr. Rejula . K	Kochi Mumbai	Dr. Sajesh V. K. Dr. S. Monalisha Devi
Indian Council of Agricultural Research (ICAR) Projects				
32	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. Mrs. Alfiya P.V. Mrs. Razia Mohamed A. * Dr. Ajeesh Kumar K. K. * Mr. Lijin Nambiar M. M. * Mr. Mohd. Safwan T. A. * Dr. B. Madhusudana Rao Dr. L. N. Murthy
33	All India network project on fish health	Dr. K. Ashok Kumar	Kochi	Dr. S.K. Panda Dr. Rajisha R.* Mrs. Nanitha Krishna E. K.*

34	Investigations on ghost fishing by derelict traps and gillnets in selected areas of Infian waters and mitigations measures	Dr. Saly N. Thomas	Kochi	Dr. P. Muhamed Ashraf Dr. K.M. Sandhya Mrs. Harsha K. * Mr. Aiswarya Ghosh K.A. * Ms. Mary Baby K.A. *
35	Network programme on Assessment of Antimicrobial Resistance (AMR) in microorganisms associated with fisheries and aquaculture in India	Dr. M. M. Prasad	Kochi Visakhapatnam	Dr. B. Madhusudana Rao
Department of Science and Technology (DST) Projects				
36	Development of clam cluster an clam processing facility at Perumbalam village, Thycatusherry block, Cherthala taluk, Alappuzha	Dr. Nikita Gopal	Kochi	Dr. J. Bindu Mr. V. Chandrasekar Shri S. Sreejith Ms. K.H. Sreedevi* Mr. James J. Pullikottil*
37	Livelihood enhancement of Sidi tribal women and Kharwa fisherwomen of veraval in Gujarat through the implementation of improved fish post harvest technolgies	Dr. S. Remya	Kochi Veraval	Dr. C.N. Ravishankar Dr. C.O. Mohan Dr. A.K. Jha
38	Determining seasonal occurrence of multiclass endocrine disrupting chemicals in the fishes, crustaceans and mollusks of the Vembanad urban estury: Risk assessment by an untargeted metabolomics appraoch	Dr. N.S. Chatterjee	Kochi	
39	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 Samuel Dr. Aniesrani Delfiya D. S Smt. P. V Alfiya Dr. SajeshV. K* Shri. Amal Dev*
Department of Biotechnology (DBT) Indo-UK Collabrative Projects				
40	Diagnostics for one health and user driven solutions for AMR (DOSA)	Dr. Ravi Krishnan, IIT, Delhi Dr. Till Bachmann, Univ. Edinburgh, UK	Kochi, Delhi, Silchar, Bangaluru, Edinburgh, Bardford, Southampton,) and London (UK)	Dr. G. K. Sivaraman

41	Does antimicrobial resistance (AMR) in livestock contribute to AMR in people in NE India? An inter-disciplinary study investigating antibiotic use, drivers of AMR and transmission dynamics	Dr. B.Shomes ICAR-NIVEDI, Assam Dr. Mark Holmers, University of Cambridge, UK	Kochi Assam UK	Dr. G.K. Sivaraman
Department of Biotechnology (DBT)Projects				
42	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	Kochi Visakapatanam	Dr. M. M. Prasad Dr. G. K. Sivaraman Dr. V. Murugadas Dr. S. Visnuvinayagam Smt. G. Devika* Smt. R. Karthika*
43	Evaluating cost and benefits of prophylactic health products and novel alternatives on small holder aquaculture farms in Asia and Africa	Dr. Toms C. Joseph	Kochi	
Food Safety and Standards Authority of India (FSSAI) Project				
44	Monitoring of heavy metal in finfish & shellfish species along the Indian coast and possible mitigation measures	Dr. Satyen Kumar Panda	Kochi	Dr. Mohan C.O. Dr. Pankaj Kishore
45	Natural levels of formaldehyde in freshly harvested finfish and shellfish species	Dr. Satyen Kumar Panda	Kochi	Dr. N. S. Chhatterjee Ms. Priya E. R.
National Innovations in Climate Resilient Agriculture (NICRA) Project				
46	Global warming potential (GWP) of mechanized fishing methods of India and mitigation strategies: Analysis using Life Cycle Assessment (LCA) – Data Envelopment Analysis (DEA) approach	Dr. Leela Edwin	Kochi Visakhapatnam	Dr. V. R. Madhu Shri M.V. Baiju Shri V. Chandrasekar Shri P. N. Jha Dr. R. Raghu Prakash Shri. Sreejith S. Kumar * Shri. Rithin Joseph* Smt. Yasmi V. S.*
Indian National Centre for Ocean Information (INCOIS) Projects				
47	Vaidation and dissemination of ocean state forecast advisories along Gujarat coast	Dr. V.R. Madhu	Kochi, Veraval	Dr. K.K. Prajith Shri G. Kamei Shri K.V. Vinod*
National Fisheries Development Board (NFDB) Project				
48	National surveillance programme for aquatic animal diseases	Dr. V. Murugadas	Kochi	Dr. Toms C. Joseph Shri K. A. Basha Dr. S. Ashaletha Shri. P. G. Akhil Nath* Shri. P. Shaheer*

ICAR-National Fellow Project				
49	Biomodulation of marine biopolymers for the preparation of biomaterials of healthcare importance	Dr. R. Anandan	Kochi	Dr. P. R. Sreerekha* Smt. Divya K. Vijayan*
Ministry of Food Processingt Industries (MOFPI) Project				
50	Design and development of hot air assisted continous Infrared drying system for high value fish and fishery products	Dr. D.S. Anisesrani Delfiya	Kochi	Dr. Manoj P. Samuel Dr. S. Murali Smt. P. V. Alfiya Shri K. Prashob*
Worldfish Project				
51	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, Mr.Tejpal.C.S
Coconut Development Board (CDB) Project				
52	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 Ms. Hitha P. V* Ms. Jesna Sudhakaran* Mrs. Leonna Angela Morris*
United Nations Development Programme-The East Godavari River Estuarine Ecosystem Project				
53	Harvest & post harvest interventions for mainstreaming biodiversity conservation into the fisheries sector of east Godavari riverine and estuarine ecosystem	Dr. Raghu Prakash	Visakapatanam	Dr. U. Sreedhar Dr. B. Madhusudana Rao Dr. Viji P. Dr. Jesmi Debbarma Shri. G. Kamei
Marine Products Export Development Authority (MPEDA) Project				
54	Assessing Seafood Exporting Units' needs for exporting Value added products and capacity building requirements	Dr. C. O. Mohan	Kochi Veraval Visakhapatnam 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 Debbarma Dr. Jeyakumari, A. Mrs. Laly S.J. Dr. Ashish Kumar Jha Mrs. Renuka V.

** Research Fellow*

LIST OF PERSONNEL IN ICAR-CIFT

(As on 31st December, 2019)

Managerial Personnel

Director: **Dr. C.N. Ravishankar**

HEADS OF DIVISIONS

Fish Processing Division	:	Dr. K. Ashok 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 Assurance & 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. Toms C. Joseph, Principal Scientist

Senior Administrative Officer	:	Shri W. Sreenivasa Bhat
Finance & Accounts Officer	:	Shri K.S. Sreekumaran

SCIENTIFIC PERSONNEL

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1. Dr. T.V. Sankar (On deputation)
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. A. Suresh
13. Dr. G.K. Sivaraman
14. Dr. V.R. Madhu
15. Dr. K.K. Asha
16. Dr. S.K. Panda

Senior Scientist

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2. Dr. M.V. Sajeev
3. Dr. C.O. Mohan

Scientist

1. Shri V. Radhakrishnan Nair
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3. Dr. P. K. Binsi
4. Shri V. Chandrasekar
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6. Dr. V. Murugadas

7. Dr. K. Nagalakshmi
8. Dr. S. Visnuvinayagam
9. Dr. V.K. Sajesh
10. Dr. Niladri Sekhar Chatterjee
11. Dr. K.M. Sandhya
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13. Dr. Nenavath Rajendra Naik
14. Smt. U. Parvathy
15. Dr. N. Manju Lekshmi
16. Dr. Pankaj Kishore
17. Shri Ranjit Kumar Nadella
18. Shri S. Sreejith
19. Dr. Hanjabam Mandakini Devi
20. Dr. Anuj Kumar
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22. Dr. K. Elavarasan
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25. Shri S. Chinnadurai
26. Shri Paras Nath Jha
27. Smt. T. Muthulakshmi
28. Dr. R.K. Renjith
29. Smt. K. Sarika
30. Smt. K.R. Sreelakshmi
31. Smt. E.R. Priya
32. Smt. Lekshmi R.G. Kumar
33. Dr. Devananda Uchoi
34. Shri K. Sathish Kumar
35. Dr. V.S. Minimol
36. Shri K.K. Anas
37. Shri S. Ezhil Nilavan
38. Dr. Murali S.
39. Dr. D.S. Aniesrani Delfiya
40. Smt. Rehna Raj
41. Smt. P. V. Alfiya

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5. Shri Rakesh M. Raghavan
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3. Shri Ajith V. Chellappan
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6. Smt. Anu Mary Jose
7. Smt. G. Archana
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10. Smt. K. Reshmi
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2. Shri T. Viswanathan (On deputation)
3. Shri K. B. Sabukuttan
4. Shri M. N. Vinodh Kumar
5. Smt. T. K. Shyma
6. Smt. V. S. Aleyamma

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Stenographer Grade-III

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13. Shri K. Thinakaran
14. Shri P. N. Nikhil Das
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16. Shri K. S. Ajith
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Visakhapatnam Research Centre

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3. Shri Gaihiamngam Kamei
4. Shri Kusunur Ahamed Basha

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3. Shri Ramesh Mirdha

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3. Smt. Nalla Naveena

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4. Smt. Gyana Netri Nag
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6. Shri Kedar Meher
7. Shri Lalit Oram

Veraval Research Centre

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1. Dr. Ashish Kumar Jha
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3. Smt. V. Renuka
4. Dr. Anupama T. K.

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2. Shri G. Kingsely

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3. Shri Ranjan Singh

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Assistant

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4. Smt. Pushpaben P. Chudasama
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7. Shri P. Ramakrishna
8. Shri Rotash

Auxiliary Staff

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Mumbai Research Centre

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Scientist

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2. Dr. Abhay Kumar
3. Smt. S. J. Laly
4. Dr. Sukham Monalisha Devi

Technical Personnel
Chief Technical Officer

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2. Smt. Thriven G. Adiga

Senior Technical Assistant

1. Smt. Priyanka Ajay Nakhawa

Technical Assistant

1. Kum. G. Megha

Senior Technician

1. 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

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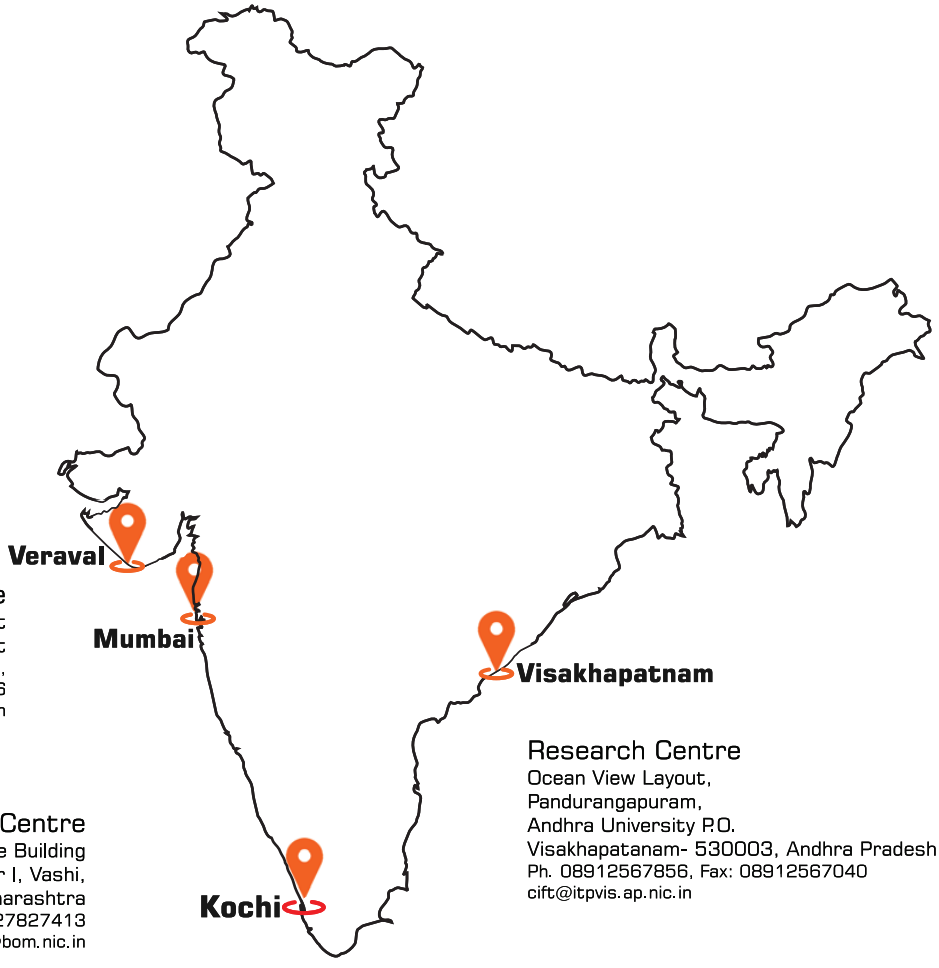

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