



# Annual Report वार्षिक प्रतिवेदन 2021



**ICAR-Central Institute of Freshwater Aquaculture**  
**Indian Council of Agricultural Research**

(An ISO 9001:2015 Certified Institute)

Kausalyaganga, Bhubaneswar-751 002, Odisha





# ANNUAL REPORT 2021



**ICAR-CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE**  
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)  
(AN ISO 9001:2015 CERTIFIED INSTITUTE)  
KAUSALYAGANGA, BHUBANESWAR-751 002, ODISHA, INDIA

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## Preface



*Warm Greetings from ICAR-CIFA!*

Amidst the impact of COVID-19 pandemic, in the year 2021, ICAR-CIFA implemented a very unique research and development programme to make stakeholders self-reliant, and enabling their socio-economic upliftment. On the research front, significant strides have been made in successful induced breeding of striped murrel, *Channa striata* broodstock raised in the re-circulatory aquaculture system and breeding and seed production protocol of various diversified fish species including *Mystus cavasius*, *Labeo kontius* and *Macrognathus pancalus*, captive breeding of melon barb, *Haludaria fasciata* and mascara barb, *Dawkinsia assimilis*, development of bio-floc research facility, aquaponic systems, organic aquaculture, designer pearl production, ecological engineering for intensive aquaculture, Life Cycle Analysis of different aquaculture practices, control of microcystis in culture ponds, productivity enhancement through zinc and iron application, grow-out rearing and multi-location trials of selectively bred 12<sup>th</sup> generation CIFA-GI Scampi.

'Jayanti rohu' seeds have been disseminated to 10 states while improved catla seeds have been distributed to farmers and stakeholders of 6 states. Significant progress has been made in proteomics analysis of *Argulus* parasite. Incorporation of solid state fermented mahua oil cake at 40% level in rohu showed promising results. Up to 50% replacement of fishmeal in the diet of striped murrel was achieved through incorporation of black soldier fly larvae meal. Around 240 freshwater fish farms in Odisha and Andhra Pradesh were surveyed and screened for Antimicrobial Resistance (AMR) in fish. Substantial progress has been made in documenting the development of novel therapeutics & alternatives to antimicrobials for health promotion and disease management AMPs, Probiotics, herbal products, immunopotentiators (TLRs), medicinal plants and herbal formulation to parasitic diseases in fish.

ICAR-CIFA took initiatives to organize major events such as 'Azadi Ka Amrit Mahotsav' to commemorate India's 75<sup>th</sup> anniversary of independence and a series of virtual lectures by domain experts were organized during the year. World Water Day, national virtual consultation on "Indian Ornamental Fisheries 2.0-The Way Forward" Mahila Kisan Diwas, World Food Day, Vigilance Awareness Week, World Antimicrobial Awareness Week, National Webinar on "Selective Breeding for Sustainable Growth of Aquaculture and Way Forward in India", Constitution Day, Women in Agriculture Day, World Soil Day, Poshan Vatika Maha Abhiyan, tree plantation drive, were some of the highlights. The Institute also participated in two international events of USAID and NACA. Launching of MatsyaSetu-The Virtual Learning App by the Shri. Giriraj Singh, Hon'ble Union Minister for Fisheries, Animal Husbandry & Dairying in presence of several dignitaries on 6<sup>th</sup> July, 2021 was a memorable event. National Fish Farmers Day was commemorated in a befitting manner, with awards presented to successful farmers across the country. In addition, the institute organized series of events to promote use of Rajbhasha Hindi in official work.



In the outreach and capacity building domain also the institute has outperformed the previous years and trained about 6682 stakeholders and organised five exhibitions and various interfaces across the country. As part of the agreed action plan, KVK-Khordha, which is hosted by our institute, held 78 trainings throughout the year for farmers, farm women, rural youth, and extension officials on issues relating to agriculture and associated sectors for 2071 beneficiaries.

Six new Aquaculture Field Schools (AFS) were established in various districts of different states. Twelve MoUs were signed by ICAR-CIFA with different organizations for sharing research and development achievements of the institute. The North-Eastern Region development programme with aquaculture as a component were undertaken in six states; Assam, Arunachal Pradesh, Manipur, Mizoram, Nagaland and Sikkim in collaboration with the respective State Govt. departments and local NGOs. The institute in collaboration with KVK Diphu, Karbi Anglong organized the 'Awareness program on scientific aquaculture' at Growth Centre (Agriculture), Diphu, Karbi Anglong, Assam. Under STC/TSP programme, the training, demonstration and input distribution programmes were undertaken in Koraput, Nabarangpur and Kalahandi district of Odisha. The several training and input distribution activities were undertaken in Odisha, West Bengal, Andhra Pradesh, Telangana and Rajasthan under SCSP programmes of the Institute. The critical inputs like seed, feed, lime, net, crates and weighing balances, etc., were supplied to SC beneficiaries.

The institute is working in close collaboration with different international research and development agencies like FAO, NACA, and WorldFish, as well as national agencies like DBT, DST, SERB etc. The NFDB, PMMSY, RKVY, and the State S&T Department have also been associated with us and have provided funding help, which is tremendously appreciated. As a result of our sustained efforts to translate research into public goods, several peer-reviewed articles, training manuals, extension bulletins, and video classes have been released. Besides, the institute also involved in executing the government of India's flagship programmes like MGMG and Swachha Bharat Abhiyan.

The institute had the honor of the hosting distinguished visitors like Shri Parshottam Rupala, Hon'ble Minister, MoFAHD, GoI, Shri Pratap Chandra Sarangi, Hon'ble MoS, MoFAHD & MSME and MP, Balasore (Odisha) and Shri Tage Taki, Hon'ble Minister for Agriculture, Horticulture, Animal Husbandry, Veterinary, Dairy Development and Fisheries, Govt. of Arunachal Pradesh.

I owe a huge debt of gratitude to Dr. Trilochan Mohapatra, Director General of ICAR and Secretary of DARE, for the encouragement and guidance to carry out research and development. My sincere thanks are due to Dr. J. K. Jena, Deputy Director General (Fisheries Science) for his noble guidance, generous support, painstaking efforts and encouragement all the time in planning and implementation of the research programme. I would also like to express my gratitude to Dr. B.P. Mohanty, ADG (Inland Fisheries), and Dr. P. Pravin, ADG (Marine Fisheries) for their unwavering support, enthusiasm, and timely guidance in helping us accomplish our objectives. I also appreciate the Chairman and Members of the 35<sup>th</sup> RAC for mentoring us through our research projects. I am extremely thankful to the Chairman and Members of the Annual Report committee's meticulous efforts in putting together the report for the year 2021.

The institute makes consistent effort to develop need-based technologies for the benefit of our valued aquaculture farmers, entrepreneurs, researchers, policymakers, and other stakeholders. I firmly believe that by accelerating our efforts in the years to come, we will be able to contribute towards the betterment society at large and realize the aspirations of *Atmanirbhar Bharat*.

Thank you so much for joining us on this historic and challenging journey.



**Saroj Kumar Swain**  
Director (Acting), ICAR-CIFA



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## कार्यकारी सारांश

- विभिन्न ट्रीटमेंट्स के तहत 75-97 प्रतिशत निषेचन और 53.5-96 प्रतिशत हैचिंग दर के साथ, एक री-सर्कुलेटरी एकाकल्चर सिस्टम (आरएएस) में पाले गए स्ट्रिप्ड मर्रेल, चन्ना स्ट्रिएटा, ब्रूडस्टॉक का प्रेरित प्रजनन प्रभावी साबित हुआ।
- कैष्टिविटी में *मिस्टस कैवासियस* के प्रेरित और प्राकृतिक प्रजनन सफलता पाया गया है, और विभिन्न जीवित फ्रीड और संचयन घनत्व के साथ मछली के विभिन्न चरणों के विकास और अस्तित्व की जांच की गई है।
- हिल्सा (*तेनुलोसा इलीशा*) का ऑन-बोट प्रजनन और मछली के विभिन्न चरणों का पालन सफलतापूर्वक किया गया।
- भाकृअनुप के रहरा केंद्र ने स्पाइनी ईल, *मैक्रोग्रैथस पैन्कलस* के प्रजनक मछलियों के विकास, पालतू बनाना, बायोमेट्रिक लक्षण वर्णन, फ्रीड और स्वास्थ्य निगरानी को सफलतापूर्वक पूरा किया।
- उच्च प्रकाश तीव्रता 1500 लक्स के साथ लंबी फोटो पीरियड और 500 लक्स प्रकाश तीव्रता के साथ तटस्थ फोटोपीरियोड *ओम्पोक बिमाकुलैटस* में बढ़े हुए जनांग परिपक्वता और बेहतर प्रजनन उत्पादन को प्रोत्साहित करते हैं।
- तालाब संवर्धित *एल कोंटियस* ने डेढ़ साल की उम्र में पहली परिपक्वता प्राप्त की और नर और मादा दोनों मछलियों के लिए एसजीएनआरएच (0.5मिली/किग्रा शरीर के वजन) का उपयोग करके पहली बार सफलतापूर्वक प्रेरित किया गया।
- आलंकारिक मछली मेलन बार्ब (*हलुदरिया फासीटाटा*) और मस्करा बार्ब (*डॉकिनसिया एसिमिलिस*) को कैष्टिविटी में सफलतापूर्वक प्रजनन कराया गया था।
- तिलापिया के जेंडर ओरिएंटेशन पैटर्न की जांच के लिए जियोमेम्ब्रेन बायोफ्लोक टैंक में कई प्रयोग किए गए।
- गुणवत्ता डिज़ाइनर मोती के उत्पादन के लिए डिज़ाइनर न्यूक्लियस तैयार करने और मसल्स के पालन के लिए प्रोटोकॉल को अनुकूलित किया गया था।
- बायोफ्लोक सुविधा के लिए बुनियादी ढांचा तैयार किया गया है जिसमें इनडोर में 12 टैंक (6 सं - 5.0 मीटर व्यास; 6 सं - 4.0 व्यास) और बाहरी सिस्टम में 6 टैंक शामिल हैं।
- स्कैम्पी हैचरी सेटअप के कई घटकों के 3डी मॉडल अध्ययन का विकास पूरा किया गया।
- पिट्यूटरी अर्क का उपयोग करके जैविक भारतीय प्रमुख कारप (आईएमसी) का प्रेरित प्रजनन और बीज उत्पादन किया गया।
- अध्ययन से पता चला है कि कार्बन स्रोत के रूप में ग्लूकोज और साइट्रेट का उपयोग, स्फूडोमोनास एरुगिनोसा आइसोलेट डब्ल्यूएस एल-9 की नाइट्रोजन (अमोनियम-एन) और नाइट्रेट हटाने की क्षमता 48 घंटों के बाद क्रमशः 80% और 60% से अधिक थी।
- छत्तीसगढ़, आंध्र प्रदेश और ओडिशा में कार्प पालन और पंगेसियस पालन प्रणालियों का अध्ययन एक जीवन चक्र विश्लेषण (एलसीए) का उपयोग करके किया गया था।



- आंध्र प्रदेश में पाकु संवर्धन में उत्पादन कारकों और बाधाओं के प्रभाव का प्रदर्शन किया गया।
- जूप्लवक विविधता और आक्रमणित पारिस्थितिकी तंत्र की प्रचुरता पर सेलफिन कैटफ़िश (*टेरिगोप्लिक्थिस* प्रजाति) के प्रभाव का प्रदर्शन किया गया।
- रोहू भ्रूणों में, उप-घातक सांद्रता में ग्लाइफोसेट के कारण रूपात्मक असामान्यताएं होती हैं जैसे कि योल्क थैली एडोइमा, पेरिकार्डियल एडिमा, पेट की वक्रता, पूंछ किंक गठन, रक्तस्राव और विलंबित विकास।
- गहन मछली उत्पादन प्रणाली के लिए एयरलिफ्ट वातन प्रणाली की डिजाइनिंग और एसआई मूल्य और जल पंपिंग क्षमता का अनुमान लगाया गया था।
- निष्कर्षों के अनुसार, कंक्रीट पालन प्रणाली में जयंती रोहू की वृद्धि को बढ़ाने के लिए 0.10 मिग्रा जिंक /ली. + 0.20 मिग्रा लौह /लीतक जिंक और आयरन के संयोजन का उपयोग करना सहायक होता है।
- एजोला और पिस्टिया को इष्टतम पानी की गुणवत्ता सुनिश्चित करने के साथ-साथ माइक्रोसिस्टिस जनसंख्या विकास को दबाने के लिए भी पाया गया, यह सुझाव देते हुए कि वे सिस्टम से माइक्रोसिस्टिस के उन्मूलन के लिए उपयोगी हस्तक्षेप हो सकते हैं।
- कुल मिलाकर, उन्नत रोहू (जयंती) (2021 वर्ष वर्ग, 12वीं पीढ़ी) के 58 पूर्ण-सिब फॅमिली और ए हाइड्रोफिला के खिलाफ रोहू की प्रतिरोधी और कण्ट्रोल रेखा के साथ उन्नत कतला (तीसरी पीढ़ी) के 33 पूर्ण-सिब परिवारों का उत्पादन किया गया।
- 66.4% उत्तर्जिवित्ता दर के साथ सीफा-जीआई स्कम्पी की 12वीं पीढ़ी के ग्रो-आउट पालन का प्रदर्शन किया गया।
- डे नोवो ट्रांस्क्रिप्टोम असेंबली 525BP की औसत कॉन्टिग लंबाई के साथ 14,02,926 कंटिग्स उत्पन्न करती है और रोहू में 57% पूर्णता के साथ BUSCO का उपयोग करके असेंबल गुणवत्ता का मूल्यांकन किया गया था।
- *कतला कतला* में ~ 20000 उच्च गुणवत्ता वाले एसएनपी के लिए कुल ~ 140 जीबी अनुक्रम डेटा उत्पन्न किया गया था और स्टैक्स सॉफ्टवेयर उत्पन्न जीनोटाइपिंग डेटा का उपयोग करके जीनोटाइपिंग कॉलिंग।
- *अर्गुलस स्यामेंसिस* के 19-मेर पेप्टाइड एंटीजन का उपयोग कार्प में आर्गुलोसिस के खिलाफ टीके के विकास के लिए किया गया था।
- रोहू में फैटी एसिड बायोसिंथेसिस के नियमन में एसआरईबीपी (स्टेरोल रेगुलेटरी एलिमेंट बाईंडिंग प्रोटीन) की भूमिका का पता लगाया गया।
- ओडिशा और पश्चिम बंगाल की कार्प हैचरी में आनुवंशिक परिवर्तनशीलता के स्तर और पैटर्न का अध्ययन किया गया।
- अध्ययन के अनुसार, *हिपसेलबारबस पल्चेलस* की अंगुलिका के लिए आहार प्रोटीन की आवश्यकता 31.80 और 32.76 प्रतिशत के बीच थी।
- अध्ययन से संकेत मिलता है कि 2.5 से 10% के आहार लिपिड स्तर का *एच. पल्चेलस* की वृद्धि पर समान प्रभाव पड़ता है, लेकिन, 7.5% से अधिक के स्तर का शव प्रोटीन सामग्री और प्रोटीन पाचनशक्ति पर नकारात्मक प्रभाव पड़ता है। *एच. पल्चेलस* कम आहार वसा के स्तर की आवश्यकता लगता है।
- सूक्ष्मजीवों के दो उपभेदों, *सैक्रोमाइसेस सेरेविसिया* और *बैसिलस सबटिलिस* का उपयोग करके, महुआ तेल खल्ली का ठोस अवस्था किण्वन किया गया, और यह पाया गया कि 40% महुआ तेल पर



- खिलाए गए रोहू में आंत एंजाइम गतिविधि, जैसे अल्फा एमाइलेज और प्रोटीज, में वृद्धि हुई थी।
- अध्ययन से पता चला है कि 50% एफएम बीएसएफ लार्वा भोजन के साथ, हर्मेटिया बिना विकास, पोषक तत्वों के उपयोग, और चन्ना स्ट्रेटा फिंगरलिंग में पूरे शरीर की संरचना को प्रभावित करता है।
  - निष्कर्षों के अनुसार, मोरिंगा (*मोरिंगा ओलीफेरा*) पत्ती भोजन को एच. पल्सेलस विकास या शव समीपस्थ संरचना को प्रभावित किए बिना 15% तक सुरक्षित रूप से आहार में जोड़ा जा सकता है।
  - स्ट्राइड म्युरेल में, सी. स्ट्रिएटा, एलिसा हार्मोन प्रोफाइलिंग ऑफ टेस्टोस्टेरोन, एस्ट्राडियोल, प्रोजेस्टेरोन, फॉलिकल-स्टिम्युलेटिंग हॉर्मोन (FSH), और ल्यूटिनाइजिंग हॉर्मोन (LH) ने प्री-स्पॉनिंग, स्पॉनिंग में उपचार समूहों के बीच पर्याप्त अंतर प्रकट किया। और स्पॉनिंग के बाद के मौसम।
  - ओडिशा, आंध्र प्रदेश, कर्नाटक और पश्चिम बंगाल के विभिन्न जिलों में स्थित विभिन्न मछली फार्मों में सर्वेक्षण और रोग जांच की गई और इसके प्रेरक जीवों की पहचान की गई और किसानों और उद्यमियों को विभिन्न बीमारियों के लिए सलाहकार और सुझावात्मक उपाय प्रदान किए गए।
  - आंध्र प्रदेश और ओडिशा में कोविड -19 अवधि के दौरान पैंगेसियस कल्चर (5-10%) की तुलना में कार्प कल्चर (15-20%) में आर्थिक नुकसान अधिक देखा गया।
  - फ्लोर्फेनिकॉल औषधीय फ़ीड के प्रशासन के बाद रोहू, लैबियो रोहिता में गैर-विशिष्ट प्रतिरक्षा मापदंडों का पता लगाया गया।
  - राष्ट्रीय रेफरल प्रयोगशाला के तहत, एरोमोनास वेरोनी के दो मामले, एंटरोबैक्टर क्लोके का एक, अर्गुलस सियामेंसिस का एक, पैराडेक्टाइलोग्रस कैटलियस का एक, एक ए. हाइड्रोफिला, एक सीईवी, और एक मामला सिक्लिडोगाइरस एसपीपी का है। स्तर III निदान का उपयोग करके निदान किया गया था।
  - मत्स्य पालन और जलकृषि में रोगाणुरोधी प्रतिरोध (एएमआर) पर आईसीएआर नेटवर्क कार्यक्रम के तहत, ओडिशा और आंध्र प्रदेश से 239 मीठे पानी के मछली फार्मों का सर्वेक्षण किया गया था और नमूनों को एंटीबायोटिक प्रतिरोध पैटर्न (एएसटी) विश्लेषण के लिए संसाधित किया गया था और सीएलएसआई के बाद WHONET 5.6 सॉफ्टवेयर का उपयोग करके डेटा का विश्लेषण किया गया था।
  - अध्ययन से पता चला है कि 60 दिनों के लिए एल्लिनेट-चिटोसन एनकैप्सुलेटेड एल प्लांटारम एसएम 33 पूरक आहार के निरंतर प्रशासन ने मेजबान, रोहू की आंत में एलएबी के 108 सीएफयू / जी की एक महत्वपूर्ण (पी <0.05) व्यवहार्य गिनती की स्थापना सुनिश्चित की और बेहतर प्रतिरक्षा प्रदान की एरोमोनास हाइड्रोफिला के खिलाफ।
  - मछली रोगजनकों के खिलाफ चयनित आंत बैक्टीरिया की जीवाणुरोधी गतिविधि की गई।
  - औषधीय पौधे एंड्रोग्राफिस पैनिकुलता (ग्रीन चिरेटा) @3% (v/v) के अर्क को मौखिक और स्नान ट्रीटमेंट दोनों से क्रस्टेशियन परजीवी अर्गुलस संक्रमण को नियंत्रित करने के लिए प्रभावी पाया गया।
  - अलग-अलग बार्ब्स और सिक्लिड्स का उपयोग करते हुए टीआईएलभी के एक होस्ट रेंज अध्ययन का अध्ययन सह-आवास पद्धति द्वारा किया गया और पाया गया कि पुन्तिअस टिकटों और अमातीतलानियानिग्रोफासिआटा (CONVICT CICH-LID) TILV के लिए अतिसंवेदनशील थे।



- रोहू परफिरिन 1 ए –लाइक फुल लेंथ सी डीएनए (2004 बीपी ) को अनुक्रमित किया गया था और इसके खुले पठन फ्रेम विश्लेषण के परिणामस्वरूप 574 AA जो कि D. RERIO PERFORIN 1-LIKE प्रोटीन के लिए 75.96% ब्लास्टप पहचान है।
- सीएसीसीसी बॉक्स, होमोबॉक्स डोमेन (सीडीएक्स), सीसीसीटीसी-बाइंडिंग फैक्टर (सीटीसीएफ), गाटा परिवार, एचएटीएच1 और एसपी1 परिवार और प्रतिरक्षा सेल-विशिष्ट ट्रांसक्रिप्शन कारकों जैसे अक्टूबर-1, एचएनएफ-1, फॉक्सडी3, पैक्स जैसे प्रतिलेखन कारकों की उपस्थिति -6 रोहू म्यूसिन 2 क्रम में प्राप्त किए गए थे।
- ओडिशा के केंद्रपाड़ा और खोरधा जिलों में मीठे पानी की जलीय कृषि में किसान उत्पादक संगठनों (एफपीओ) का गंभीर मूल्यांकन किया गया।
- जलकृषि में महिला सशक्तिकरण को मापने के लिए एक सूचकांक विकसित किया गया था।
- नबरंगपुर जिले में एक्काकल्चर क्लस्टर विकसित करने के लिए तीन सीमेंटेड कार्प हैचरी और दो एफआरपी कार्प हैचरी स्थापित की गईं और ताजा मछली बेचने के लिए लाभार्थियों को बीस जीवित मछली वेंडिंग इकाइयां प्रदान की गईं।
- माननीय श्री गिरिराज सिंह जी, पूर्व केंद्रीय मत्स्य, पशुपालन और डेयरी मंत्री ने 06.07.21 को मत्स्य सेतु का शुभारंभ किया और देश भर से 28342 हितधारकों ने ऐप डाउनलोड किया था।
- भारत की आजादी की 75वीं वर्षगांठ के उपलक्ष्य में 'आजादी का अमृत महोत्सव' जैसे प्रमुख कार्यक्रम और डोमेन विशेषज्ञों द्वारा आभासी व्याख्यानों की एक श्रृंखला वर्ष के दौरान आयोजित की गई।
- "भारतीय आलंकारिक मात्स्यिकी 2.0- द वे फॉरवर्ड का आयोजन मत्स्य पालन विभाग, Mo-FAHD, भारत सरकार के सहयोग से सजावटी मछली उत्पादन को बढ़ावा देने के लिए किया गया था।
- 2701 लाभार्थियों के लिए केवीके-खोरधा ने किसानों, कृषि महिलाओं, ग्रामीण युवाओं और विस्तार अधिकारियों के लिए कृषि और संबंधित क्षेत्रों से जुड़े मुद्दों पर 78 प्रशिक्षण प्रदान किए।
- देश भर के विभिन्न क्षेत्रों में छह नए एक्काकल्चर फील्ड स्कूल (AFS) बनाए गए हैं। आईसीएआर-सीफा ने संस्थान की अनुसंधान और विकास उपलब्धियों को साझा करने के लिए अन्य संगठनों के साथ 12 समझौता ज्ञापनों पर हस्ताक्षर किए हैं।
- राज्य सरकार की एजेंसियों और स्थानीय गैर सरकारी संगठनों के संयोजन के साथ, एक घटक के रूप में जलीय कृषि सहित पूर्वोत्तर क्षेत्र विकास कार्यक्रम छह राज्यों: असम, अरुणाचल प्रदेश, मणिपुर, मिजोरम, नागालैंड और सिक्किम में लागू किया गया था।
- संस्थान के एससीएसपी कार्यक्रमों के हिस्से के रूप में ओडिशा, पश्चिम बंगाल, आंध्र प्रदेश, तेलंगाना और राजस्थान में कई प्रशिक्षण और इनपुट वितरण गतिविधियों का आयोजन किया गया, जिसमें बीज, चारा, चूना, जाल, क्रेट, और वजन संतुलन जैसे महत्वपूर्ण इनपुट एससी लाभार्थियों को वितरित किए जा रहे थे।



## EXECUTIVE SUMMARY

- Induced breeding of striped murrel, *Channa striata*, broodstock reared in a re-circulatory aquaculture system (RAS) proven effective, with 75-97 percent fertilisation and 53.5-96 percent hatching rate under various treatments.
- Induced and natural breeding of *Mystus cavasius* in captivity has been achieved, and growth and survival of different stages of fish with different live feed and stocking density have been investigated.
- On-boat Breeding of Hilsa (*Tenualosa ilisha*) and rearing of different stages of fish was successfully carried out.
- The Rahara Centre of ICAR-CIFA successfully completed broodstock development, domestication, biometric characterization, feed, and health monitoring of the spiny eel, *Macrognathus pancalus*.
- Long photoperiods with higher light intensities (1500 lux) and neutral photoperiods with 500 lux light intensities encourage increased gonadal maturation and improved reproductive output in *Ompok bimaculatus*.
- Pond cultured *L. kontius* attained first maturity at one and half years of age and was successfully induced bred for the first time using sGnRH (0.5ml/kg body weight) to both males and females.
- The ornamental fish melon barb (*Haludaria fasciata*) and mascara barb (*Dawkinsia assimilis*) were successfully bred in captivity.
- Various experiments in a geomembrane biofloc tank were used to investigate the gender orientation pattern of tilapia.
- Protocol for designer nucleus preparation and rearing of mussel was optimised to produce quality designer pearl.
- Infrastructure for Biofloc facility has been created which includes 12 tanks (6 nos - 5.0 m dia; 6 nos - 4.0 dia) in indoor and 6 tanks in outdoor system.
- Two models of Nutrient Film Technique (NFT) aquaponic systems have been created.
- The development of a 3D model study of many components of the scampi hatchery setup has been accomplished.
- Induced breeding and seed production of Organic Indian Major Carps, (IMC) using Pituitary extract was carried out.
- Study demonstrated that the use of glucose and citrate as carbon source, the nitrogen (ammonium-N) and nitrate removal capacity of the *Pseudomonas aeruginosa* isolate WS L-9 were more than 80 % and 60% respectively after 48 hours.
- Carp farming and pangasius farming systems in Chhattisgarh, Andhra Pradesh, and Odisha were studied using a life cycle analysis (LCA).
- Impact of production factors and constraints in Pacu culture in Andhra Pradesh was demonstrated.
- Impact of sailfin catfishes (*Pterygoplichthys* spp.) on zooplankton diversity and abundance of invaded ecosystem was demonstrated.
- In rohu embryos, glyphosate at sub-lethal concentrations caused morphological abnormalities such as yolk sac oedema,



- pericardial oedema, abdominal curvature, tail kink formation, haemorrhage, and delayed development.
- Designing of airlift aeration system and estimation of SAE value and water pumping capacity for intensive fish production system was undertaken.
  - Using a combination of Zn and Fe up to 0.10 ppm Zn + 0.20 ppm Fe to increase the growth of Jayanti rohu in a concrete rearing system is helpful.
  - Azolla and Pistia were found to suppress Microcystis population development.
  - In total, 58 full-sib families of improved rohu (Jayanti) (2021 year class, 12<sup>th</sup> generation) and 33 full-sib families of improved catla (3<sup>rd</sup> generation) were produced along with resistant and control line of rohu against *A. hydrophila*.
  - Grow-out rearing of 12<sup>th</sup> Generation of CIFA-GI Scampi with survival rate 66.4% was demonstrated.
  - *De novo* transcriptome assembly generates 14,02,926 contigs with average contig length of 525bp and assemble quality was assessed using BUSCO with 57% completeness in rohu.
  - In total ~ 140 GB of sequence data was generated and genotyping calling using STACKS software generated genotyping data for ~20000 high quality SNPs in *Catla catla*.
  - The 19-mer peptide antigen of *Argulus siamensis* was used for vaccine development against argulosis in carps.
  - The role of SREBP (Sterol regulatory element-binding protein) in the regulation of fatty acid biosynthesis in rohu was studied.
  - Level and Pattern of Genetic Variabilities in Carp hatcheries of Odisha and West Bengal was studied.
  - The fingerlings of *Hypselobarbus pulchellus* had a dietary protein need of between 31.80 and 32.76 percent, according to the study.
  - The study indicated that dietary lipid levels of 2.5 to 10% have same effect on the growth of *H. pulchellus*, but, levels beyond 7.5% have negative effect on carcass protein content and protein digestibility. *H. pulchellus* seems to require lower dietary fat levels.
  - Using two strains of microorganisms, *Saccharomyces cerevisiae* and *Bacillus subtilis*, solid state fermentation of mahua oil cake was carried out, and it was found that gut enzyme activity, such as alpha amylase and protease, was increased in rohu fed on 40% mahua oil cake.
  - Study demonstrated that 50% replacement of FM with BSF larvae meal, *Hermetia illucens* did not affect growth, nutrient utilization, and whole body composition in *Channa striata* fingerlings.
  - Moringa leaf meal can be safely added into the diet up to 15% without influencing *H. pulchellus* growth and carcass proximate composition.
  - In the striped murrel, *C. striata*, ELISA hormone profiling of testosterone, estradiol, progesterone, Follicle-Stimulating Hormone (FSH), and Luteinizing Hormone (LH) revealed a substantial difference between the treatment groups in the pre-spawning, spawning, and post-spawning seasons.
  - Survey and disease investigation were carried out in various fish farms located in different districts of Odisha, Andhra Pradesh, Karnataka and West Bengal and the causative organisms were identified and advisory and suggestive measures for various diseases were provided to the farmers and entrepreneurs.



- The economic loss was noted to be more in carp culture (15-20%) compared to pangasius culture (5-10%) during COVID19 period in Andhra Pradesh & Odisha.
- Non-specific immune response in rohu, *Labeo rohita* after administration of Florfenicol medicated feed was studied.
- Under National Referral laboratory, two cases of *Aeromonas veronii*, one of *Enterobacter cloacae*, one of *Argulus siamensis*, one of *Paradactylogyrus catlaius*, one *A. hydrophila*, one CEV, and one case of *Cichlidogyrus* spp. were diagnosed using level III diagnosis.
- Under ICAR Network programme on Antimicrobial resistance (AMR) in Fisheries & Aquaculture, 239 freshwater fish farms were surveyed from Odisha and Andhra Pradesh and the samples were processed for Antibiotic Resistance pattern (AST) analysis and data were analysed using WHONET 5.6 software following CLSI guidelines.
- Study showed that continuous administration of alginate-chitosan encapsulated *L. plantarum* SM33 supplemented diet for 60 days ensured establishment of a significant ( $P < 0.05$ ) viable count of  $10^8$  CFU/g of LAB in the intestine of host, rohu and provide better immunity against *Aeromonas hydrophila*.
- Study on antibacterial activity of selected gut bacteria against fish pathogens was carried out.
- Extracts of medicinal plant *Andrographis paniculata* (green chiretta) @ 3% (v/v) was found effective to control *Argulus* infestation, both by oral and bath treatment.
- A host range study of TiLV using different barbs and cichlids was studied by the co-habitation method and found that *Puntius ticto* and *Amatitlania nigrofasciata* (Convict cichlid) were susceptible to TiLV.
- Rohu perforin 1a-like full length cDNA (2004 bp) was sequenced and its open reading frame analysis resulted in 574 aa which is having 75.96% blastp identity to *D. rerio* perforin 1-like protein.
- The presence of transcription factors like CACCC box, homeobox domains (Cdx), CCCTC-binding factor (CTCF), GATA family, HATH1 and Sp1 family and immune cell-specific transcription factors like Oct-1, HNF-1, FOXD3, Pax-6 were obtained in rohu mucin 2 sequence.
- Farmers' Producers Organizations (FPOs) in freshwater aquaculture were evaluated critically in the Kendrapara and Khordha districts of Odisha.
- An index was developed to measure women's empowerment in aquaculture.
- Three cemented carp hatcheries and two FRP carp hatcheries were established for developing aquaculture clusters in Nabarangpur district and Twenty live fish vending units were provided to beneficiaries to sell fresh fish.
- Shri Giriraj Singh ji, Hon'ble Union Minister for Fisheries, Animal Husbandry, and Dairying, launched the MATSYA SETU on 06.07.21 and 28342 stakeholders from all over the country have downloaded the app.
- Major events such as 'Azadi Ka Amrit Mahotsav' to commemorate India's 75<sup>th</sup> anniversary of independence and a series of virtual lectures by domain experts were organized during the year.
- "Indian Ornamental Fisheries 2.0-The Way Forward" was organized to boost ornamental fish production in collaboration with Department of Fisheries, MoFAHD, GoI.



- For 2701 beneficiaries, KVK-Khordha provided 78 trainings on issues connected to agriculture and related sectors for farmers, farm women, rural youth, and extension officers.
- Six new Aquaculture Field Schools (AFS) have been created in different areas across the country. ICAR-CIFA has signed 12 Memorandums of Understanding with other organisations to share the institute's research and development achievements.
- In collaboration with state government agencies and local NGOs, the North-Eastern Region Development Programme including aquaculture as a component was implemented in six states: Assam, Arunachal Pradesh, Manipur, Mizoram, Nagaland, and Sikkim.
- Several training and input distribution activities were conducted in Odisha, West Bengal, Andhra Pradesh, Telangana, and Rajasthan as part of the Institute's SCSP programme, with vital inputs like seed, feed, lime, net, crates, and weighing balances being distributed to SC beneficiaries.



## 2. Budget (2021-2022)

### a) Institute (Rs. in lakhs)

(upto 31.03.2022)

Items	Total allocation (Govt. grant + IRG)	Expenditure out of Govt. grant+IRG
Govt. grant	4701.31	4701.31
Internal Revenue Generation (IRG) from ICAR	41.78	41.78
<b>Total</b>	<b>4743.09</b>	<b>4743.09</b>

### b) Revenue generated (Rs. in lakhs)

Source	Amount
Farm produce	2.63
Sale of fish and poultry	13.91
Sale of vehicle/other machine tools	19.16
Sale of publications	0.19
Licence fee/water charges	11.83
Analytical testing fee	0.50
Cost of tender forms	0.41
Services rendered	2.10
Training	20.62
Miscellaneous	37.62
<b>Total</b>	<b>108.97</b>
Recoveries of loans & advances	3.37
<b>Grand Total</b>	<b>112.34</b>

## 3. Staff position (as on 31.12.2021)

Category (Scientific)	Sanction	In Position	Vacant
Director	1	0	1
Head of Division	4	0	4
Principal Scientist	3	1	2
Senior Scientist	14	09	5



Scientist	58	59	-1
<b>Total</b>	<b>80</b>	<b>69</b>	<b>11</b>
<b>Category (Technical)</b>	<b>Sanction</b>	<b>In Position</b>	<b>Vacant</b>
Sr. Tech. Officer (T-6)	4	0	4
Technical Assistant (T-3)	23	14	9
Sr. Technician (T-2)	3	3	0
Technician (T-1)(including Driver)	22	10	12
<b>Total</b>	<b>52</b>	<b>27</b>	<b>25</b>
<b>Category (Administrative)</b>	<b>Sanction</b>	<b>In Position</b>	<b>Vacant</b>
CAO	1	1	0
Sr. AO	0	1	-1
AO	2	0	2
AAO	6	6	0
Assistant	17	6	11
Upper Division Clerk	6	3	3
Lower Division Clerk	6	6	0
<b>Category (Finance)</b>	<b>Sanction</b>	<b>In Position</b>	<b>Vacant</b>
CF&AO	1	0	1
F&AO	1	1	0
<b>Category (Steno)</b>	<b>Sanction</b>	<b>In Position</b>	<b>Vacant</b>
Principal Private Secretary	1	0	1
Private Secretary	2	2	0
Personal Assistant	3	1	2
Security Officer	1	1	0
<b>Total</b>	<b>46</b>	<b>28</b>	<b>18</b>
<b>Category (Skilled Support Staff)</b>	<b>Sanction</b>	<b>In Position</b>	<b>Vacant</b>
<b>SSS</b>	<b>70</b>	<b>50</b>	<b>20</b>
<b>Grand Total</b>	<b>248</b>	<b>174</b>	<b>74</b>


**Staff position of KVK, Khordha (as on 31.12.2021)**

Category	Sanction	In position	Vacant
Sr. Scientist & Head, KVK	1	0	1
Subject Matter Specialist	6	4	2
Programme Assistant	3	2	1
Driver	2	2	0
Assistant	1	0	1
Jr. Steno-III	1	1	0
SSS	2	2	0
<b>Total</b>	<b>16</b>	<b>11</b>	<b>5</b>

**4. Research Projects**

- a) Institute-based : 29
- b) Externally-funded : 40
- c) DST Women/DST Inspire : 01
- d) Contract Research : 01
- e) Emeritus Scientist Scheme : 01

**5. Training programmes conducted**

Level	No. of programmes	No. of participants
National	40	6682
International	-	-
<b>Total</b>	<b>40</b>	<b>6682</b>

**6. Human Resource Development**

- a) No. of persons trained at national level : 06
- b) No. of persons trained at international level : 04 (virtual)
- c) No of persons trained (in house) : 21 (ministerial staff up to the level of AAO & AF&AO) and 135 Casual labours



### 7. Conference/Seminar/Webinar/Workshops organized

National : 05

International : -

### 8. Participation in symposia/seminars/workshops/webinar, etc.

Level	No. of participants
National	85
International	25

### 9. Central Instrumentation Facility

An infrastructure facility has been created as 'Central Instrumentation Facility' to facilitate the research activities in the institute. At present the following major instruments are available in this facility:

Sl.No.	Instrument	Make
1	Ultra deep freezer (-80 °C)	Newbrunswick, Eppendorf
2	Thermocycler	PEQ-Lab
3	Fluorescent microscope	Zeiss
4	Gel Documentation System with Chemiluminescent	Syngene
5	Shaker incubator	Scigenics biotech
6	Compound microscope	Olympus
7	Ice flake machine	Brema ice makers
8	ELISA reader	Accureader
9	Spectrophotometer	Analytical technologies
10	Water purification system	Merck Millipore
11	Sonicator	Ningbosjialab equipments
12	Freeze Dryer (Lyophilizer)	Ningbosjialab equipments
13	Electrophoresis unit (horizontal and vertical)	Genaxy
14	Automatic cell counter	Biorad
15	Nanodrop	Nabi microdigital



## 10. Seed production

Sl.No	Species	Spawn (in lakhs)
1	Jayanti Rohu ( <i>Labeo rohita</i> )	119.00
2	<i>Labeo rohita</i>	44.70
3	<i>Catla catla</i>	19.01
4	Improved Catla ( <i>Catla catla</i> )	17.50
5	<i>Labeo calbasu</i>	21.00
6	<i>Cirrhinus mrigala</i>	10.14
7	<i>Cirrhinus reba</i>	4.50
8	<i>Labeo bata</i>	2.50
9	<i>Labeo fimbriatus</i>	10.00
10	<i>Labeo kontius</i>	0.50
11	<i>Hypselobarbus pulchellus</i>	0.88
12	<i>Osteobrama belangiri</i>	7.26
Sl.No	Species	Fry (in lakhs)
1	<i>Anabas testudineus</i>	1.16
2	<i>Channa marulius</i>	0.40
3	<i>Channa striata</i>	0.90
4	CIFA GI Scampi	0.82 lakhs PL
5	<i>Clarias magur</i>	0.85
6	<i>Clarias dussumieri</i>	0.07
7	<i>Mystus cavasius</i>	1.10
8	<i>Pangasianodon hypophthalmus</i>	1.50
9	<i>Heteropneustes fossilis</i>	1.70
10	<i>Puntius gonionotus</i>	0.62
11	<i>P. carnaticus</i>	0.015
12	Tilapia	0.20
13	Koi carp	0.50



## 1. INTRODUCTION

The ICAR-Central Institute of Freshwater Aquaculture had its modest beginning as the Pond Culture Division of the ICAR-Central Inland Fisheries Research Institute, which was established at Cuttack, Odisha in 1949. The Division was later upgraded as the Freshwater Aquaculture Research and Training Centre (FARTC) in 1976 with UNDP/FAO assistance. Further, the Centre attained the status of an independent Institute under the organization plan of ICAR in 1986, and the functional existence of the Institute came into effect from 1<sup>st</sup> April, 1987.

The Institute has comprehensive mandate of research, training, education and extension in different aspects of freshwater aquaculture. With the largest freshwater farm in the country comprising over 380 ponds of assorted sizes and yard facilities at Kausalyaganga, Bhubaneswar, the Institute is undertaking researches on diversified indigenous freshwater fish and shellfish species like carps, catfishes, murrels, freshwater prawns and pearl mussel. In addition to food fishes the institute is also working on indigenous freshwater ornamental fishes. The Institute possesses hatcheries and seed rearing facilities for

the above species, and fully equipped laboratories in the disciplines of finfish and shellfish breeding and culture, pearl culture, aquatic chemistry, microbiology, fish physiology, nutrition, genetics, biotechnology and pathology.

The Institute has four Regional Research Centres operating in different parts of the country to cater to the specific needs of the regions, viz., Regional Research Centre, Rahara (West Bengal); Regional Research Centre, Bengaluru (Karnataka); Regional Research Centre, Vijayawada (Andhra Pradesh); and Regional Research Centre, Bathinda (Punjab).

The Institute is recognized as the Regional Lead Centre on Carp Farming under the Network of Aquaculture Centres in Asia-Pacific (NACA), which is an inter-governmental organization. A Depository Library of the Food and Agricultural Organisation (FAO) of the United Nations is also operational at the Institute. The ICAR-CIFA works closely with many government organizations like Department of Animal Husbandry, Dairy and Fisheries (DAHD&F) and National Fisheries Development Board (NFDB) of Government of India.

### MANDATE

- Basic and strategic research for the development of sustainable culture systems for freshwater finfish and shellfish.
- Species and systems diversification in freshwater aquaculture.
- Human resource development through training, education and extension.

### VISION

Making Indian freshwater aquaculture globally competitive through eco-friendly and economically viable fish production systems for livelihood and nutritional security

### MISSION

Excellence in research for developing sustainable and diversified freshwater aquaculture practices for enhanced productivity, quality, water use efficiency and farm income.



Name & address of the Institute

ICAR-Central Institute of Freshwater Aquaculture  
Kausalyaganga, Bhubaneswar - 751 002, Odisha, India

a) Headquarters

Kausalyaganga, Bhubaneswar - 751 002, Odisha

b) Regional Centres

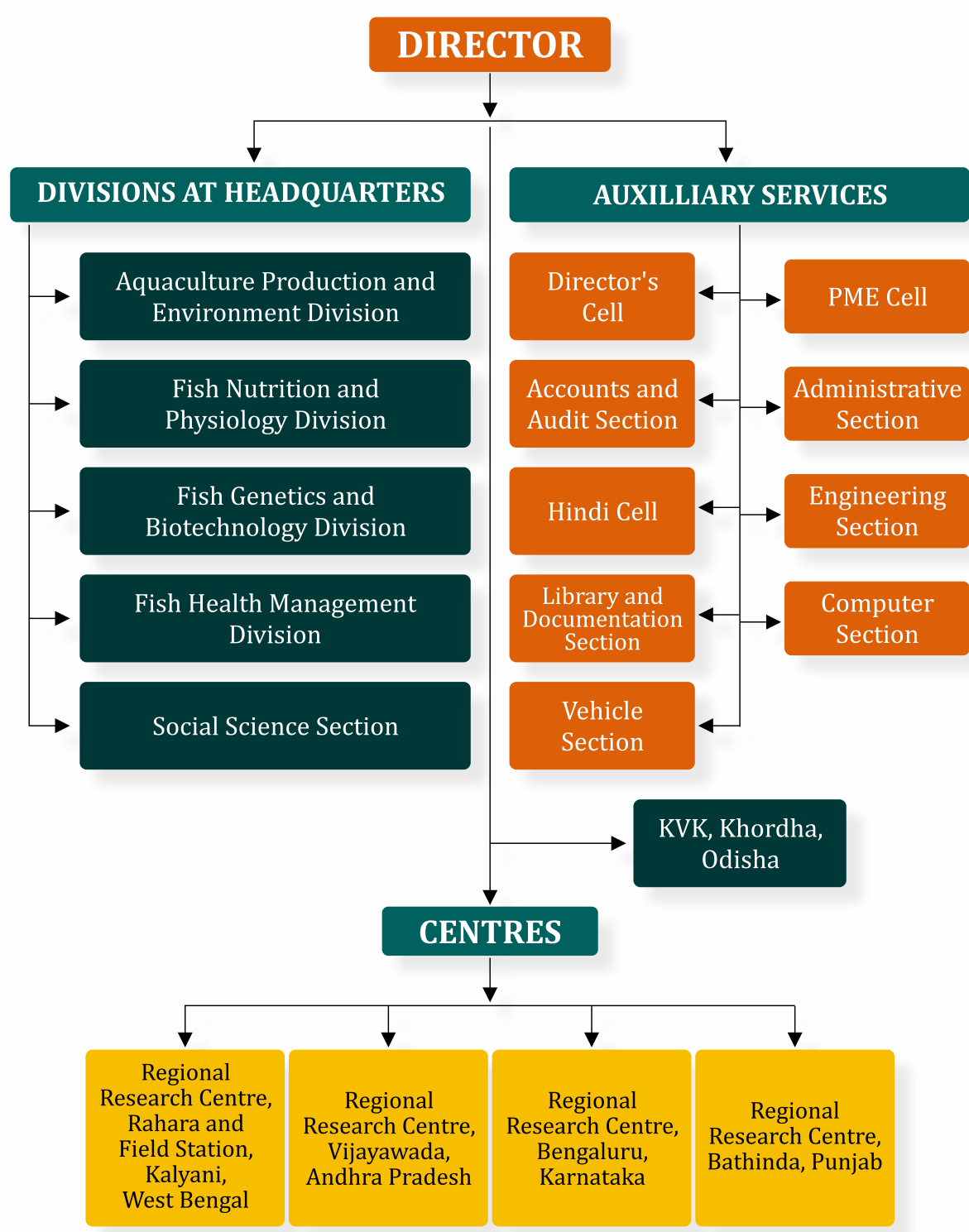
- i) Regional Research Centre  
Rahara Fish Farm, Rahara - 743 186, West Bengal  
(Field Station of RRC, Rahara: A/5, Phase-III Santhalpara, Nadia, Kalyani - 741 235, West Bengal)
- ii) Regional Research Centre  
Hessarghatta Lake, Bengaluru - 560 089, Karnataka
- iii) Regional Research Centre  
Penamaluru Fish Seed Farm, Penamaluru, Vijayawada - 521 139, Andhra Pradesh
- iv) Regional Research Centre  
Fish Market Complex, Jodhpur Romana, Bathinda - 151 001, Punjab

c) KVK

Krishi Vigyan Kendra (Khordha)  
Kausalyaganga, Bhubaneswar - 751 002, Odisha



# ICAR-CIFA ORGANOGRAM





## 2. RESEARCH ACCOMPLISHMENTS

### 1. SPECIES AND SYSTEM DIVERSIFICATION

#### A. BROODSTOCK DEVELOPMENT AND DOMESTICATION

**Project: Standardization of broodstock development and seed rearing of striped murrel, *Channa striata* in recirculatory system (I-109)**

#### **Successful induced breeding of striped murrel, *Channa striata* broodstock raised in the re-circulatory aquaculture system (RAS)**

The adult striped murrel (300-550 g) were stocked in the re-circulatory aquaculture system (RAS) to evaluate the effect of varied stocking densities on gonadal development and its spawning performance during November 2020. The stocking densities were of 0.5 (T1), 1.0 (T2), and 1.50 (T3). Fishes were reared in RAS until the next breeding season (August 2021). The highest

gonadosomatic index (GSI) by both the male ( $0.20 \pm 0.01$ ) and female ( $4.88 \pm 0.06$ ) striped murrel was observed in T1 during the breeding season (May 2021). The RAS raised brooders of size 400-500 g were taken for the induced breeding trials from all the treatment groups during the pre-breeding (March-April 2021) and monsoon breeding (May-August 2021). During the pre-breeding season, only the T1 group positively responded with fertilization rate and hatching rate of 86% and 58% respectively. During the breeding season, experiments were undertaken and the different treatment groups responded as follows: T1 (fertilization 85-97%; hatching rate: 71.50-94%), T2 (fertilization: 78-97%; hatching rate: 62-96%) and T3 (fertilization: 75-94%; hatching rate: 53.5-94%).

#### **Effect of elevated temperature on hatching percentage and survival of *Channa marulius* larvae**

An experiment was conducted to know the adverse effect of elevated temperature on embryonic development, egg hatching, and larval survival of *C. marulius*. The different temperature used for the study were  $28 \pm 1^\circ\text{C}$  (T1),  $30 \pm 1^\circ\text{C}$  (T2),  $32 \pm 1^\circ\text{C}$  (T3),  $34 \pm 1^\circ\text{C}$  (T4),  $36 \pm 1^\circ\text{C}$  (T5) and  $38 \pm 1^\circ\text{C}$  (T6). The results showed a significantly higher percentage of hatching rate in T1 (95.67%), followed by T2 (82.67%) and T3 (81.33%). However, eggs in T5 and T6 could not hatch. Deformities during embryonic development were observed at higher temperature which led to the failure in hatching. All groups (T1, T2, T3 and T4) that hatched were reared further for three weeks at normal water temperature to observe the survival and growth. After three weeks of rearing, the survival rate was found to be highest at  $28 \pm 1^\circ\text{C}$  (95.54%) followed by  $30 \pm 1^\circ\text{C}$  (92.95%).





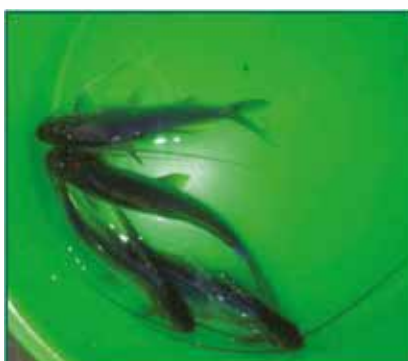
### B. BREEDING AND SEED PRODUCTION TECHNOLOGY

**Project: Protocol development for breeding and seed rearing of *Mystus cavasius* in captivity (I-101)**

#### Induced breeding of *Mystus cavasius*

*Mystus cavasius* is a medium sized freshwater bagrid catfish species having high consumer preference and market demand in India. The

breeding and seed production technologies of *Mystus cavasius* has been successfully standardized by ICAR-CIFA. The broodstock size of 20-60 g selected for induced breeding study. Male and female brooders were induced with synthetic GnRH based hormone (Ovatide™) at 1.0-1.5 ml per kg body weight. Total fecundity of 12000-48000 nos were estimated and the fertilization and hatching rates were observed in the range of 78-90%



*Mystus cavasius* broodfish



Female and male – brood fish



Sacrificing male for sperm suspension preparation



Egg stripping



Stripped egg / Fertilization



*Mystus cavasius* fingerlings

and 64-82%, respectively.

#### Natural breeding

An experiment was conducted to ascertain the effect of broodstock size on the reproductive performance of *M. cavasius* under natural breeding condition. Male and female brooder size of 20 to 40 g were grouped into two groups (B-23 g; B-36 g) and the brooders were injected with Ovatide™ at dose of 1.0

ml per kg brooder. Breeding tanks were provided with aeration and aquatic plants to create the natural environment for breeding courtship. Brooders were stocked at 2 males: 1 female ratio and the injected at evening hours. Spawning was observed after 10-12 hours of hormonal injection. The fecundity was observed relatively higher for bigger sized brooders (B-36 g) compared to smaller (B-23 g) brooders (Fig 1). The fertilization

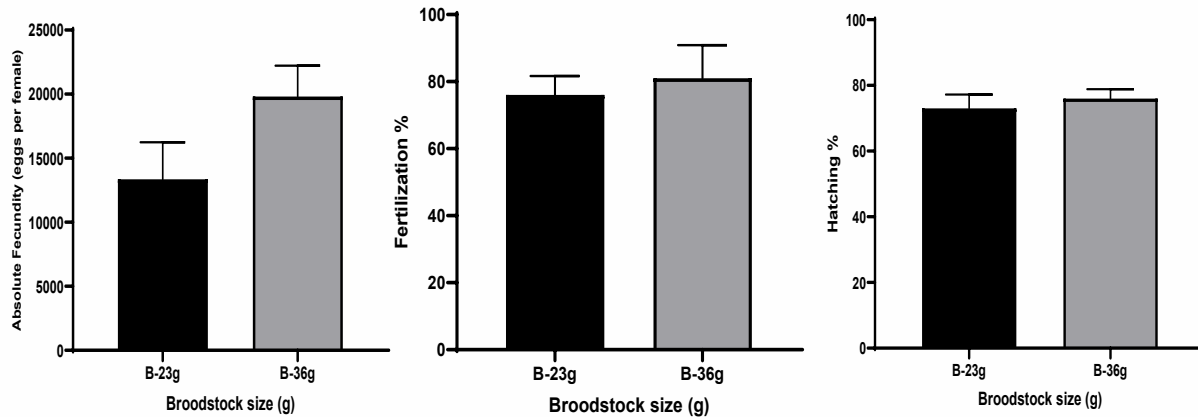


Fig. 1. Effect of broodstock size on reproductive performance of *Mystus cavasius* under natural breeding condition

and hatching rate were not significantly affected by the broodstock size. This study recommends that broodstock size above 20g could be used for induced breeding operation and quality seed production.

### Effect of various live feeds on growth and survival of *M. cavasius* larvae

An experiment was conducted to ascertain the best live feed to improve the growth and survival in *M. cavasius* larvae. The 4 days post hatching (dph) larvae were stocked at 20 nos per tank and the study was carried out for 21 days. Three different live feeds were used in this study such as *Artemia* nauplii, tubifex and mixed plankton. It was observed that *M. cavasius* larvae fed with tubifex worms as live feed had significantly ( $p < 0.05$ ) higher body weight and survival rate compared to

other live feeds (Fig. 2). It is recommended that tubifex worms could be an excellent live feed to improve the growth and survival of *M. cavasius* larvae.

### Standardization of weaning protocol for *M. cavasius* larvae

The weaning protocol for *M. cavasius* larvae was studied for 21 days. Larvae were weaned to formulated feed at 10 dph, 15 dph and 20 dph. The finding clearly indicates that the *M. cavasius* larvae needs live feed until 15 dph as weaning to formulated feed from 15 dph resulted in higher growth and survival.

### Effect of stocking density on growth and survival of *M. cavasius* larvae

An experiment was conducted to evaluate the effect of stocking density on the growth and survival of *M. cavasius* larva. 4 dph larva were stocked at 5, 10, 15 and 20 larvae/L and reared under indoor laboratory conditions. The larva were fed with *Artemia* nauplii at *ad libitum*. After three weeks of rearing, the larva stocked at 5 larva/L showed the highest growth and survival, whereas the larvae reared at 15 or 20/L density showed survival of 27% and 39%, respectively. The stocking density up to 10 larva/L may be considered to get more fry as it showed an average survival of more than 50%.

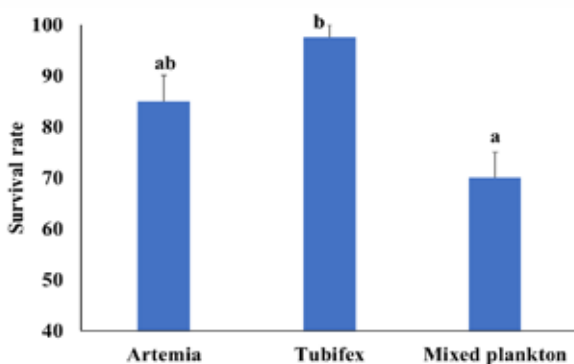


Fig. 2. Live feed



### Effect of stocking density on growth and survival of *M. cavasius* fry

An experiment for a period of two months was conducted at variable stocking density of *M. cavasius* (50, 100, 200, 300, 400 nos per m<sup>2</sup>) to evaluate the growth performance of fry. The *M. cavasius* fry initial average length and weight were measured 1.66 cm and 32.58 mg, respectively. The fry were fed at 5% of body weight with crumbled feed containing 32% crude protein and 7% crude lipid twice a day. The study findings revealed that fry reared under 50 and 100 nos per m<sup>2</sup> showed highest body weight and survival, whereas fry reared in higher densities 200, 300 and 400 per m<sup>2</sup> had lower survival rate (Fig 3). The result indicates that 50-100 nos per m<sup>2</sup> would be the ideal stocking density to produce fingerlings and further increase in densities leads to reduced growth and survival in *M. cavasius* fry.

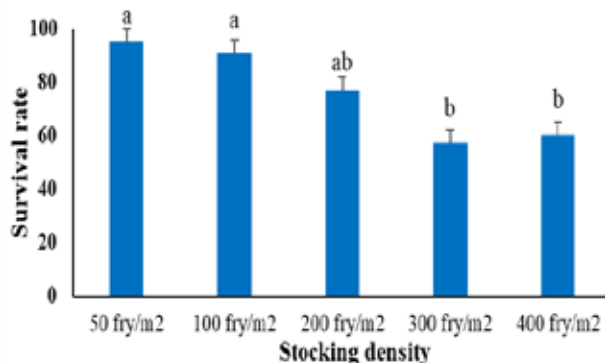


Fig. 3. Stocking density

### Effect of stocking density on growth and survival of *M. cavasius* fingerlings

An indoor laboratory experiment was conducted to evaluate the effect of two density levels (5 and 10/m<sup>2</sup>) on growth and survival of *M. cavasius* in 16 m<sup>2</sup> cement tanks for the period of 90 days. It was observed that high density (10/m<sup>2</sup>) stocking resulted in lower growth. The growth was found to be significantly higher for fish reared under lower stocking density (5/m<sup>2</sup>).

### Project: Captive breeding of hilsa, *Tenualosa ilisha*: Phase-II (E-135)

#### On-boat breeding of hilsa

Hilsa (*Tenualosa ilisha*) was successfully bred in Hooghly River through dry stripping method during February, 2021. The fertilized eggs were transported to Rahara centre and successfully hatched in cemented carp hatcheries, where 2.0 lakh hilsa spawn (4-d old larvae) were produced.

#### Rearing of larvae to fry

Larval rearing of hilsa was conducted at RRC, Rahara in circular FRP tanks (800 L water volume) at three stocking densities (250, 400 and 600 nos./m<sup>3</sup>). The larvae were fed with chlorella, rotifers, mixed zooplankton and supplementary feed for fry production. After 44 days of rearing, the survival rate was observed to be 41, 53 and 40%, respectively at three different stocking densities



#### Rearing of fry to fingerlings

Hilsa fry produced in FRP tanks were further stocked at the density of 2 lakh/ha in a rectangular cement cistern (0.006 ha) with soil base for production of fingerlings. Fry were reared for 4 months during April to August 2021. During this rearing period fry grew to 66 mm/2.52 g from the initial stocking size of 19.6 mm/0.06 g with 44%



survival rate. Fish were fed once/day with mixed zooplankton and twice/day with supplementary feed (45% CP and 10% fat) *ad libitum*.

### Rearing of hilsa fingerlings in pond

Early fingerlings (66 mm/2.52 g) of hilsa were stocked in two earthen ponds (0.1 and



0.4 ha) at a stocking density of 600 and 2000 per ha, respectively. The fingerlings were provided with plankton and supplementary feed at 5% of the body weight twice a day. Hilsa grew to 158 mm/37.6 g and 148.5 mm/36.15 g in four months.

**Project: Breeding, seed rearing and culture of barred spiny eel, *Macrognathus pancalus* (Hamilton, 1822). (I-121)**

**Morphology and length-weight relationship of *M. pancalus*, collected from wild**



*Macrognathus* species were collected from nearby water bodies and their meristic and morphometric characteristics and the length-weight relationships (LWR) were studied. Based on the meristic and morphometric characters, among ten *Macrognathus* spp. reported from India so far, two species

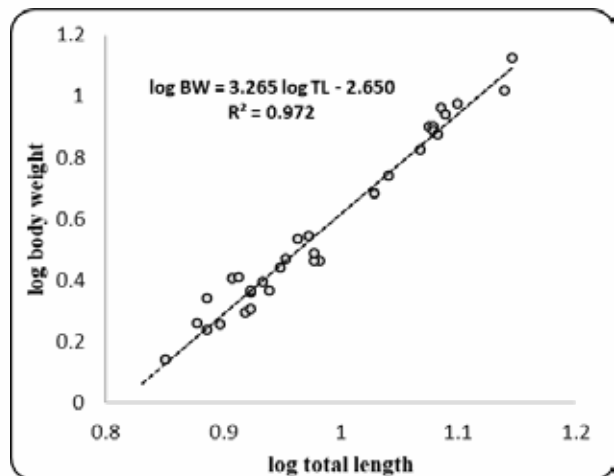


Fig 4. Length-weight relationship of *M. pancalus* collected from natural sources



have been confirmed from the collected samples viz., *M. pancalus* and *M. aral*. The length-weight relationships of *M. pancalus* (minimum 7.1 cm and maximum 14.0 cm) were calculated using the expression:  $\text{Log } W = \log a + b \log L$ , where  $W$  is the body weight in grams,  $L$  is the total length in cm,  $a$  is a coefficient related to body form, and  $b$  is an exponent. The  $b$  value (3.265) of the LWR indicated positive allometric growth (Fig.4).

**Brooder collection, stock development and biology**

A total number of 32 brooders including both males and females were collected and stocked in rectangular FRP tanks. Out of 32 brooders stocked for acclimatization, the average length of the fishes collected from wild was  $16.65 \pm 2.47$  cm and weight was  $23.36 \pm 5.43$  g. The condition factor ( $k$ ) ranges from 0.53 to 1.12, it indicate that the fish species were in good condition. The hepatosomatic index (HSI) value ranges from 0.90 to 1.39. The gonado-somatic indices (GSI) ranged from 8.49 to 11.4 in the collected

fish. In September, another broodstock of *M. pancalus* of 179-186 mm/23.2-24.4 g was examined to study its gonadal maturation that showed a total weight of 0.30 - 0.45 g of two ovaries with 380-393 no. of eggs/g of ovary weight.

**Isolation at bacteria from gill and intestine of wild *M. pancalus***

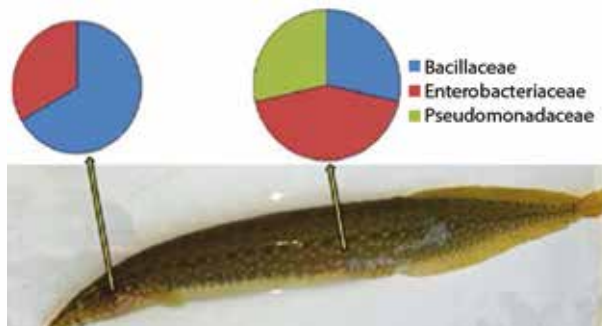
To enumerate the total viable bacterial counts from the gill and intestine, the barred spiny eel were euthanized, whole intestine (foregut, mid gut and hind gut) and gills were removed aseptically, serially diluted and spread plated on TSA for the enumeration of total viable bacterial counts. All the plates were incubated at  $30 \pm 2$  °C for 48 h. The mean values of TVCs of the gills and intestines were  $3.32 \pm 0.22$  log<sub>10</sub> cfu/g and  $4.20 \pm 0.55$  log<sub>10</sub> cfu/g, respectively. Bacteria isolated from gills and intestines from *M. pancalus* collected from wild mainly belong to three family Bacillaceae, Pseudomonadaceae and Enterobacteriaceae. In gill, *Bacillus*



Mature ovary of female *M. pancalus*



Ovary of *M. pancalus*





spp. dominated (66.67%), followed by *Pseudomonas* spp. (33.33%), whereas, in intestine, *Pseudomonas* spp. (42.86%) was the dominated group, followed by *Enterobacter* spp. (28.57%) and *Bacillus* spp (28.57%).

### Natural breeding of *M. pancalus*

Aquatic plants such as *Eichhornia crassipes* and *Pistia strateotes* were kept in brooder tank to simulate natural environment. The



*M. pancalus* eggs attached on *Eichhornia* root



Fingerling of *M. pancalus*

natural breeding of *M. pancalus* occurred in the month of August. They laid fertilized eggs were found adhering on root hairs of aquatic plants. Fertilized eggs were spherical to oval in shape, transparent, demersal, adhesive, yellowish- brown in colour and  $1.51 \pm 0.005$  mm in diameter. Egg yolk is very large and covers almost the entire area of the egg. It was found that  $8.79 \pm 1.13$  (mean  $\pm$ SE) numbers of eggs ranging from 3-23 were attached in each plant. Hatching took place within 48-60 hours. Yolk sac of the larvae is fully absorbed within 2 days after hatching. Cylindrical PVC pipes were used in the rearing tanks for their hideouts. The larvae were fed initially with planktons and later on with tubifex worm and formulated feed.

**Project: Improving broodstock management and quality seed production of *Ompok bimaculatus* through application of molecular endocrinology (E-121)**

### Influence of light intensity and photoperiod on growth, gonadal maturation, hormone profile and reproductive performance of *Ompok bimaculatus*

A study was conducted to assess the effect of light intensity and photoperiod on pabda. Pabda collected from grow-out ponds, acclimatised and a group of 20 fish (1:1) of female and male were then stocked in 0.4 m<sup>3</sup> rectangular tanks covered with black paint coated FRP sheet. The experiment was subjected to six photoperiod treatments: 24:0 light: dark (L:D), 12L:12D, 15L:9D, 9L:15D, 24D:0L and natural conditions for 60 days. Except for full dark and natural conditions, the rest of the photoperiod treatments were conducted with 3 different light intensities (500 lux, 1000 lux, and 1500



lux). The fish were fed a commercial diet (40% crude protein) at a daily rate of 2% of body weight, twice a day, for 60 days.

The difference in mean weight of *O. bimaculatus* among the treatment groups was not statistically significant ( $P>0.05$ ) at 30 d post experiment. The highest final body weight gain, average daily gain, specific growth rate (SGR), and feed conversion ratio (FCR) were observed in 15L:9D photoperiod at 500 lux intensity on 60d. However, the weight gain differed significantly ( $P<0.05$ ) in day-60 and was significantly higher ( $P<0.05$ ) than day-30 in all the treatment groups. After 30 and 60 days of exposure in discrete photoperiod conditions, the mean gonado-somatic index (GSI) values had a significant difference among treatments ( $p < 0.05$ ) in both sexes. In females, the highest GSI was recorded in the 0L:24D group followed by 15L:9D photoperiod at 500 lux intensity on 60d. The mean value of GSI in the fishes exposed to 12L:12D with higher light intensity (1000 and 1500 lux) found to be lowest on 60 days post experimentation. The mean GSI value of females exposed to 24L:0D photoperiod in 60 days has seen to be doubled compared to 30 days post experimentation. In females and males, the highest hepato-somatic index (HSI) was observed in 12L:12D at 1000 lux intensity and 0L: 24D photoperiod on day 60. The results of the study showed that GSI had an inverse relationship with HSI in *O. bimaculatus*.

The effects of photoperiod on circulating levels of testosterone (T) and 11-keto testosterone (11-KT) was assessed. In Females, the highest level of testosterone ( $9.05 \pm 0.03$  pg/ml) and 11-keto testosterone ( $4.56 \pm 0.03$  pg/ml) was observed in 12L:12D

photoperiod at 1000 lux light intensity. Testosterone levels slightly decreased in dark conditions. In males, the higher concentration of testosterone ( $10.48 \pm 0.05$  pg/ml) and 11 keto testosterone ( $4.57 \pm 0.03$  pg/ml) was achieved in 9L: 15D and 15L:9D photoperiod at 1000 lux intensity. Interestingly, irrespective of photoperiod conditions, the light intensity of 1000 lux had overall higher testosterone concentration than other light intensity tested. No significant difference ( $P>0.05$ ) was found in the level of testosterone among sexes. The results showed that the photoperiod manipulation stimulates the testosterone production in pabda.

The voluntary captive spawning was observed in treatment groups except control and all photoperiods at 500 lux intensity. Natural captive spawning was observed in 12-18 hours after injecting synthetic hormone Ovasis™ (USV Private Limited, India). The hatching time varied between the treatments. In 12L:12D photoperiod conditions, the hatching was observed in 10-14 hours, whereas in dark and short photoperiod hatching was observed in 20-26 hours. The results showed that fertilization rate, hatching rate, and survival of *O. bimaculatus* differed significantly ( $P<0.05$ ) between the treatments. The highest and lowest fertilization rate was observed in 12L:12D photoperiod (89%) and 15L:9D photoperiod (30%) at 1000 lux intensity, respectively. The highest mean hatching rate was observed in 24L:0D photoperiod at 1500 lux intensity followed by 24L:0D photoperiod at 1000 lux intensity and 12L:12D photoperiod (at 500 lux intensity). Results of the present study showed that the best survival of larvae was achieved in 24L:0D photoperiod at 1500 lux intensity. Long photoperiods with



higher light intensity (1500 lux) and neutral photoperiod with 500 lux light intensity promote advanced gonadal maturation and better reproductive performance of pabda. From this, it is concluded that an increase in day length is a vital environmental signal, regulating the maturation and spawning of pabda.

**Successful breeding of *O. bimaculatus* without sacrificing males**

Breeding of *O. bimaculatus* without sacrificing the males was tested with pond raised brooders. Two sets comprising



Breeding set



Pabda haul

Hormonal injection

eight brooders in 1:1 ratio was released in different flow-through systems. Females weighing 70 - 179 g were injected with ovatide @ 0.15 ml and males weighing 55 - 78 g @ 0.075 ml per 100 g body weight. In the first system, fish were released directly in the tank and provided continuous aeration. In the second system, a cotton hapa was fixed inside a FRP tank with provision of shower. Physico-chemical parameters of underground water used in each set-up was measured as temperature-24°C, pH-7.6, DO-4 ppm, total hardness 96 ppm and total alkalinity 116 ppm. After about 12-13

hours of hormone injection, three females of second system were responded partially to hormone injection. A total of about 6500 larvae were produced. The fertilization rate recorded was 56%.

**Project: Species diversification in peninsular aquaculture: Strategies for mass seed production of peninsular carps and their successful introduction to aquaculture system (I-111)**

**Successful induced breeding of the peninsular carp *Labeo kontius***

The peninsular carp *Labeo kontius*, commonly called the pig mouth carp or Cauvery carp, is endemic to Western Ghats and is recorded from rivers Cauvery, Bhavani and Moyar and its tributaries in the states of Karnataka, Tamil Nadu and Kerala. Pig mouth carp is reported to attain a maximum size of 61 cm. Under the natural riverine habitat, *L. kontius* is observed to breed once a year during the monsoon season in during June-August.

For captive breeding, broodstock was raised in earthen ponds @ 2000/ha with provision of quality feed (35% protein), regular health checks and management of water quality. Females during breeding season are distinguished by the white and



Female *L. kontius*



Male of *L. kontius*



swollen belly and pinkish vent in contrast to flat belly and release of milt on slight application of pressure near the vent in males. Pond cultured *L. kontius* attained first maturity at one and half years of age and was successfully induced bred for the first time using sGnRH (0.5 ml/kg body weight) to both males and females. Hormone administered brooders were released to the breeding pool of a circular hatchery. Spawning occurred

28 hours post hormone administration. Fertilized eggs were transferred to the hatching pool. Hatching occurred within 20-24 hours of incubation and the spawn that hatched out were transparent, with conspicuous yolk mass and distinct head with transparent eyes. The yolk got completely absorbed and the larvae started feeding on 5 days post hatching.



Fertilized egg



Egg with larval development



1 day post hatch



5 days post hatch

**Standardization of stocking density for fingerling rearing of the Carnatic carp *Barbodes carnaticus* (Jerdon, 1849)**

*B. carnaticus* (Jerdon, 1849), commonly known as Carnatic carp, is a threatened species, endemic to the Western Ghats of India. To establish the optimal stocking density for fry to fingerling rearing, *B. carnaticus* fry (mean length  $0.98 \pm 0.04$  cm; weight  $4.55 \pm 0.04$  mg) were reared in 24 m<sup>2</sup> cement tanks for 90 days at stocking densities of 15, 30, 45, 60, 75, 90, 105 and 120 fish/m<sup>2</sup>. While the length of fish at harvest ranged from 3.55 cm in 120/m<sup>2</sup>

to 6.66 cm in 15/m<sup>2</sup> densities, the weight ranged from 0.48 g in 120/m<sup>2</sup> to 3.53 g in 15/m<sup>2</sup> (Table 1). No difference ( $P > 0.05$ ) in condition factor and survival was recorded between the treatments. While the condition factor ranged between 1.01 and 1.20 in the treatments, the survival ranged between 84.55 to 91.47%. Fish biomass per tank was the highest ( $P < 0.05$ ) under the stocking densities 30 and 45/m<sup>2</sup> indicating the optimal stocking density of up to 45/m<sup>2</sup> fry to fingerling rearing of the species in cement tanks. Mean values in the same column with same superscript do not differ significantly.



Table.1. Growth, survival and biomass (mean  $\pm$  SD; n=2) of *B. carnaticus*

Stocking density (No./m <sup>2</sup> )	Length (cm)	Wt (g)	Condition factor	Survival (%)	Biomass/tank (g)
15	6.66 $\pm$ 0.03 <sup>e</sup>	3.53 $\pm$ 0.13 <sup>f</sup>	1.20 $\pm$ 0.03 <sup>a</sup>	91.47 $\pm$ 3.11 <sup>a</sup>	1166.55 $\pm$ 66.41 <sup>a</sup>
30	6.10 $\pm$ 0.23 <sup>e</sup>	2.56 $\pm$ 0.41 <sup>e</sup>	1.12 $\pm$ 0.05 <sup>a</sup>	91.31 $\pm$ 3.51 <sup>a</sup>	1761.20 $\pm$ 47.22 <sup>b</sup>
45	5.20 $\pm$ 0.54 <sup>d</sup>	1.54 $\pm$ 0.46 <sup>d</sup>	1.07 $\pm$ 0.02 <sup>a</sup>	90.02 $\pm$ 5.61 <sup>a</sup>	1511.86 $\pm$ 54.46 <sup>ab</sup>
60	4.71 $\pm$ 0.14 <sup>d</sup>	1.06 $\pm$ 0.08 <sup>cd</sup>	1.01 $\pm$ 0.01 <sup>a</sup>	87.01 $\pm$ 6.75 <sup>a</sup>	1325.28 $\pm$ 88.65 <sup>a</sup>
75	4.13 $\pm$ 0.11 <sup>c</sup>	0.72 $\pm$ 0.03 <sup>b</sup>	1.03 $\pm$ 0.11 <sup>a</sup>	88.74 $\pm$ 4.82 <sup>a</sup>	1142.54 $\pm$ 55.82 <sup>a</sup>
90	3.97 $\pm$ 0.11 <sup>c</sup>	0.67 $\pm$ 0.12 <sup>ab</sup>	1.07 $\pm$ 0.11 <sup>a</sup>	86.99 $\pm$ 3.74 <sup>a</sup>	1285.37 $\pm$ 90.56 <sup>a</sup>
115	3.79 $\pm$ 0.13 <sup>bc</sup>	0.60 $\pm$ 0.10 <sup>ab</sup>	1.10 $\pm$ 0.06 <sup>a</sup>	87.82 $\pm$ 6.78 <sup>a</sup>	1369.67 $\pm$ 97.33 <sup>a</sup>
120	3.55 $\pm$ 0.14 <sup>ab</sup>	0.50 $\pm$ 0.03 <sup>a</sup>	1.07 $\pm$ 0.23 <sup>a</sup>	85.66 $\pm$ 6.91 <sup>a</sup>	1277.50 $\pm$ 42.45 <sup>a</sup>

Mean values in the same column with same superscript do not differ significantly.

**Effect of stocking density on growth and survival of the Deccan mahseer, *Tor khudree* (Sykes, 1839) during fingerling rearing**

Effect of stocking density on the growth and survival of blue-fin mahseer, *Tor khudree* was evaluated during fingerling rearing. Fry (initial length 1.31 $\pm$ 0.09 cm; weight 9.49 $\pm$ 0.12 mg) were reared for 90 days at

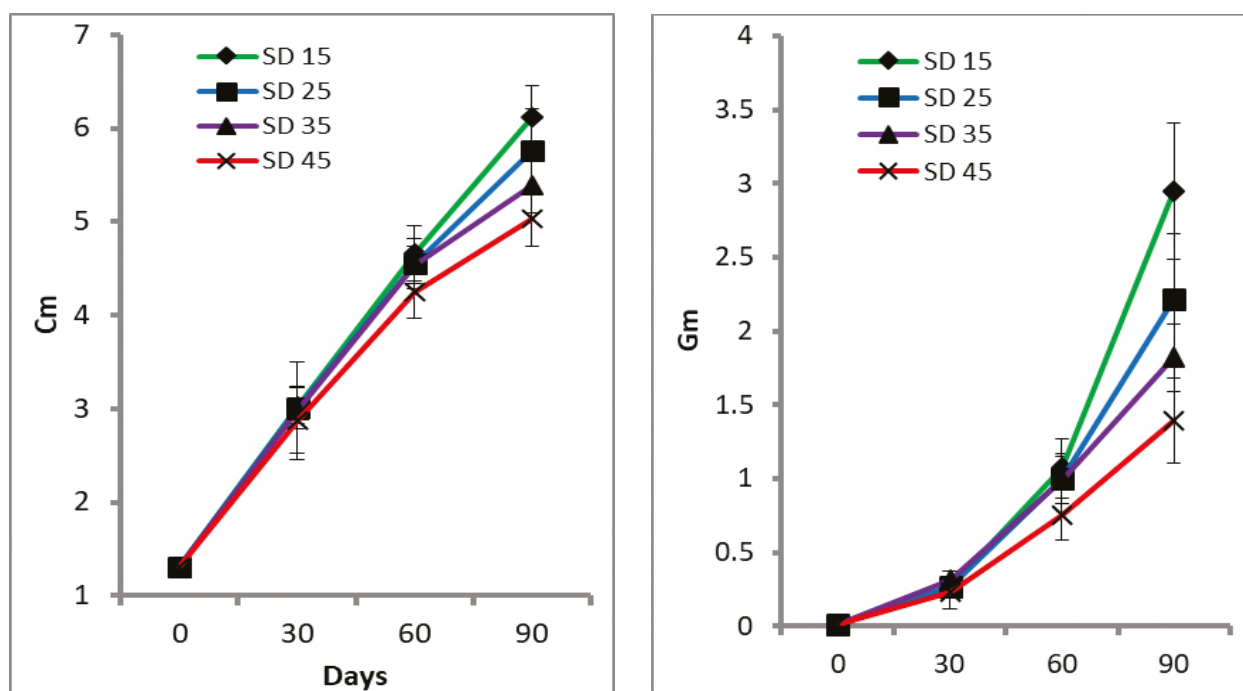


Fig. 5. Length and weight increments of *T. khudree* recorded during the monthly samplings.



stocking densities of 15, 25, 35, and 45 fish/m<sup>2</sup>. The length of fish at harvest ranged from 5.03 to 6.43 cm and weight from 1.39 to 3.47 g (Fig. 5). The mean final length, weight, SGR and condition factor were the highest ( $P<0.05$ ) under 15/m<sup>2</sup> and lowest under 45/m<sup>2</sup> stocking density (Table 2). The condition factor remained above 1 under all the treatments. No significant ( $P>0.05$ )

difference in the survival of fish at harvest was recorded. Fish biomass estimates were higher ( $P<0.05$ ) at higher stocking density. Similar ( $P>0.05$ ) final length and condition factor among the stocking densities 15, 25 and 35/m<sup>2</sup> and the highest fish biomass at 35/m<sup>2</sup> indicated that a stocking density of 35 fry/m<sup>2</sup> as optimal for fry to fingerling rearing.

Table 2. Growth parameters and survival (mean± SD) of *T. khudree* at harvest

Stocking density	Length (cm)	Weight (g)	Specific growth rate (%/day)	Condition factor	Survival (%)	Fish biomass (g/tank)
SD 15	6.43±0.74 <sup>b</sup>	3.47±0.60 <sup>c</sup>	6.37±0.30 <sup>c</sup>	1.27±0.09 <sup>b</sup>	84±6 <sup>a</sup>	890.90±48.67 <sup>a</sup>
SD 25	5.76±0.44 <sup>ab</sup>	2.22±0.44 <sup>b</sup>	5.96±0.19 <sup>b</sup>	1.16±0.15 <sup>ab</sup>	81±8 <sup>a</sup>	1081.14±84.57 <sup>b</sup>
SD 35	5.39±0.29 <sup>ab</sup>	1.82±0.23 <sup>ab</sup>	5.76±0.12 <sup>b</sup>	1.16±0.09 <sup>ab</sup>	82±6 <sup>a</sup>	1252.16±61.25 <sup>c</sup>
SD 45	5.03±0.30 <sup>a</sup>	1.39±0.29 <sup>a</sup>	5.49±0.20 <sup>a</sup>	1.09±0.12 <sup>a</sup>	77±9 <sup>a</sup>	1156.48±57.84 <sup>c</sup>

Figures in the same column with different superscript differ significantly ( $P<0.05$ ).

**Project: Network project on Ornamental fish breeding and culture (NPOFBC)**  
**CIFA Component: Breeding and culture of freshwater ornamental fishes, *Trichogaster chuna* and *Dawkinsia assimilis* (E-123)**

**Captive breeding of melon barb, *Haludaria fasciata* in captivity**

Stock of melon barb, *Haludaria fasciata* (length- 4.9 cm and weight-1.75 g) were collected from Western Ghats and brought to ICAR-CIFA for broodstock development. They were fed with commercial pellet (0.8 mm, 40% CP) and supplemented with tubifex worms. Three initial breeding trials of melon barb were undertaken with 2:1 (Male: Female) ratio. Four sets were stocked in a 1000 litre tank inside a breeding hapa. Aquatic plants were provided to simulate

the natural environment. Average mean body weight of male and female broodstock was 3.5 g and 4.3 g, respectively. Natural spawning was observed in the breeding hapa and the larvae were fed with infusoria for first one week period and followed by zooplankton for 30 days. It was further reared with formulated diet.

**Tank colour on growth and body pigmentation in filament barb, *Dawkinsia filamentosa***

An experiment was carried out in indoor tanks in triplicate having different background colours for 30 days. Experimental fishes



Melon barb

30 days old melon barb



were fed with commercial feed (40% crude protein, 6% crude lipid) twice a day till satiation level. The final body weight was recorded highest in the black colour tank followed by blue, red, green, and white. The black colour tank had the highest specific growth rate (SGR) while the white colour background tank had the lowest SGR recorded. The black colour background tank was recorded the highest survival rate (78.3%) while the white colour background tank found lowest survival rate (56.7%) at

the end of the experiment. Compared to fish reared in blue, green, or red background tank, fish reared in black background tank had the highest carotenoid content ( $2.26 \pm 0.12 \mu\text{g/g}$ ) whereas fish reared in white tank had the lowest ( $1.00 \pm 0.05 \mu\text{g/g}$ ) carotenoid level. In conclusion, the present study showed that black background tanks are preferable for filament barb fry rearing in terms of overall growth, survival, and body pigmentation in compared to blue, green, red, or white background tank.



Effect of black (a) and white (b) background coloured tank on filament barb body colouration reared for 30 days

**Project: Optimization of seed rearing protocol for commercially important freshwater fishes in salt affected regions (I-103)**

**Growth potential of commercially important freshwater fishes in salt affected regions**

*C. striata* fry were procured from ICAR-CIFA Headquarter were acclimatised in 1000 litre FRP tanks. For experimental study at different four treatments i.e. 2, 4, 6 & 8 ppt salinity

along with control (freshwater) were taken in duplicate for a period of 90 days. The initial weight and length of fishes was 0.22 g and 3.12 cm respectively. After 90 days of rearing in different salinity, there was significant difference in mean weight and length of *C. striata*. The maximum weight  $8.72 \pm 0.124$  g was recorded in 6 ppt salinity. The highest survival was recorded in 6 ppt treatment. The stoking density was kept 0.16 no. /litre (50 number fishes in 300 litre water) in this experiment. The study indicates the *C. striata*

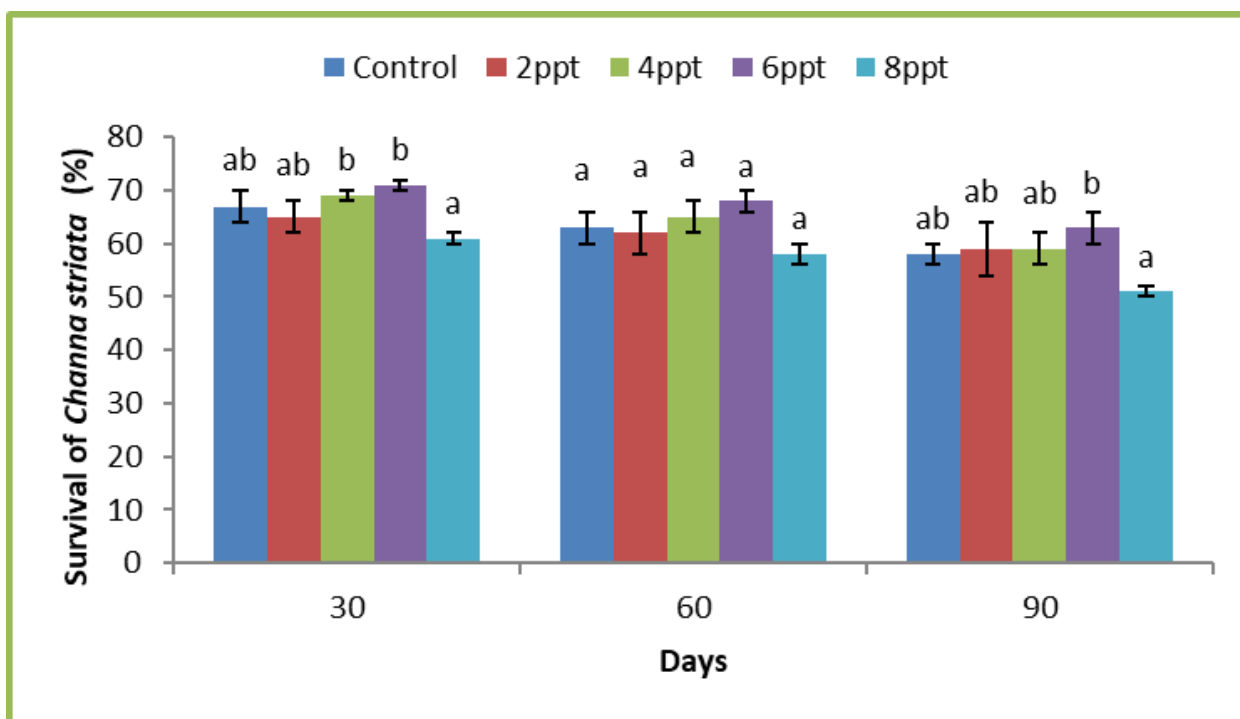


Fig. 6. Survival of *Channa striata* in different inland saline water salinity (ppt)

seed rearing (fry to fingerling) can be done upto 6 ppt without compromising in survival and growth compared to freshwater (Fig. 6).

### C. GROW-OUT CULTURE TECHNOLOGY

#### Standardization of juvenile feed of *Macrognaathus pancalus* (I-121)

A total number of 300 barred spiny eel juveniles (25 per tank) were stocked, acclimatized and experimented in FRP tanks with four feeding treatments, each with three replicates. The 1<sup>st</sup> group was fed with formulated feed and treated as control, 2<sup>nd</sup> group fed with tubifex worm, 3<sup>rd</sup> group fed with mixed zooplankton, and 4<sup>th</sup> one fed with both tubifex worm and mixed zooplankton. Feed/food was provided daily @ 3% body weight of juveniles in all the treatments.

Result of different feeding treatments showed a significant difference observed even at 30 days (Fig. 7) when both tubifex

and plankton + tubifex feedings achieved significantly ( $P < 0.05$ ) higher growth than other two groups such as plankton and control feedings. Habitually, eel prefers staying at bottom as a convenient niche for feeding as well as taking refuge inside hideout for escaping predator. Hence, its behavioural attitude is suitably accustomed accepting benthic biotic communities like sludge worms and others, which has been reflected in this experiment.

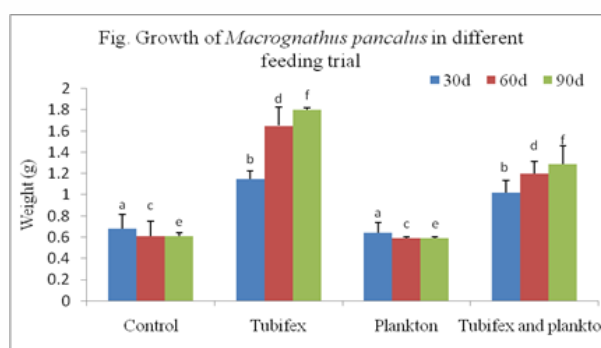


Fig. 7. Growth of *M. pancalus* in different feeding trial



The cumulative mortalities in *M. pancalus* are depicted graphically in Fig. 8. The mortalities increased with increasing days of feeding. The mortality was the maximum in control (formulated) diet fed fish (38%) followed by plankton fed group (24%) and both tubifex and plankton fed group (23%), respectively. Mortality

was least in fish fed with tubifex (18%). Significant differences ( $P < 0.05$ ) in the mortalities were observed among the *M. pancalus* of different feeding group. However, no significant difference ( $P > 0.05$ ) was found in percentage cumulative mortality of fish fed with plankton and both tubifex and plankton.

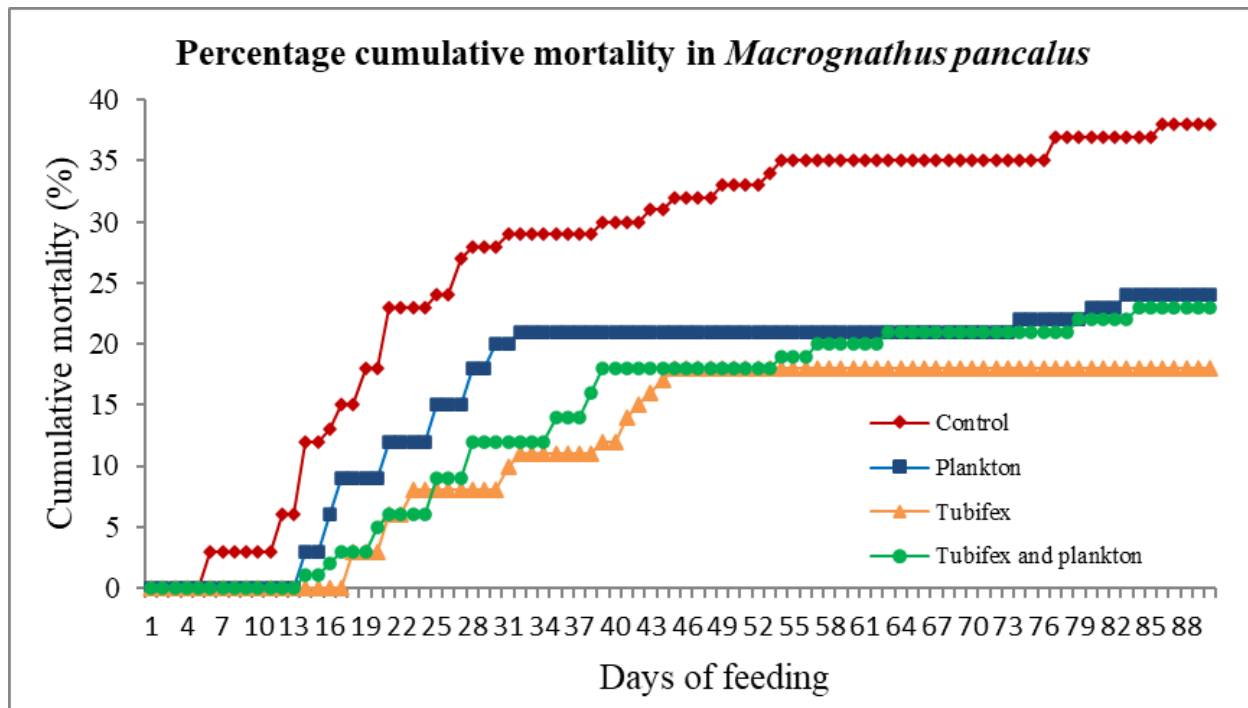


Fig. 8. Percentage cumulative mortality of *M. pancalus* in different feeding trials

**Project: Inducing sterility in carps and tilapia using different biochemical agents (I-108)**

**Effect of 17  $\alpha$  MT on the orientation pattern of sex in catla and rohu**

The effect of 17-alpha methyl testosterone (MT) studied in catla and rohu spawn (yolk sac absorbed larvae). For this, powdered feed laced with 17  $\alpha$  methyl testosterone (MT) at a rate of 40 mg/kg, 60 mg/kg, 80 mg/kg was prepared. Catla and rohu spawn stocked in the outdoor cemented tanks at a rate of 1/ litre (6000 numbers / tank), fed experimental feed twice a day until satiation for one month.

After the treatment period was over both species reared in a biofloc tank with a low floc density (5-10 ml/1000 ml). The growth of catla was poor and mortality occurred, so the experiment with catla discontinued. After a period of 8-months, rohu spawn attained an average weight of 180 $\pm$ 12 g in the biofloc tanks of 10000 litres capacity. All the treated fish reared communally with dye markings. For marking the dye (reactive red), all the treated fish were anaesthetized and marked with reactive red in their belly for identification of treatment doses (No mark: 40 mg/kg; One mark: 60 mg/kg; Two mark: 80 mg/kg). The control fish without



Dye retention check after two months treatment were dyed with reactive blue. The dye retention was confirmed after two months. The experiment is in progress.

**Evaluation of growth and sex of MT treated tilapia in geomembrane biofloc tank**

Evaluation of growth and sex of MT treated tilapia in geomembrane biofloc tanks were studied using 17  $\alpha$  methyl testosterone (MT) @ 80 mg/Kg feed). The initial MT treatment period of yolk sac absorbed larvae was 28 days. After that, normal tilapia feed containing 30% crude protein was provided. The larvae attained an average size of  $45 \pm 8$  g after 60 days. For the experiment on growth and sex orientation, each time 1000 randomly selected tilapia (mean weight  $45 \pm 8$  g) were stocked in 20000 litre tanks under biofloc system @ 50 nos/cubic meter water. After the experimental period, a significant rate of masculinization (97%) was evident from the MT treated ones whereas only 58% were observed in the control. The growth of MT treated tilapia resulted in a significant yield of 350 Kg compared to the control one as shown in the Table 3. The gender of a small percentage (1%) of fish in the MT treated group could not be ascertained and clubbed under the non-confirmed gender (NCG).

Table 3. Effect of MT treatment on the growth, survival and sexual orientation pattern of tilapia reared in biofloc tanks of 20000 litre capacity

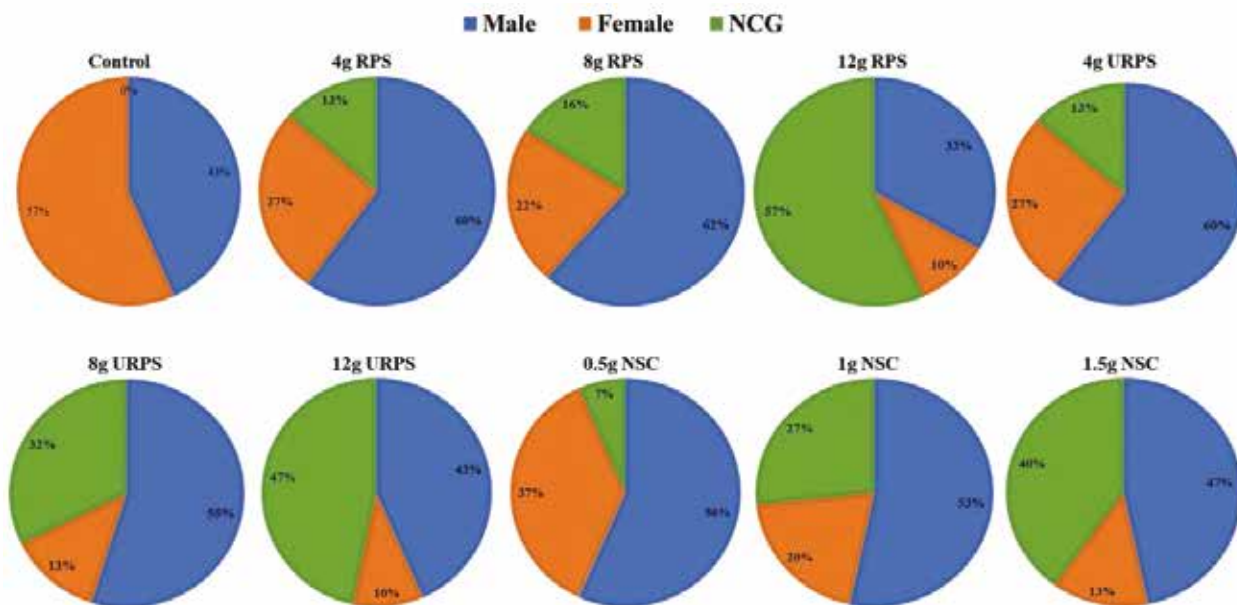
Parameters	MT treated	Control (Non-MT)
No of fish stocked	1000	1000
Average size stocked (g)	$45 \pm 8$	$45 \pm 8$
Final yield (kg)	350	190
Final survival rate (%)	99	93
Phenotypic male after six months (%)	97	58
Phenotypic female after six months (%)	2	42
Non-confirmed gender (%)	1	0
Feed given (kg)	490	490
Average floc level (ml/1000ml)	18	18



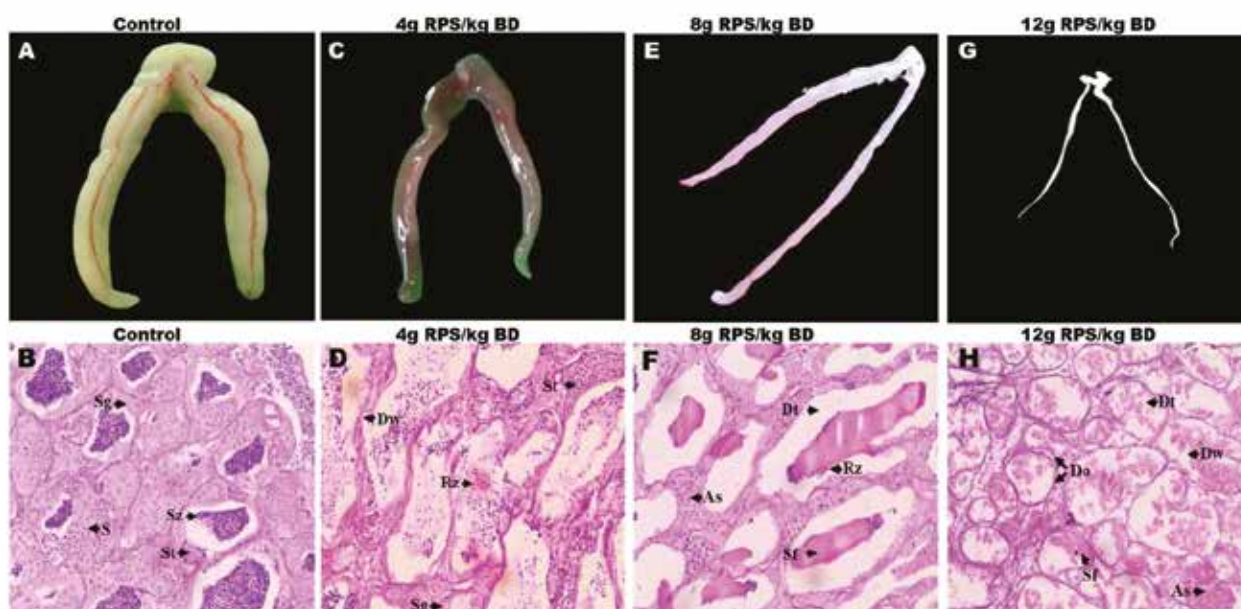
### Evaluation of plant extracts on gonadal status and gender orientation pattern of tilapia

To assess the orientation pattern of sex tilapia, three types of plant products were selected viz. unripe papaya seed meal (URPS), ripe papaya seed (RPS) meal and neem seed cake (NSC) meal at different levels of incorporation to a basal feed. Tilapia yolk absorbed larvae (5-day old) were used for experimental purposes. Initial average size of tilapia larvae was 0.04 g. After 8-months the average weight attained by tilapia was  $180 \pm 15$  g. The level of incorporation was 4 g, 8 g and 12 g for URPS and RPS. The level of incorporation for NSC into the basal feed was 0.5 g, 1g and 1.5 g. After the experimental period, we found three major gender types such as males, females and non-confirmative

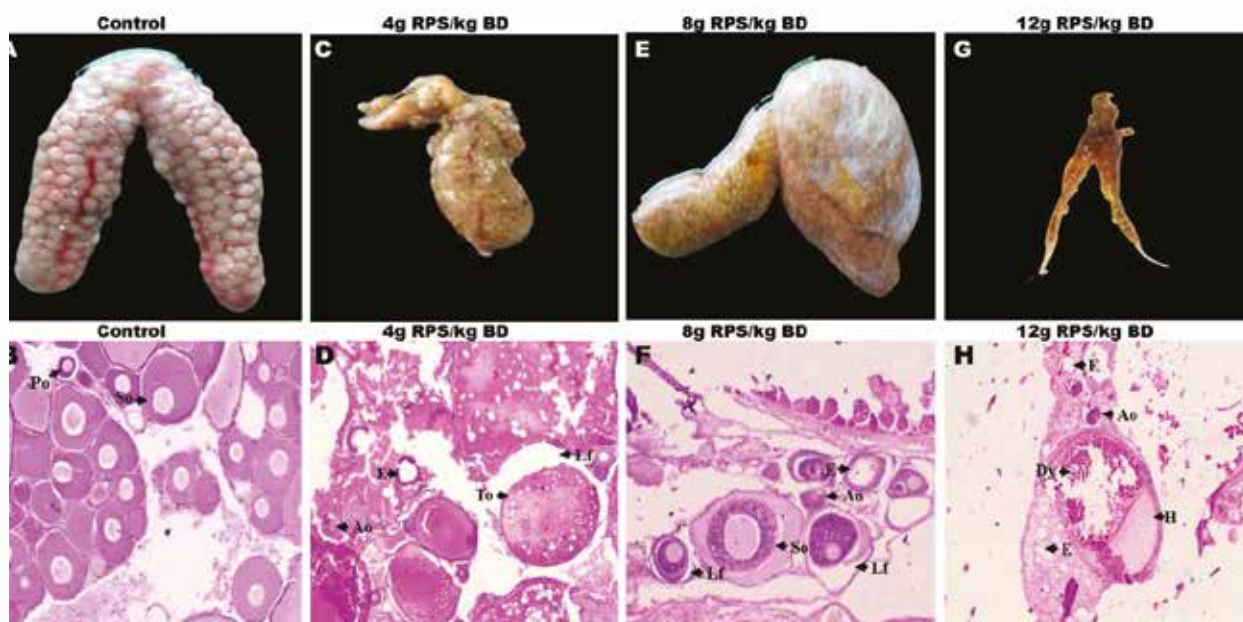
gender (NCG) in the stocked population that were checked through dissection and histological observation. The highest percentage of males (62 %) was observed in the group fed with in 8g RPS and a highest percentage of non-confirmed gender (NCG) was seen in the fish fed with 12 g RPS and URPS. The highest sex orientation towards male (56 %) was observed in 0.5 g neem seed cake/kg of basal diet and the lowest (47%) was observed in 1.5 g neem seed cake/kg of basal diet. It was seen that nearly 40% NCG could be observed when incorporation level of URPS, RPS and NSC were 12 g, 12 g and 1.5 g respectively. This indicates that both these plant products have the potential to impair the gonadal activity and inducing sterility. The details of incorporation and effects on gender orientation pattern are shown in Figs. 9-11.



**Fig. 9.** Orientation pattern of sex in *O. niloticus* fed with graded levels of plant products viz. ripe papaya seed (RPS), unripe papaya seeds (URPS), and neem seed cake. \*NCG: non-confirmative gender.



**Fig. 10.** Changes in the gonads (testis) of *O. niloticus* fed with different inclusions of ripe papaya seeds (RPS). A, B, C and D: intact testis of tilapia. E, F, G and H: transverse sections of tilapia testis, stained with H and E (40X). Sg: spermatogonia, S: spermatocytes, St: spermatids, Sz- spermatozoa, Dw: damaged walls of seminiferous tubules, Rz: residual spermatozoa, Sf: expanded efferent ducts filled with sperm fluid slightly stained with hematoxylin and with very few spermatozoa, Dt: degeneration of tubules, Do: disorganized tubules and As: arrest of spermatogenesis.



**Fig. 11.** Changes in the gonads (ovary) of *O. niloticus* fed with different inclusions of ripe papaya seeds (RPS). A, B, C and D: intact ovary of tilapia. E, F, G and H: transverse sections of tilapia ovary, stained with H and E (10X). Po: primary oocytes, So: secondary oocytes, To: tertiary oocytes, Lf: loose follicular lining of oocytes, E: empty oocytes, Ao: atretic oocytes, Dy: tertiary oocyte with damaged yolk granules and H: disintegrated yolk granules.



**Project: Optimization of freshwater pearl mussel culture technology through dietary and environmental intervention for greater adoptability to the farming communities (I-119)**

**Development of designer nucleus for quality pearl production**

For the preparation of the designer nucleus, a new unique technique was established based on previous experience. Shell powder was employed in this case, and the nucleus was made in such a way that precise shape could be achieved. In the new designer image, there was no outer/excess extension of any part. Nacre deposition is considerably better in the improved nucleus compared to the old nucleus. The new technique is expected to provide pearl farmers more opportunities to produce quality designer pearls.



Designer nucleus using new protocol



Designer nucleus using old protocol

**Designing of the flow-through tank for the better survival of mussel**

The formation of high-quality pearl necessitates a moderate flow of water. Keeping the mussel as stress-free as possible. A flow-through tank was designed to test the survival of mussels. Fifty mussels were suspended from the water's surface



in a pocket net at a rate of two mussels per net. In the tank, a gentle flow of water was maintained. The mussel was fed with mixed plankton. No mussel mortality could be observed in the flow-through tank after 30 days. This design will help to produce freshwater pearls in an FRP tank with minimal area.

**D. ADVANCED PRODUCTION SYSTEM DEVELOPMENT**

**Project: Development of Bio-floc based technology (BFT) for production of freshwater fish and demonstration for peri-urban fish farmers and rural youth (E-132)**

**Biofloc facility**

Biofloc facility has been developed at ICAR-CIFA, Bhubaneswar. The facility has 12 tanks (6 nos - 5.0 m dia; 6 nos - 4.0 dia) in indoor and 6 tanks in outdoor system.



C:N ratio of 15:1, in all these tanks. No water exchange was done except compensating the evaporation loss once in every 15 days. After six months of rearing, there were 6.4 folds increase in biomass in tilapia (128 kg/ tank) while it almost doubled (39.3 kg) in IMC and in silver barb (37.4 kg). Catla and rohu showed only 36 and 59% increase in biomass, while actual increase in biomass of pengba could not be ascertained due to sudden heavy mortality in tanks at the end of 5<sup>th</sup> month.

**Project: Development of economically viable and farmer-friendly aquaponic systems for fish and plant biomass production (E-03 a)**

### Evaluation of growth performance of different species in biofloc system

Growth evaluation of different freshwater species was conducted in 12 large concrete tanks (50 m<sup>2</sup> each) modified to support as biofloc system. The tanks were covered with PPE net blocking 90% light incidence. Aeration was supplied continuously (except feeding time) and uniformly in all tanks from turbo air blowers (3.5 hp). Six treatments (in two replicates) were used. While five treatments (T-1 to T-5) were stocked with juveniles of catla, rohu, pengba, silver barb and GIFT tilapia separately under monoculture, T-6 stocked with the three species of Indian major carps (Catla, rohu and mrigal). 20 kg biomass of respective species was stocked in each tank. The fishes were fed with 2 mm floating pellet feed (CIFA-Grower) containing 28% protein, provided in two meals daily (10.00 AM and 4.00 PM). Molasses and urea were used as the carbon and nitrogen sources to maintain suitable

### FRP based NFT Aquaponics

Two triplicate systems of Nutrient Film Technique (NFT) aquaponic have been developed, one set incorporating a mechanical settling unit and the other without a settler (Fig.12). Each aquaponic

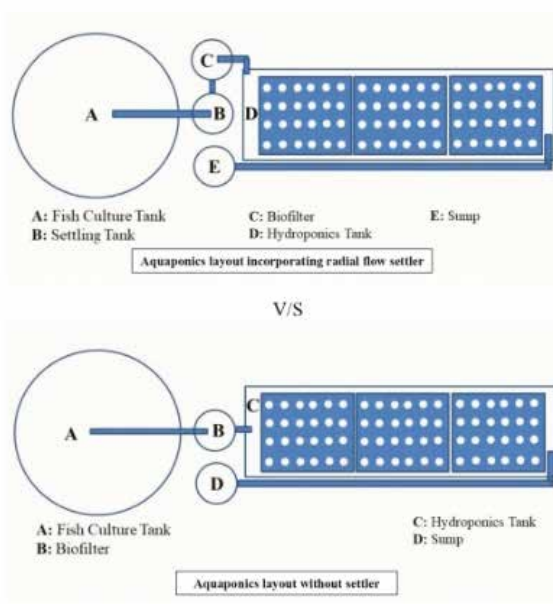


Fig. 12. Comparison of aquaponic systems

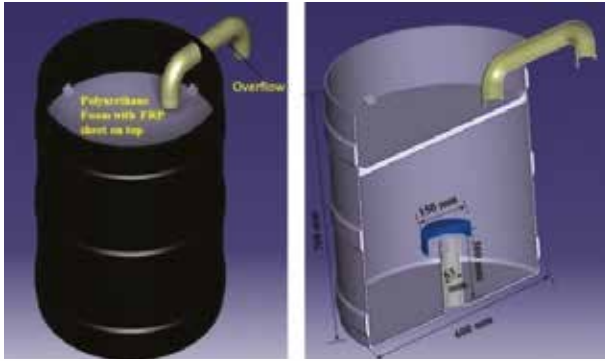


Fig. 13. 3D model of Radial Flow Settling Unit

unit is fabricated from Fiber Reinforced Plastic (FRP) with one circular fish culture tank  $2.15 \times 0.9$  m, operational capacity of 2800 L; HDPE biofilter utilizing 185 L of filtration volume out of 200 L total capacity (25%: 75% :: Gravels : Seashell (V/v)) with S:V of 5.39; one FRP hydroponics tank ( $4 \times 0.9 \times 0.35$  m) with FRP trays having 84 perforations ( $\text{Ø}$  63.5 mm) to hold the plastic mesh pots and a 200 liter HDPE sump. The water circulation from the sump is automated with three conductive water level sensors actuating a 0.3 HP submersible water pump. Each aquaponic unit from the triplicate set incorporating the settling system is fitted with one 200 L Radial-Flow settling unit between the fish culture tank and biofilter (Fig. 13). The settling unit is a cylindrical HDPE tank with dimensions of  $\text{Ø}$   $0.6 \times 0.7$  m. The turbulence baffle cylinder is of PVC material and has a length of 0.3 m with an inner tube diameter of 0.063 m and the top dome is  $\text{Ø}$   $0.15 \times 0.08$  m in size. A 25 mm thick open-cell polyurethane with roughly  $80 \mu\text{m}$  pore is cut into a circular sheet of diameter 0.6 m to be used as a filtration layer.

Both of the systems (with settler and without settler) were operated for 90 days, from 22 March 2021 to 20 June 2021 with tilapia fish (*Oreochromis niloticus*) ( $3.0 \text{ kg/m}^3$ ) and okra plant (*Abelmoschus esculentus*) (9

plants/ $\text{m}^2$ ). The average TSS concentration removed was calculated to be  $128.55 \text{ mg/L}$  on dry-weight basis and a mean efficiency of  $80.06 \pm 9.36\%$  was observed in the experiment with a surface loading rate of  $1.03 \text{ L/min}$  per square meter of the radial flow settler. For the assessment of the biomass production, the yield of okra was  $860 \text{ g/m}^2$  (total okra harvest was  $10.320 \text{ kg}$  from  $12 \text{ m}^2$  area) and tilapia was  $3.56 \text{ kg/m}^3$  (net gain) from the system with the radial-flow aquaponic system. Whereas, the total yield from the aquaponic system without settler was  $792 \text{ g/m}^2$  of okra (total okra harvest was  $9.5 \text{ kg}$  from  $12 \text{ m}^2$  area) and  $3.3 \text{ kg/m}^3$  tilapia. In another experiment, the two sets of aquaponic systems (with settler and without settler) were in operation with tilapia fish (*Oreochromis niloticus*) with stocking density (SD)  $3 \text{ kg/m}^3$  and tomato (*Solanum lycopersicum*)  $10 \text{ plants/m}^2$  in the hydroponics tank. In 45 days of operation, the system with settler showed  $28.5 \pm 9.2\%$  more growth of the tomato plant in comparison with the system without settler. The tomato size and quantity were also higher in the system incorporating the settler. The plantation density per sq. meter is being studied for optimum value. Another pilot-scale experiment for the economic evaluation was conducted in the NFT aquaponic system rearing puntius (*Puntius gonionotus*) seed and marigold (*Tagetes patula*) plant. Culture tanks of each unit were stocked with 200 numbers of puntius advanced fry of 44-63 mm length and 3-5 g weight. Hydroponics tanks were planted with marigold plants with varying densities, i.e., 42, 63 and 84 numbers. After 75 days, advanced fingerlings were harvested with size 100-147 mm length and 20-56 g weight with a survivability rate of  $92.33 \pm 2.31\%$ . Marigold plants in 75 days of



experimentation grew from the heights 90-110 mm to 182-358 mm. The hydroponics tanks with higher plant densities gave a maximum harvest of flowers, *i.e.*, 2.49 kg/m<sup>2</sup>. The net profit was calculated to be INR 498 per m<sup>2</sup> land in a year.



Marigold plant in aquaponics system



NFT aquaponics in PVC tubes

### Vertical Aquaponics

A vertical aquaponics setup has been designed and developed for indoor decor as well as sustainable technology to promote a healthy lifestyle, using  $\varnothing 0.16 \times 1.5$  m PVC tube with 50 L fish rearing tank. A 300 LPH



submersible pump moves the water from the bottom of the fish rearing tank to the top of the vertical tube *via* one 12 mm silicon pipe. Water at the top is then sprinkled in three channels in such a way that it dribbles along the wall of the vertical PVC tube. The plantation is done in 50.8 mm cups in 20° slanted holes fabricated into the PVC pipe (Fig. 14). The system was initially tested with 30 numbers of *Puntius gonionotus* fry and 15 numbers of marigold, *Tagetes erecta* plants. This system was operated from 25 November 2021 to 31 December 2021 with 15 numbers of guppy fish; and 12 nos of ornamental plants (6 numbers of



white & orange Gemini with 6 numbers of violet Petunia). The system being a basic aquaponics, it can be used to grow organic herbs and spices at home.

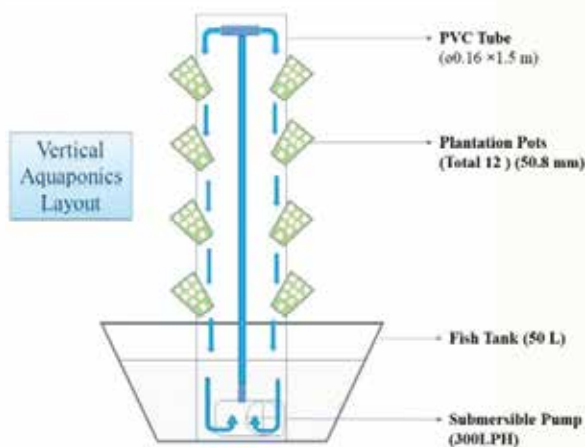
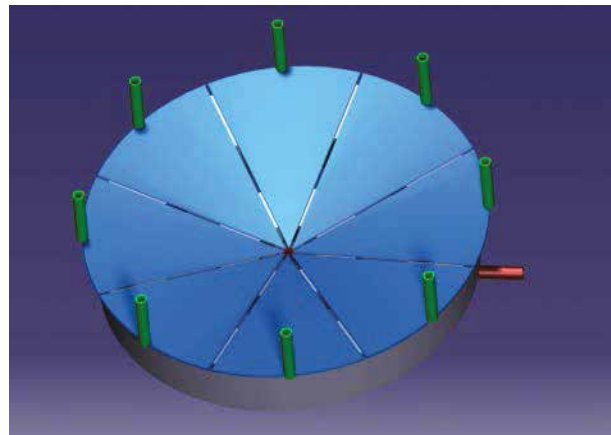


Fig. 14. Vertical aquaponics layout



### Project: Development of user-friendly biofloc fish rearing facility (E-03 b)

#### Design of Biofloc Fish Rearing Facility

One biofloc fish rearing facility has been designed incorporating a fish rearing tank, a mechanical settler and one bioreactor.

#### Fish culture tank

It is 3.0 x 1.2 m cylindrical PVC coated polyester lining surrounded by rigid plastic mesh (25 mm). The lining and the mesh are supported on 8 portable FRP sectors of 3.2 m dia. with vertical support columns at the end. The support columns are 3.81 mm PVC pipes that can be detached during transportation. A bottom curvature of R2.5 m is provided for adequate sludge removal while maintaining structural integrity. The flexible polyliner moulds to the shape of the 8 rigid FRP sectors which are interlocked with butt joints. The drain pipe at the bottom centre is a 50.8 mm PVC.

#### Settler

The settling unit is a 200L HDPE tank radial flow type. The inside of the settler is equipped with L-shaped upward flowing 63 mm piping capped with a turbulence baffle. The settler is designed to handle water loading of 150-200 LPH. The sedimentations settle at the bottom and water from the top level is passed to the Bioreactor.

#### Bioreactor

One HDPE 200 L tank is filled with lava rocks (120 L) and provided with 13.8 kPa of internal aeration. The water from the bioreactor is pumped back to the fish rearing biofloc tank *via*. an inline 3000 LPH 63 x 63 mm pump. Bioreactor designs are being made.

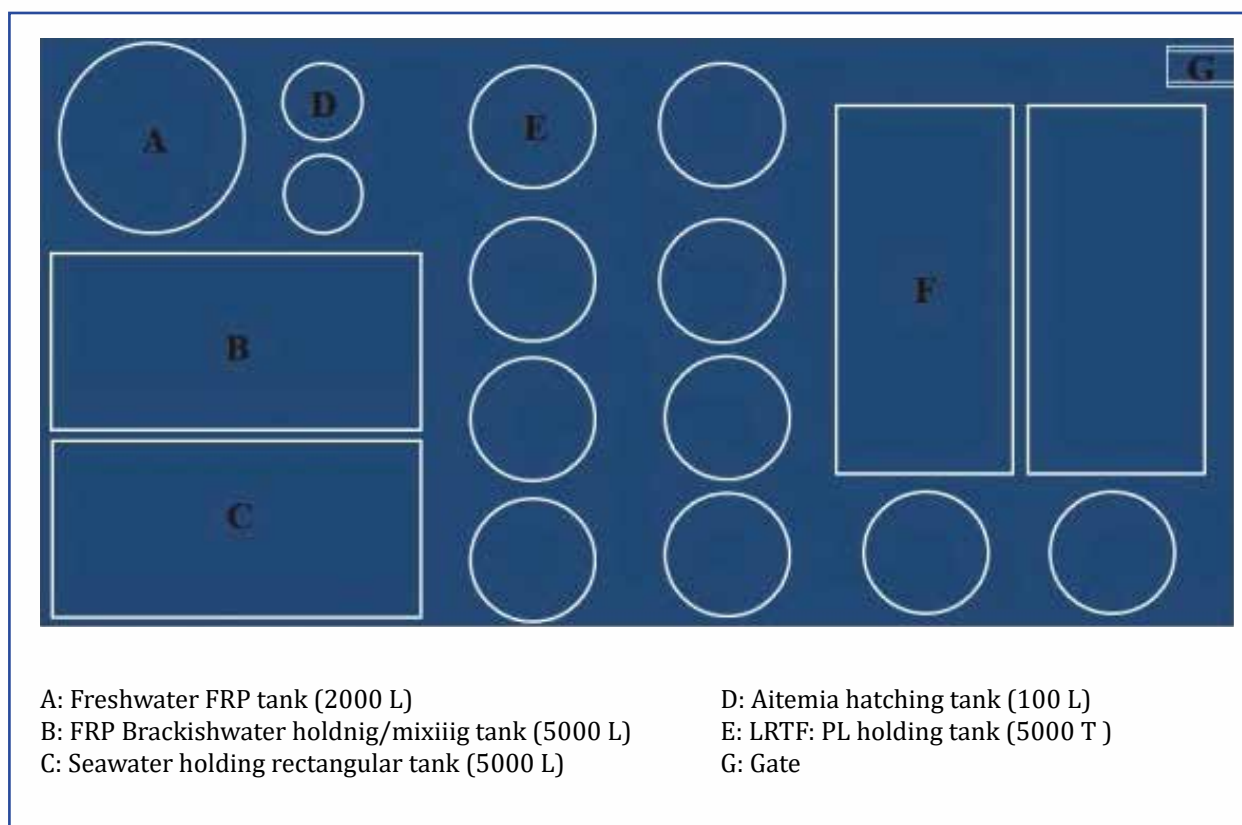


Fig. 15. Scampi hatchery layout

### Design and development of transportable scampi seed production system (E-03 c)

#### Design of Portable Scampi Hatchery

Drafting and 3D model analysis of different components of the scampi hatchery setup has been done. The following components are designed and the layout of the scampi hatchery unit is shown in Fig. 15.

#### Larval rearing tank

Cylindro-conical FRP tanks with central drainage system fitted with ball valve to control the flow (capacity 1000 L). The tanks are 2 feet above the surface with three legs sufficiently withstand the load of 1000 litre water.

#### Seawater storage and mixing tank

Two rectangular, 5000 litre capacity and inside painted with salt water-resistant paint.

#### Live feed hatching tanks (Brine shrimp cyst hatching)

A 100 litres cylindro-conical fitted with a ball valve to control the flow. The cylindrical part needs to be painted with dark colour, while the conical part with transparent or light colour anti-corrosion paint.

The hatchery is designed for the production of 4 Lakh PL in a year and the details are provided as follows (Table 4).



Table. 4. Details of Portable Scampi Hatchery

Particulars	Nos.
PL production target per annum	400000
No. of cycles per annum	4
PL production target per cycle	100000
Zoea-I required (@25% survival)	400000
Berried prawns required (50g each)	10
12 ppt water required @ 50 nos./litre	2000
Total 12 ppt water requirement (5 times of LRT)	10000
No. of LRT required (1000 litre)	10
Artemia hatching tank (100 litre)	2
FRP tub with handle (20 litre capacity)	5
Freshwater FRP tank (capacity 2000 litre)	1
FRP Brackish water holding (mixing) tank (5000 litre)	2
Seawater holding rectangular tank (5000 litre)	1
PL holding rectangular tank @10nos/litre (capacity 5000 litre)	2

### Project: Production performance of peninsular carps in biofloc based seed rearing system (I-122)

#### Growth performance of *H. Pulchellus* during fry to fingerling phase in biofloc based seed rearing

A 90 days experiment was conducted to investigate the effect of different carbon sources addition (jaggery, tapioca flour, rice flour, corn flour) on the growth and survival of *H. pulchellus* during fry to fingerling phase in biofloc based seed rearing. Growth

performance of *H. pulchellus* was the best with jaggery followed by corn flour, rice flour and tapioca carbon sources (Table 5).

#### Microbial dynamics in biofloc based *H. pulchellus* fry to fingerling rearing

Microbial dynamics studies indicated that the supplementation of carbohydrates in the biofloc treatment increased the total heterotrophic bacterial (THB) count compared to control (Fig. 16). The highest THB load was found in corn flour followed by jaggery treatments among the biofloc groups.



Table 5. Growth performance of *H. pulchellus* during fry to fingerling phase

Parameters	Control	Jaggery	Tapioca flour	Rice flour	Corn flour
Initial length (cm)	1.2	1.2	1.2	1.2	1.2
Initial weight (g)	0.0068	0.0068	0.0068	0.0068	0.0068
Final length (cm)	3.98 ± 0.08	4.61 ± 0.05	4.21 ± 0.08	4.23 ± 0.04	4.28 ± 0.06
Final weight (g)	0.59 ± 0.02	0.77 ± 0.04	0.67 ± 0.01	0.69 ± 0.02	0.71 ± 0.03
Weight gain (g)	0.58 ± 0.02	0.76 ± 0.04	0.66 ± 0.01	0.68 ± 0.02	0.70 ± 0.03
Weight gain (%)	8527.45 ± 298.17	11174.51 ± 565.32	9703.92 ± 129.69	10096.08 ± 343.14	10292.15 ± 497.5
SGR (%/day)	4.95 ± 0.04	5.25 ± 0.06	5.1 ± 0.01	5.14 ± 0.04	5.16 ± 0.06
Survival (%)	93.00 ± 0.58	95.67 ± 0.88	94.33 ± 1.2	93.33 ± 0.88	94.00 ± 1.15

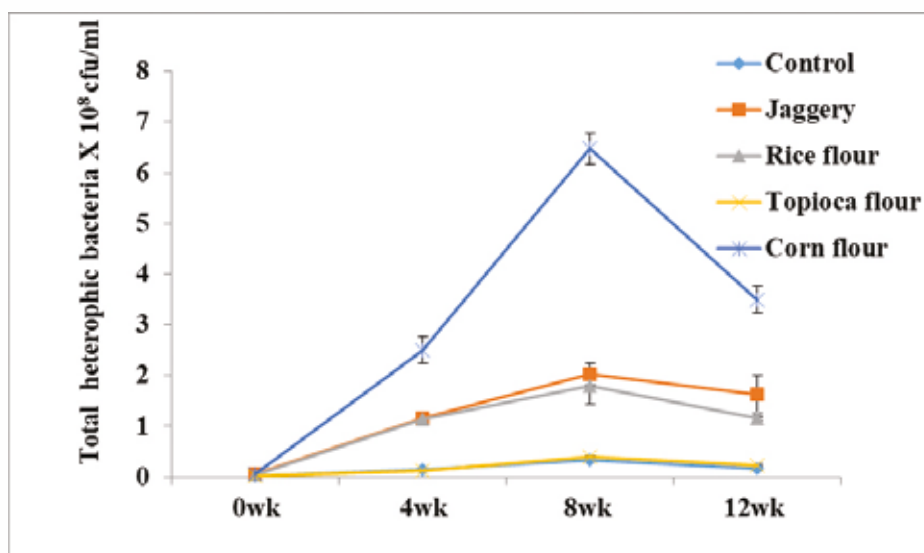


Fig.16. Microbial dynamics in biofloc experimental tanks and control group



## 2. ENVIRONMENTAL MANAGEMENT FOR SUSTAINABLE AQUACULTURE

**Project: Development of protocol for organic fish farming: A sustainable production approach in freshwater ecosystems (I-110)**

### Standardisation of protocol for organic fish farming:

To standardize the protocol for organic farming, a study was conducted in six renovated earthen ponds of ICAR-CIFA

breeding hapas fixed in organic fish culture ponds. Spawning was done in breeding hapa but hatching was done in incubation pools. Spawns of these three species produced were reared in large concrete (50 sq.m) tank with organic protocol up to fry stage.

For sustained production of natural fish food organisms in the rearing tanks, a mixture of mohua oil cake, raw cow dung obtained from cows grazed on wild and natural



Induced breeding and seed production of Organic Indian Major Carps,(IMC) using Pituitary extract at ICAR-CIFA Farm, Kausalyaganga, Bhubaneswar, Odisha

farm with no history of fish culture during last 10 years. Induced breeding and seed production of Catla and Rohu were achieved successfully using carp pituitary gland extracts whereas fingerlings of mrigal were sourced from ICAR-CIFA farm to ensure three species polyculture. A trial was undertaken for production of carp seeds organically at organic farm facility, ICAR-CIFA. Females were injected with pituitary gland (PG) extract twice while males were injected only once through intraperitoneal route. First dose was given in the evening hours to female @ 5-6 mg/kg body weight and second dose after 4-6 hours of first injection @ 8-16 mg/kg body weight. Males were injected at the time of second dose of female @ 4-5mg/kg body weight. Induced breeding was carried out taking two males per female in

grass, kalabati rice (organic rice) powder, yeast, jaggery, and organic rock phosphate were applied weekly and spawns were fed daily with supplementary diet of 1:1 ratio (kalabati rice powder: fish meal).

Fingerlings of all three IMCs were stocked at combined two stocking density (SD) of equal



Fermented Mohua oil cake, MOC and Pelleted feed prepared by using locally available organic feed ingredients.



species ratio of 1:1:1. For nursery rearing we used cement tanks and for fingerlings production earthen organic ponds. Fingerlings produced from earthen organic ponds of IMC were stocked in two different stocking densities (SD) in triplicate in grow-out ponds experiments (SD: 4, 000 nos./ha and 8, 000 nos./ha). The experimental fish were fed with a feed prepared by using locally available organic feed ingredients. The fingerlings were fed with a feed (Crude Protein: 27.72%, Dry Matter: 92%, Ether Extract: 6.31%, Crude Fiber: 7.6 %, Total Ash: 12.0%, Gross Energy (GE): 3.53 Kcal/g) prepared by using locally available organic

feed ingredients (Mohula oil cake, Polanga oil cake, wheat flour, organic rice, fish meal). After the culture period of 15 months, the maximum & minimum weight of rohu, catla & mrigal ranged from 658-824 g, 850-1450 g, 727-1065 g in SD of 4, 000 nos. /ha, respectively and in SD of 8, 000 nos. /ha. rohu, catla & mrigal ranged from 570 g-750 g, 652-746 g & 622-861 g, respectively. The survival rate was 46.20% and 40.18% for the SD of 4, 000 nos. /ha & SD of 8, 000 nos. /ha, respectively. The fish production of 1197 kg/ha & 1767 kg/ha and FCR was found to be 1.68 and 2.28 of SD of 4, 000 nos. /ha & SD of 8, 000 nos. /ha, respectively.



Haul of Organic Indian Major Carps,(IMC)

**Project: Bioprocessing of fish wastes for productive end use (E-114)**

**Fish waste recycling for productivity development**

The fermentation process and microbial dynamics were analyzed for fish waste in both natural and controlled condition for productive end use (Fig.17). Fish waste collected was naturally fermented using molasses in appropriate ratio at ambient temperature for 30 days. Final pH of the product was 4.7 and microbial analysis showed an increase in Lactic acid bacteria (LAB) count, a decrease in the total aerobic count and almost absence of Enterobacteriaceae from the final product. 16S microbiome profiling and metagenomic analysis showed the microbial

succession and enormous diversity in the samples analysed at regular interval. Order Lactobacillaceae dominated most of the samples and its relative abundance in the final product was found to be 83.23%. In controlled fermentation, pH of 4.41-4.49 was achieved in the first week of fermentation itself. Firmicutes dominated throughout the fermentation process. At family level, in the fresh samples Micrococcaceae dominated whereas in the experimental set-ups Lactobacillaceae dominated. C/N ratio in the controlled fermentation sets were 24.46 and 23.00 where as in uncontrolled or naturally fermented sample, it was 18.70 showing clear advantage of controlled fermentation. In bioassay of the product, hydrolysate by natural or uncontrolled fermentation was more toxic to fish than controlled ones.

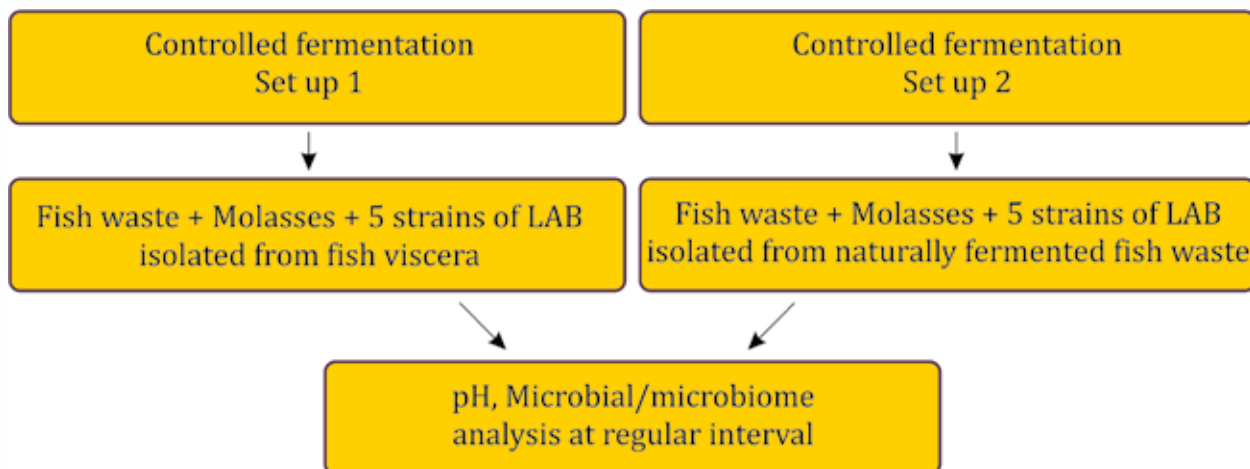


Fig 17. Schematic representation of controlled fermentation of fish waste using molasses and strains of LAB isolated from fish viscera and naturally fermented fish waste

**Isolation and characterization of heterotrophic ammonia oxidising bacteria (AOB) and their application (I-105)**

**Ammonium and Nitrate removal potential of *Pseudomonas aeruginosa* WS-L9 isolate**

*P. aeruginosa* WS-L9 isolate was isolated from domestic waste water. Nitrification media (NM) consisting of ammonium chloride as nitrogen source and glucose as carbon source was used for evaluation of nitrifying capability of *P. aeruginosa* WS-L9 isolate and the assay was conducted at C: N ratio of 10. The samples were collected for estimation

of ammonia at 12 h intervals and also the optical density of same sample was taken for observing bacterial growth. Increase in growth of isolate was recorded in NM media and it was maximum at 96 h *i.e.*, 1.43 (Fig. 18). the isolate could able to remove ammonia 30 ppm and 10 ppm, respectively within 36 h and 48 h. Growth of isolate in the NM media was directly proportional to ammonia removal ability. The results revealed that with the use of glucose and citrate as carbon source, the nitrogen (Ammonium-N) and nitrate removal capacity of the isolate WS L-9 were more than 80 % and 60% respectively, after 48 hours (Fig. 19).

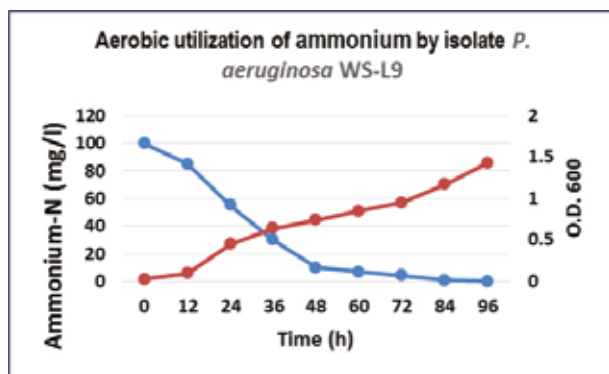


Fig. 18 Ammonia removal ability of WS-L9 isolate in Nitrification media

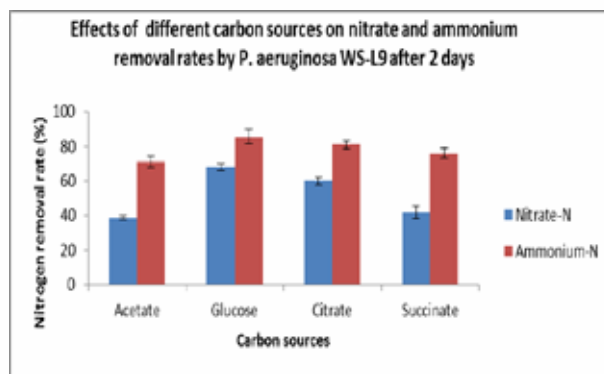


Fig. 19. Nitrogen removal capacity of *P. aeruginosa* WS L-9 in different carbon sources



**B. ENVIRONMENTAL IMPACT ASSESSMENT, CARBON FOOTPRINT AND SEQUESTRATION**

**Project: Development of sustainable aquaculture practices through life cycle analysis (LCA) of selected aquaculture production systems and performance evaluation of improved varieties of carps and freshwater prawn (E-126)**

Data on carp farming and pangasius farming system from Chhattisgarh, Andhra Pradesh and Odisha were collected for Life Cycle Analysis (LCA) study. Tables below provides the state-wise profile of IMC and Pangasius productions systems based on the survey data (Table 6 & 7). Table 8 provides the use of feed Inputs (%) of farms in different states.

**Table 6.** Profile of IMC production

Attributes	Chhattisgarh	Andhra Pradesh	West Bengal	Odisha
Pond Area (ha.)	1.60 (0.6-2.80)	27.76 (5.0-92.8)	1.65 (2.0-8.0)	1.71 (1.00-10.00)
Productivity (t/ha.)	8.25 (5.4-12.5)	8.42 (6 - 12.3)	7.90 (3.05 -15)	4.88 (3.75-6.45)
FCR	1.93 (1.5-3.01)	2.98 (1.6-3.8)	2.34 (1.09-3.82)	1.8 (1.36-2.63)

**Table 7** Profile of Pangasius production

Attributes	Andhra Pradesh Pangas	Chhattisgarh Pangas	Chhattisgarh IMC-P	Chhattisgarh IMC-P-T	Chhattisgarh P-T
Pond Area(ha)	21.64 (3.50-85.00)	40.43 (2.00-240.0)	9.38 (2.0-34.0)	8.59 (2.0-22.0)	8.0 (1.0-15.0)
Productivity (t/Ac.)	12.77 (6.66-26.92)	12.74 (5.78-17.45)	18.3 (3.0-36.5)	23.35 (9.5-43.5)	25.77 (10-41.53)
FCR	1.60 (1.25-2.00)	1.58 (1.43-1.80)	1.53 (1.33-1.84)	1.46 (1.25-1.71)	1.6 (1.6-1.6)


**Table 8** Use of feed Inputs in different farms in percentage of farms

Attributes	Ch-IMC	AP-IMC	WB-IMC	Od-IMC	AP-Pangas	Ch-Pangas	Ch-IMC-P	Ch-IMC-P-T	Ch-P-T
Rice bran	0	100	85.7	100	8.10	14.3	50	0	0
Groundnut oil cake	0	81.3	71.4	100	5.40	0	8.3	0	0
Mustard oil cake	25	0	57.1	16.6	0	0	50	36.4	0
Maize	25	0	57.1	50	0	0	33.3	0	0
Cotton Seed	0	50	0	0	0	0	0	0	0
Pellet feed	75	18.8	71.4	83.3	100	100	100	100	100

#IMC: Indian major carps; IMCP: IMC+Pangas; IMCPT: IMC+Pangas+Tilapia; PT-Pangas + Tilapia.

**Project: Efficient use of critical inputs towards sustainable aquaculture in the Moyna of Purba Midnapore, West Bengal through cluster approach (I-98-E)**

#### Uses of *Channa punctata* and *Channa striata* to control small tilapia from carp polyculture ponds

The fish *C. punctata* and *C. striata* could be used successfully to control small tilapia, which enters into the carp polyculture ponds from the inlet at the time of intake of water from the river irrespective of the use of nets. Farmers stocked 75 kg of *Channa* spp. of average 70 to 80 g along with equal ratios of rohu, catla, mrigal and common carp. Initial size of these carps was 300 to 350 g, while the harvested size were 1.2 to 2.0 kg with an average of 1.65 kg. The gross production was 12.5 t/ha while the net production was 10.0 t/ha. In addition to the control of tilapia by the use of *Channa* spp, around 1.0 t of *C. punctata* and *C. striata* was also produced in

the pond. The fish were fed with rice polish and ground nut oil cake @ 3:2 for the first 4 months at 3% body weight. Later on, the ratio was 4:1. Fortnightly, juice was added to the pond. The juice was prepared by mustard oil cake, ground nut oil cake, mineral mixture, black molasses (non-edible), and yeast @ 25:12.5:5:5:1.5 kg/ha.

**Project: Ecological Assessment of the Exotic Sailfin Catfishes in the Indian Fresh Water Systems and Developing a Species Specific Molecular Tool to Measure Their Detection in the Wild (E-124)**

#### Impact of sailfin catfishes (*Pterygoplichthys* spp.) on zooplankton diversity and abundance of invaded ecosystem

Effect of sailfin catfishes on zoo-planktonic diversity and abundance of invaded ecosystem was compared with native fishes (Indian Major Carps). Control ponds



consisted of IMC (@ 7500 nos./ha) were compared with the treatment ponds having additional sailfin catfish population (stocked with IMC @ 7500 nos./ha + sailfin catfish @ 1500 nos./ha). Zoo-planktonic diversity of the ponds was recorded monthly for a period of four months. Variations were observed in the dominating planktonic group during different sampling point and at the end of the experiment, while in control ponds Rotifers were the dominating group, in treatment ponds it were the Copepods (Fig. 20).

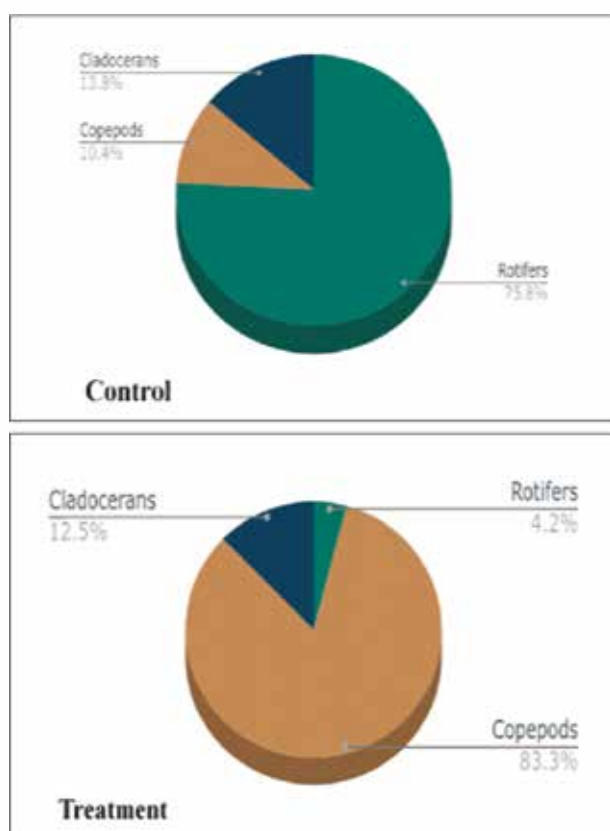


Fig. 20. Mean percentage composition of various zooplankton groups in Control and treatment pond.

**Impact of Exotic fish species farming on sustainability of carp culture in Andhra Pradesh (I-102)**

### Impact of production factors and constraints in Pacu culture in Andhra Pradesh: A case study

The major factors that contribute to production cost in red-bellied pacu culture are feed (64%) followed by lease (13%), seed (10%), labour (7%), medicines (3%) and electricity & other charges (3%). Early completion of culture cycle in 8 months could be possible by stocking 100-150 g sized seeds. Farmers have diverged equally on the response that red-bellied pacu attacks carp in polyculture systems. Based on the survey, recurrence of red disease in red-bellied pacu culture was stated as one of the major limiting factors by 40.7% farmers followed by 37.9% of farmers who opined that the species is highly sensitive to DO stress. It is interestingly recorded that argulosis problem was not encountered in red-bellied pacu farms. Carps stocked in polyculture ponds along with red-bellied pacu were not found to be infested by Argulus.

### Diseases management and economic loss in Pangasius culture

Small and marginal farmers are incurring economic losses due to escalating cost of feed and health management when compared to large farmers. Owing to easy management and culture operations, fish farmers adopted pangasius culture in the Andhra Pradesh. Seed contributes to second most important cost that accounts for 12 to 14% of pangasius cultivation cost. The farmers practiced higher stocking ratios for pangasius in monoculture compared to freshwater carps. Due to high stocking density, it may lead to stress and deterioration in water quality, risk of parasitic and bacterial infections in pangasius culture.



## Project: Assessment of endocrine disruption in fish reproduction (E-130)

### Database development

Based on the existing information of endocrine disruptors and their impact on fishes a database named EDFHdb (Endocrine Disruption & Fish Health Database) was developed.

### Effect of glyphosate on rohu embryos

The sub lethal concentration of glyphosate resulted in morphological changes like yolk sac edema, pericardial edema, abdominal curvature, tail kink formation, hematoma and delayed development in embryos. Increase in the percentage of malformation with an increase in the duration of pesticide exposure was observed. The deformities like yolk sac and pericardial edema appeared after hatching. Kink formation in the tail region was observed in spawn exposed to the pesticide. The kink formation occurred due to deformed collagen fibers.

### In-silico interaction study of EDCs with different enzymes and proteins

The *in-Silico* study on EDC'S (Molecular Modelling) was carried out with the macromolecules (Brain Aromatase, Ovarian Aromatase, Kisspeptin-1 and Kisspeptin-2 proteins) (Fig. 21-24) and pesticides (Chlorpyriphos and monocrotophos), and it was found that CPF binds to kisspeptin-1 only when used in combination with glyphosate and monocrotophos. Monocrotophos binds to kisspeptin-1 when used in combination with glyphosate and chlorpyriphos. Monocrotophos and chlorpyriphos interact with ovarian aromatase only when used in combination with monocrotophos, glyphosate, and chlorpyriphos. CPF doesn't

interact with brain aromatase but it changes the interacting residues for glyphosate and monocrotophos when used in combination (Table 9).

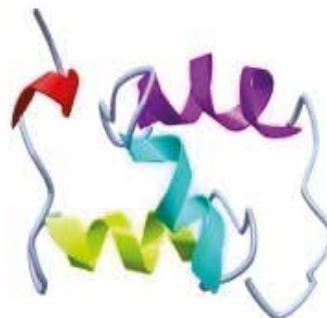


Fig. 21. Brain Aromatase



Fig. 22. Ovary Aromatase

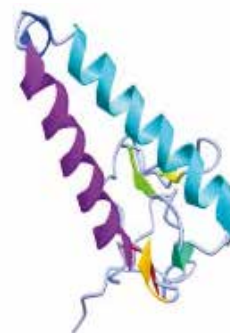


Fig. 23. Kisspeptin 1 protein



Fig. 24. Kisspeptin 2 protein



The tertiary structure of Aryl Hydrocarbon Gene (Ahr2), miRNA-21zebrafish hatching enzyme-01( ZHE-1) and Vitellogenin-1( VTG-1)of *Danio rerio* were derived using

HHPRED molecular modelling platform, and iFoldRNA server (for miRNA-21) and then validated using SAVES server (Fig. 25-27).

**Table 9. RMSD value, ACE score & binding interaction of the proteins.**

Sl. No	Protein	RMSD value	ACE score	Binding interaction observed
1	Vitellogenin-01	1.5 A	-64.18	Yes
2	Aryl Hydrocarbon Receptor-02	1.5A	-39.27	No
3	MicroRNA-21	1.5A	-66.25	No

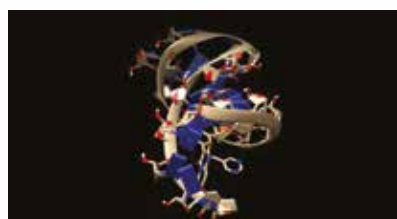


Fig. 25. Pexalon vs miRNA

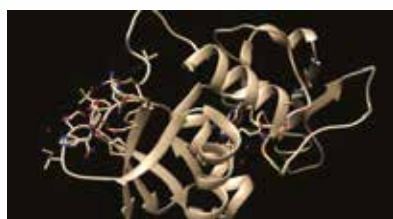


Fig. 26. Pexalon vs vtg- 1



Fig. 27. Pexalon vs Ahr

These structures were further used for conducting the molecular docking study, to find out the binding sites, and to get a computational data for the experiment. *In-silico* study from primary docking inferred that Vitellogenin-1(3LQB), interacted with triflumezopyrim & glyphosate. With Ahr2 and miRNA-21, the ligand molecules (pexalon & glyphosate) possessed binding

affinity, as it was found to be in between the binding pockets. But no interaction was observed between them with the pesticides.

### Impact of pexalon on zebrafish

Lethal concentration (LC<sub>50</sub>) of glyphosate and pexalon/ triflumezopyrim in model fish *Danio rerio* was measured for the biomarker study. The sublethal concentration of pexalon,

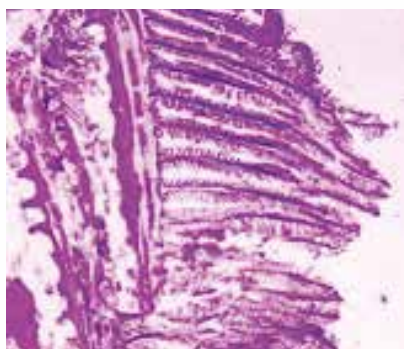


Fig. 28. Disintegration of lamellae in gills

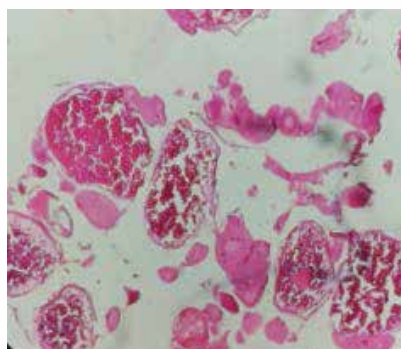


Fig. 29. Damaged tubular structure of testis

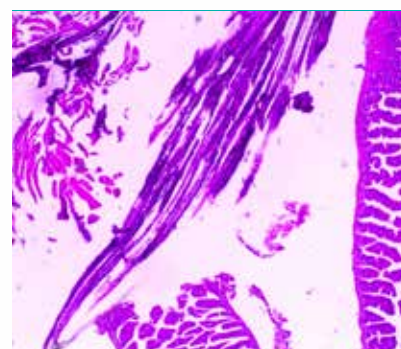


Fig. 30. Multilocal follicular atresia in ovary



resulted in damaged tubular structure of testis, multilocal follicular atresia in ovary, and disintegration of lamellae in gills (Fig. 28-30).

Effect of pexalon on body homogenate of zebrafish was examined through antibiotic sensitivity assay by measuring the zone of inhibition. Most bacterial isolates in the control plate were marked as sensitive (S), and some were intermediate (I), or resistant (R) to each of the antibiotics (gentamycin, levofloxacin, polymyxin- B, gatifloxacin, erythromycin, colistin, ciprofloxacin, azithromycin and piperacillin) used in the assay. Whereas in treated plates, microbial development was absolutely nonexistent, indicating, bacteria are fully wiped off due to the contaminant exposure.

#### E. WATER PRODUCTIVITY IMPROVEMENT

**Project: Ecological engineering in pond aquaculture for intensive fish production system (I-120)**

##### **Designing of airlift aeration system and estimation of SAE value and water pumping capacity**

The aim of this study was to develop and standardize an efficient airlift aeration system which can be deployed under intensive fish production system. To achieve this, regenerative blower (1 hp) was used to pump atmospheric air and injected at the bottom of a standing PVC pipe. So, the rising column of bubble in the air-water mixture has flowed up-ward and releasing on the surface water, creating vertical circulation between the tank bottom and the surface. Two different diameter of PVC pipe (i.e. 1 and 2 inch.) were used with three different submergence ratios to find out the optimum flow rate. The perusal of data on water flow rate under different operating conditions are presented in Table 10. The data shows that air blower (1 hp) with 120 m<sup>3</sup>/h air flow rate, i.e. 2000 l/min flow rate, with 27 nos. of pipe outlet (2 inch dia. pipe), can pump 80 m<sup>3</sup> water/ h (approx.). Further, it showed that at same air flow rate, 2-inch diameter pipe can pump more water than 1 inch diameter pipe. It is estimated that, total water volume of experimental pond (100 m<sup>3</sup> approx.) can be pumped within 1 h 20 min.

Table 10. Water flow rate of airlift aeration system under different operating conditions

Pipe Size (Inch)	Submergence ratio	Water Flow (l/min)	Total water flow (total pipe outlet, n = 27) (m <sup>3</sup> /hr/hp)	Air flow (l/min)
1	0.9	42	68.0	75
	0.8	31	50.2	75
	0.7	20	32.4	75
2	0.9	50	81.0	75
	0.8	43	69.7	75
	0.7	30	48.6	75



### Estimation of Standard Aeration Efficiency (SAE) of Air lift system

The oxygen transfer rate was determined by the unsteady state procedure outlined in ASCE Standard 2-91 (ASCE, 1992). Cobalt chloride ( $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ ) catalyst and sodium sulphite ( $\text{Na}_2\text{SO}_3$ ) were added to de-oxygenate the water. With the same air lift system and 1 hp blower, the Standard Aeration Efficiency (SAE) under inhouse FRP tank was estimated as 1.22 kg  $\text{O}_2$ /Kw-hr (approx.). i.e. if the blower (1 hp or 0.75 Kw) operates for 1 hr and 15 mins, then it will deliver 1.2 kg Oxygen into the water. These, preliminary study will help to decide the maximum carrying capacity of the pond based on the capacity of the aeration system. This initial experimental data will be the basis for final pond experiment and a deciding factor for prevention of fish mortality due to sudden oxygen depletion.

**Project: Aqua-mimicry for sustainable production of Indian major carps (I-112)**

### Development of plankton with application of liquid fermented rice bran (LFRB)

Experiment was setup to develop plankton using liquid fermented rice bran (LFRB). Finely powdered rice bran (1 kg) mixed with probiotics (1g) and 5 litres of water and kept for fermentation for 96 h under constant aeration at ambient temperature. During the process, pH was adjusted to about 7.0 by adding powdered sodium bicarbonate. Two treatments (with and without soil) in FRP tanks with a capacity of 1000 litre filled with borewell water up to 800 litre. The fermented rice bran added @ 5 ppm to each treatment. Phytoplankton was developed after four days of inoculum (LFRB) and zooplankton was developed in seven days and 10 days in with and without soil, respectively.

### Observations of Plankton diversity using liquid fermented rice bran (LFRB):

With the application of liquid fermented rice bran (LFRB) @ 5 ppm/day in aquamimicry system, the phytoplankton viz., *Closterium*, *Oedogonium*, *Oscillatoria*, *Zygnema*, *Diatom* and *Volvox* group of phytoplankton's were commonly found however the group of phytoplankton's viz., *Closterium*, *Oedogonium*, *Oscillatoria* were predominantly found in these system. In case of zooplankton's, the



Fig. 31. Plankton observed in Aquamimicry system



copepods are predominantly found in this system while cladocerans and rotifers were also observed (Fig. 31).

### Growth performance of rohu in aquamimicry system

The carp seed rearing experiment was conducted in FRP tank (800 litre capacity) with and without soil base. The planktons were developed into the tanks with

application of liquid fermented rice bran (LFRB). The rohu seed were stocked into the tanks @ 3 lakh/ha after the development of zooplankton. During rearing period, tanks were regularly fertilised with 5 ppm dose of (LFRB) and Groundnut oil cake also provided as a supplementary feed. During 60 days of rearing, the growth performance of rohu not shown any significant difference in both the tanks (Fig. 32).

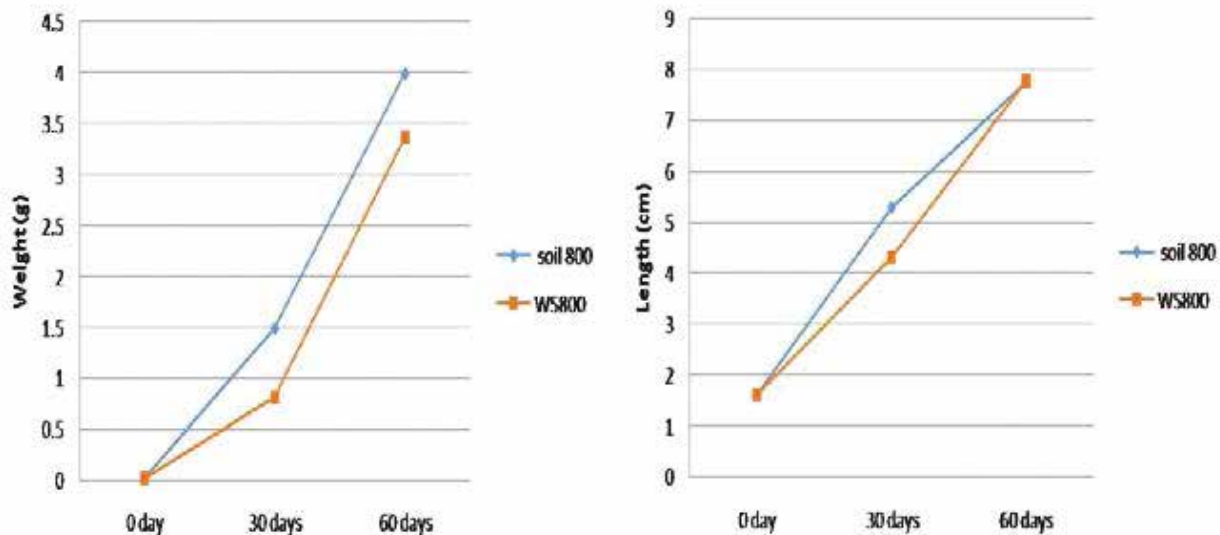


Fig.32. Growth performance of *L. rohita* in Aquamimicry system

### Project: Effect of Zinc and Iron Enrichments on Freshwater Plankton Productivity and growth of improved Rohu (*Labeo rohita* H.) (I-98 c)

#### Effect of different Zinc and Iron doses on fish survival and growth

As emanated from the results of previous series of experiments in controlled conditions, an experiment was conducted with optimum doses of Zn and Fe. For this purpose, four treatments were taken: (i) Control, (ii) Zn (0.10 mg /L), (iii) Fe (0.20 mg /L), and Zn+Fe (0.10 mg Zn/L+0.20 mg Fe/L)

to study their impact on survival, growth, and development of fingerlings of Jayanti Rohu (*L. rohita*). The fingerlings (mean weight: 21.6 g; mean length: 10.02 cm) were reared for 5 months in 1500 litre concrete tanks under open conditions. The other nutrients, except Zn (through zinc sulphate) and Fe (ferrous chloride) were supplied periodically based on the water analysis results to maintain the plankton population in each treatment. The initial water quality parameters (pH: 8.10; total alkalinity: 81 ppm; total hardness: 72 ppm; total ammoniacal nitrogen: 0.19 ppm; soluble orthophosphate: 0.03 ppm; dissolved



Zn: 0.07 ppm; dissolved Fe: 1.85 ppm) were estimated. At the end, the fish fingerlings were harvested and survival, length, weight were recorded. Data on survival suggested that there was no mortality across the treatments. Further, the results on mean weight of fingerling suggested that there was significant increase in weight under the treatment with 0.10 mg/L Zn and 0.20 mg Fe/ L (114.2 g and 113.3 g, respectively) over control (101.8 g). However, the combined application of Zn and Fe resulted in even greater increase in fish weight (123.2 g) (Fig. 33). Similarly, the highest increase in mean length was observed under the treatment Zn+Fe (23.78 cm) followed by Zn alone (22.84 cm) as well as Fe alone (21.57 cm), which were significantly higher than control

(101.8 cm) (Fig. 34). Thus, the results suggested that combined application of Zn and Fe up to 0.10 mg Zn/ L + 0.20 mg Fe/L is beneficial in increasing the growth of fish in concrete rearing system. Fish samples have been collected and preserved and analysis of innate immunity parameters is under process.

**Project: Protocol development for control of noxious algal bloom in culture ponds (I-98 d)**

**Biological control of *Microcystis***

Two floating aquatic macrophytes (*Azolla* sp. and *Pistia* sp.), one herbivore (*C. idella*) and two omnivore fishes (*O. belangeri* and *Puntius japonicus*) were evaluated and compared for their efficiency as bio-manipulators to suppress *Microcystis* population for a period of thirty days. The experiment constituted five treatments and a simultaneous control (neither macrophyte nor fish supplemented) with two replications. Cement tanks (50 m<sup>3</sup>) were approx. uniformly inoculated with defined quantum of *Microcystis* inoculum ( $2.29 \times 10^4$  cells ml<sup>-1</sup>) without artificial feeding. *Azolla* and *Pistia* were supplemented @ 7.5 kg in two treatments and fishes (grass carp, puntius and pengba) were stocked @ 100 nos. of fingerlings in three treatments. *Azolla* based treatment has recorded pH, total phosphorous (TP) and Total Ammonium Nitrogen (TAN) of  $8.40 \pm 0.56$ ,  $0.04 \pm 0.03$  ppm and  $0.14 \pm 0.07$  ppm, respectively, whereas *Pistia* supplemented tanks have recorded  $8.90 \pm 0.30$ ,  $0.05 \pm 0.03$  ppm and  $0.12 \pm 0.05$  ppm, respectively. Though there was inhibition in *Microcystis* growth in initial 15 days in fish-based treatments, the population increased thereafter. There was a significant and continuous check on *Microcystis* growth



Fig. 33. Effect of different doses of Zn and/ Fe on mean weight of improved Rohu 'Jayanti' fingerlings

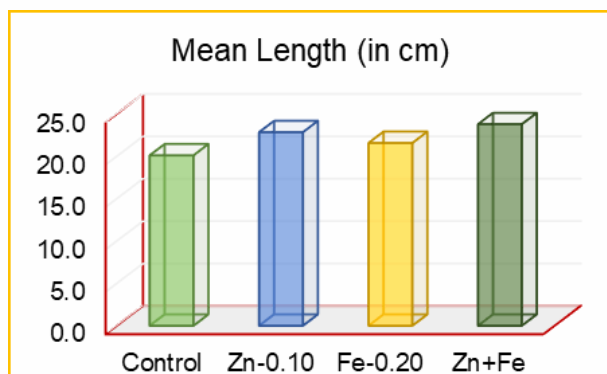


Fig. 34. Effect of different doses of Zn and/ Fe on mean length of improved Rohu 'Jayanti' fingerlings



in weed treatments rather than fish treatments. The percentage weight gain followed the order of puntius (24.5 %) > pengba (22.7 %) > grass carp (20.5 %) with minimum survival rate of 95 %. *Azolla* and

*pistia* maintained optimum water quality and could appreciably suppress *Microcystis* population growth, hence can be potential interventions for exclusion of *Microcystis* in the system (Fig. 35).

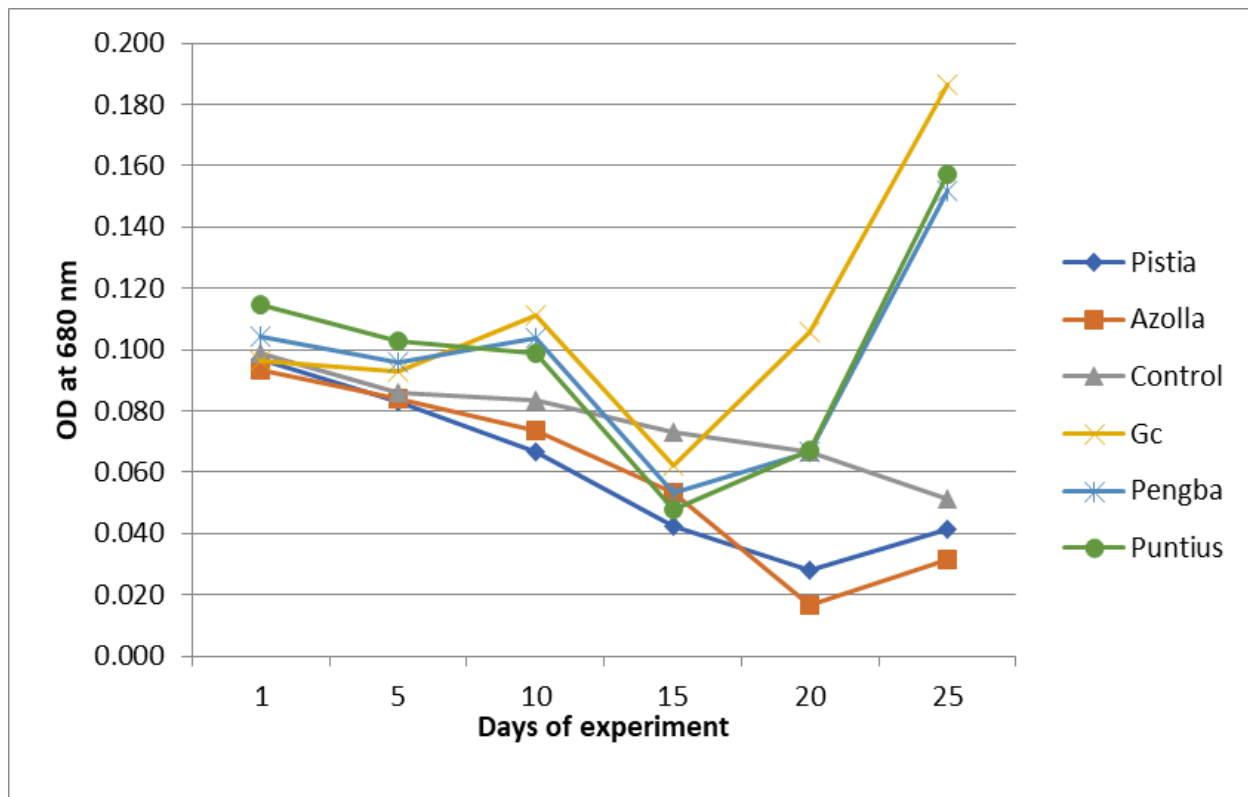


Fig. 35. Control of *Microcystis* by different biological agents

### 3. GADGETS APPLICATION IN AQUACULTURE

#### Development of gadgets and tools

**Project: ICAR-Network Program on Precision Agriculture (NePPA) (E-139)**

In this project, the gadgets and devices required for water quality monitoring, aeration, feeding and health management will be developed. An automated fish feeding device development work is under progress. As well as the establishment of Smart Pond work at ICAR-CIFA is under progress. Smart hatchery for intensive magur seed

production will be established at ICAR-CIFA. The decision support system for mapping of CIFA farm facility is also under progress.

### 4. GENETIC IMPROVEMENT

#### Genetic upgradation of freshwater fish and shellfish

**Project: Genetic improvement of rohu (*Labeo rohita*) for growth and disease resistance against *A. hydrophila* and its effective dissemination (I-99)**

The selective breeding programme of rohu and catla are continued for further generation production and distribution.

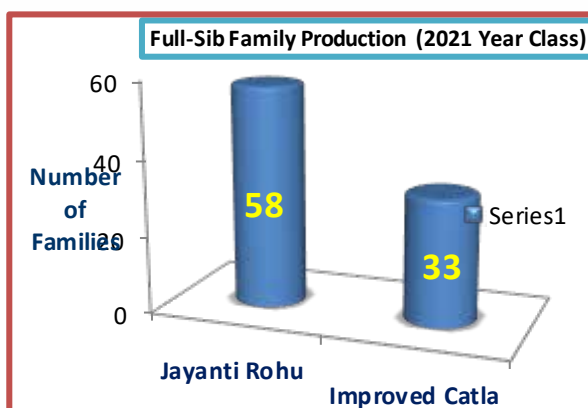


Fig 36. Production of Full-Sib Families (June-Sept, 2021)

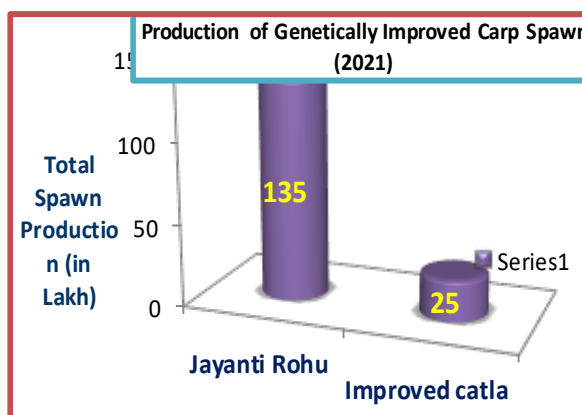


Fig 37. Production of improved carp spawn (June-Sept, 2021)

**Family production of improved rohu (Jayanti) and catla.**

In total, 58 full-sib families of improved rohu (Jayanti) (2021 year class, 12<sup>th</sup> generation) and 33 full-sib families of improved catla (3<sup>rd</sup> generation) were produced along with resistant and control line of rohu against *A. hydrophila* (Fig. 36). 135 lakh improved rohu (Jayanti) and 25 lakh improved catla spawn

are produced (Fig. 37). Fourty lakh improved rohu (Jayanti) spawn has been supplied to National Freshwater Fish Brood Bank (NFFBB), Kausalyaganga, Bhubaneswar and 95 lakh spawn were disseminated to farmers of nine states (Table 11). Similarly, 24.75 lakh improved catla spawn are distributed to the farmers from six states for field trial (Table 12).

**Table 11. Dissemination of improved rohu spawn from ICAR-CIFA (2021)**

Sl. No.	State	Quantity (In lakh)
1.	Odisha	54.75
2.	NFFBB, Kausalyaganga	40.00
3.	West Bengal	10.00
4.	Meghalaya	5.00
5.	Gujarat	2.50
6.	Assam	8.00
7.	Tripura	1.00
8.	Jharkhand	8.00
9.	Punjab	3.00
10.	Bihar	2.00
<b>Total</b>		<b>134.25</b>



**Table 12. Distribution of improved catla spawn from ICAR-CIFA (2021)**

Sl. No.	State	Quantity (In lakh)
1.	Odisha	18.25
2.	West Bengal	2.50
3.	Meghalaya	2.00
4.	Kerala	1.00
5.	Jharkhand	0.50
6.	Maharashtra	0.50
<b>Total</b>		<b>24.75</b>

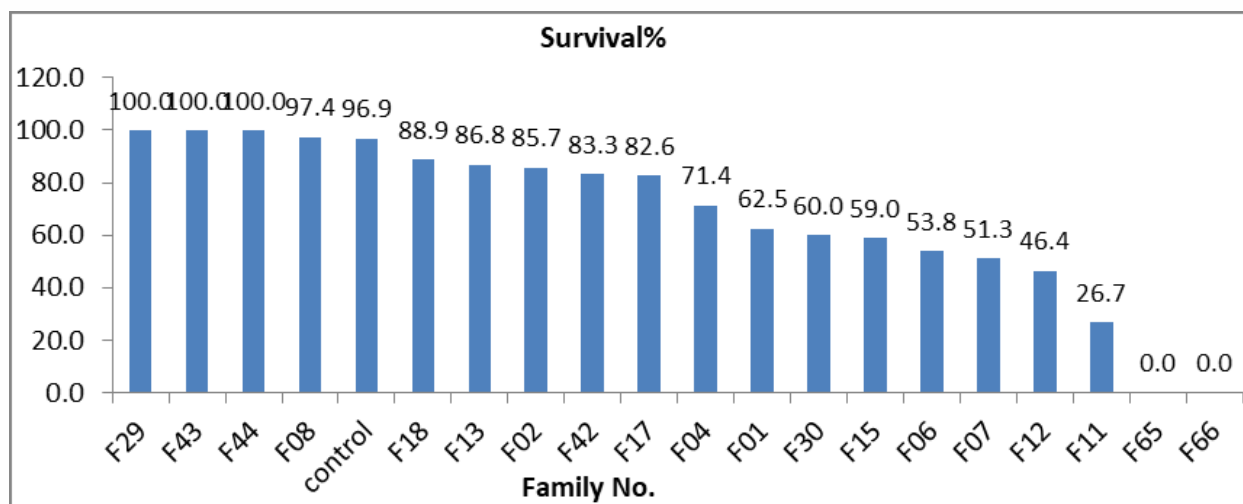
**Tagging of 2020 year class improved rohu (Jayanti) and improved catla**

In addition to improved rohu “Jayanti” and improved catla family production, during March-April 2021, 1230 number of Jayanti rohu fingerlings belonging to 42 nos. full-sib families generated in the previous year along with control and resistant group were tagged with PIT (Passive Integrated Transponder) tags and released in three communal ponds for growth evaluation. At the same time 364 number of improved catla fingerlings from 21 nos. full-sib families along with

control group were tagged with PIT tags and released in same three communal ponds along with improved rohu (Jayanti) for growth evaluation.

**Production of disease resistant rohu**

Twenty families of rohu were challenged with *Aeromonas hydrophila* intraperitoneally at a constant dose of  $1.25 \times 10^7$  CFU per Kg body weight and observed for any mortality for 10 days. Among the families, two families showed 100% mortality whereas three families even showed 100% survival (Fig. 38).



**Fig. 38. Family wise survival rate**



### Trait improvement through genetic selection

**Project: Scaling up of genetic improvement programme of freshwater prawn *Macrobrachium rosenbergii* (scampi) (E-134)**

### Grow-out rearing of 12<sup>th</sup> generation of CIFA-GI Scampi

At the end of G12 grow-out rearing, final survival was 66.4%. The mean initial and final size of the 69 families of G12 was

4.93±1.19 g and 28.71±13.63 g respectively (Fig. 39). The mean final size of G12 families after grow-out is presented in Figure 1. During final data collection all survived prawns were collected and classified by sex and male morphotype. All prawns were individually measured for carapace length, standard length, total length, and individual weight. Ten to 12 heaviest male and 15-20 heaviest female prawns were selected from each family and tagged with VIA tag for further rearing.

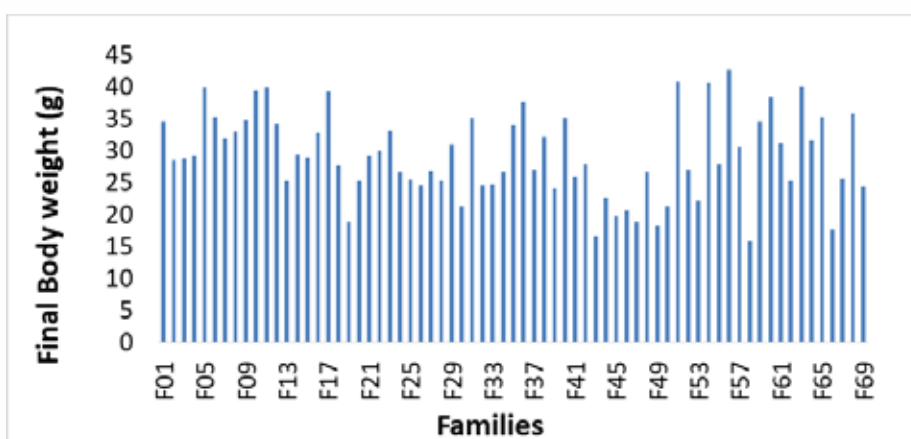


Fig. 39. Average final body weight in different families of Generation 12 (G12) of CIFA-GI Scampi

### Production of G13 of CIFA-GI Scampi

Mate allocation and breeding of 12<sup>th</sup> generation of CIFA-GI Scampi was initiated during April 2021. A total of 83 post larval batches were successfully completed for further rearing as full sib families of G13.

Twenty-day old post larvae (PL) (400 nos from 83 families) were nursed in hapas (80 nos per happa) and achieved average weight of 4g. At the end of nursery rearing of 90 days, the average weight of 6.2 g and the survival of 73% were achieved.



Grow-out rearing of CIFA-GI Scampi (G13)



## DEVELOPMENT OF GENETIC RESOURCES

**Project: Identification of SNPs linked to body weight trait in genetically improved rohu, 'Jayanti' (I-113)**

### Transcriptome analysis of rohu

De novo transcriptome assembly generates 14,02,926 contigs with average contig length of 525bp and assemble quality was assessed using BUSCO with 57% completeness. Functional annotation reveals the potential involvement of transcripts in molecular processes of binding and catalytic activity. Differential expression analysis of transcripts between Low breeding and High breeding value groups revealed 3644 up-regulated and 4446 down-regulated transcripts. Most of the upregulated transcripts were associated with muscle integrity, regeneration etc while downregulated transcripts were found to be involved in signal transduction. In total, 2,14,655 high quality cSNPs were identified with Ts/Tv ratio was observed to be 1.542. Functional annotation of SNPs revealed their presence in downstream region of genes more than upstream regions.

**Project: Genetic enhancement of economically important freshwater fish, *Catla catla* using genetic and molecular approaches (E-112)**

### Construction of SNP based linkage map in catla

Genotyping-by-sequencing on Illumina platform was carried out for 200 catla mapping individuals comprising from five mapping families including their parents. In total ~ 140 GB of sequence data was generated and genotyping calling using STACKS software generated genotyping data for ~20000 high quality SNPs. Among the five catla mapping families family 11

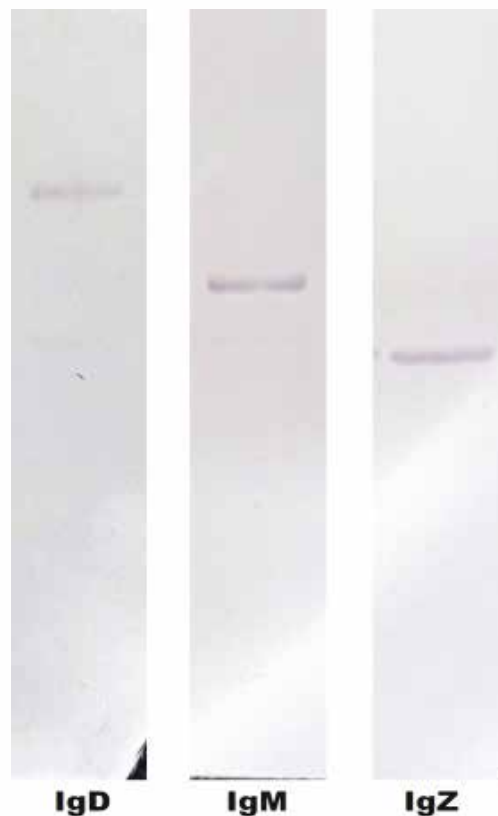
(F11) observed to contain highest number of SNPs. Therefore, the genotyping data of F11 family was taken further for linkage analysis using the program Joinmap. Linkage analysis resulted in 25 linkage groups in catla.

## 5. MOLECULAR GENETICS AND BIOTECHNOLOGY

### a. Genomics and proteomics

**Project: Novel approaches towards vaccine development against argulosis in carps (ICAR-CRP) (E-97)**

Experiments were conducted in ponds as well as in outdoor cement tanks to assess the effectiveness of earlier identified 19 mer peptide antigen (*Argulus siamensis*). In these two experiments, *L. rohita* juveniles were bath immunized with the peptide antigens and were released into outdoor ponds/tanks



**Fig. 40.** Specificity of rabbit polyclonal antibodies to rohu serum antibodies.



along with unvaccinated controls. Fishes were cohabitation challenged with *A. siamensis*-infected fish @10% of total number of fishes in the ponds/tanks. In both the experiments, the results were inconclusive as there was no specific trend observed relating to vaccine efficacy. Further experiments are necessary to evaluate the effects of the peptide vaccine in outdoor conditions. In our earlier experiment, detection of anti-peptide IgM antibody was carried out in serum of bath immunized rohu in ELISA and very low level of IgM could be found. Possibly, mucosal immunity (particularly IgZ antibodies) plays the major role in bath immunization process effecting protection. Hence, rabbit polyclonal antibodies against rohu (*L. rohita*) antibodies (IgM, IgZ and IgD) were prepared commercially to facilitate the detection of specific antibody isotype response against the peptide. The specificity of all the three rabbit antibodies were confirmed in western blot with rohu serum (Fig. 40).

**b. Molecular endocrinology**

**Understanding the role of SREBP (Sterol regulatory element-binding protein) in the regulation of fatty acid biosynthesis in rohu**

Lipid metabolism is tightly regulated by sterol regulatory element-binding protein1 (SREBP-1), an important transcriptional factor that regulates the transcription of most

genes involved in lipogenesis. To understand the role of SREBP in the regulation of fatty acid biosynthesis in IMC, initially we have identified the SREBP gene from liver cDNA through PCR amplification procedure. A partial cDNA sequence of 1425 bp has been obtained till date. RACE (both 5 prime and 3 prime) experiment is going on to get the full length cDNA sequence (Fig. 41).

**C. GENE EDITING AND TRANSGENIC RESEARCH**

**Project: Establishment of captive breeding protocol and value additions to selected indigenous ornamental fishes from North-East India (E-120)**

**Value addition by generating stable lines of ornamental transgenic freshwater fishes**

The HSP90A is believed to play critical roles in diverse physiological functions of cell viability and chromosomal stability



Fig. 41. PCR amplification of SREBP-1 primers with rohu liver cDNA

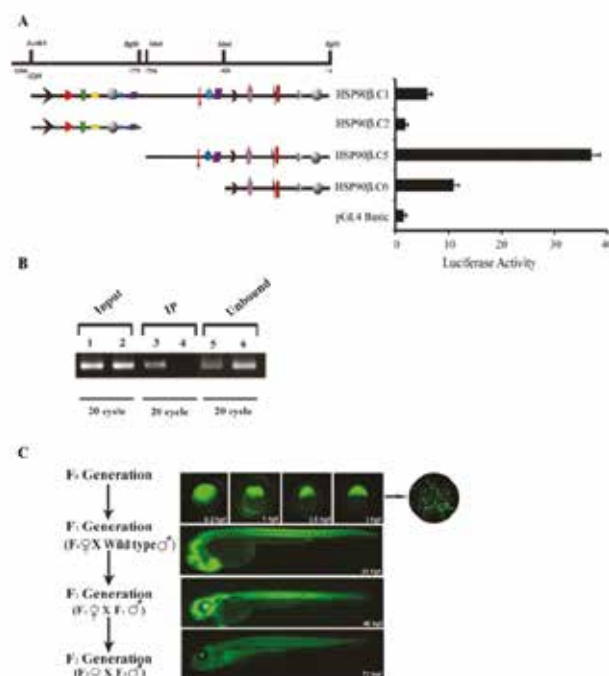


Fig. 42. Disruption of *hsp 90β* gene



including stress management. Heightened abundance of *hsp90β* transcript was documented in *Channa striatus*, a freshwater fish, which is capable of surviving within an extremely hypoxic environment. To better understand the mechanism of *hsp90β* gene expression (Fig. 42), we investigated its genomic organization. Eleven exons were identified, including a long upstream intron with a remarkable similarity with human, but not with chicken counterpart. Dual-luciferase assays identified promoter activity in a 1366 bp 5'-flanking segment beyond the transcription initiation site. Examination detected a minimal promoter of 754 bp containing a TATA-box, CAAT-enhancer in addition to providing clues regarding other enhancer and repressor elements. The driving capability of this minimal promoter was further validated by its binding ability with TATA-box binding protein and the generation of GFP expressing transgenic zebrafish ( $F_2$ ). Further, deletion of an inverted HIF (hypoxia inducible factor) motif RCGTG (upstream of the TATA-box) dramatically reduced luciferase expression in a hypoxic environment ( $\text{CoCl}_2$  treated cultivable cells) and was identified as a *cis*-acting HIF responsive element, necessary for the hypoxia-induced expression. The results obtained herein provide an insight regarding how *hsp90β* gene expression is controlled by HIF responsive element in teleost both during hypoxia stress management and normal physiological functions, and suggested that the *hsp90β* gene promoter could be used as a potential candidate for generating ornamental and food-fish transgenics.

#### D. POPULATION GENETICS

**Project: Level and pattern of genetic variabilities in carp hatcheries of Odisha and West Bengal (I-124)**

Two number of carp hatcheries from northern Odisha located at Saramanga,

Bhadrak district and DighiRahania, Balasore district and four number of hatcheries from eastern Odisha located at Sarkana, Kausalyaganga of Khordha district and Gop, Bramhagiri of Puri district were selected for this study. Primary data for eight years from 2014 to 2021 on the species, date, month and year of breeding, number of males and females used for breeding, and the number of females spawned etc. from the breeding records of the hatcheries were collected. Effective population size and annual rate of inbreeding (Falconer & Mackay, 1998) were estimated (Fig 43-45). Carp hatcheries in

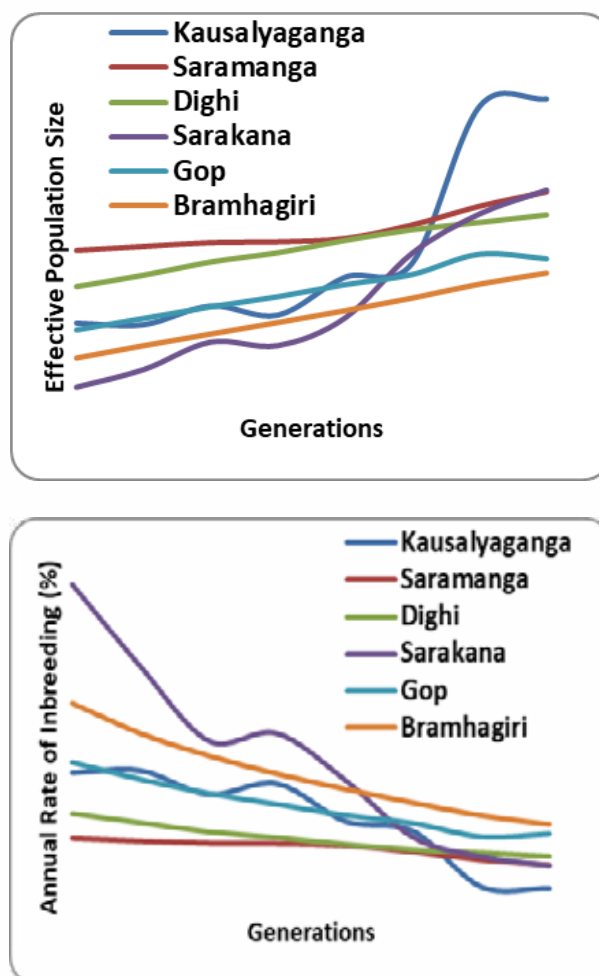


Fig. 43. Effective Population Size and Annual rate of Inbreeding (%) of *Labeo catla* in carp hatcheries of Odisha

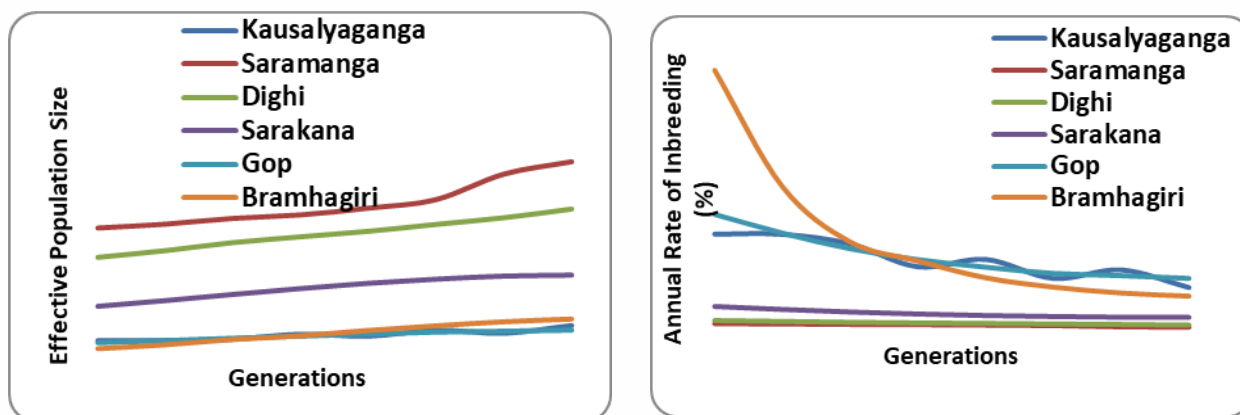


Fig. 44. Effective Population Size and Annual rate of Inbreeding (%) of *Labeo rohita* in carp hatcheries of Odisha

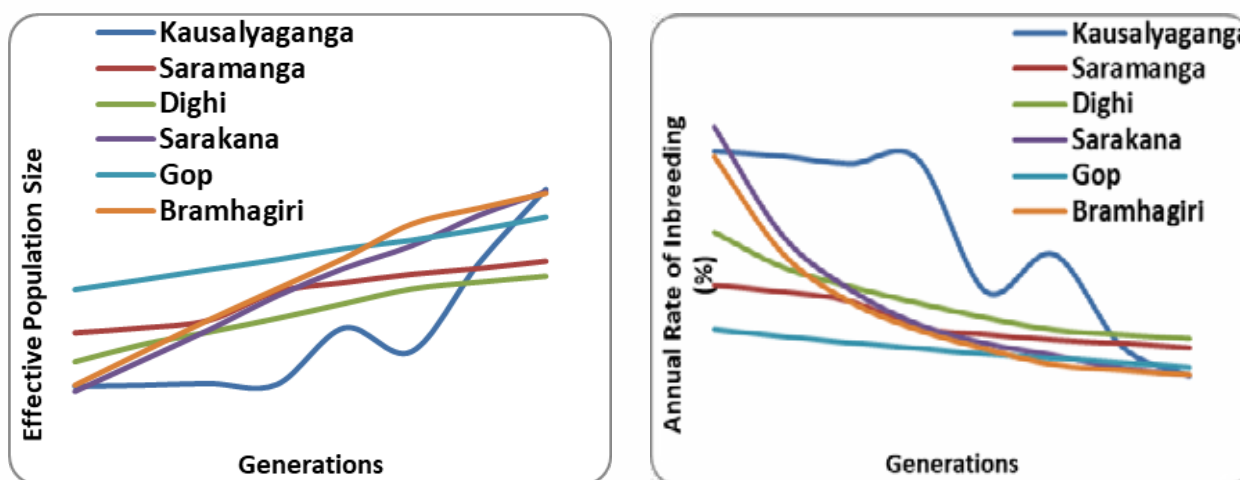


Fig. 45. Effective Population Size and Annual rate of Inbreeding (%) of *C. mrigala* in carp hatcheries of Odisha

Odisha are replacing 2-17 % of their carp broodstocks with local stocks each year. The annual rate of inbreeding (%) in the hatchery populations of *Labeo catla*, *Labeo rohita* and *Cirrhinus mrigala* were in the range of 0.13 – 0.73, 0.05 - 1.83 and 0.16 – 0.73, respectively. The effective carp population size of northern hatcheries are relatively higher than those of

eastern hatcheries. Annual rate of inbreeding (%) is also comparatively lower in northern hatcheries than eastern hatcheries. Public hatcheries are maintaining higher populations than those in private hatcheries and accordingly the inbreeding rate is lower in public hatcheries than those observed in private hatcheries.



## 6. FISH FEED DEVELOPMENT

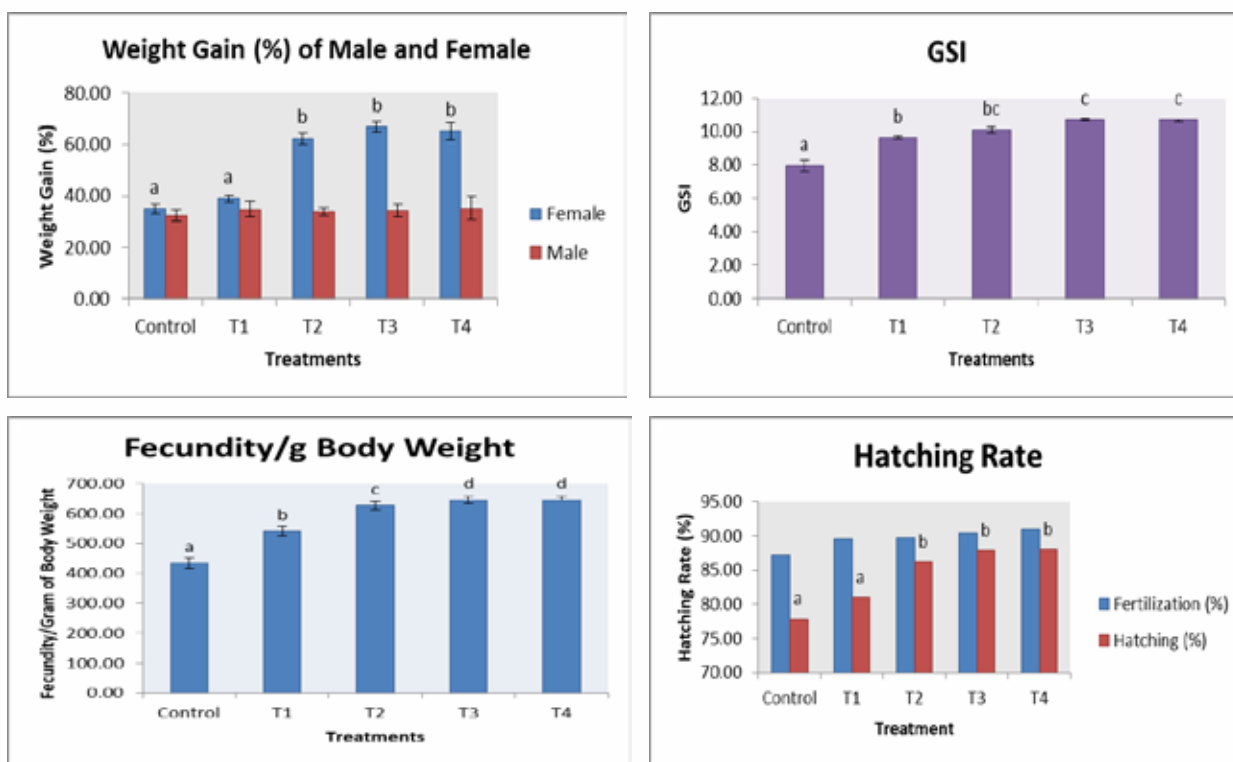
**Project: Enhancing larval survivability of climbing perch through dietary intervention I-107)**

### Broodstock and larval feed development for diversified species

On *Anabas testudineus* brood fish, the effect of dietary n3/n6 ratio of fatty acids (FA) on gonadal maturation, fecundity, hatching rate, and offspring survival was investigated. Five iso-nitrogenous (CP 40%) and iso-lipidic (EE 8%) diets were formulated to contain 0.25 (T1), 0.5 (T2), 0.75 (T3) and 1.25 (T4) n3/n6 FA ratio, while the control (T0) contained saturated fat. The brood fish were randomly distributed into 15 tanks (1000L capacity) containing 6 males (average weight: 233 g) and 6 females (average weight: 335 g).

The fish were fed experimental diets for 90 days at 3% of their body weight. The results showed that the gonado somatic index (GSI) was significantly greater in T2, T3, and T4 fed fish than in control and T1 fed fish (P0.05). With increasing levels of n3/n6 ratios, relative fecundity increased, with higher values in T3 and T4 compared to other dietary treatments (P 0.05). The dietary treatments had no effect on the rate of egg fertilisation (P>0.05).

The hatching rate (percent) of fish fed T3 and T4 was greater than that of fish fed T1 and T2. The starvation study with newly hatched larvae (0 day post-hatch (dph) to 11 dph) revealed that increasing the n3/n6 ratio in the diet improves larval survival, with the highest survival rates for larvae fed T3 and T4 diets (Fig. 47).



**Fig. 46.** Impact of dietary n3/n6 ratio of fatty acids on body weight gain and gonadal maturation, (GSI, fecundity and hatching rate)

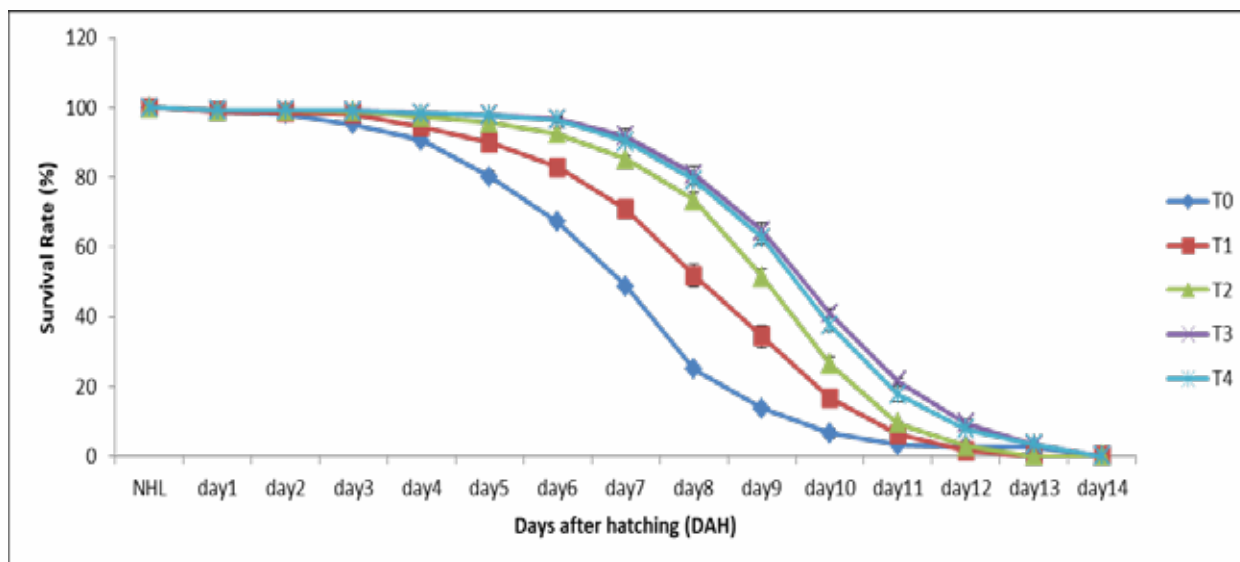


Fig. 47. Survival of larva fed with diets containing different n3/n6 ratio

The results of the study suggest that a dietary n3/n6 ratio between 0.75 and 1.25 could be the optimal inclusion level in the diet of *Anabas tesudineus* brood stock for maximising reproductive performance.

**Project: Implication of fat accumulation on gonadal maturation in *Catla catla* (I-104)**

Catla spent broodstock of similar age were fed with three different feeds (Feed1, Feed2 and Feed3) @ 3% body weight and twice a day for the period of three months. Blood sSerum 17 β-estradiol concentration was higher in fishes fed with Feed-2 with (33.67% protein and 26.76% CHO) followed by Feed-1 with (43.97% protein, 23.71 CHO) and Feed-3 with (29.81% CHO and 23.37%

protein). Similarly, serum progesterone concentration was higher in fishes fed with Feed -1 and Feed-3 whereas lower level of serum progesterone level was observed lower in Feed-2 treatment. Testosterone was also assayed and it was seen that fishes fed with high protein diets (Feed-1), 43.97% protein) showing lower level of serum testosterone whereas fishes fed with (Feed-2), 33.67%) showing higher level of serum testosterone followed by fish fed with high carbohydrate diets (Feed-3), (29.81% CHO). Further, insulin assays showed higher level of serum insulin fishes fed with high level of dietary CHO (Feed -3), 29.81% CHO and 23.37% protein) whereas fishes fed with higher protein (Feed-1), 43.97% protein and Feed-2, (33.67%) showing almost similar level of serum insulin level (Fig. 48).



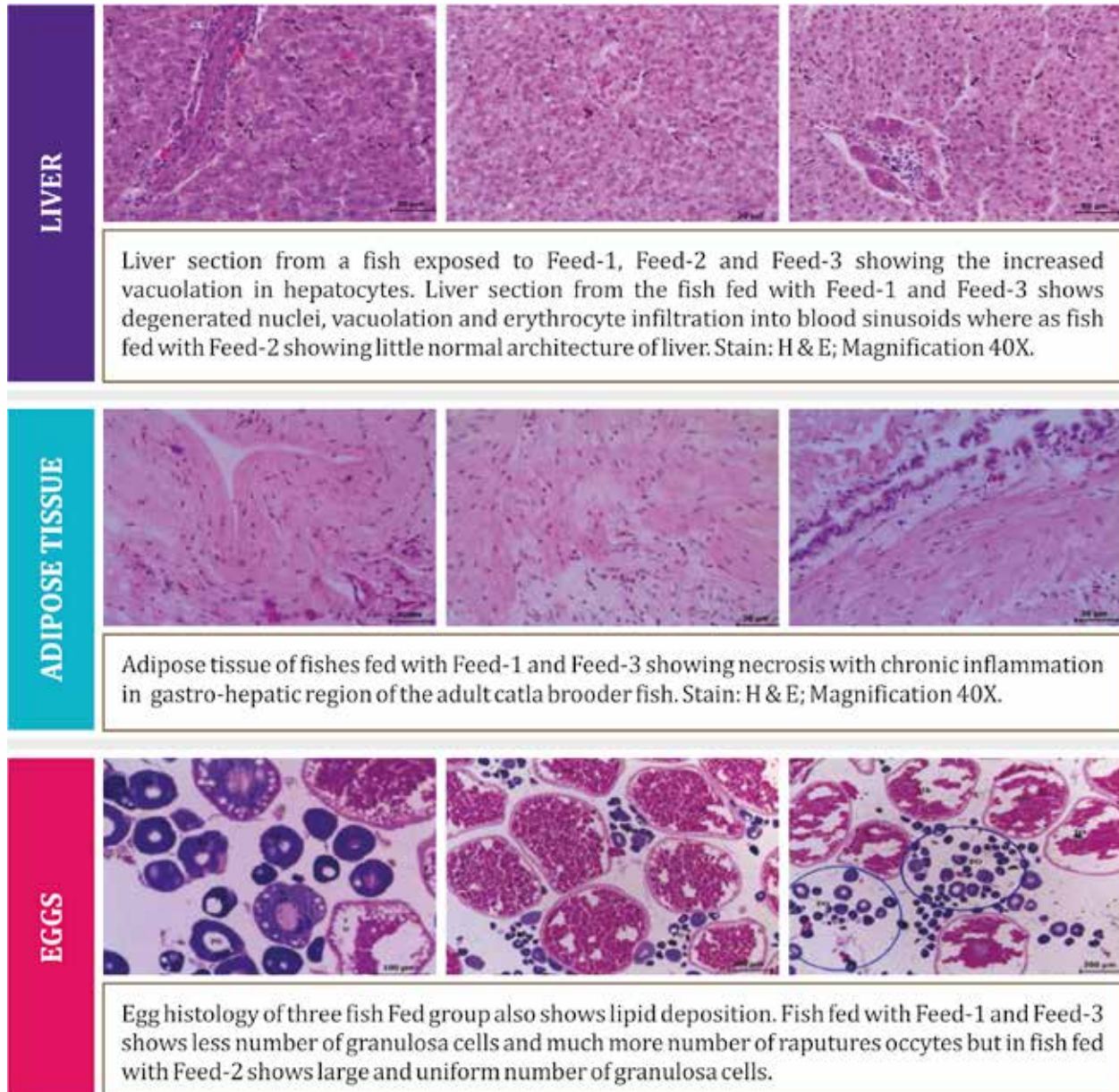


Fig. 48. Histological observation of Liver, Adipose tissue and Eggs fed with high protein and high carbohydrate rich diets

### Effect of three different diets on gonad maturation and seed production

The effect of different diets on gonad maturation and seed production were presented in the table 13.





**Table 13.** Effect of different diets on gonad maturation and seed production in catla

Parameter (Mean ± S.D)	Feed-1	Feed-2	Feed-3
Number of Breeding Set	2 (5 female and 5 male)	2 (5 female and 5 male)	2 (5 female and 5 male)
Weight of Female(kg)	2.8 ± 0.44	2.6 ± 0.07	2.5 ± 0.16
Weight of Male (kg)	2.03 ± 0.19	1.85 ± 0.02	2.1 ± 0.12
Gonado Somatic Index (GSI) (%) (At 90 days)	8 ± 2.42	12±6.2	7± 3.26
Relative Fecundity (lakh/kg bw)	1.15 ± 0.31	1.76 ± 0.89	0.76 ± 0.132
Milt volume (ml/kg bw)	4.75 ± 1.89	6.87 ± 1.60	4.26 ± 1.59
Fertilization Rate (%)	0	92.3 ± 2.5	0
Egg Diameter (mm)	3.71±0.31	4.66±0.179	3.32±0.24
Hatching Rate (%)	0	38.3 ± 5.85	0
Relative Spawn Recovery (lakh)	0	1.10 ± 0.23	0

**Project: Species diversification in peninsular aquaculture: Strategies for mass seed production of peninsular carps and their successful introduction to aquaculture system (I-111)**

**Effects of dietary protein levels on growth performance, carcass composition, nutrient digestibility and digestive enzyme activity of *Hypselobarbus pulchellus***

The dietary protein requirements of the critically endangered peninsular carp, *H. pulchellus*, were determined via a feeding trial with five isocaloric diets formulated to contain 20 to 40 percent crude protein (CP20, CP25, CP30, CP35, and CP40) using casein and gelatin as the protein sources. *H. pulchellus* fingerlings (average weight: 4.71 g) were fed 5% of the biomass for sixty

days. The growth parameters increased with increasing levels of dietary protein up to 35 percent, then decreased with the CP40 diet (Table 14). The food conversion ratio was lowest (P0.05) with a 35% protein diet. The protein efficiency ratio was inversely proportional to the amount of protein in the diet. The condition factor ranged from 0.94 to 1, and there were no significant differences between treatments. No difference in fish survival was observed (P > 0.05). The highest levels of trypsin and total protease activity were found in the intestine and hepatopancreas of fish fed a diet containing 35 percent crude protein. Analysis of weight gain rate and specific growth rate using a second-order polynomial regression revealed a dietary protein requirement between 31.80 and 32.76 percent for *H. pulchellus* fingerlings (Fig. 49).



**Table 14.** Growth parameters (average  $\pm$  SD; n=3) of *H. pulchellus*.

Growth parameters	CP20	CP25	CP30	CP35	CP40
Initial weight (g)	4.78 $\pm$ 0.19	4.78 $\pm$ 0.19	4.67 $\pm$ 0.17	4.60 $\pm$ 0.17	4.72 $\pm$ 0.09
Final weight (g)	8.12 $\pm$ 0.11 <sup>a</sup>	8.37 $\pm$ 0.10 <sup>ab</sup>	8.77 $\pm$ 0.22 <sup>b</sup>	9.55 $\pm$ 0.33 <sup>c</sup>	8.41 $\pm$ 0.22 <sup>ab</sup>
Weight gain rate (%)	69.65 $\pm$ 2.21 <sup>a</sup>	75.53 $\pm$ 2.05 <sup>ab</sup>	88.00 $\pm$ 4.77 <sup>b</sup>	110.07 $\pm$ 7.39 <sup>c</sup>	78.16 $\pm$ 4.72 <sup>ab</sup>
Specific growth rate (%/day)	0.88 $\pm$ 0.02 <sup>a</sup>	0.94 $\pm$ 0.12 <sup>ab</sup>	1.05 $\pm$ 0.04 <sup>b</sup>	1.23 $\pm$ 0.06 <sup>c</sup>	0.96 $\pm$ 0.05 <sup>ab</sup>
Feed conversion ratio	3.37 $\pm$ 0.11 <sup>a</sup>	3.12 $\pm$ 0.08 <sup>ab</sup>	2.74 $\pm$ 0.14 <sup>b</sup>	2.28 $\pm$ 0.15 <sup>c</sup>	3.05 $\pm$ 0.19 <sup>ab</sup>
Protein efficiency ratio	1.46 $\pm$ 0.04 <sup>a</sup>	1.26 $\pm$ 0.03 <sup>b</sup>	1.25 $\pm$ 0.07 <sup>b</sup>	1.26 $\pm$ 0.08 <sup>b</sup>	0.82 $\pm$ 0.05 <sup>c</sup>
Survival (%)	89 $\pm$ 10 <sup>a</sup>	100 $\pm$ 0 <sup>a</sup>	100 $\pm$ 0 <sup>a</sup>	100 $\pm$ 0 <sup>a</sup>	89 $\pm$ 10 <sup>a</sup>
Condition factor	1.01 $\pm$ 0.03 <sup>a</sup>	0.98 $\pm$ 0.01 <sup>a</sup>	1.00 $\pm$ 0.02 <sup>a</sup>	1.07 $\pm$ 0.04 <sup>a</sup>	0.94 $\pm$ 0.02 <sup>a</sup>

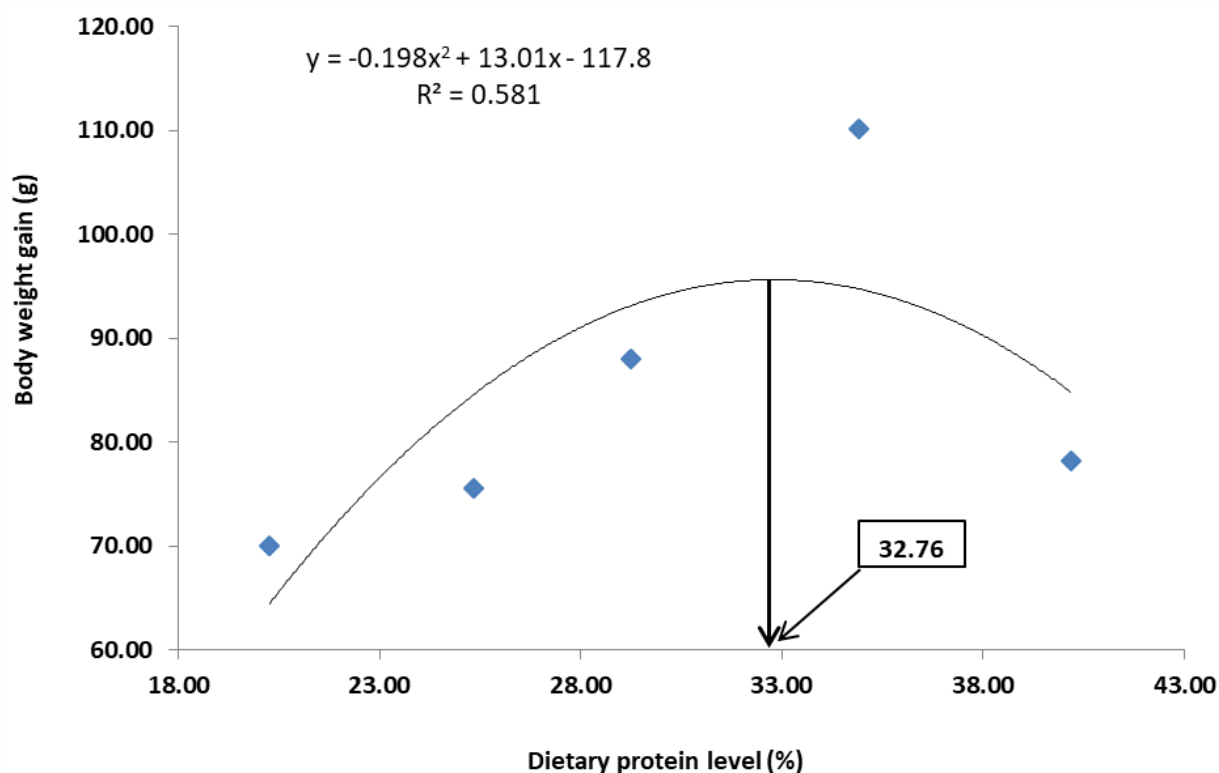


Fig. 49. Relationship between body weight gain and dietary protein level for *H. pulchellus* as indicated by second-order polynomial regression.



**Effect of dietary lipid levels on the growth, carcass composition and nutrient digestibility of the peninsular carp *Hypselobarbus pulchellus***

*H. pulchellus* fingerlings were fed up to satiation with one of the five isonitrogenous diets formulated and prepared using pure ingredients to contain lipid levels ranging from 2.5 to 12.5% for a period of 90 days. The final weight and length gain (%) decreased at 12.5% lipid incorporation level with no difference ( $P>0.05$ ) among the other treatments (Table 15). Proximate composition analysis of fish carcass revealed

no difference in moisture and ash contents. However, the crude protein values reduced and fat values increased at 10 and 12.5% lipid feeding. Apparent digestibility of crude protein was the highest under 5.0% L and lowest under 12.5% L (Fig. 50). Fat digestibility value was the lowest under 2.5% L and comparable ( $P>0.05$ ) among the other treatments. The study indicated that dietary lipid levels of 2.5 to 10% have same effect on the growth of *H. pulchellus*, but, levels beyond 7.5% have negative effect on carcass protein content and protein digestibility. *H. pulchellus* seems to require lower dietary fat levels.

**Table 15.** Growth parameters (mean  $\pm$  SD) of *H. pulchellus*

	2.5%L	5.0%L	7.5%L	10.0%L	12.5%L
Initial weight (g)	1.33 $\pm$ 0.06	1.33 $\pm$ 0.06	1.33 $\pm$ 0.06	1.30 $\pm$ 0.06	1.33 $\pm$ 0.11
Final weight (g)	2.71 $\pm$ 0.09 <sup>a</sup>	2.72 $\pm$ 0.09 <sup>a</sup>	2.73 $\pm$ 0.02 <sup>a</sup>	2.65 $\pm$ 0.13 <sup>a</sup>	2.40 $\pm$ 0.05 <sup>b</sup>
Weight gain (%)	103.36 $\pm$ 6.71 <sup>a</sup>	104.41 $\pm$ 6.95 <sup>a</sup>	105.64 $\pm$ 1.37 <sup>a</sup>	103.91 $\pm$ 10.34 <sup>a</sup>	80.70 $\pm$ 3.71 <sup>b</sup>
Length gain (%)	507.33 $\pm$ 15.95 <sup>a</sup>	510.33 $\pm$ 6.11 <sup>a</sup>	510.33 $\pm$ 3.21 <sup>a</sup>	502.00 $\pm$ 7.55 <sup>ab</sup>	482.33 $\pm$ 4.04 <sup>b</sup>
Condition factor	1.21 $\pm$ 0.06	1.19 $\pm$ 0	1.20 $\pm$ 0.01	1.23 $\pm$ 0.04	1.22 $\pm$ 0.01

Figures in the same row with different superscript are significantly different ( $P<0.05$ ).

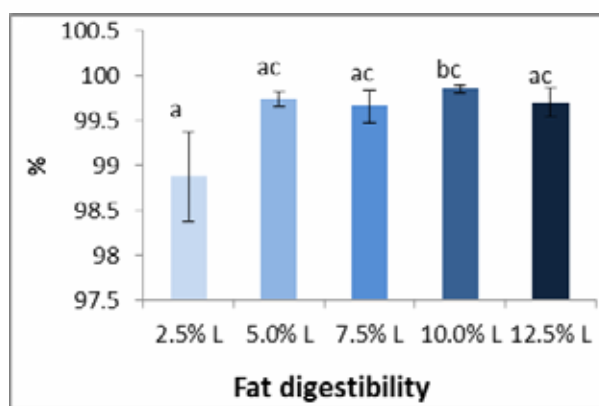
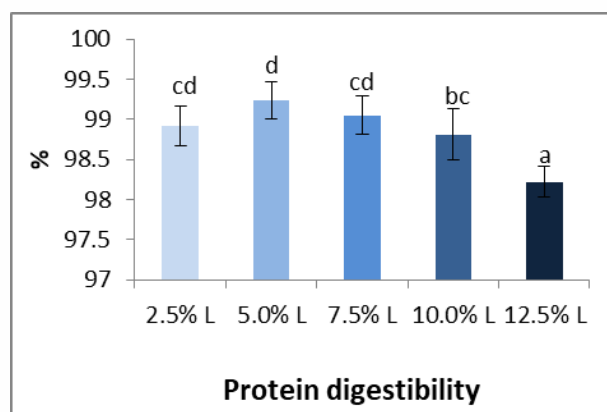


Fig. 50. Apparent digestibility of crude protein and fat in *H. pulchellus* fed varied lipid levels.

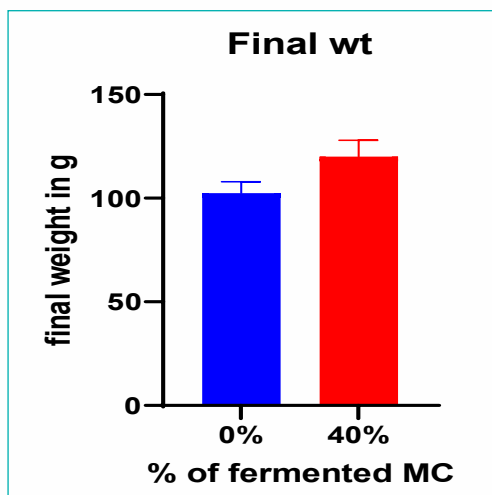


**Project: Solid State Fermentation (SSF) of mahua oil cake as fish feed ingredient for Indian Major Carps (I-106)**

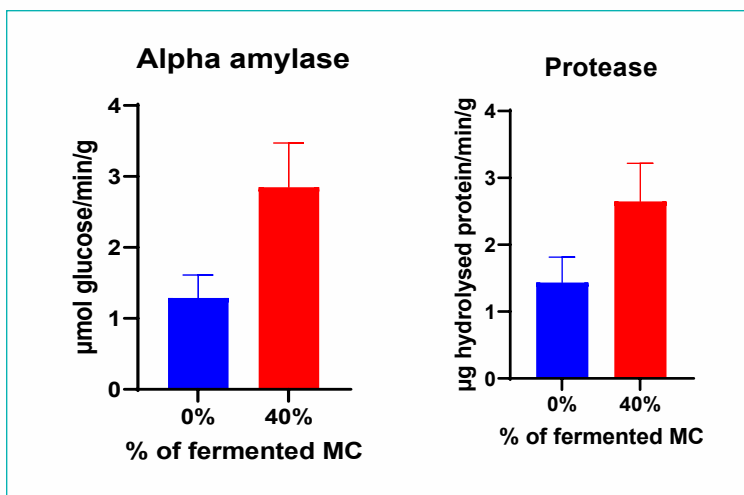
**Evaluation of novel feed ingredients and feeding strategies**

Two strains of microorganisms, *Saccharomyces cerevisiae* and *Bacillus subtilis*, were utilised in the solid-state fermentation of mahua oil cake. The moist substrate was inoculated with *Saccharomyces cerevisiae* and fermented for 24 hours at 37 degrees Celsius. After the initial phase of fermentation, the fermented mixture was inoculated with *Bacillus subtilis* and incubated for 24 hours at 37°C under anaerobic conditions. After 48 hours of anaerobic fermentation, wet samples were collected and treated at 105°C for 30 minutes to prevent continuous

fermentation. The inoculated samples were subsequently dried, cooled, and ground. During a five-month pond experiment, two iso-nitrogenous feeds for rohu (*Labeo rohita*) were formulated by incorporating solid state fermented mahua oil cake at two different levels, namely 0 and 40 percent, along with other ingredients to maintain 28 percent crude protein (CP) in each diet. The five-month pond experiment revealed that the addition of fermented mahua oil cake at a concentration of 40 percent increased the growth of *L. rohita*. From an initial weight of 13.5 g, fish in the treatment group grew to 120 g (Fig. 51), while fish in the control group grew to 102 g. Alpha amylase and protease were more active in the digestive tracts of rohu fed a mahua oil cake containing 40 percent oil (Fig. 52).



**Fig. 51.** Growth performance of rohu after inclusion of fermented mahua oil cake



**Fig. 52.** Gut enzyme activity of rohu after inclusion of fermented mahua oil cake



**Project: Utilization of insect larvae meal as protein source in the diet of *Channa striata* and *Anabas testudineus* production system (I-114)**

The effect of replacing fishmeal (FM) with black soldier fly larvae meal (BSF), *Hermetia illucens*, on the growth performance, nutrient utilisation, and digestive capacity of *Channa striata* fingerlings was investigated. In five iso-nitrogenous (42 percent crude protein) diets, BSF meal was used to replace 0, 25, 50, 75, and 100 percent of FM. For nine weeks, 450 fingerlings ( $16.36 \pm 0.09$  g)

were assigned to 15 individual tanks and fed specific diets. The results revealed that fish fed the BSF75 and BSF100 diets grew more slowly than those fed the control diet. There was no statistically significant difference between BSF0, BSF25, and BSF50 in terms of fish growth performance or nutrient utilisation ( $P > 0.05$ ). Significantly lower protease activity was observed in fish fed BSF75 and BSF100 compared to the other diets (Table 16). The results demonstrated that up to fifty percent of FM can be replaced with BSF larvae meal without affecting growth, nutrient utilisation, or body composition.

**Table 16.** Growth performance of *Channa striata* fingerlings fed different dietary groups

Growth performance	Control	BSF25	BSF50	BSF75	BSF100
SGR	1.97 <sup>b</sup>	1.96 <sup>b</sup>	1.87 <sup>b</sup>	1.69 <sup>a</sup>	1.56 <sup>a</sup>
FCR	1.61 <sup>a</sup>	1.63 <sup>a</sup>	1.70 <sup>a</sup>	1.98 <sup>b</sup>	2.17 <sup>b</sup>
PER	1.38 <sup>b</sup>	1.39 <sup>b</sup>	1.33 <sup>b</sup>	1.15 <sup>a</sup>	1.05 <sup>a</sup>
PR (%)	25.97 <sup>c</sup>	25.63 <sup>c</sup>	24.35 <sup>bc</sup>	21.96 <sup>ab</sup>	21.15 <sup>a</sup>
Survival (%)	100	100	100	100	100

Values presented as Mean  $\pm$  SE (n=3); Mean values in the same row with different superscript differ significantly ( $P < 0.05$ ). SGR-Specific growth rate; FCR- Feed conversion ratio; PER-protein efficiency ratio; PR-Protein retention.

**Effect of incorporation of moringa (*Moringa oleifera*) leaf meal on the growth, survival and carcass proximate composition of *H. pulchellus***

A growth trial was conducted with *H. pulchellus* fingerlings for 90 days to evaluate the effect of incorporation of graded levels (5, 10, 15 and 20%) of moringa leaf meal (MLM) in their diet by replacing the major ingredients - groundnut oil cake and rice bran of the basal diet (control). Fingerlings maintained at a stocking density of 1 fish/

m<sup>2</sup> were fed isonitrogenous and isocaloric pelleted diets at 5% of the body weight. No significant ( $P > 0.05$ ) difference in final length, weight survival and condition factor was recorded between the different treatments (Table 17). However, there was an apparent reduction in weight and length increment and biomass (g/tank) with 20% MLM treatment. The study indicated that MLM can be incorporated in the diet safely up to 15% level without affecting the growth as well as carcass proximate composition (Table 18).


**Table 17.** Growth parameters (mean  $\pm$  SD) of *H. pulchellus* fed MLM incorporated diets.

	0% M	5% M	10% M	15% M	20% M
Initial weight (g)	1.72 $\pm$ 0.04	1.69 $\pm$ 0.18	1.66 $\pm$ 0.04	1.63 $\pm$ 0.01	1.78 $\pm$ 0.04
Initial length (cm)	5.73 $\pm$ 0.65	5.63 $\pm$ 0.42	5.58 $\pm$ 0.50	5.43 $\pm$ 0.25	5.77 $\pm$ 0.32
Final weight (g)	16.09 $\pm$ 1.10	15.92 $\pm$ 0.11	16.10 $\pm$ 0.50	15.83 $\pm$ 0.15	15.17 $\pm$ 0.99
Final length (cm)	11.41 $\pm$ 0.08	11.29 $\pm$ 0.14	11.33 $\pm$ 0.20	11.12 $\pm$ 0.01	11.13 $\pm$ 0.31
Increment in wt. (%)	836.14 $\pm$ 64.18	843.70 $\pm$ 6.28	872.37 $\pm$ 30.31	874.46 $\pm$ 9.14	751.65 $\pm$ 55.58
Increment in length (%)	99.13 $\pm$ 1.48	100.53 $\pm$ 2.51	103.05 $\pm$ 3.55	104.79 $\pm$ 0.26	92.89 $\pm$ 5.39
FCR*	1.89 $\pm$ 0.14	1.90 $\pm$ 0.01	1.87 $\pm$ 0.06	1.90 $\pm$ 0.02	2.02 $\pm$ 0.15
PER**	1.98 $\pm$ 0.15	1.94 $\pm$ 0.01	1.95 $\pm$ 0.07	1.93 $\pm$ 0.02	1.81 $\pm$ 0.13
Survival (%)	96.87 $\pm$ 4.42	100 $\pm$ 0	96.87 $\pm$ 4.42	96.87 $\pm$ 4.42	96.87 $\pm$ 4.42
Biomass (g/ tank)	249.00 $\pm$ 5.72	254.80 $\pm$ 1.70	249.45 $\pm$ 3.60	245.49 $\pm$ 13.50	235.48 $\pm$ 26.07
Condition factor	1.08 $\pm$ 0.10	1.11 $\pm$ 0.05	1.11 $\pm$ 0.02	1.15 $\pm$ 0.01	1.10 $\pm$ 0.02

The figures in the same row did not differ significantly ( $P > 0.05$ ).

\*FCR= Food conversion ratio \*\*PER=Protein efficiency ratio

**Table 18.** Proximate composition (% , mean  $\pm$  SD) of fish carcass.

	0% M	5% M	10% M	15% M	20% M
Moisture	66.60 $\pm$ 1.02 <sup>a</sup>	67.00 $\pm$ 0.89 <sup>a</sup>	67.97 $\pm$ 0.21 <sup>a</sup>	67.17 $\pm$ 1.06 <sup>a</sup>	70.78 $\pm$ 0.41 <sup>b</sup>
Crude protein	18.73 $\pm$ 0.45 <sup>ab</sup>	19.28 $\pm$ 0.17 <sup>a</sup>	19.68 $\pm$ 0.22 <sup>a</sup>	19.46 $\pm$ 0.06 <sup>a</sup>	17.87 $\pm$ 0.24 <sup>b</sup>
Fat	8.38 $\pm$ 0.32 <sup>a</sup>	7.32 $\pm$ 0.13 <sup>b</sup>	7.18 $\pm$ 0.01 <sup>b</sup>	7.36 $\pm$ 0.10 <sup>b</sup>	6.03 $\pm$ 0.13 <sup>c</sup>
Ash	3.44 $\pm$ 0.06 <sup>a</sup>	3.89 $\pm$ 0.01 <sup>b</sup>	3.72 $\pm$ 0.06 <sup>ab</sup>	3.60 $\pm$ 0.15 <sup>ab</sup>	3.59 $\pm$ 0.04 <sup>ab</sup>

The figures in the same row having same superscript did not differ significantly ( $P > 0.05$ ).

### Nutrient digestibility and digestive enzyme activity in fringe lipped carp, *Labeo fimbriatus* (Bloch, 1795), fed cotton seed meal incorporated diets

Advanced fingerlings of *Labeo fimbriatus* (Bloch, 1795) were fed isocaloric formulated diets containing cotton seed meal (CSM)

replacing the main ingredients – groundnut cake and rice bran of the control diet at 10, 20, 30 and 40 % levels to elucidate the dry matter and nutrient digestibility of CSM in the feed. In general, the digestibility of dry matter, protein, fat and nitrogen free extract was higher in CSM incorporated diets

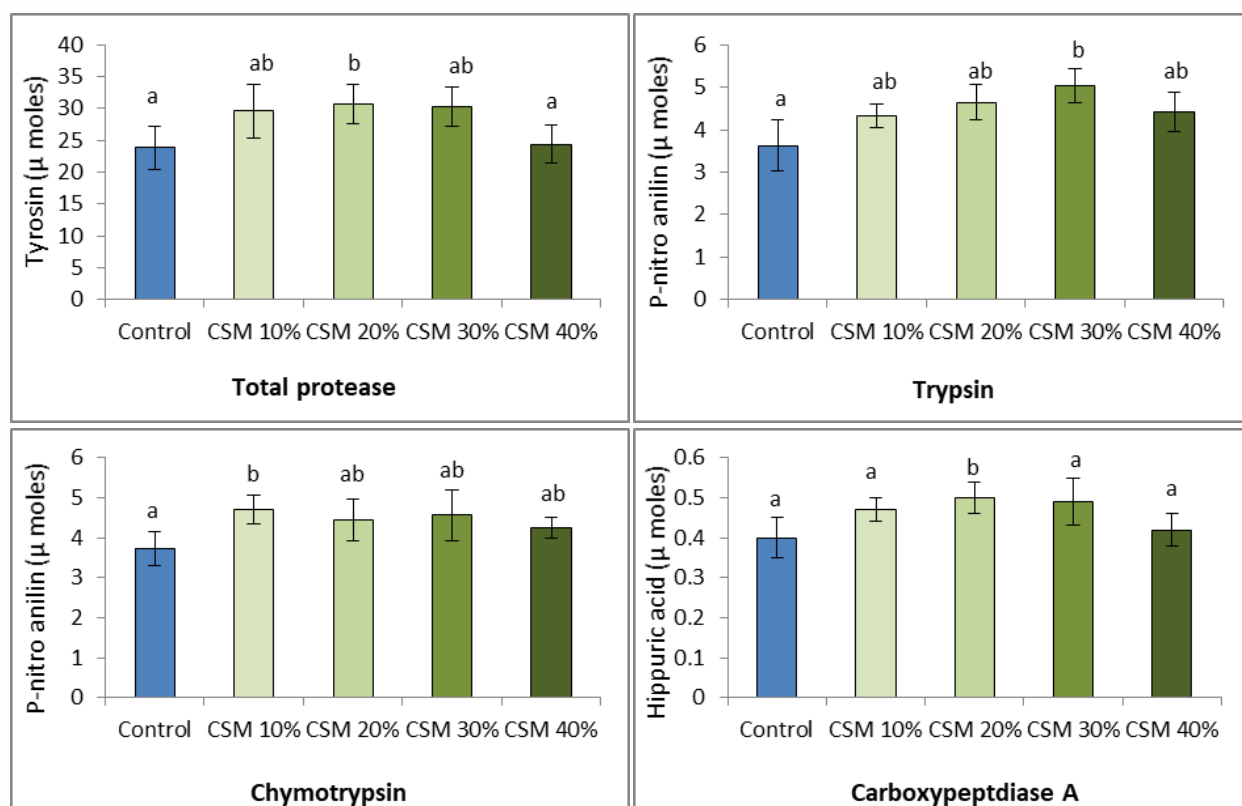


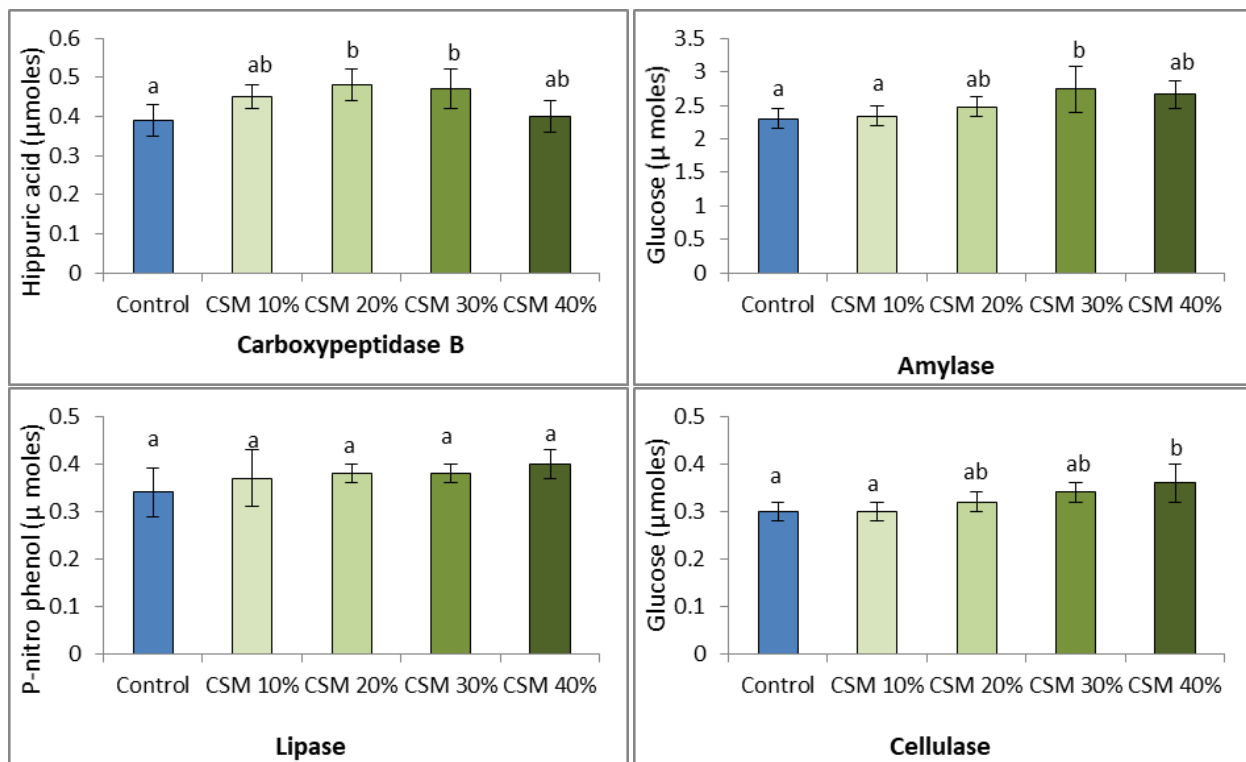
compared to control diet (Table 19). While the dry matter and nitrogen-free extract digestibility values were highest at 40% CSM incorporation level, those for protein and fat digestibility were highest in 30% and 10% levels, respectively, showing an apparent reduction thereafter. The incorporation of CSM had a stimulatory effect on the majority of the intestinal digestive enzymes studied. Fish

fed 20% CSM diet recorded highest activity of total protease and carboxypeptidases while those fed 30% CSM diet had highest trypsin and amylase activities; all showing reducing trend consequently. The study indicates the possibility of incorporation of CSM in the diet of *L. fimbriatus* up to 40% level without affecting nutrient digestibility (Fig. 53).

**Table 19.** Apparent digestibility coefficient (% Mean ± SD, n = 3) of dry matter and major nutrients of the cotton seed meal (CSM) incorporated diets

Diets	Dry matter	Crude protein	Fat
Control	71.21 ± 1.60 <sup>a</sup>	83.01 ± .03 <sup>a</sup>	91.60 ± 0.26 <sup>ab</sup>
CSM 10 %	74.12 ± 1.95 <sup>ab</sup>	85.37 ± 1.49 <sup>ab</sup>	93.15 ± 0.45 <sup>c</sup>
CSM 20 %	75.17 ± 1.04 <sup>bc</sup>	86.03 ± 0.78 <sup>b</sup>	92.79 ± 0.79 <sup>c</sup>
CSM 30 %	76.22 ± 0.45 <sup>bc</sup>	86.69 ± 0.28 <sup>b</sup>	92.42 ± 1.40 <sup>bc</sup>
CSM 40 %	78.07 ± 2.54 <sup>c</sup>	86.15 ± 1.73 <sup>b</sup>	89.68 ± 0.80 <sup>a</sup>





**Fig. 53.** Activity of digestive enzymes (mean ± SD; μ moles of product liberated h<sup>-1</sup> mg tissue protein<sup>-1</sup> at 25 °C, n = 3) in the intestine of *L. fimbriatus* fed CSM incorporated diets

## 7. FISH PHYSIOLOGY AND NUTRIGENOMICS

### Metagenomics and fish reproduction

**Project: Investigation of key transcripts and regulatory networks associated with reproductive biology and medicinal value of striped murrel (*Channa striata*) using omics approaches (ICAR-CABIN) (E-133)**

During the pre-spawning (PS), spawning (S), and post-spawning (PS) seasons, blood and tissue samples were taken from fishes (*Channa striata*) reared in two different tank conditions [treatment-1: tanks without soil bottom and microphytes, T1] and [treatment 2: tanks with soil bottom and microphytes, T2], and the fishes' length and weight were recorded. The mean Gonadosomatic Index (GSI) and Hepatosomatic Index were calculated from the collected data, and it was found that the GSI of females in treatment-2

was significantly higher than that of treatment-1 in all seasons (Fig. 54). T2 had a greater number of mature oocytes than T1 during the spawning season, as determined by histology (Fig. 55). In pre-spawning, spawning, and post-spawning seasons, testosterone, Estradiol, progesterone, Follicle-Stimulating Hormone (FSH), and Luteinizing Hormone (LH) hormone profiling using ELISA revealed a significant difference between treatment groups. Testosterone levels were greater in males under T1 than under T2 during the pre-spawning stage (Fig. 56), while oestrogen levels were greater in females under T1 than under T2 during the spawning stage (Fig. 57). The FSH levels were at their highest during the breeding season. In contrast, levels of progesterone were lowest during spawning season. During spawning season, male T2 had the highest LH levels. During spawning season, testosterone levels in males and oestrogen levels in females were higher in



T2 than in T1, and a significant LH surge was observed in T2 males. We observed significant seasonal differences in the expression patterns of all of these miRNAs (Fig. 58). A metagenomics study (gut, Mucos, soil, water, and hydrophyte) revealed that T2 has a greater bacterial diversity than T1. Inferred from a Metagenomic comparison of Post-Spawning and Spawning samples, the abundance of the phylum Proteobacteria has increased by 70 percent, indicating that

females in T2 are more diverse and have healthy gut microflora than those in T1 during the post-spawning breeding season (Fig. 59). The most abundant genus in T2 skin-mucus was *Cetobacterium*, while the most abundant genera in T1 were *Bacteria* unclassified, *Clostridiales* unclassified, and *Lactobacillus*. In T2 gut, *Clostridium* was the most abundant genus, whereas in T1 gut, *Bacteria* not classified was the most abundant genus.

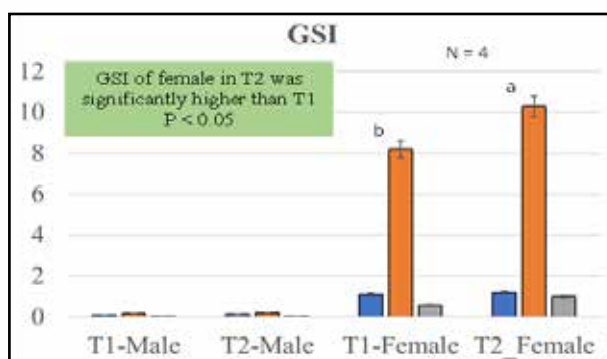


Fig. 54. Gonadosomatic index of male and female murels

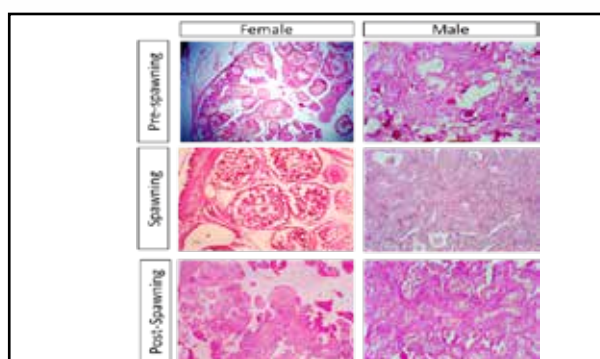


Fig. 55. Histology of male and female gonads at different spawning season

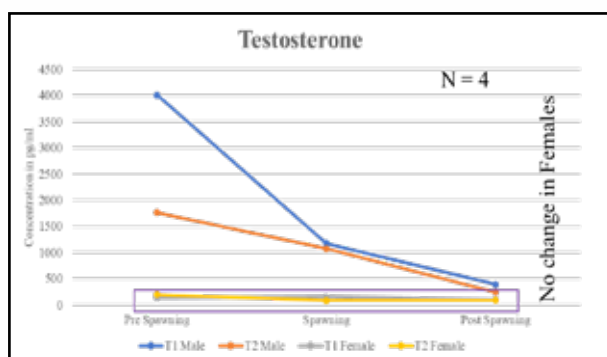


Fig. 56. Testosterone profiling of male and female murels

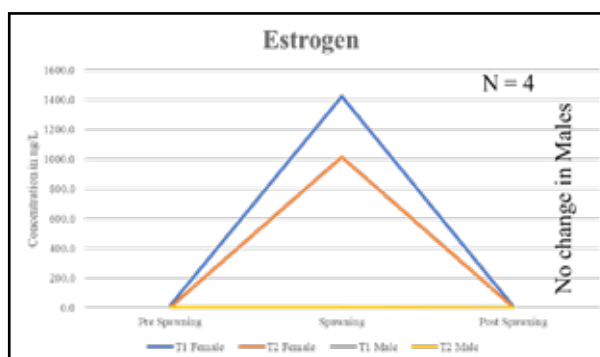


Fig. 57. Estrogen profiling of male and female murels

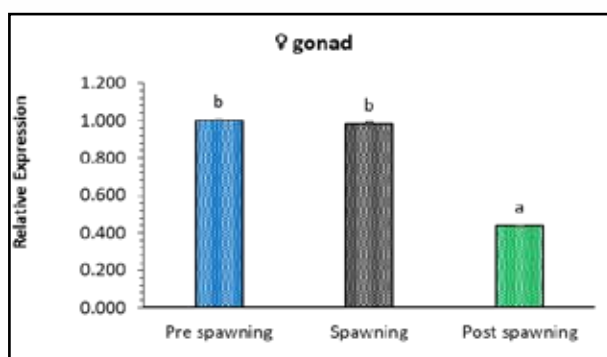


Fig. 58. Expression profile of microRNAs in murrel

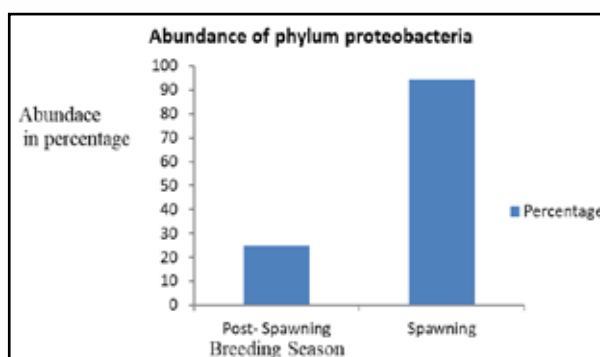


Fig. 59. Bacterial diversity in different spawning season



## 8: AQUATIC ANIMAL HEALTH MANAGEMENT

**Project: Development of suitable prophylactic and control measures for health management in challenged freshwater aquaculture systems in India (I-88-E)**

### Fish health management issues in aquaculture and economic loss due to diseases

Survey and disease investigation were carried out routinely in various fish farms located in different districts of Odisha, Andhra Pradesh, Karnataka and West Bengal and the causative organisms were identified. Around 38 fish disease samples received from different districts of Odisha were analyzed at the Fish health management division. The parasitic etiological agents identified were *Dactylogyrus* sp., *Gyrodactylus* sp., *Argulus* sp., *Trichodina* sp., *Myxobolus* sp., *Lernaea* sp., and *Epistylis* sp. Among bacterial

diseases red disease caused by *Aeromonas* sp. was very common. In ornamental fish culture, total five cases of disease occurrence were investigated and prevalence of etiological agent viz. *Argulus*, *Trichodina* and *Dactylogyrus* were identified. In Cichlid fish with fin and tail rot, haemorrhages *Aeromonas hydrophila* was isolated as etiological agent. Suitable preventative and control measures were suggested to the farmers to control the disease. Through Whats App group “Fish Health Management” around 120 advisory and suggestive measures for various diseases were provided to the farmers and entrepreneurs.

In West Bengal the occurrences of diseases were more during the onset of winter. Bacterial haemorrhagic septicaemia and dropsy was documented in *L. bata* from North-24-Parganas district. Ulceration, haemorrhages causing early mortality were observed in *Pangasianodon hypophthalmus* in a farm situated at Canning, South-24-



Cichlid infected with *A. hydrophila*



Gold fish infested with *Trichodina* spp



Ulcer and gill rot



Haemorrhagic septicaemia



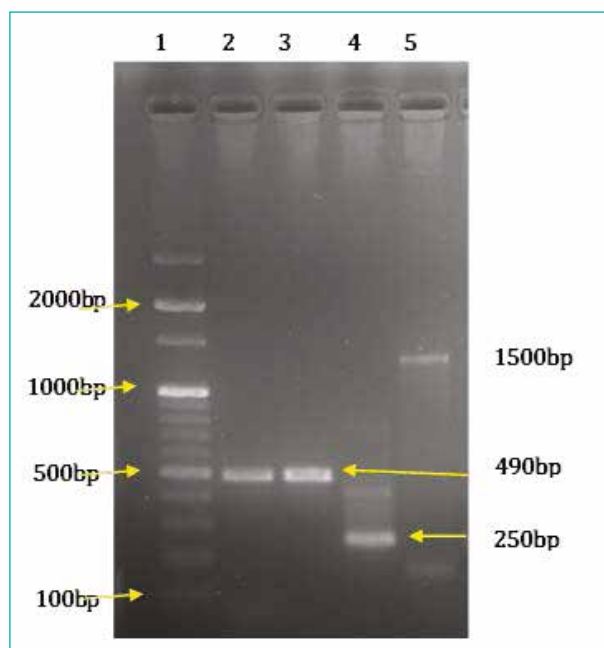
Tilapia infected with Tilapia Lake Virus showing external and internal lesions

Parganas district of West Bengal. Ulcer and gill rot was also observed in *Clarias magur* cultured at Moyna, East Midnapore district. Argulosis cases were reported in *L. rohita* and *C. catla* from different districts of West Bengal.

In Karnataka large scale mortality of Tilapia were reported from lakes at Mandaya and Mysore. During disease investigation, the fish were found with gross lesions like opacity of lens, rupture of lens in advance cases, skin erosions. The post mortem examination revealed severe hemorrhages on liver, intestine and kidney (Fig.4). The TiLV infection was confirmed by RT-PCR using Nested ext-1 (5'-TATGCAGTACTTCCCTGCC3') and Nested ext-2 (5'-TTGCTCTGAGCAAGAGTACC-3') primers followed by the 7450/150R/ME2 and ME1 primers ((5'-TATCACGTGCGTACTCGTTCAGT-3') & (5'-GTTGGGCACAAGGCATCCTA-3') (Fig. 60).

### Compilation of indigenous technologies (ITKs) used by the farmers for control of fish disease

During the survey various indigenous technologies practised by the fish farmers in West Bengal were recorded. Turmeric paste/ash of hay or bamboo/neem leaves/garlic and salt along with copper sulphate and potassium permanganate are sprayed over pond water to control EUS. For toxic



**Fig. 60.** RT-PCR amplification of Tilapia lake virus; lane 1: Marker (Sigma), 2&3: Nested ext-1 & Nested ext-2 primer; Lane 4:7450/150R/ME2 and ME1 primer; 5: Segment 3.

gas removal, banana stem were used by the farmers. Hollow bamboo poles were also reported to be placed vertically from the mud of the pond bottom upto surface water level to release gas through the pole from the pond bottom.

### All India Network Project on Fish Health

A total 204 freshwater aquaculture farms in Andhra Pradesh (125) and Odisha (79) were surveyed and information were recorded through a scheduled questionnaire. It was



observed that, in Andhra Pradesh very few farmers (around 15-20 %) were able to understand the disease problems and quantify disease-related losses, while the majority (around 80%) were dependent on consultants, marketing personnel, friends and dealers for advice on disease diagnosis and treatment needed. Ectoparasitic diseases accounted for 60-70% of the problems, while bacterial and fungal diseases account for 20-23% and 5-7%, respectively. The main causative agents were *Argulus* sp., *Myxobolus* spp. And gill flukes, observed during the survey. Further, in some cases, secondary bacterial infection with aeromoniasis and columnaris were observed. More cases of disease occurrence were reported from ponds where poultry manure was used as fertilizers as practiced by few farmers. In Odisha, most of the farmers (around 70%) were dependent on other progressive farmers/ neighbours to consult in case of any problem with regard to fish seed, feed and disease management. Only 20-30% farmers seek advices from the experts, in case of culture problems. Ectoparasitic diseases accounted for 70-80% of the problems, while bacterial and fungal diseases account for 10-15% and 1-5%, respectively.

### Use of various drugs and chemicals in freshwater aquaculture

Under ICAR-Network Project on Fish health, survey were carried out in Andhra Pradesh & Odisha to record usage of drugs and chemicals in fish farming. The various inputs used by the farmers were categorized according to purpose of use into following types viz., Pond management, Feed additives, Antiparasitic, Disinfectants, Antibiotics, Probiotics for water etc. and documented as used by fish farmers in Odisha (Fig. 61)

and Andhra Pradesh (Fig. 62). The economic loss was noted to be more in carp culture (15-20%) compared to pangasius culture (5-10%) during COVID19 period. Forty percent of the farmers stated that in Roopchand culture, recurrence of red disease was one of the major limiting factors and 30% of farmers revealed that it is highly sensitive to DO stress. However, it showed economic loss of 5-10% of the total income to farmers.

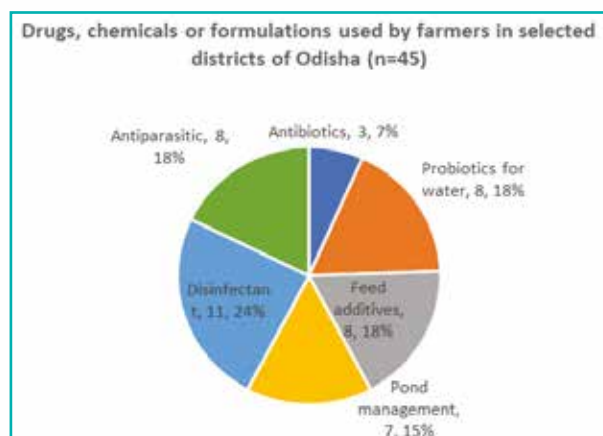


Fig. 61. Drugs, chemicals or formulations used by farmers in selected districts of Odisha (N=45)

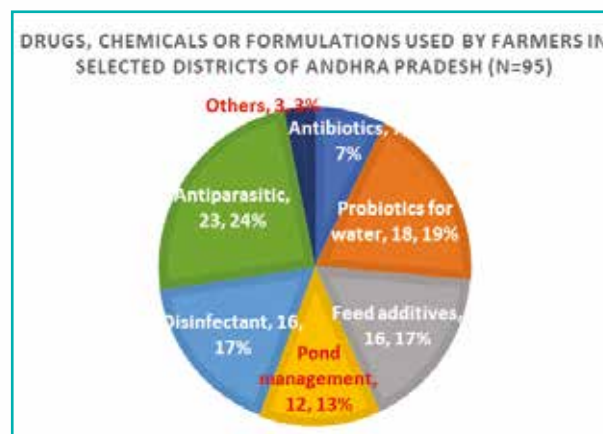


Fig. 62. Drugs, chemicals or formulations used by farmers in selected districts of Andhra Pradesh (N=95)



### **Estimation of Minimum Inhibitory Concentration (MIC) of commercially available aqua chemicals against the bacterial pathogens**

MIC of Benzalkonium chloride 50% (BKC 50%), Didecyl dimethyl ammonium chloride (DDAC) and Povidone iodine 10% were evaluated against three bacterial isolates, viz. *A. hydrophila*, *E. coli*, and *Staphylococcus sp.*, isolated from fish by broth micro dilution method. MIC of BKC 50% for *A. hydrophila*, *E. coli* and *Staphylococcus sp.* were determined as 0.5 µg/ml, 8 µg/ml and 1 µg/ml respectively. MIC of DDAC for *A. hydrophila* obtained as 0.5 µg/ml. Similarly, MIC for *E. coli* and *Staphylococcus sp.* was determined as 8 µg/ml and 1 µg/ml respectively. MIC of Povidone iodine is >120 µg/ml for *A. hydrophila*, *E. coli* and *Staphylococcus sp.*

### **Evaluation of nonspecific immune parameters in rohu, *Labeo rohita* after administration of Florfenicol medicated feed**

Experimental feeds were prepared containing antibiotic florfenicol at different concentrations viz., 0, 10, 30, 50, 100 mg/kg of fish biomass per day designated as Control, T1, T2, T3, T4 were fed @ 3% average body weight per day to rohu fingerlings (avg. size 15±2 g) for 30 days followed by feeding with the control diet (without FFC) for another ten days (up to the 40<sup>th</sup> day) for post FFC dosing observation. It was observed that there was no significant effect of drug on growth within the experimental group compared to control. Slight or no variations in respiratory burst activity (NBT) in blood and serum myeloperoxidase activity was noticed during 20<sup>th</sup> to 30<sup>th</sup> day which was retained to normal range on 40<sup>th</sup> day on comparing with control group. The lysozyme activity was found

slightly higher in T1 at 20<sup>th</sup> day and in T1 and T2 at 30<sup>th</sup> day than control and at 40<sup>th</sup> day all treatment groups has shown lesser than control group.

### **Surveillance of freshwater fish and shellfish diseases in Odisha and Andhra Pradesh and National Referral Laboratory for Freshwater Fish Diseases**

Under National disease surveillance programme, Jagatsinghpur, Cuttack, Jajpur, Kendrapara, Puri, Khurda, Nayagarh, Sambalpur and Baragarh of Odisha and East Godavari, West Godavari, Krishna, Guntur and Nellore of Andhra Pradesh were covered for both passive and active surveillance. Baseline information from 288 fish farms was collected from these two states. Total 40 nos. of passive cases were documented during this period. Twenty-two cases were solved by telephonic conversations and advisory services provided. In this year 12 online awareness meetings were organized at different places in Odisha and Andhra Pradesh in which 108 farmers participated. Under National Referral laboratory, two cases of *Aeromonas veronii*, one of *Enterobacter cloacae*, one of *Argulus siamensis*, one of *Paradactylogyrus catlaius*, one of *A. hydrophila*, one of CEV, and one case of *Cichlidogyrus spp.* were diagnosed using level III diagnosis.

### **Antimicrobial resistance in Fisheries & Aquaculture**

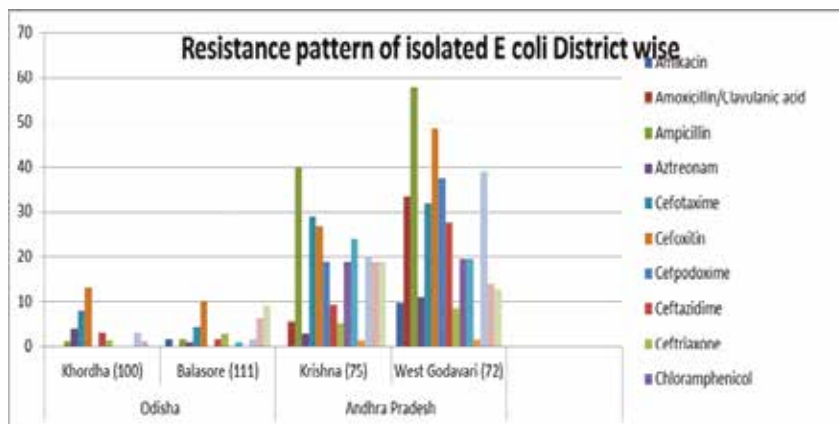
#### **Network Programme on Antimicrobial Resistance (AMR) in Fisheries & Aquaculture**

Under ICAR Network programme on Antimicrobial resistance (AMR) in Fisheries & Aquaculture, 239 freshwater fish farms were surveyed from Odisha (Balasore-

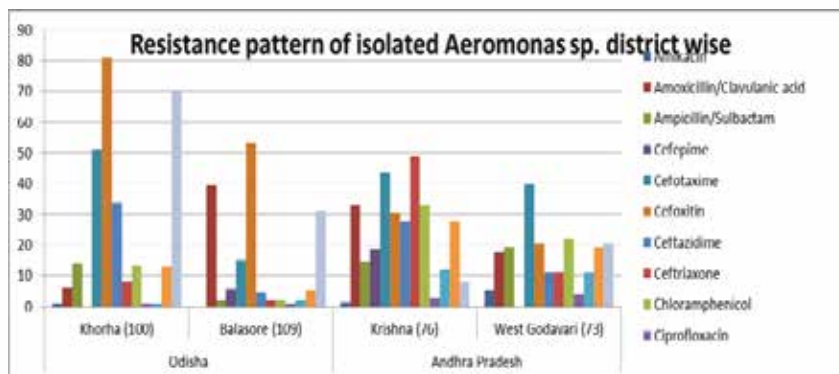


Bhadrak-57, Khordha-Puri-82) and Andhra Pradesh (Krishna-43, West Godavari-57); 158 fish samples and 277 water samples were collected and processed for isolation of *E. coli*, *Aeromonas* sp. and *Staphylococcus* sp. A total of 1272 bacterial isolates were isolated and analysed comprising of 417 isolates of *E. coli*,

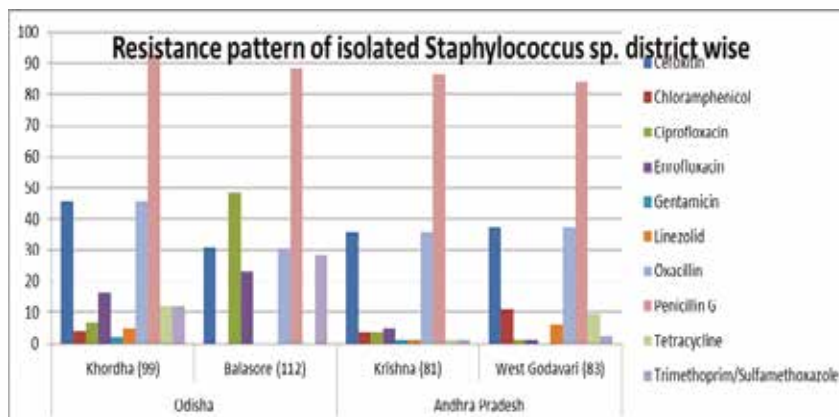
437 isolates of *Staphylococcus* sp., and 418 isolates of *Aeromonas* sp. The samples were processed for Antibiotic Resistance pattern (AST) analysis and data were analysed using WHONET 5.6 software following CLSI guidelines (Fig. 63-65).



**Fig. 63.** Resistance pattern in *E. coli* isolated from fish farms of Odisha & Andhra Pradesh.



**Fig. 64.** Resistance pattern in *Aeromonas* sp. isolated from fish farms of Odisha & Andhra Pradesh



**Fig. 65.** Resistance pattern in *Staphylococcus* sp. isolated from fish farms of Odisha & Andhra Pradesh



Antibiotic sensitivity test of the isolated *E. coli* isolates showed that 21 % isolates were resistant to ceftiofur followed by ampicillin (18.1%), cefotaxime (15.2%) and nalidixic acid (12%). The isolates were highly sensitive to amikacin and imipenem. *Aeromonas sp.*, were found resistant to ceftiofur (55%) followed by trimethoprim/sulfamethoxazole (40.7%), cefotaxime (39.2%). The isolates were sensitive to amikacin and imipenem. *Staphylococcus sp.* were found to have highest resistance to penicillin (88.6%), followed by oxacillin (36.2%) and ceftiofur (36.3%). The isolates were sensitive to gentamicin and linezolid antibiotics. It was observed that more resistance was found in Andhra Pradesh samples compared to Odisha samples.

### Development of novel therapeutics & alternatives to antimicrobials for health promotion and disease management (AMPs, Probiotics, herbal products, immunopotentiators (TLRs)

Encapsulated adherent putative lactic acid bacteria as dietary probiotic supplement with optimized feeding regime for Indian major carp, *Labeo rohita*

### Fish Health Enhancement using probiotics

Three strains of putative adherent Lactic Acid Bacteria; *Lactobacillus plantarum* SM18, *L. plantarum* SM33, *L. salivarius* SM61 showing maximum *in vitro* immunomodulatory effects were successfully encapsulated in Na-Alginate (2-2.5%) coated with chitosan

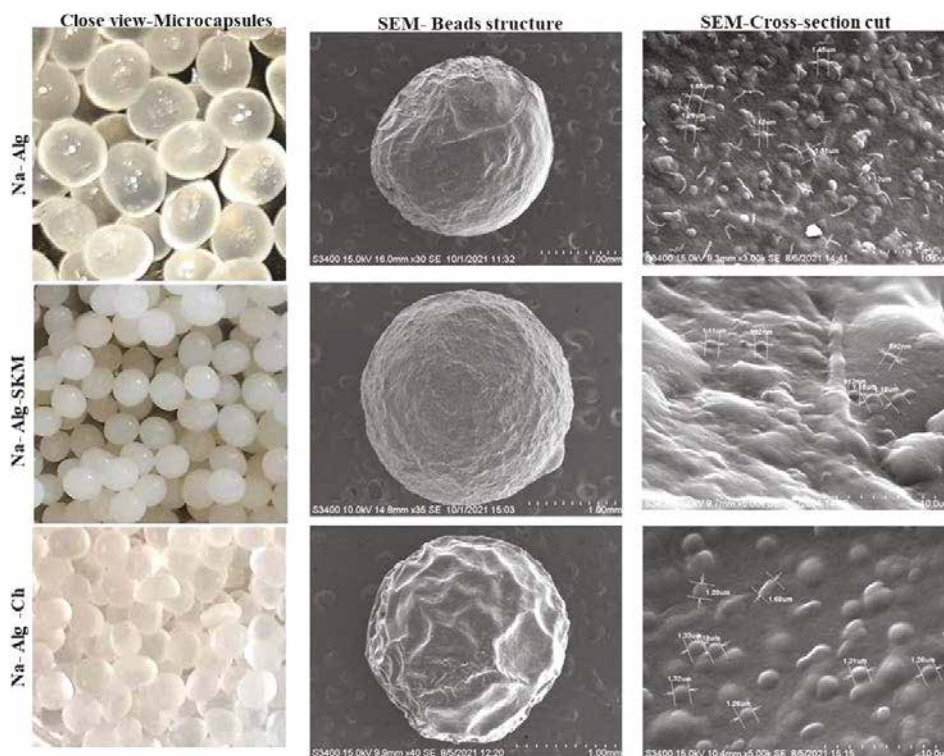


Fig 66. Magnifying and SEM images of Na-Alginate, Alginate-Skim Milk and Alginate-Chitosan capsules loaded with *Lactobacillus plantarum* SM33



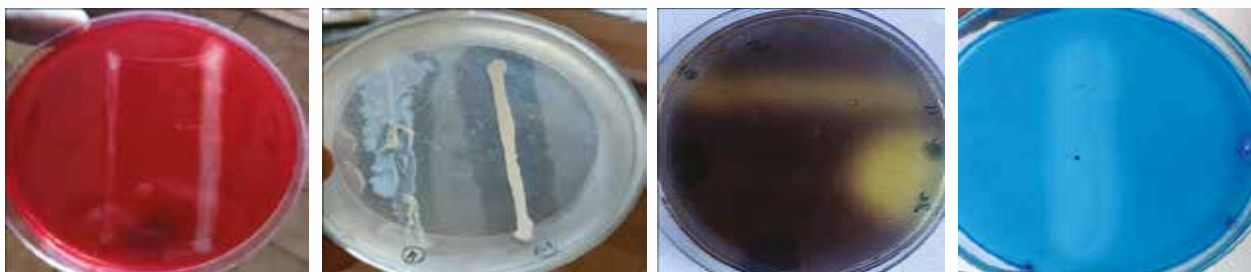
(0.4%) and skim milk (5%) by extrusion method (Fig. 66). Probiotic cells encapsulated in Na-Alginate coated with chitosan and skim milk showed better viability than those in the uncoated microcapsules and the free cells, at low pH, high bile concentration and longtime storage. The coated microcapsules also showed continuous sustained release of bacteria in Simulated Gastro-Intestinal Fluid thus maintaining maximum viability of cells. In order to assess the efficacy in oral delivery, an *in vivo* feeding trial of 60 days using diets supplemented with  $10^9$  CFU/g of *L. plantarum* SM33 in free and encapsulated form was conducted in rohu. Among all the treatment groups, continuous administration of alginate-chitosan encapsulated *L. plantarum* SM33 supplemented diet for 60 days ensured establishment of a significant ( $P < 0.05$ ) viable count of  $10^8$  CFU/g of LAB in the intestine of host, rohu. This triggered immune regulatory responses mediating a control of balance between pro- and anti-inflammatory cytokines TNF- $\alpha$  and IL-10 respectively in the liver and intestine tissues of host combined with significant ( $P < 0.05$ ) enhancement of its other innate immune parameters such as respiratory burst activity and myeloperoxidase activity. This overall elevated the immunological state of the host thus resisting pathogenic insults by improving the immune-readiness which was most likely responsible for significant protection of probiotic fed rohu against

*Aeromonas hydrophila* challenge conducted after 60 days of probiotic feeding. Also, the alginate-chitosan coated *L. plantarum* SM33 significantly down regulated the HSP70 gene and enhanced the body weight gain in the treated host.

#### **Quantification of digestive enzyme activity in bacteria isolated from peninsular carps**

Bacterial isolates from the gut of *H. pulchellus* and *P. carnaticus* were streaked on selective media to quantify different digestive enzyme intensity/activity, viz; CMC agar for cellulase; Starch agar for Amylase; Gelatin/Peptone Agar for protease, and Tributyrin agar for lipase activity. The culture plates were incubated for 48 h at 28 °C. After 48 h the agar plates were stained with substrate specific stains: Congo Red for Cellulase activity, Lugols Iodine for Amylase activity and Comassie Brilliant blue for protease activity. Lipase activity was detected by visible zone of inhibition on tributyrin agar (Fig. 67).

Enzyme intensity was quantified using the formula: Enzyme intensity (EI) = (colony diameter + halo zone diameter)/colony diameter. Different isolates with their enzyme intensity is given in the Table.20. Isolate PLi12 has highest lipase activity, PPr7 the highest protease activity, PC4 the highest cellulase activity and PA11 the highest amylase activity.



**Fig.67.** Digestive enzyme activity determined with substrate specific stains.



**Table.20.** Enzyme Intensity of digestive enzymes by different bacterial isolates

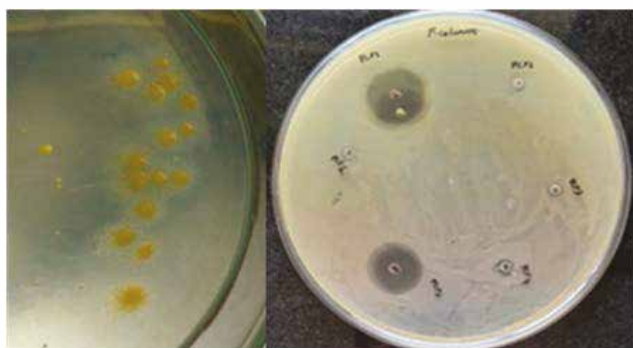
Isolate	Amylase EI (mm)	Isolate	Lipase EI (mm)	Isolate	Cellulase EI (mm)	Isolate	Protease EI (mm)
PA2	4.66±1.15	PLi4	7.5±0.57	PC2	4.33±1.52	PPr1	3.5±0.5
PA4	6.0±1.0	PLi12	18±1.0	PC4	5.66±2.08	PPr 7	6.0±1.0
PA5	2.66±0.57	PLi11	6.06±0.57	PC7	2.66±0.57	PPrc8	5.43±0.6
PA8	8.0±1.0	PCaLi	7.2±0.6				
PA11	11.66±1.52						

**Antibacterial activity of selected gut bacteria against fish pathogens**

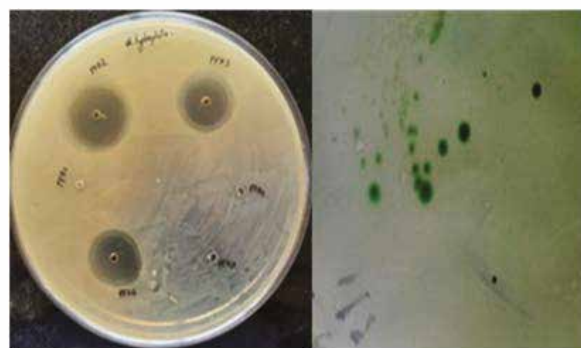
Lactobacillus group of bacteria (98 colonies) isolated on MRS agar plates from the gut of *H. pulchellus* and *P. carnaticus* were screened for their antibacterial activity against motile *Aeromonas hydrophila* and *Flavobacterium columnare* on Mueller-Hinton agar plates. The bacterial isolates were grown for 24h in nutrient broth and filtered culture supernatant was poured into wells made on Mueller-Hinton agar plates with *F. columnare* and *A. hydrophila* separately. The diameter of zone of inhibition was measured

for respective bacterial isolates. The Isolates PCF1 and PCF5 have shown antibacterial activity against *F. columnare* and PPA2, PPA3 and PPA6 showed antibacterial activity against motile *A. hydrophila* (Fig. 68 & 69).

Apart from ABST, time killing kinetics of selected isolates against pathogens was studied. About 100µl of bacterial isolate showing antibacterial activity on ABST test were co-cultured with *F. columnare* and *A. hydrophila* and incubated for 24 h. The OD of the bacterial culture was assessed every 2hr interval. PCF1 isolate showed maximum antibacterial activity at all time intervals



**Fig. 68.** Antibacterial activity against *F.columnare*



**Fig. 69.** Antibacterial activity against *A.hydrophila*



compared to PCF5 against *F. columnare* (Fig.70) and PPA2 strain showed maximum antibacterial activity against *A. hydrophila* at all the time points followed by PPA3 & PPA6 (Fig. 71).

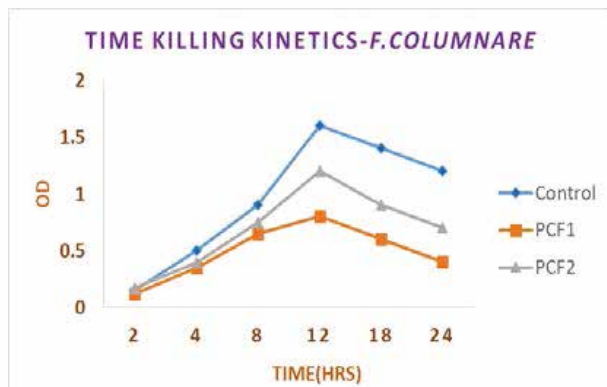


Fig.70. Time killing kinetics against *F. columnare*

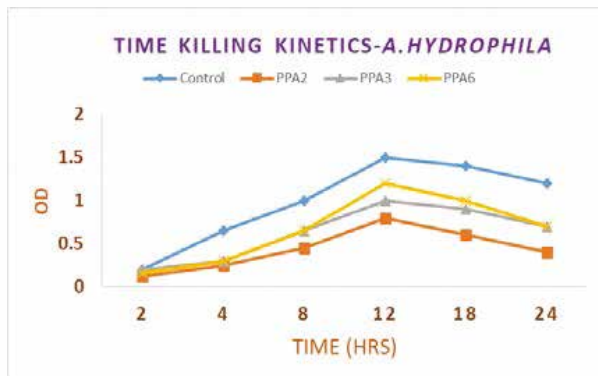


Fig. 71. Time killing kinetics against *A. hydrophila*

**Project: Development of suitable prophylactic and control measures for health management in challenged freshwater aquaculture systems in India (I-88-E)**

### Medicinal plants and Herbal formulation to parasitic diseases in fish

Extracts of medicinal plant *Andrographis paniculata* (green chiretta) @3 % (v/v) was found effective to control crustacean parasite *Argulus* infection both by oral and bath

treatment. To further enhance the efficiency of the formulations various wetting agents/surfactants along with some oil bases were evaluated to reduce the required dose/acre. Tween20 (T20) and Activ Gold 80 (AG80) surfactants along with some oils were used to form the formulations and dose was standardized. AG80 showed highest efficacy @10% (v/v) i.e 10ml of AG80+90ml of Herbal formulation under *in-vitro* studies on killing metanaupli stage of *Argulus* (Fig.72). Addition of surfactant AG80 @ 10% to herbal formulation could able to reduce the dosage requirement from 3 % (v/v) to 0.003 % (v/v) under *in-vitro* studies on killing metanaupli stage of *Argulus* (Fig.73).

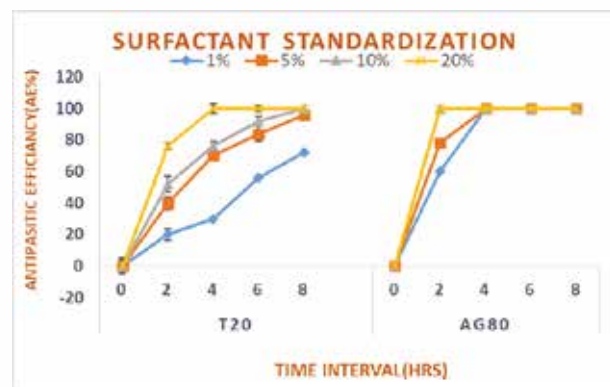


Fig.72. Dose standardization of surfactants Tween 20 and AG-80 to reduce the dose of herbal formulation

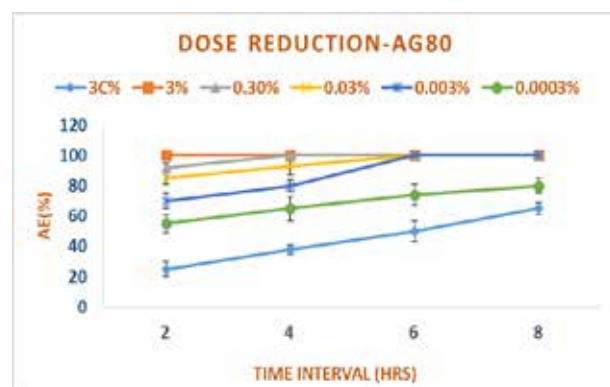


Fig.73. Dose reduction of hebal formulation with AG-80 inclusion



**Project: Identification and characterization of organic compounds from medicinal plants for the control of diseases in freshwater fish species (I-88-F)**

#### **Antimicrobial efficacy of medicinal plant extracts:**

Classical solvent extraction protocol has been standardized for the extraction of organic compounds from plant X (*Chromolaena sp.*) and plant K (*Asteracantha longifolia*). The FTRE analysis of these plants extracts revealed the presence of amines in the organic compounds. The function of these organic compounds/plant extracts has been evaluated on the *A. hydrophila* and *B. subtilis*, and the data revealed their potent anti-bacterial properties. In addition to the antimicrobial properties, some of the innate immune genes are known to be activated by various plant extracts. We investigated it in the rohu fingerlings by feeding *Chromolaena sp* extract as feed additive. The extracts of chromolaena has been also tested in the LRG-cell line. Our data shows that it is cyto safe and also does not cause any visible side effects in fish.

**Health Management protocols for disease and better environment management (Bioremediation, Nanotechnology applications, Vaccine developments, Diagnostics)**

**Project: Development of vaccines against Tilapia Lake virus (TiLV) and Cyprinid herpesvirus -2 of fish in Indian aquaculture system (E-137)**

The project is a multi-institutional collaborative project among C. Abdul Hakeem College, KUFOS, Kochi, ICAR-CIFA, and CAH College being the coordinating Institute.

The project aims at development of vaccine against Tilapia lake virus infecting tilapia and Cyprinid herpes virus 2 of goldfish. A host range study of TiLV using different barbs and cichlids was studied by the co-habitation method. *Puntius ticto* and *Amatitlania nigrofasciata* (Convict cichlid) were found to be susceptible to TiLV. Further, ten suspected samples (goldfish) were screened for CyHV 2 (Cyprinid Herpesvirus 2) and found to be negative.

#### **DISEASE SURVEILLANCE AND REPORTING**

##### **Bacterial infection in striped murrel fingerlings**

*Channa striata* fingerlings were found to be infected with multiple bacterial infections. The clinical signs were a swollen eye, ulceration, loose scaling, and haemorrhages. Isolation of the causative bacteria was done through culture in selective media, Leeds Acinetobacter Medium and Pseudomonas isolation Agar suggesting *Acinetobacter sp.* and *Pseudomonas sp.* as the possible etiological agent. Further, AST of the *Acinetobacter sp.* described it as multi-antibiotic resistant. However, the bacteria were found to be susceptible to tetracycline, and fishes were treated using tetracycline.

**Project: C.R.Edit – CRISPR/Cas9 edition to test and control genes implicated in influencing *Aeromonas* disease resistance in carp and salmon (E-129)**

New Indo-Norge collaborative project Funded by Research Council of Norway and Department of Science and Technology India under Bilateral cooperation with India has been initiated. The project is on CRISPR/Cas9 editing to test and control genes implicated in influencing *Aeromonas* disease resistance in carp and salmon. The bilateral



project has an objective to use CRISPR/Cas9 gene editing technologies to test whether up- or down-regulation of the expression of specific gene candidates in rohu carp makes the fish more or less susceptible/resistant to *Aeromonas hydrophila* infection.

### **Cloning and sequence analysis of perforin and mucin genes of rohu**

Two isoforms of perforin 1 gene (perforin 1a and 1b) were cloned from rohu liver cDNA sample based on the partial gene sequence of rohu and heterologous species sequence information. Rohu perforin 1a-like full length cDNA (2004 bp) was sequenced and its open reading frame analysis resulted in 574 aa which is having 75.96% blast identity to *D. rerio* perforin 1-like protein. The conserved domain search of obtained protein identified C2 domain of Perforin and complex MAC/Perforin domain. A partial sequence of perforin 1b (820 bp) was amplified that showed 93.31% similarity with *Sinocyclocheilus rhinoceros* perforin – 1 like mRNA on nucleotide blast after sequencing. The promoter sequences of perforin isoforms (P1a and P1b) of 1 kb size were also amplified. The promoter analysis does not reveal the presence of TATA box in these sequences. Further, transcription factors [Sp1, Ets family and MEF (myeloid elf-1 like factor)] were identified for 1 kb promoter sequence using online tools (Transfac, Tfsitescan, PROMO). The sequence of 45 mucin amino acid sequences from rohu whole genome data was subjected to conserved domain analysis that resulted in 5 mucin amino acid sequences having a higher domain similarities to mucin conserved domains. These 5 mucin isoforms were

checked for amplification in skin cDNA of rohu. Only mucin-2-like isoform X1 (Protein ID: RXN24069.1, 1615aa) was amplified and it was re-amplified with RACE PCR to generate a 2066 bp sequence of mucin. nBLAST results confirmed the sequence is mucin-2-like transcript variant. Further, 2 kb mucin 2 promoter sequence from rohu DNA was amplified. TATA box was found to be located 40 bases upstream of the transcription start point. The presence of transcription factors like CACCC box, homeobox domains (Cdx), CCCTC-binding factor (CTCF), GATA family, HATH1 and Sp1 family and immune cell-specific transcription factors like Oct-1, HNF-1, FOXD3, Pax-6 were obtained in rohu mucin 2 sequence.

### **Ontogeny of identified perforin and mucin genes in rohu**

To analyse the expression of Perforin 1a, perforin 1b and mucin 1 genes during different developmental stages of rohu, milt, eggs, and larvae at different time periods (0, 1, 3, 6, 9, 12 and 18h, 1, 2, 3, 5 and 15 days post-fertilization) were collected from three pairs of broods separately. The relative gene expression qRT-PCR analyses for all samples were performed in triplicate with  $\beta$ -actin as the reference gene. The 0 h developmental stage sample was taken as study calibrator. The relative quantification was done by calculating  $2^{-\Delta\Delta Cq}$ . The average fold expression values were obtained for each sample in triplicate. All three genes were ubiquitously expressed at all stages of sampling and only perforin 1b transcript showed a gradual reduction in expression after hatching of eggs till the last sampling point.



## 9. DEMONSTRATION, SOCIO-ECONOMICS, POLICY RESEARCH, INFORMATION SYSTEMS

### Technology Transfer (Technology support for doubling Production / Farmer's income)

**Project: Farmers' Producers Organizations (FPOs) in freshwater aquaculture – a critical assessment (I-118)**

Survey was conducted in Kendrapara and Khordha district to study fisheries FPOs. Personal interview of members was also carried out with the help of structured interview schedule. A case study on Maa Kharakhai Women Fish Farmers Company is prepared to gain deeper understanding of the issues confronting FPO. Primary data have been collected from 28 member farmers belonging to Odisha and Andhra Pradesh. The factors like identification of the FPO; trust among the members; incentive for joining FPO; transparency & democratic way of functioning play crucial role in determining sustainability of FPOs.

#### Maa Kharakhai Fish Farmers Producers Company Ltd.

Maa Kharakhai FPC Ltd. was established at Pimpudi, Rajkanika, Kendrapara, Odisha-754220 having CIN-U011100R2019PTC030912. This FPC is promoted by Gram Uthan, an NGO situated at Rajkanika, Kendrapara. It has 10 directors and had 364 share holder members. All the members of the FPC are women. Rs. 1000 was taken as membership fee and FPC has a share amount of Rs. 3, 64, 000/-. Forty percent (40%) of total dividend *i.e.* Rs. 64, 000/- was distributed among the

shareholders at the end of first year. It began its journey in 2019 with only 50 members. Later in the year, other women fish farmers, SHG group members and Producers Group of women joined. The FPC constituted members from 33 gram panchayats and 160 villages of Kendrapara district. The total operational area was divided into 5 zones (East, West, North, South and Central) and 2 Directors were chosen for each zone. The Directors are responsible for coordination in their respective areas. Two people among them mainly look after the bulk purchase of input and selling of produce to ensure higher producer's share in consumer's rupee by eliminating the middleman resulting in higher profitability. The FPC registered a transaction of Rs 72 lakhs in the first year itself. They hold one Annual General body Meeting (AGM) each year, 4 quarterly meeting in which all members participate and share their views with other members. Monthly meetings were only attended by Directors of the company.

The FPC has developed a sound business plan and according to it 1% of total members were assigned for rearing of spawn and fry to fingerlings, 4% were assigned to rear fingerlings to yearlings and 95% of members were taking grow out culture. This helps them in easy and readily available of quality fish seed at right time and in the required size. This approach has rendered the group self-sufficiency in fish seed. The grow out farmers practice four month culture cycle and once the fish attains a body weight of 500 g or more they start selling the produce. They sell the table fish in the local market and get Rs. 140-160 per kg of fish. However, they have to depend on the middlemen for selling of Vietnam climbing perch, Gift



tilapia species as there is less demand in the local market. These species are in demand in Kolkata market and the FPC sells it to Royal Fish agency, a private trader. In one consignment 1-1.5 ton of climbing perch and 2.5 ton of tilapia are normally sent to Kolkata in live condition to get premium price. Among the hurdles it faces are non-availability of cold storage, processing unit and higher cost of inputs. To overcome this the FPC has taken the dealership of ABIS fish feed and entered into agreement with other feed companies- Pasupati feeds, Mohan feeds and Grow well etc for bulk procurement. The collectivization in procurement of input reduced the cost of Rs. 1600 to Rs. 1500 per bag of fish feed. The FPC is charging Rs. 20 per bag as service charge i.e the farmers are getting it at a price of Rs 1520. At the end of the year, the dividend is distributed among the member farmers. The members are procuring and using approx.15-18 ton of fish feed per month.

#### **Project: Farm Based S & T intervention and socio-economic development in aspirational district of Nabarangpur (RKVY)**

Three cemented carp hatcheries and two FRP carp hatcheries were established for developing aquaculture clusters in Nabarangpur district, namely Kusumjar, Kapur, Kosagumuda, Umerkote, and Taragaon, under the RKVY-funded project 'Farm Based S & T intervention and socio-economic development in aspirational district of Nabarangpur. Farmers bred and produced species such as IMCs, Improved rohu and catla, Amur carp, silver barb, and common carp to produce almost 5 crore spawn for the first time in the district from the installed hatcheries. In addition, fifty-eight new nursery ponds were built. Aside

from that, the project beneficiaries received a soil-water testing kit, a drag net, a cast net, spawn collection happas, aluminum handis, and plastic crates to help with aquaculture operations and marketing. Twenty live fish vending units were provided to beneficiaries to sell fresh fish.

## **10. IMPACT ASSESSMENT OF TECHNOLOGIES**

### **Project: New extension methodologies and approaches (NEMA) (E-125)**

#### **Economics of fish culture in Andhra Pradesh & Odisha**

A comparative study on the economics of composite carp culture practices in two randomly selected districts in eastern India, namely West Godavari (Andhra Pradesh) and Jagatsinghpur (Odisha). Personal interviews with respondents (102 from West Godavari and 90 from Jagatsinghpur) were conducted using a structured interview schedule and a multistage random sampling technique. West Godavari district has a greater level of composite carp culture technology adoption than Jagatsinghpur district. Farmers in West Godavari had an average pond area of 5.82 acres, while fish farmers in Jagatsinghpur district had an average pond area of 0.91 acres. It was observed that the seed stocking size and the cost of feed differed significantly between the districts. The average production was about 8.3 t/ha/year in West Godavari whereas in Jagatsinghpur it was 2.7 t/ha/year. Analysis on the input use pattern revealed that the higher output is attributed to its input-intensive culture and entrepreneurial interest of the farmers on adopting the scientific aquaculture practices. The B: C ratio of grow out carp culture in West Godavari was calculated to be 1.66, compared to 1.52 in Jagatsinghpur (Table 21).



**Table 21.** Comparative economics of composite carp culture in West Godavari and Jagatsinghpur

Particulars	Amount (₹)	
	West Godavari (n=102)	Jagatsinghpur (n=90)
No. of respondents	102	90
Total Area (ha)	593.70	81.58
Avg. area (ha)	5.82	0.91
Total fixed cost (₹)	1, 18, 094	29, 617
Total variable cost (₹)	4, 32, 393	2, 24, 543
Cost of production (₹)	5, 50, 487	2, 54, 160
Total production (kg/ha)	8323	2, 769
Total revenue (₹)	9, 15, 610	3, 87, 732
Gross Margin (₹)	4, 83, 217	1, 63, 189
Net Margin (₹)	3, 65, 122	1, 33, 572
Rate of return on total investment (ROI)	66.33	52.04
B:C ratio	1.66	1.52

### GENDER RESEARCH

#### Project: Development of Index for measuring Women’s Empowerment in Aquaculture (I-117)

During 2020-21, an index was developed to measure women’s empowerment in aquaculture as part of the institute-funded project Development of Index for Measuring

Women’s Empowerment in Aquaculture, which followed established procedures such as selecting a domain, assessing content validity through expert rating, and screening domains using the Likert’s summated rating technique by calculating the ‘t’ value. The statements were also examined, and relative weights for the indicated domains were assigned using scale-product approach (Fig. 74).

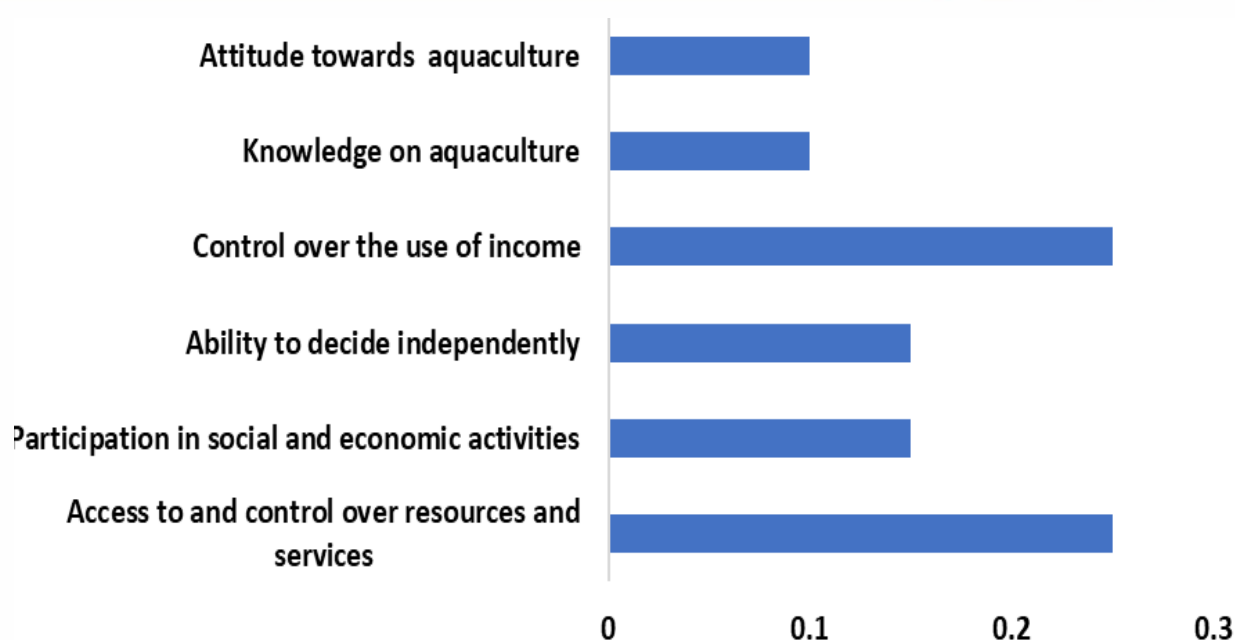


Fig. 74. Relative Weight of the domains of WEAI

## ENTREPRENEURSHIP DEVELOPMENT

### Project: Agri-business Incubation Centre (ABI-NAIF II)

The Agri Business Incubator of ICAR-CIFA incubate technology-business enterprises in the field of freshwater aquaculture. During 2021-22, 618 number of potential entrepreneurs have made an enquiry to ABI-CIFA for carrying out new start-ups. Among them large number of entrepreneurs showing interest in seed production of commercially important species, composite

fish, aquaponics, magur, murrel, tilapia, Jayanti rohu, ornamental fish culture, FRP hatchery, fish hydrolysate, pearl culture, fish processing, feed production and feed plants, etc. 35 new membership applications was registered to become incubatee in ABI-CIFA. During this year, total 7 number of Detailed Project Report/Bankable project have been made and submitted by ABI-CIFA. It also facilitated the submission of 18 technologies of the institute to Agri innovate Ltd for the commercialization process, out of which following technologies were commercialized in 2021 (Table 22).

Table. 22. Details of technologies commercialized during the year 2021

Name of technologies	Name of the firm	Date of Agreement
Bind Add	Dr. Organics, Gajapati, Odisha	22.03.2021
FRP-Carp hatchery	M.R Aquatech, Bhubaneswar, Odisha	08.09.2021
CIFAX	Agarwal Trading Co., Chhattisgarh	01.10.2021
Starter M & Gram Ca feed	Sahajogi, West Bengal	31.12.2021



## DEMONSTRATION OF AGRICULTURE & ALLIED TECHNOLOGIES

**Project: Promoting improved agriculture and allied sector technologies in Khordha district through Farmer First Approach (E-105)**

Four villages Anthuari, Purohitpur (Block-Balianta); Siddha Kutila; and Brahman Khandi were selected for technological interventions. The PRA survey and baseline data were analysed to identify and prioritise problems. 35 extension events involving 970 beneficiaries were organised, including field days, farmers-scientists interface, and capacity building programmes. Six modules were exhibited, including agriculture,

horticulture, IFS, aquaculture, and nutri-garden technology. Bhargabi Fish Farmers Producers Company Limited is in process to establish a one-stop aqua shop to meet the needs of member farmers (quality fish seed, feed, medications, and other inputs) (Table 23).



**Table 23.** Technology assemblage under Farmer First project 2021-22

Sl No.	Crop/Variety/Technology/Methodology	No. of Farmers	Area Covered (ha)
1	Scientific Fish Farming	166	6.00
2	Fish based Integrated Farming System	3	2.00
3	Introduction of Cauliflower Var. Fujiyama	30	1.00
4	Introduction of bush type French bean	40	1.25
5	Green gram in rice fallow	120	20.00
6	Nutri garden	10	-
	<b>Total</b>	369	30.25

## Leveraging ICT for information Dissemination

**Project: Capacity Building of Knowledge Intermediaries and Primary Stakeholders in Freshwater Aquaculture through Virtual Learning Approach (E-108)**

MATSYA SETU, ICAR-CIFA's digital extension platform was developed as a significant deliverable of the project. The virtual learning android app includes video-based self-learning online course modules on breeding, seed production, and grow-out culture of commercially important fishes such as carp, catfish, scampi, murrel, ornamental



fish, pearl farming, and more . The course platform also included Better Management Practices for preserving soil and water quality, feeding, and health management in aquaculture operations. For the learners' convenience, the courses are separated into small video chapters with supplemental learning materials. Quiz/Test alternatives for self-assessment were also introduced to motivate learners and create a vibrant learning experience. An e-Certificate can be generated automatically after each course module is completed successfully. Farmers can use the app to ask questions and receive specialized advice from specialists. The video modules are now accessible in English and Hindi, with regional language versions are under development. On 06.07.21, Shri Giriraj Singh ji, the Hon'ble Former Union Minister for Fisheries, Animal Husbandry, and Dairying, launched the app. As of 31<sup>st</sup> December 2021, 28342 stakeholders from

all over the country had downloaded the app.

### Others

#### Project: Estimation of production and utilization pattern of milk and milk products in India (Collaboration under ICAR-NDRI, Karnal) (E-131)

Under the NSO funded project on Estimation of production and utilization pattern of milk and milk products in India (in Collaboration with ICAR-NDRI, Karnal, Haryana), Sampling for the eastern India was done and four states i.e. Odisha, West Bengal, Jharkhand, Bihar was selected for sampling (Table 24). In each state 4 districts were selected to give a representative sample for each state. Questionnaires for the data collection from Producers, Consumers, Creameries, Halwai, Community dairy units, Industries, milk vendors, Non-profit organizations were finalized.

**Table 24.** Sampling targets & achievements are as given below.

State	Total sample	Sampled collected	% Achievement
Bihar	866	752	86.9
WB	672	559	83.18
Odisha	360	314	87.2
Jharkhand	295	251	85.08
Zone Total	2193	1876	85.54



### 3. TECHNOLOGY TRANSFER & CAPACITY BUILDING

#### Training programmes

The Institute offered several short-term training courses during the year for capacity-building of field-level functionaries, who in turn would transmit advanced technical know-how to the end-users. The programmes were demand-driven and the delivery was based on the principle of 'learning by doing' with adequate background in theory and sufficient hands-on practical exercises. Besides, extension officers in the state department of fisheries, college/university

teachers, students, entrepreneurs and NGO officials were also benefited from the courses. Since, last year the training programmes have been conducted through virtual mode in addition to physical trainings. More emphasis was given in interactive sessions to clarify the doubts of the participants. Virtual training helped ICAR-CIFA to reach out to a larger number of aspiring farmers during this difficult situation. Training programmes conducted this year are presented in the following Table 25.

**Table 25.** Training programmes conducted during 2021

Sl. No.	Title of Training Programme	Duration	No. of participants
1	Carp Seed Rearing	20 January 2021	453
2	Breeding and seed production of <i>Hypselobarbus pulchellus</i>	22 January 2021	112
3	Freshwater Pearl Culture	25 January 2021	570
4	Disease management in Aquaculture	27 January 2021	384
5	Productivity Enhancement in Freshwater Aquaculture	28 January 2021	119
6	Feeds and Feeding in Aquaculture	30 January 2021	356
7	Breeding and seed production of <i>Puntius carnaticus</i>	2 February 2021	73
8	Breeding & Culture of Pabda	2 February 2021	213
9	Breeding & Culture of Major Carps (in Kannada)	3 February 2021	29
10	Wastewater Aquaculture	4 February 2021	156
11	Ornamental Fish Culture and Breeding	15-17 February 2021	140
12	Murrel Farming	18 February 2021	250
13	Breeding & culture of Pangas	18 February 2021	102



14	Anabas Farming	19 February 2021	141
15	Freshwater Prawn Farming	20 February 2021	266
16	High value Catfish Farming- An emerging profitable venture in Northern India	24 February 2021	178
17	Magur Farming	25 February 2021	191
18	BMPs for Quality Seed Production	26 February 2021	247
19	Soil & Water Quality Management	27 February 2021	298
20	Breeding and seed production of <i>Puntius kolus</i> and <i>Tor khudree</i>	2 March 2021	65
21	Carp Breeding & Hatchery Management	5 March 2021	193
22	Seed production and hatchery management of air-breathing fishes	15-17 June 2021	67
23	Freshwater Pearl Culture for Entrepreneur Development	14-16 July 2021	636
24	Hands on Training Programme on “Pabda breeding, rearing and culture” for officers of Directorate of Fisheries, Govt. of Bihar	09 -12 August 2021	02
25	Carp hatchery management and Seed production under STC Program and S&T Intervention Project	16-18 August 2021	25
26	Polyculture of Scampi with Indian Major Carps	20 August 2021	376
27	Breeding & culture of Murrel and Anabas	25-27 August 2021	130
28	Soil and water analysis and its management in Aquaculture	1-3 September 2021	95
29	Breeding & Culture of Minor carps and Barbs	15-17 September 2021	57
30	Breeding, seed production and culture of freshwater prawn	21-23 September 2021	91
31	Fish species diversification in freshwater aquaculture	28-30 September 2021	15
32	Freshwater Aquaculture	29 September 2021	50
33	Fish culture Practices in Wastewater	4-6 October 2021	19
34	Fish culture and practices in wastewater	4-6 October 2021	19
35	Breeding, seed production and culture of Peninsular and Major Carps	26-28 October 2021	16



36	Fish Health and Pond Environment Management	29 October to 1 November 2021	28
37	Breeding and seed production of indigenous catfishes	15-17 November 2021	28
38	Hands on Training Programme on Feed Technology for Sustainable Aquaculture	15-18 November 2021	12
39	Basic Laboratory Techniques in Microbiology	25 November to 04 December 2021	01
40	Freshwater Pearl Culture for Entrepreneur Development	1-3 December 2021	479
		<b>Total:</b>	<b>6682</b>

### Exposure Visits

A total of 27 groups visited ICAR-CIFA Headquarters and the Regional Research Centres during the year (Table 26). The visitor groups comprised of students, farmers, farm women, extension workers and trainees from different organisations. Duration of the

visits were mostly one day and in some cases 2-3 days. Visitors were taken round the farm facilities, museum, selected laboratories and ATIC. Educational videos were screened for the visitors. Interactive sessions with farmer groups were also organized for addressing their queries.



**Table 26.** Details of the group visits to ICAR-CIFA

Venue	Groups	No. of groups	Visitors		Total
			Male	Female	
ICAR-CIFA Headquarters and its RRCs	Farmers and farm women	23	314	61	375
	Students	03	10	10	20
	Trainees from Institutes	01	01	-	01
	<b>Total:</b>	<b>27</b>	<b>325</b>	<b>71</b>	<b>396</b>



### Agricultural Technology Information Centre (ATIC)

The Agricultural Technology Information Centre as a sub-component of the “Innovations in Technology Dissemination” under National Agricultural Technology Project (NATP) has been established at the Institute to provide technology products, services and information through a single window system to farmers and entrepreneurs. During the year 2021, total 767 visitors visited ATIC and CIFA facilities. This Centre has generated revenue of Rs.7500/- from sale of Books & CDs; Rs. 4, 38, 718/- from sale of fish and Rs. 23335/- from sale of other farm produce. A large number of pamphlets/booklets were also distributed to the visitors in free of cost. HELPLINE services has been initiated wherein a group of experts attend to telephonic queries on fixed days of the week.

#### Farmer’s Point

A single window system for servicing visitors to the Institute is operationalized. It is established at the main building (#109).



During the period under report 767 visitors were received, their requirements were understood and guided to the respective units/ sections/ divisions as per their need. Samples were received at this Farmer’s Point and user fees collected for–soil & water analysis, disease diagnosis, feed analysis, etc (Table 27). Level of satisfaction of the customers are also recorded. Digitization of visitor’s particulars is being done. Sale of priced publications, distribution of free literatures are streamlined. In short, visiting of farmers/ entrepreneurs are given utmost attention to ensure that their requirements are satisfied.

**Table 27. Details of technical guidance (individual)**

Months	Samples tested				Tech. queries
	Water	Soil	Fish disease	Feed	
January 2021	26	5	4	-	26
February 2021	28	8	3	-	38
March 2021	32	16	3	-	50
April 2021	23	09	02	-	38
May 2021	10	-	-	-	06
June 2021	46	13	01	-	30
July 2021	41	-	-	10	51
Aug 2021	37	03	-	-	59



Sept 2021	30	01	-	-	52
Oct 2021	24	06	-	-	52
Nov 2021	22	03	02	-	34
Dec 2021	16	02	02	-	34
<b>Total</b>	<b>335</b>	<b>66</b>	<b>17</b>	<b>10</b>	<b>470</b>

### Exhibitions

Table 28. The institute participated in following exhibitions during 2021

S.No.	Exhibition	Venue	Period
1	SMART AQUA EXPO INDIA 2021	Virtual Mode, New Delhi	6-12 February 2021
2	KISAN MELA 2021	Dr Rajendra Prasad Central Agricultural University, Pusa Samastipur, Bihar	7-9 February 2021
3	Agri Vision 2021: An International Conference on Agriculture	ILS, Chandrashekharapur, Bhubaneswar	14-16 March 2021
4	World Fisheries Day-2021 by NFDB, Department of Fisheries, Govt. of India	Rail Auditorium, Bhubaneswar	21 November 2021
5	FISH MART	Confederation of Indian Industry (CII), Odisha State office, Bhubaneswar at CII Hive	24-30 November 2021





## SUCCESS STORY

### Demonstration of freshwater pearl farming activity in Nagaon, Assam

Designer freshwater pearl farming has been proven a successful venture in the farmer's field of many states in India. Due to the concerted efforts of ICAR-CIFA, the technology has effectively disseminated to farmer's fields. Many farmers/entrepreneurs adopted this technology and got success. Mr. Rulen Hazarika native of Bechamari, Nagaon district, Assam is a trainee of Pearl Culture Unit of ICAR-CIFA, Bhubaneswar who was training during 9-11 November 2020. After, the successful completion of the training, he initiated a pilot project on designer pearl farming in 2 Bigha ponds along with fish culture. He adopted an innovative method of designer nucleus preparation. He has followed all the pond management protocols like timely fertilization and liming in order to enhance the primary productivity of the culture systems. As mussel is a filter-



feeding organisms they required sufficient plankton in order to produce quality pearls. At present, he is producing a range of pearl-based items, including designer pearls, shell by-products such as jewellery, and buttons from MOP, using his unique processes to turn waste into wealth with a meager investment of Rs. 60, 000/- and produces pearls to the value of Rs. 300-400 each and able to make a good amount of profit. Thus, freshwater pearl farming helps the farmer in alleviating poverty, ensuring the economic viability of his family. His success story can be used as a model case for promoting sustainable agricultural techniques including pearl farming for the North-Eastern states of India.

## DISSEMINATIONS AND DEMONSTRATIONS

### Encouraging growth performance of 'CIFA GI-Scampi™' in carp-scampi polyculture system in West Bengal for improving farmer's income

As a component of CIFA PMMSY Scampi project, multi-location trial of 'CIFA-GI-scampi™' (genetically improved and fast growing strain of freshwater prawn, *Macrobrachium rosenbergii*) developed by ICAR-CIFA was conducted in Haldia district of West Bengal in collaboration with Department of Fisheries, Government of West Bengal. The size of the selected ponds ranged from 0.12 to 0.38 ha. Stocking density of CIFA GI-Scampi juveniles (ABW-0.75g) ranged from 8000 to 9400 per ha, while advanced fingerlings of *C. catla* (158.00 to 273.13 g) and *L. rohita* (54.33 to 104.03g) were stocked @ 6000 fingerlings/ha at 20:80 ratio respectively. The selected farmers were provided with inputs i.e. seed, floating feed, lime etc. The farmers were provided technical guidance by ICAR-CIFA. Sampling was conducted at monthly interval



to assess the growth and health of the stock. After 134 days of culture, the average body weight of GI-scampi ranged from 35.0 to 44.9 g whereas the same for *C. catla* was 537.8 to 969.3 g and *L. rohita* ranged from 290.2 to 464.3 g in the demonstration ponds in West Bengal. The average daily growth (g/d) of GI Scampi ranged from 0.28 to 0.32 g, which was much higher than the earlier reports.

**Public outreach**

ICAR-CIFA in collaboration with Water Resource Department (WRD), Govt. of Odisha organized a fish seed ranching programme in

Jhumka Dam, Khordha, Odisha on 8 January, 2021. The purpose of the programme was to replenish the depleting fish species in the natural open water bodies and increase the availability of fish to the people. For the ranching programme 22,000 fingerlings of *Labeo fimbriatus* (Khursia) and *Labeo calbasu* (Kalabainisi), were ranched in natural water bodies.

A field day on aquaculture was organised at Aquaculture Field School, Sarakana, Baliana, Khordha owned by Padmashri Bata Krushna Sahu on 24 February, 2021. On





this occasion a farmers-scientists interface was also conducted in which Director and a team of scientists from ICAR-CIFA and Dr B. P. Mohanty, ADG (I.Fy), ICAR, New Delhi, in the interaction meeting. Dr. Mohanty congratulated and felicitated Shri Sahu for the rare accomplishment and for his long-standing association with ICAR-CIFA. Shri Raghunath Nayak, Retd. FEO, Baliana block and Shri A. K. Bastia, DFO, Khordha were also present in the programme.

### **Ornamental Aquaculture Field School of Odisha inaugurated at Kochila Nuagaon, Cuttack**

The ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha inaugurated the First Ornamental Aquaculture Field School of Odisha at the farm of Shri Rajesh Ranjan Mohapatra of Kochila Nuagaon Village, Tangi, Choudwar Block, Cuttack District, Odisha. The Unique Field School is established for facilitating the farmer-farmer learning and dissemination of ornamental fish culture techniques. The school envisages at empowering the Scheduled Caste Ornamental Fish Farmers/ Farm Women of the nearby Villages contributing greatly to the extension and advisory services delivery. Around 50 farmers and farm women participated in the event.



### **Promotion of ornamental fish farming among women SHG's at Kendrapara, Odisha**

Two women SHG's of Kendrapara district comprising of 21 members belonging to SC community were selected as beneficiary



**Distribution of FRP tanks to the women SHG's**



**Director, ICAR-CIFA delivering lecture to the women SHG member**

for demonstration on ornamental fish breeding and culture. A one-day orientation programme on promotion of ornamental fish farming among women Self-Help Groups was held on 17 August, 2021 at KVK Kendrapara. District Collector Shri Amrut Ruturaj, IAS and Director, ICAR-CIFA handed over FRP tanks to the beneficiaries.

### **Technology Commercialization**

#### **MoU signed for Murrel technology**

MoU signed between ICAR-CIFA and Rajnandgaon Agri & Fisheries, Chhattisgarh



on 05/08/2021. ICAR-CIFA will provide technical support for murrel seed production and culture. Initially, ICAR-CIFA has provided 8,000 advanced fry of *C. striata* and 2000 advanced fry of *C. marulius* for raising into broodstock for further breeding and seed production.

**Dissemination of ‘CIFA-GI Scampi’**

In order to disseminate the new improved and fast-growing breed of scampi ‘CIFA-GI Scampi’ to farmers across India, three scampi hatcheries in Andhra Pradesh (ASR hatchery, Nellore; BKMN AQUA, Nellore and MSR Aqua Pvt. Ltd, West Godavari) were selected as multiplier units of ‘CIFA-GI Scampi’ after following due procedures (Advertisement in National Newspapers across India, scrutinizing applications and on-site inspection of all hatcheries). On 4<sup>th</sup> October 2021 MoU was signed with all the three selected multiplier scampi hatcheries. The selected hatcheries were also provided with limited quantity of the improved brood seed of ‘CIFA-GI Scampi’ for brood raising and seed production in the coming season. It is expected that the selected scampi hatcheries will produce large quantities of improved seed ‘CIFA-GI Scampi’ for supply to farmers across India which in turn will help in higher production and income for farmers.

In addition to the above, a total of 20,000 seed of ‘CIFA-GI Scampi’ were provided to National Freshwater Fish Brood Bank (NFFBB), Kausalyaganga, Bhubaneswar,



Supply GI Scampi for demonstration at Haldia



Stocking of GI Scampi for demonstration in Odisha



Adopted farmer from Jajpur & Cuttack Districts of Odisha





Odisha for raising to brood stock and supply to network scampi hatcheries in June 2021. Another 9,600 seed (representing 19 families of G13) were also supplied to M/s Maharaja Hatchery from Andhra Pradesh with whom ICAR-CIFA has entered into an MoU for developing and disseminating genetically improved scampi.

### **Survey of Balasore area to study the brackish water pond production of Scampi seed**

A survey was conducted to study the pond seed production activities of freshwater prawn being carried out in Balasore district of Odisha. The survey revealed that the pond seed production of freshwater prawn (scampi) is going on in few pockets in Balasore district. Maximum of these activities are concentrated to Gudu Pahi area, while other production sites are Hidigaon, Jayadev Kasab Pahi, Badakia, Huda Pahi, 8 miles, 9 miles, 12 miles, 17 miles, Bhimpur Pahi, Bardhanpur Pahi, Kalamatia, Thakur Pahi, Khandia Khapara etc. These places are coming under three panchayats like Gudu Pahi, Padmapur and Jayadev Kasab Pahi. While discussing with the seed producers it was found that these seed production activities started in Gudu Pahi area during 2015. Slowly these activities spread over to other areas. However, most of the production is coming



from this Gudu Pahi area due to suitable soil and water availability for seed production. Although farmers from other areas tried for production of seed, they were not fully succeeded over the years. On an average they have been producing around 20 lakhs of seed per year in two crops. Most of them are mainly culturing marine shrimp *P. vannamei*. In nutshell, the production cycle starts from February and ends in May. After harvesting *P. vannamei* in November, the ponds are dried during December to January. The pond bottom is prepared following standard pond preparation methods. In addition, probiotics and yeast are also added for higher plankton growth. Once the plankton is developed (after 15-20 days) 500-600 nos. of berried prawns of 30-60 g is released to a one-acre pond. During January the salinity of the pond water taken through brackish water canal is 15-17 ppt. The berried prawns are fed twice daily with commercial shrimp or scampi pellet feed. After 3-4 days, the larval density is checked with scoop net. Once the larvae are present in the water, they are fed with milk powder, fine wheat flour, sooji etc. Only few farmers could afford to operate air blower and the remaining farmers do not use any aeration devise. After a period of 4 weeks once the PL is around 10 days old, it is collected through scoop net and sold. Salinity during harvesting of first crop during April remains around 15 ppt, while during 2nd crop it reaches to 7-8 ppt during July due to rain. Most of the farmers are selling the seed in about 15 ppt salinity at a price ranging from Rs. 300 to 800 per/1000 seeds. The price of the seed initially remains high at approx. Rs. 800/1000 nos. and slowly comes down to Rs. 300 at the end of the season. The seed farmers do not have the facility to acclimatize the seed to lower salinity. On an average each farmer earns about Rs.3 to 10 lakhs per annum. The



number of seed growers is increasing every year due to existing problem in vannamei farming and due to higher rate of returns and low investment in short duration crop of 6 months. Most of the seeds are being sold through the middleman to West Bengal. The seed market was affected due to the COVID-19 restrictions in transport in 2020 and 2021. The farmers depend on the middlemen for packing and transportation. The farmers opined that there is huge potential of seed production in the area, while marketing of

these seeds have been a major challenge faced by all the farmers. Data collection from farmer engaged in scampi seed production in brackish water pond in Balasore.

**Performance Assessment of genetically improved rohu**

To evaluate the performance of Jayanti rohu in farmers field, data were collected from three different states. The state wise details of the data collected for the performance assessment of Jayanti rohu is given in table 29.

Table 29. State wise details of the data collected on Performance assessment of Jayanti rohu

State	Jayanti Rohu Farmer (Number)	Local Rohu Farmer (Number)	Jayanti Rohu Multiplier Unit (Number)
Odisha	50	30	3
Assam	46	38	3
West Bengal	5	25	1
Total	101	93	7

Table 30 Techno-economic characteristics of Jayanti rohu and Local rohu under polyculture systems in Odisha

Variables	Jayanti Rohu Farmers (N=50)	Local Rohu Farmers (N=30)
Stocking density (ha)	6667 ± 112	6626 ± 131
Size at stocking (g)	13.18 ± 0.66	12.39 ± 0.70
Size at harvesting (g)	1163.63 ± 35.83 <sup>b</sup>	857.8 ± 8.23
Culture Period (days)	300 ± 4.00	301 ± 3.00
Survival (%)	78.33 ± 0.65 <sup>b</sup>	66.04 ± 0.43 <sup>a</sup>
AGR (g/day)	3.84 ± 0.12 <sup>b</sup>	2.81 ± 0.046 <sup>a</sup>
Yield per ha per crop cycle (kg)	4,196 ± 126 <sup>b</sup>	3,200 ± 65 <sup>a</sup>
Sale price (INR/kg)	141 ± 1.61	140 ± 1.11
Revenue (INR) (Avg.)	5, 93, 030.3 ± 18712.9 <sup>b</sup>	4,48,814 ± 9820.2 <sup>a</sup>
Input cost (INR) (Avg.)	3,01,533 ± 9365.8 <sup>a</sup>	3,02,436 ± 11765.5 <sup>a</sup>
Net Benefit (Avg.)	2,91, 497 ± 10735.2 <sup>b</sup>	1,46,378 ± 6675.03 <sup>a</sup>



Analysis of the performance data of Jayanti rohu from Odisha was carried out. Analysis of the socio-economic characteristics of the two groups revealed that farmers who cultivated Jayanti rohu were more educated and had more area under aquaculture compared to those who cultivated local rohu. Age of the farmer and experience in fish farming were more or less similar in both the groups. The technical characteristics of the two groups are presented in table 30. The results revealed that stocking density and stocking size were more or less same in both the groups however, harvest size, survival and average daily growth of Jayanti rohu was significantly higher than that of local rohu. Similarly yield per ha, net benefit, benefit cost ratio and return on investment were all superior in case of Jayanti rohu compared to local rohu (Table 30).

The results revealed significantly higher production and income from the culture

of genetically improved fish (Jayanti rohu) compared to local rohu.

### Performance Assessment of genetically improved freshwater prawn

Data from 14 districts (Balasore, Bhadrak, Kendrapada, Jagatsinghpur, Khordha, Puri, Ganjam, Bolangir, Cuttack, Deogarh, Jajpur, Mayurbhanj, Nayagarh and Nuapada) in Odisha were collected and analysed to evaluate the performance of genetically improved freshwater prawn (CIFA-GI scampi) compared to local unimproved scampi. The farmers followed polyculture of scampi with Indian major carps (*Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*). Data were collected through interview using a structured interview schedule.

Results revealed that majority of CIFA-GI scampi farmers were fish farmers by occupation, owned smaller farms, and had higher educational qualifications. Stocking

Table 31. Stocking and harvest details of the GI scampi and non-GI scampi groups

Variables	GI scampi (n=28)		Non-GI scampi (n=18)	
	IMC	Scampi	IMC	Scampi
Stocking density (ha)	8311 ± 1137	12,831 ± 1,585	7918 ± 1377	13,521 ± 2482
Size at stocking (g)	6.14 ± 1.1	0.03 ± 0.01	5.39 ± 1.2	0.08 ± 0.05
Size at harvesting (g)	963 ± 48	68 ± 3.97	746 ± 31	38 ± 5.1
Survival (%)	35.00 ± 5.61	63 ± 8.18	43.0 ± 10.51	59 ± 11.86
AGR (g/day)	3.37 ± 0.24	0.26 ± 0.02	3.34 ± 0.20	0.17 ± 0.02
Yield/ha/crop cycle (kg)	1985 ± 225	416 ± 46	2093.65 ± 250.41	218 ± 28
Sale price (INR/kg)	151 ± 6.27	418 ± 17	132 ± 4.01	368 ± 13



size, density and survival were more or less similar in the two groups (Table 31). Significant differences were observed in harvest size, average daily growth, yield, sale price, crop duration, production cost and gross profit. CIFA-GI scampi showed 53% higher growth rate, 91% higher yield, fetched 14% higher farm gate price and gave nearly 2 times higher profit. The results clearly indicated the superiority of the genetically improved CIFA-GI Scampi over local scampi.

### Dissemination of murrel and anabas seeds

During 2021, a total of 1.50 lakhs *Channa striata*, 0.60 lakh *Channa marulius*, and 1.60 lakhs *Anabas testudineus* hatchlings were produced. The produced hatchlings were reared under indoor conditions and weaned on the formulated diet. The weaned advanced fry and fingerlings were given to the farmers and stakeholders of Odisha, Chhattisgarh, and Punjab.

### Demonstration of CIFA-Carp Grower developed by ICAR-CIFA in farmer's field Bhadrak, Odisha

In Bhadrak, Odisha, rohu fingerlings (average 105 g) were stocked with stocking density of 3000/acre in both treatment and control ponds. Fish in treatment ponds were fed with CIFA-Carp Grower whereas fish in control ponds were fed with oil cakes and rice bran mixture supplemented with minerals and vitamins. After 10 months of feeding experiment, average size of fish with carp grower was 1088 g whereas average size of fish in control pond was 890 g. The fish had good acceptability to carp grower compared to other feeds. The survival % of fish fed with CIFA-Carp grower was 82% whereas survival % of fish fed with existing

feed was 78%. Feed Conversion Ratio (FCR) of CIFA-Carp Grower was calculated as 1.29 whereas FCR of existing feed was 2.87. The yield and net return was higher by feeding with CIFA-Carp Grower compared to other feeds indicating higher acceptability by farmers of this region.



Sampling of fish in Bhadrak, Odisha during demonstration

### Balianta, Khordha

A feeding experiment was carried out at Kazipur, Balianta, Khordha, Odisha. Rohu fingerlings (50 g/per fish) were stocked with stocking density of 7500/hectare in both treatment and control ponds. The fish of control ponds were fed with ground nut oil cakes and rice bran mixture supplemented with minerals and vitamins whereas fish of treatment ponds were fed with CIFA-Carp



Demonstration of CIFA-Carp Grower at Kazipur, Baliana, Khordha, Odisha

Grower developed by ICAR-CIFA. The results of the demonstration showed that, the average size of fish after feeding with CIFA-Carp Grower were 1017 g at 10 months of feeding whereas average size of fish fed with existing feed was 742 g. The result indicated the FCR of 1.18 in CIFA-Carp Grower whereas FCR of existing mash feed was 2.39. The immunity parameters (bacterial agglutination, lysozyme, myeloperoxidase, haem-agglutination and haemolytic activity) of grow out rohu fed with CIFA-Carp Grower was higher compared to existing feed practiced by many farmers in this region.

### Strengthening quality freshwater fish seed supply chain through 'Cluster Seed Villages' approach in Odisha

Two sites were selected, one at Bangiriposhi in Mayurbhanj district and the other at Katisahi in Balasore district of Odisha for the project implementation. A meeting was

organized with the farmers of Bangiriposhi during the visit and 18 farmers having 3.95 ha water area has been selected. But due to COVID-19 restriction, the project activities started late and by that time few farmers have already released fish for grow-out purpose. A total of 1.05 lakh fry of Indian major carps were supplied in October 2021 for release in the 18 ponds. Also, fish feed, lime, fish net and other inputs were also provided. Regular water quality monitoring and onsite pond monitoring is being done with the help of Project personnel stationed at the Project site. A training programme for the Bangiriposi farmers was organized at ICAR-CIFA during 22-24 November 2021.



Sampling of the ponds adopted under the project at Baliapal, Balasore



### FARMERS MEETS AND HEALTH CAMPS

#### National Awareness programme on 'CIFA-GI Scampi'

ICAR-CIFA in collaboration with Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD), Government of India, and NFDB, Hyderabad organized a virtual National Awareness programme on 'CIFA-GI Scampi: The Genetically improved and fast-growing strain of scampi for higher production and income' on 27 July 2021. The objective of the program was to create awareness about the 'CIFA GI Scampi' and partner with the potential state fisheries departments and scampi hatcheries in disseminating the improved strain. Shri. J.N. Swain, IAS, Secretary, Department of Fisheries, MoFAHD, Government of India, New Delhi was the chief guest of the program. Guests of Honors who attended the workshop were Dr. J.K. Jena, Deputy Director General (Fisheries Science), ICAR, New Delhi, Dr. C. Suvarna, IFS, Chief Executive, NFDB, Hyderabad and Shri Sagar Mehra, Joint Secretary (Inland Fisheries), Department of Fisheries, MoFAHD. A total of 364 stakeholders including state fisheries department officials from 11 states, scampi hatchery operators, farmers, scientists and academicians participated in the one-day awareness program.



Virtual National Awareness programme on 'CIFA-GI Scampi'

#### Awareness workshops on "Improved variety of carps and freshwater prawn for enhancing farmers' income"

Organized two awareness workshops on "Improved variety of carps and freshwater prawn for enhancing farmers' income" during 15 & 16 December 2021 for fish farmers and hatchery owners of Assam under ICAR-WorldFish collaborative project. The awareness workshops were conducted to sensitize the fish farmers, hatchery owners and other stakeholders on the importance of quality fish seed and adoption of improved variety of carps (Jayanti rohu and improved catla) and freshwater prawn (CIFA-GI Scampi) in enhancing the farmer's income. On 15 December 2021, 50 farmers participated in the workshop at Kalong Kapili, Bogibari, Kamrup, Guwahati, Assam along with Shri. Jyotish Talukdar, Director of NGO Kalong Kapili. During the workshop. On 16 December 2021, another 50 farmers



Workshop at Kalong Kapili Assam



along with MLA from Nalbari District Shri. Jayanta Malla Baruah, District Fisheries Officer, Nalbari Shri. Trailokya Saloi and Shri. Debajit Barman, proprietor of Debajit farm attended awareness workshop on “Improved variety of carps and freshwater prawn for enhancing farmers’ income”.

### Workshop at Nalbari, Assam

In West Bengal one Awareness workshop on “Genetically Improved Variety of Carps and Freshwater Prawn for Higher Production and Income” was organized in collaboration



with Sasya Shyamala KVK, Sonarpur, West Bengal on 18 December 2021. A total of 62 fish farmers and entrepreneurs participated in the awareness program. In the technical session scientists explained the advantages of using genetically improved fish and prawn species for enhancing production and income. Topics covered during the technical session were a) Genetically improved carps for higher production and income, b) Genetically improved freshwater prawn for higher production and income, c) Soil and water quality management in fish culture pond and d) Disease management in carps and scampi culture systems. The technical session was followed by a farmers-scientist interaction where the various issues raised by the farmers were addressed by the scientists.

### National Virtual Consultation on “Indian Ornamental Fisheries 2.0 - The Way Forward”

ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, New Delhi and National Fisheries Development Board (NFDB), Hyderabad organised the National Virtual Consultation on “Indian Ornamental Fisheries 2.0 - The Way Forward” is organised during 22-24 April 2021. Hon’ble MoS, MoFAHD & MSME, Shri Pratap Chandra Sarangi, inaugurated this programme and called for indigenous manufacturing of aquariums and the accessories for an *Atma Nirbhar Bharat* and promoting the aquarium hobbying thus increasing the production of ornamental fish to develop the ornamental fisheries sector in the country. Other dignitaries for the inaugural programme were Shri Atul Chaturvedi, IAS,



Secretary, Department of Fisheries & Animal Husbandry and Dairying, Dr C. Suvarna, IFS, CE, NFDB, Dr J.K. Jena, DDG, Fisheries Science, Dr J. Balaji, IAS, Jt. Secretary, DoF, Dr Dilip Kumar Former Vice Chancellor, ICAR-CIFE, Dr S. Felix, Former Vice-chancellor, TNJFU, Dr V. V. Sugunan, Former ADG, ICAR, Dr S. Raizada, Former ADG (Inland Fy), ICAR and many other scientists and top officials from the ministry participated in the event. The three days consultation covered different thematic areas for discussion such as enhancing the domestic ornamental fish production & constraints in marketing, achieving self-reliance in manufacturing of aquarium accessories, quality feed, medicines & aquatic plants, promoting the domestic retail trade of ornamental fish & hobby promotion, boosting ornamental fish exports and issues in imports, biodiversity concerns & policy issues and research & development priorities, & capacity building. Thirty-two key stakeholders from different key segments of the sector participated in the consultation and shared their opinions and the event was attended by more than 2000 other stakeholders.

### National Campaign on “System Diversification in Aquaculture” on the occasion of Azadi Ka Amrit Mahotsav

ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha organized National campaign on “System Diversification in Aquaculture” on 1 September 2021 in a virtual mode through zoom platform to commemorate the 75<sup>th</sup> anniversary of India’s Independence. This national campaign webinar focused on the recent trends in system diversification in aquaculture



technologies. Dr. J. K. Jena, Deputy Director General (Fisheries Science), ICAR, New Delhi was the Chief Guest of this event. Dr. B. P. Mohanty, Assistant Director General (Inland Fisheries), ICAR was the Guest of Honor. Dr. S. Felix, Former Vice-Chancellor, Tamil Nadu Dr. J. Jayalalithaa Fisheries University was keynote speaker. A total of 148 participants from 12 states attended the webinar. The event was coordinated by Dr. B.R. Pillai, PS & HoD, APED, ICAR-CIFA.

### Farmers’ awareness programme on “Balanced Use of Fertilizers in Freshwater Aquaculture”

ICAR-CIFA and KVK, Khordha organised a Farmers’ awareness programme on “Balanced Use of Fertilizers in Freshwater



Aquaculture” virtually on 18 June, 2021. This event was organized under a series of programs being organized by ICAR, New Delhi to celebrate 75 Years of Indian Independence. Swami Shivakarananda, Principal, Samaj Sevak Kendra, Ramakrishna Mission, Belur Math was the Chief Guest of the meeting. The event was attended by about 140 fish farmers.

### World Antimicrobial Awareness Week, 2021

On the eve of World Antimicrobial Awareness Week, 2021 and Azadi ka Amrit Mahotsav-National campaign, ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, one of the centre under FAO-ICAR-INFAAR Network organized a national webinar, a special lecture and three Farmers Scientist interaction Meet and Awareness programme at Odisha and Andhra Pradesh to educate and create awareness on antimicrobial resistance among the researchers, scholars, students, farmers, entrepreneurs, Govt. Officials, public and other stakeholders. During the week a debate (physical mode) and art competition (virtual mode) were organized among the scholars and students on relevant topics.

### National webinar on Antimicrobial Resistance (AMR)

National webinar on “Antimicrobial Resistance & One Health” was organized at ICAR-CIFA, Bhubaneswar on 18 Nov 2021. Dr. J. K. Jena, DDG (Fisheries Science), ICAR, was the Chief guest of the programme. Dr. B. P. Mohanty, ADG (Inland Fisheries) and Dr. S.K. Swain, Director, ICAR-CIFA also addressed the participants. Dr. Manoj Kumar Das, Project Director, the INCLIN trust international, New Delhi, gave a special talk on ‘Antimicrobial Resistance: Impact on Human Health. Dr. Gaurav Rathore, PS & Head of Fish Health Management & Exotics Division, ICAR-NBFG, Lucknow also talked on ‘AMR Issues in Fisheries and Aquaculture’ and Dr. Rajesh Bhatia, Former Director, Department



National webinar on Antimicrobial Resistance & One Health



of Communicable Diseases at WHO, Regional Office for South-East Asia, talked on the topic 'Antimicrobial Resistance & One Health'. More than 80 participants consisting of scientists, students, and farmers etc. participated in the webinar. All the three lead lectures were excellent and the program was ended with good interaction with participants.

Special lecture by eminent personalities working on on antimicrobial resistance & one health was organized at ICAR-CIFA, Bhubaneswar on 20<sup>th</sup> Nov, 2021, on the occasion of World Antimicrobial Awareness Week, 18-24 Nov, 2021 and Azadi ka Amrit Mahotsav- National Campaign at ICAR-CIFA, Bhubaneswar. Dr. (Prof) Ashoka Mohapatra, Dept. of Microbiology, AIIMS, Bhubaneswar delivered the special lecture on the topic 'AMR issues in human health and one health approach for its containment'. Another lecture by Dr. Debducta Bhattacharya, Scientist D & In-Charge Cobas Lab. ICMR-RMRC, Bhubaneswar on the topic 'Tackling AMR, a global issues'.



### Farmers – Scientists interaction meet and Awareness programme on Fish Disease management in Freshwater Aquaculture development

The Regional Research Center, Vijayawada in collaboration with Fish Health Management Division, ICAR-CIFA organized a “Farmers – Scientists interaction meet and Awareness



Farmers – Scientists interaction meet and Awareness programme on Fish Disease management in Freshwater Aquaculture development”

programme on Fish Disease management in Freshwater Aquaculture development” was held at Peravali, Guntur district, Andhra Pradesh on 28.11.2021. Water and fish samples brought by the farmers were tested at the site and advised accordingly. Dr. B.S. Giri, PS, addressed the farmers about the present situation in Krishna and West Godavari districts in Andhra Pradesh with much loss due to fish diseases. So many varieties of drugs & chemicals being used in the culture ponds which are unwarranted. Dr S. S. Mishra, HoD, FHMD advised the farmers to maintain optimum stocking density and check water quality regularly



to avoid loss due to disease. Dr. Ramesh Rathod, elaborated about different field level diagnostics for early diagnosis of disease. Total 54 fish farmers, entrepreneurs with local representatives attended programme.

### **Farmers meet and Awareness programme on “Responsible use of Drugs & Chemicals for Sustainable Aquaculture development”**

The Farmers meet and Awareness programme on “Responsible use of Drugs & Chemicals for Sustainable Aquaculture development” was held at AP State Referral Lab for FW Aquaculture, Department of Fisheries, Govt. of A.P., Eluru, Krishna district, Andhra Pradesh on 30.11.2021. Mr. V. Ramachandra Raju, President Delta fish farmers Association, Mr. K.S.V. Nagalingacheryulu, Joint Director Fisheries, Eluru, and Mr. K. Verranjaneilu, ABT Corporation, Eluru were the guest speakers. Dr. P.V. Rangacharyulu, PS & SIC, RRC-CIFA, Vijayawada elaborated the activities of RRC-

CIFA for fisheries Development in the region. Mr. Ramachandra Raju, briefed about the problems being faced by the farmers with low profit margin and high incidence of disease occurrence in fish culture. Incidence of fish lice has been very common that has caused havoc in the region as no chemicals are not able to prevent the disease. Mr. Nagalingacharyulu, requested ICAR-CIFA Scientists to look into the issues being faced by the local farmers and requested to facilitate HRD and skill development of departmental staff in disease management. Dr S.S. Mishra stressed that due to lack of Aqua-drug policy and monitoring system in the state, any chemical and antibiotics being used in Veterinary medicine are being used in aquaculture, which is not a good sign and requested state Govt department to look into the issues. The Programme was coordinated by Dr. Ramesh Rathod, and Dr. Ajit Keshav Chaudhari, RRC-CIFA, Vijayawada Centre. A total of 60 farmers, entrepreneurs attended the programme.



Farmers meet and Awareness programme on “Responsible use of Drugs & Chemicals for Sustainable Aquaculture development”

**Table 32. Farmers Training & Awareness Programs**

Sl. No.	Title of the training programme	Venue	Durations	No. of participants		
				Male	Female	Total
1	Fish Disease Diagnosis and Management in Freshwater Aquaculture	Duba Fish Farm, Kudutai, Ganjam	05-06 February 2021	55	13	68
2	Fish Disease Diagnosis and Management in Freshwater Aquaculture	Ghoradia, Delanga, Puri	10-12 February 2021	69	0	69
3	Fish Disease Diagnosis and Management in Freshwater Aquaculture	Bhatapada, Banpur, Khordha	08 March 2021	47	11	58
4	Training, Demonstration and Distribution of inputs to tribal beneficiaries for Integrated farming development in Gajapati dist., Odisha	Chandragiri, Mohana	15-16 March 2021	0	71	71
5	Training, Demonstration and Distribution of inputs to tribal beneficiaries for Integrated farming development in Gajapati dist., Odisha	Jagannathpur, Kujasingh, Gumma	17-18 March 2021	0	61	61
6	Training, Demonstration and Distribution of inputs	Umarkote, Nabarangapur	10 November 2021	49	51	100
7	Training program on fish health and environment management and input distribution	Bhawanipatna, Kalahandi	13 November 2021	2	38	40
8	Fish disease management and awareness on prudent use of drugs and chemicals	Khajipalem, Guntur, AP	25-26 November 2021	59	6	65
9	Training of tribal beneficiaries and distribution of inputs for fisheries development in Gajapati dist., Odisha	Chandragiri, Mohana	20-23 December 2021	0	63	63
10	Training of tribal beneficiaries and distribution of inputs for fisheries development in Gajapati dist., Odisha	Bhubani, Gumma	21-22 December 2021	3	52	55



### Fish health camp and awareness programme

Conducted 5 fish health camp and awareness programme at different locations to make fish farmers well aware about the different kind of fish diseases, on farm diagnosis,

preventive and control measures to be followed to minimize the loss due to diseases. Also to sensitize the fish farmers about responsible use of chemicals, medicines and antibiotics in food fish culture.

**Table 33. Details of health camp and awareness programme**

Sl No..	Programme	Venue/ Place of conduct	Date of conduct	No. of participants
1	Farmers scientist interaction meet and awareness programme	KVK, Bhadrak	19 January 2021	55
2	Farmers scientist interaction meet and awareness programme	DFO Office, Balasore	21 January 2021	40
3	Farmers scientist interaction meet and awareness programme on “Fish disease management in freshwater aquaculture”	Shri MVKR Fisheries polytechnic college, Bhavadevarapalli, Krishna, AP	06 February 2021	65
4	Farmers meet and awareness programme on “Responsible use of drugs and chemicals in aquaculture for sustainable development Fish disease management in freshwater aquaculture”	Kaikalur, Krishna, AP	09 February 2021	72
5	Farmers meet and awareness programme on Responsible Aquaculture	Tarata, Nischintakoili, Cuttack, Odisha	22 February 2021	74
6	Farmers meet and awareness programme on Responsible Aquaculture for sustainable development	Peravali, Guntur, AP	28 February 2021	54
7	Farmers meet and awareness programme on “Responsible use of drugs and chemicals in aquaculture for sustainable development”	Eluru, West Godavari, AP	30 November 2021	65



**OTHER EXTENSION ACTIVITIES**

**Student/Education Programmes**

ICAR-CIFA has provided In-plant trainings to B.F.Sc. students from College of Fisheries,

OUAT, Rangailunda and College of Fishery Science, Jabalpur, MP during the period. The Institute has also provided attachment training for M.F.Sc. students of ICAR-CIFE, Mumbai on Biotechnological techniques.

**Table 34. List of MoUs signed**

Sl.No.	Name of the Institute	Date signed	Purpose
1	Sahajogi, Sonarpur, South 24 Parganas, WB (Licensee) through Agrinnovate India Ltd., New Delhi (Facilitator)	29 Dec 2021	Magur larval feed-‘Starter-M’ and Farm made grow out carp feed – ‘Gram-CA Feed’
2	XIM University, Nijigada, Kurki, Harirajpur, Puri, Odisha	15 Nov 2021	For facilitating students training, internship/undergraduate research / scientists exposure / Joint Research Projects & Involvement
3	M/s IREL (India) Limited (GoI undertaking, Dept. of Atomic Energy) Matikhalo, Po: Matikhalo, Ps: Chatrapur, Dist: Ganjam (Odisha)	05 Oct 2021	Tank Based Tilapia Culture in Bio-Floc System for weaker section under CSR
4	MSR Aqua Pvt. Ltd., D.No.9-208/1, Konapapapeta, Ponnada Village, U.Kothapalli Mandal, East Godavari District, Andhra Pradesh	04 Oct 2021	Multiplier Hatchery for CIFA-GI-Scampi™ under PMMSY CS Project “Scaling up of Genetic Improvement Programme of Freshwater Prawn <i>Macrobrachium rosenbergii</i> (Scampi)”
5	BKMN Aqua, Ramudupalem Village, Mudivarthipalem Post, Indukurpet Mandal, SPSR Nellore, Andhra Pradesh	04 Oct 2021	Multiplier Hatchery for CIFA-GI-Scampi™ under PMMSY CS Project “Scaling up of Genetic Improvement Programme of Freshwater Prawn <i>Macrobrachium rosenbergii</i> (Scampi)”
6	ASR Hatchery, Gangapatnam Village, Indukurpet Mandal, SPSR Nellore District, Andhra Pradesh	04 Oct 2021	Multiplier Hatchery for CIFA-GI-Scampi™ under PMMSY CS Project “Scaling up of Genetic Improvement Programme of Freshwater Prawn <i>Macrobrachium rosenbergii</i> (Scampi)”



7	Sambalpur University (Odisha)	23 Sept 2021	Academic and Research Collaboration
8	M/s MR Aquatech, Bhubaneswar through Agrinnovate India Ltd	08 Sept 2021	Technology License Agreement for FRP Carp Hatchery
9	Indian Farmers Fertilizer Cooperative (IFFCO) Ltd., IFFCO Sadan, New Dehli	02 Sept 2021 – 01 Sept 2022	A contract research project on “Evaluation of seaweed based dietary formulation on growth performance in <i>Labeo rohita</i> ”
10	Sewa International	26 Aug 2021	Providing technical support for scientific fish farming in NEH region
11	Rajnandgaon Agri & Fisheries, Chattisgarh	05 Aug 2021	Providing technical support for murrel seed production and culture
12	NFDB-NFFBB, Bhubaneswar	26 April 2021	Foundation seed (spawn) of latest generation Jayanti Rohu on regular basis during breeding season to NFDB



**IPR issues (Patents, Commercialization of Institute’s products, etc)**

**Project: XII Plan Scheme National Agriculture Innovation Fund (NAIF) (Component-I Innovation Fund) (E-61(NAIF))**

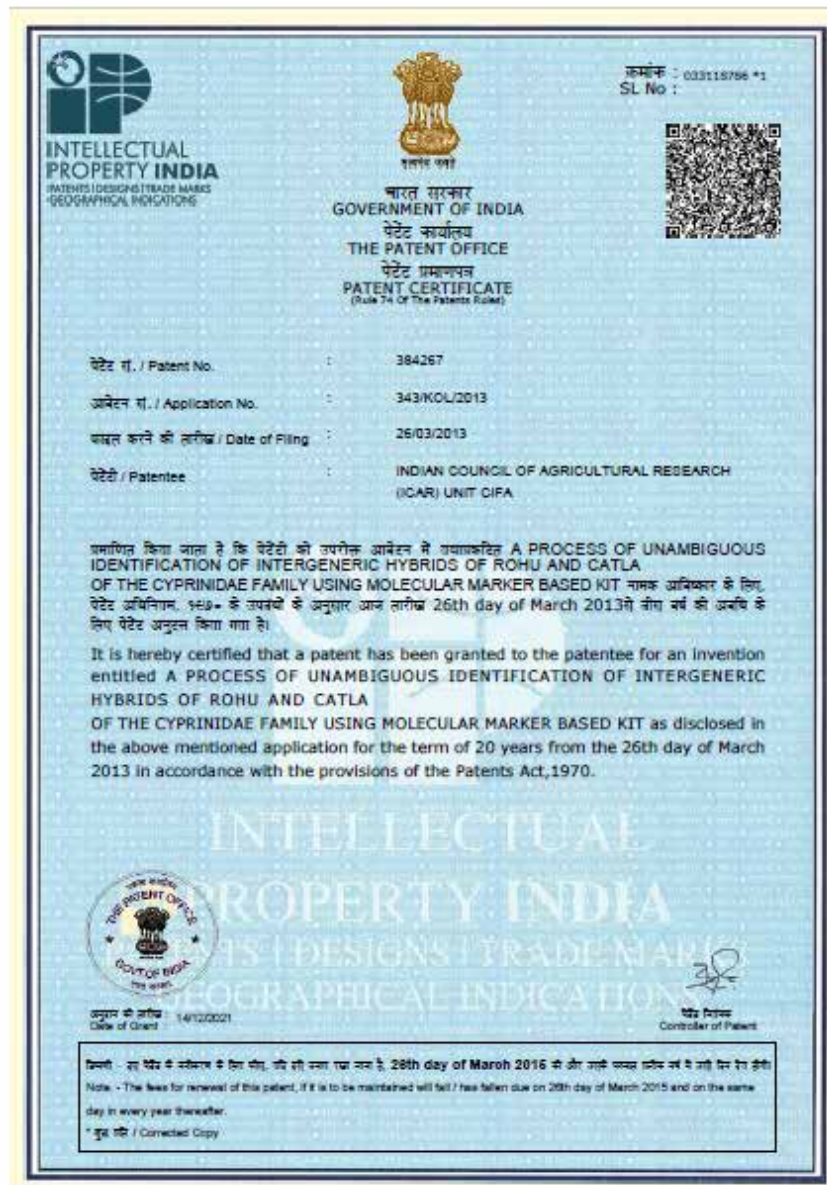
**Patents:**

**Patent Application No** : 343/KOL/ 2013 Granted

**Title of patent** : “A process of unambiguous .....based kit”

**Date from which granted** : 26 March 2013

**Inventors** : P. Jayasankar, Mausumee Mohanty, Lakshman Sahoo, P. Das, B.K. Das, P. Routray, D.K. Verma





**NBA cases handled patents:** Two Patents was handled NBA cases and Approved NBA and submitted form III, form 27

1108/KOL/2013 (A method for identification and differentiation of two important argulus species *Argulus siamensis* and *Argulus japonicus*), Dated-21/12/2021

343/KOL/ 2013 (Process of unambiguous identification of intergeneric hybrid of rohu and catla (Family Cyprinidae) using molecular marker based kit.), Dated-29/11/2021

**Patents Granted:**

672/KOL/2014 (A Process for purification of ABC binding protein of *Aeromonas hydrophila*), Patent No- 368823, Date of granted - 08/06/2021

343/KOL/ 2013 (A Process of unambiguous identification of intergeneric hybrid of rohu and catla (Family Cyprinidae) using molecular marker based kit.), Patent No- 384267, Date of granted -14/12/2021

**Trademarks:**

**Trademarks Filed (1):**

“SHINING BARB”- Application registration number -. 5059593, Date-26/07/2021

**Trademarks Granted (4):**

CIFA CARP STARTER - Application registration number - 4522450, Date of grant-21/01/2021

CIFA CARP GROWER - Application registration number - 4522478, Date of grant-23/01/2021

Nanoplus@CIFA - Application registration number - 4522477, Date of grant -23/01/2021

CIFA GI SCAMPI - Application registration number - 4522451, Date of grant -23/01/2021

**C-Copyright (5) :** Number of copyrights granted five

Magur larval feed “STARTER M” and farm made grow out carp feed “GRAM-CA-FEED’ were commercialized and licensed through Agriinnovate India Ltd to M/S. Sahajogi, Sahaberabad, South 24 Praganas, West Bengal.

**Table 35. Details of Technologies commercialized through Agrinnovate during 2021**

S No	Name of Institute	Name of Technology/ Know-How	IP Protection (Yes/No)*	Name of Contracting Party	Mode of Partnership**	Date of Licensing	Revenue Earned (₹)
1	ICAR-CIFA	BIND ADD (FEED BINDER CUM ADDITIVE)	NO	Dr. Organics, Raja Farm House, Totagumuda, Kujasing Road, Via Uppalada, District Gajapati, Odisha-761211, India	MOU	(22.03.2021 - 21.03.2026)	1, 50, 000/- + GST



2	ICAR-CIFA	FRP Carp Hatchery	NO	M. R. Aquat- ech, Bhu- baneshwar, Odisha 751016	MOU	08.09.2021- 07.09.2026)	2, 0, 000/- + GST
3	ICAR-CIFA	CIFAX	YES Trade mark Regd.No. 796393, class - 1.	M/s. Agraw- al Trading Co., 1 <sup>st</sup> Floor, Maa Anna- purna Com- plex, Banjari road, Rai- pur-492001, Chhattisgarh	MOU	10.11.2021 - 09.11.2023	32, 53, 970/-

**Table 36. ITMC Meetings**

S.N	Details of Meeting	Duration
1	ITMU Technology Transfer and Commercialization Meeting	03.03.2021
2	ITMU Technology Transfer and Commercialization Meeting	15.06.2021
3	ITMU Technology Transfer and Commercialization Meeting	02.09.2021
4	Techno-Commercial Assessment and Expert Committee Meeting	21.09.2021



## 4. RESEARCH CO-ORDINATION AND MANAGEMENT

### Research Advisory Committee

The Institute conducted 34<sup>th</sup> Annual Research Advisory Committee (RAC) meeting during 22-23 February, 2021 in a virtual mode under the Chairmanship of Dr K.K. Vass, Former Director, ICAR-CIFRI & DCFR. The other members were Dr Riji John, Vice Chancellor, KUFOS, Cochin; Dr B.P. Mohanty, ADG (I.Fy), ICAR, New Delhi; Dr Sudhir Raizada, Former ADG (I.Fy), ICAR, New Delhi; Dr H. Sivananda Murthy, Former Dean, College of Fisheries, KVAFSU, Mangalore; Dr G. Gopikrishnan, Former Head, Nutrition, Genetics & Biotechnology, ICAR-CIBA; Dr N. C. Biswal Former Consultant to ICZMP; Dr S.K. Swain, Director, ICAR-CIFA, Members and Dr J.K. Sundaray, Member Secretary.

### Institute Research Council

The Institute conducted 35<sup>th</sup> Annual IRC meeting during 7-9 June, 2021 under the Chairmanship of Dr S. K. Swain, Director, ICAR-CIFA. Dr. P. Das, Member Secretary, IRC, welcomed Chairperson and members of

IRC, presented the overview of the institute based and externally funded projects along with agenda of the IRC. He briefed the house about the ongoing, completed, and new projects to be commenced during the IRC. He also mentioned that considerable work is being carried out under the different developmental programmes like STC, SCSP and NEH.

### Project Monitoring Committee (PMC)

The third PMC meeting of ICAR-CIFA was held in the committee room of the institute on 19 January 2021. The meeting was chaired by the Director, ICAR-CIFA, wherein, Dr. A. K. Sahu, Former Head, APED, ICAR-CIFA attended as External Expert and Dr. K. D. Mahapatra, Pr. Scientist as Internal Member Expert. The house thoroughly discussed the merits of the new projects and their objectives as well as the expected output/outcome.

### Prioritization, Monitoring and Evaluation (PME) Cell

- During the year under report, the Prioritization, Monitoring and Evaluation (PME) Cell of ICAR-CIFA undertook the following activities:
- Documentation and dissemination of research, extension and training activities of the Institute through ICAR-CIFA Newsletter, Annual Report and other publications
- Organizing meetings of senior officers to discuss the monthly progress of various activities of the Institute including research, teaching, training, publications





and other administrative and financial matters. The proceedings were prepared and follow-up actions monitored.

- Scrutiny of research project proposals for external funding, abstract presentation at Seminars, research papers and e-publications submitted to Journals, applications for awards, fellowships, foreign deputations and higher posts by the staff of the institute, etc are done from time to time.
- Supported for conducting QRT, RAC, IMC and IRC meetings
- Evaluation and monitoring of Institute-based and external funded research projects
- Preparation of documents and maintenance of MoUs and 12 MoU was signed during this reporting period.
- Action taken reports on recommendations of ICAR Regional Committee Meetings
- Action taken reports for Directors' conference
- Responses to Parliament queries on freshwater aquaculture

**Publications**

- Annual Report of the Institute for 2020 (in English & Hindi)
- CIFA News Vol. 28 (Nos. 1, 2, 3, 4)
- Research Project Proposals – 2020-21
- Leaflets and Brochures
- Number allotment for Training Manuals and Extension Series of ICAR-CIFA



**Communication of reports**

- Material for DARE-ICAR Annual Report 2021
- Action taken report on proceedings of the meeting of Directors of ICAR Institutes
- Weekly, monthly, quarterly and half-yearly progress reports to the Council
- Replies to Parliament queries
- RFD and strategic plan document
- Reports for e-Samikshya and Niti Ayog, etc.

**Formation of New IJSC 2021 - 2024**

The 11<sup>th</sup> Institute Joint Staff Council of ICAR-CIFA was constituted on 02 September, 2021 for a period of three years (02 September 2021 to 01 September 2024). The IJSC of ICAR-CIFA had organized a Free Eye Check-up Health Camp for the staff and their family members of ICAR-CIFA on 19 February, 2021 in the Institute premises.



## 5. IMPORTANT EVENTS ORGANIZED

### Hon'ble Union Minister of State Sri Pratap Chandra Sarangi, released technology publications for the Aqua-farmers of Odisha

Sri Pratap Chandra Sarangi, Hon'ble Union Minister of State, Fisheries, Animal Husbandry & Dairying (FAHD) and Micro, Small & Medium Enterprises (MSME), Govt. of India visited the Institute on 9 January, 2021 and reviewed various research activities being carried out. On this occasion, the Hon'ble Minister addressed the staff of ICAR-CIFA and released a set of 16 Odia leaflets on popular aquaculture technologies developed by the Institute. The leaflets are meant for creating awareness among the farmers about scientific aquaculture practices. In addition, three e-booklets and one book entitled "Actionable Strategies for Increasing the

Freshwater Aquaculture Production in India" were also released by the Hon'ble Minister. The interaction meet was live telecasted across all KVKs and District Fisheries Offices of Odisha. Other important dignitaries, like Sri Sagar Mehra, Joint Secretary (Inland Fisheries), Dept. of Fisheries, FAHD, Govt. of India; Dr. J. Balaji, IAS, Joint Secretary (Marine Fisheries), Dept. of Fisheries, FAHD, Govt. of India; Dr. C. Suvarna, IFS, Chief Executive, NFDB; Dr. Pawan Kumar Agrawal, Vice chancellor, OUAT, Bhubaneswar and Sri R. Raghu Prasad, IFS, Commissioner cum Secretary of Fisheries and Animal Resources Development Department, Govt. of Odisha also participated. The dignitaries had visited the farm facilities of the institute. During this occasion, the RAS facility in murrel culture unit was also inaugurated..





### World Radio Day

ICAR-CIFA in collaboration with Radio Club of Odisha and Krishi Vigyan Kendra, Khordha celebrated the National Event of

World Radio Day-2021 on 13<sup>th</sup> February 2021 at VG Jhingran Auditorium, ICAR-CIFA, Kausalyaganga.



### National Science Day

The National Science day was celebrated at ICAR-CIFA Kausalyaganga, Bhubaneswar. The 28th February of every year is celebrated as National Science day in India to mark the discovery of 'Raman effect' in 1928 by eminent physicist Sir C V Raman, who won Nobel Prize in 1930. The theme for National

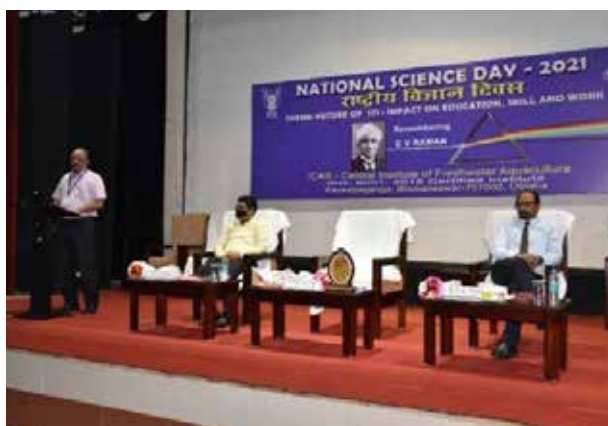
Science Day 2021 is "Future of STI: Impacts on Education, Skills, and Work". More than one hundred participants including students of R. D. Womens' University, Bhubaneswar; Mahatma Gandhi Memorial College, Pubasasan; Scientists of ICMR-RMRC, Bhubaneswar; Scientists, technical officers, Administrative staff and research



Participants of the National Science Day 2021



Address of Director, ICAR-CIFA to participant



Address of Chief Guest to participants



Visit of students to Central Laboratory



scholars of ICAR-CIFA attended the event. Visit of students to Central Instrumentation laboratory and aquarium of ICAR-CIFA was organised to enrich their knowledge on various aspects of aquaculture science. They were also shown some important field facilities of the Institute to gain more practical knowledge on fisheries. On this auspicious day, Director, ICAR-CIFA spoke the detailed information about opportunities for students in fisheries sector both in India and abroad. Dr. Manoranjan Ranjit, Scientist-G, RMRC, Bhubaneswar, Chief Guest of the occasion suggested for using Science in each sphere of life. He also shared the important experiences of Sir C V Raman during his journey of discovering 'Raman Effects'.

### World Water Day

The world water day was celebrated at ICAR-CIFA on 22 March 2021. The event was carried out by organising one workshop on "Valuing of water for Life". To commemorate the occasion one quiz competition was also organised for the college students. More than 100 participants including farmers, scientists, extension officials and students from the nearby institutions and villages attended the programme. Chief Guest, Shri Hemant Kumar Panda, Director of Soil Conservation and Watershed Development, Govt of Odisha, emphasized upon the global water crisis and focussed for implementation of conservation measures including rainwater



Participants of World Water Day 2021 at ICAR-CIFA



Address of Director, ICAR-CIFA on World Water Day



Prize distribution to winners of Quiz Competition



harvesting, integrated farming system so as to multiplying the farmers yield and income. Dr S C Rath, former Principal Scientist of ICAR-CIFA, Bhubaneswar and Guest of Honour narrated the valuation of water, saving of water, implications of water crisis on daily life, water requirement for different crops and water budgeting for different daily activities by an individual. Dr S.K. Swain, Director, ICAR-CIFA, Bhubaneswar narrated about the current water scarcity. He also stressed upon the need based technologies for conservation of water and reduction of wastage of water. ICAR-CIFA is enrolled in water budgeting research work on consumptive water requirement. Shri S K Mohanty, Lecturer of MGM Higher Secondary School of Education and Technology, Kausalyaganga, Bhubaneswar told the effect of scarce and excessive accumulation of water on daily life.

### ICAR-CIFA Annual Day

The Institute celebrated 34<sup>th</sup> CIFA Annual Day on 1<sup>st</sup> April, 2021. Shri Tage Taki Hon'ble Minister for Agriculture, Horticulture, Animal Husbandry, Veterinary, Dairy Development and Fisheries, Govt. of Arunachal Pradesh as Chief Guest, Dr Pravin Puthra, ADG (MF), Dr B.P. Mohanty, ADG (IF), ICAR and Shri P. K. Bisoi, Secretary, Department of Posts and Chairperson, Postal Services Board, New Delhi graced on the occasion as Guests of

The ICAR-CIFA Open Gymnasium facility was inauguration by Shri Tage Taki Hon'ble Minister for Agriculture, Horticulture, Animal Husbandry, Veterinary, Dairy Development and Fisheries, Govt. of Arunachal Pradesh on 31 March, 2021.



Honour. A bunch of twelve philatelic picture post cards (with bilingual description of important freshwater fish species) was released by the dignitaries to mark this occasion. Dr. N. Sarangi, Former Director, ICAR-CIFA; Ms. Tana Yami, Director, Papum Pare Eco Agro, Papum Pare Tea Estate Private Limited, Arunachal Pradesh; Col. Jaleswar Kanhar, Chief Post Master General, Odisha circle also spoke on the occasion. ICAR-CIFA Annual Awards-2020 and Scholarships were also distributed to the awardees.





Table 37. The ICAR-CIFA Annual Awards (for the year 2020) were as following:

Category	Winner
Best Division	Fish Genetics and Biotechnology Division
Best Scientist (above 40 years)	Dr J.K. Sundaray, Principal Scientist and Head (I/c), FGBD
Best Scientist (below 40 years)	Mr Anirban Paul, Scientist, FHMD
Best Technical staff member	Shri D. P. Rath, STO, Social Science Section
Best Administrative Person	Shri Lokanath Senapati, Assistant, Estt-I
Best Supporting / Field Staff	Shri Laxmidhar Behera, SSS, APED Shri Pramod Kumar Khatua, SSS, APED
Best Extension Worker	Dr Shailesh Saurabh, Sr. Scientist, APED
Best Research Scholar	Miss Simantini Shasani, SRF, Social Science Section
Award for School Children: / Best Boy Child Award for the highest scorer in Class-X in 2020	Mr Abhisekh Mohanty (S/o Mr Sisir Kumar Mohanty, STO)



ICAR-CIFA has instituted two scholarships for promoting academic excellence among the children of the staff. One, with a donation of Rs. 1, 20, 000/- by Dr. Hiralal Choudhuri in the memory of his father is named as 'Girish Chandra Chaudhuri Memorial Scholarship' and the other with a donation of Rs. 60, 000/- by Dr S. Ayyappan in the name of his mother

and is named as 'Smt. S. Susheelamma Scholarship'. Applications are invited every year from the staff wards and the scholarship is given on the basis of merit. Two more awards *i.e.*, Dr T. Ramaprabhu Memorial and Dr B.R. Mohanty Memorial for research scholars were instituted with donations from Mrs. Ramaprabhu, and Parents of Late Dr B.R. Mohanty.



Table 38. Awardees of the different scholarships (2020-21)

Name of the scholarships/ Award	Awardee	Class
Girish Chandra Chaudhury Memorial Scholarship	Archana Priyadarshini, D/o Mr. Bhikari Charan Bhoi	Post-Matriculation
	Bandana Priyadarshini, D/oMr. Bhikari Ch Bhoi	Post-Graduation
Smt. Susheelamma Scholarship	Siba Prasad Mohapatra, S/o Mr. Gopal Ch Mohapatra	VIII-X
Dr T. Ramaprabhu Memorial Award	Miss Simantini Shasani	SRF, NIMA Project
Dr B. R. Mohanty Memorial Award	Er. Sandip Kumar Panda	YP-II, AICRP on PEASEM

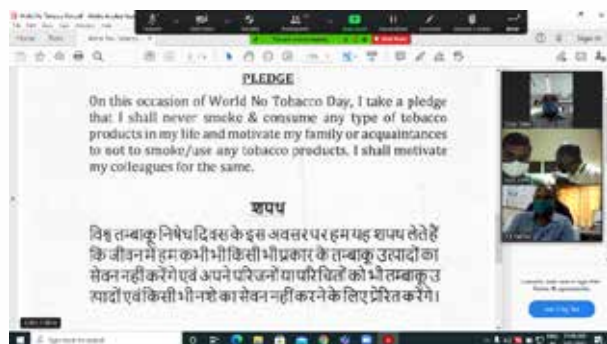


### Anti Terrorism Day

The Institute observed “Anti Terrorism Day” on 21 April, 2021. All staff members of ICAR-CIFA were participated and taken a pledge on the occasion.

### World No Tabaco Day

The Institute observed “World No Tabaco Day” on 31 May, 2021. All staff members of ICAR-CIFA were participated and taken a pledge on the occasion.



### World Environment Day

The Institute observed World Environment Day on 5 June, 2021.

### 7<sup>th</sup> International Yoga Day

The Institute observed “7<sup>th</sup> International Yoga Day” on 21 June, 2021. All staff members were participated.

### National Fish Farmers’ Day

### Webinar on National Fish Farmers’ Day-2021 and Azadi Ka Amrit Mahotsav – National Campaign on Ecosystem Management for Sustainable Fisheries

ICAR-CIFA had organised a Webinar on 21<sup>st</sup> National Fish Farmers’ Day along with Azadi Ka Amrit Mahotsav – National Campaign on Ecosystem Management for Sustainable Fisheries on 10 July, 2021.



Dr. S. K. Swain, Director, ICAR-CIFA welcomed all participants virtually and introduced the Guests. The lead speakers of 1<sup>st</sup> session were Dr Shakuntala Haraksingh Thilsted, Global Lead for Nutrition and Public Health, WorldFish, Malaysia & World Food Prize Laureate 2021 and Dr J. K. Jena, DDG (Fisheries Science), ICAR, New Delhi. Dr. J. K. Jena briefed about epoch-making discovery of induced breeding of Indian major carps by Dr K H Alikunhi and Dr Hiralal Chaudhury on 10<sup>th</sup> July 1957. He also emphasized on the importance of the day. Dr Shakuntala shared presentation on “The Role of Aquatic Foods in Nourishing India”. Dr P.C. Das, Principal Scientist, ICAR-CIFA delivered a lecture on “Pond Ecosystem Management for Sustainable Aquaculture”. Progressive fish farmers from different parts of the country participated in the event and the aquaculture experts from the institute had a detailed discussion on various problems faced by the farmers. Director, ICAR-CIFA had felicitated 15 fish farmers on this occasion. Similarly, all the four RRCs of ICAR-CIFA have observed the National Fish Farmers’ Day and Bharat ka Amrit Mahotsav in their respective regional languages. More than 600 participants had joined the webinar including all staff of ICAR-CIFA.



The Institute conducted a Plantation Programme in collaboration with Inner Wheel Club, Bhubaneswar on 14<sup>th</sup> July, 2021. Smt. Aparajita Sarangi, Hon’ble MP, Bhubaneswar was the Chief Guest on the occasion.

### Poshan Vatika Maha Abhiyan & Tree Plantation

As a part of the “Poshan Vatika Maha Abhiyan & Tree Plantation” programme, tree plantation campaign with planting of trees in the campus was undertaken on 17<sup>th</sup> September 2021 in the Headquarters, and RRCs of the institute and KVK, Khordha. Including 155 farmers, there were 323 participants attended the programme. To mark the occasion, 315 sapplings and 100 packets of vegetables seeds were distributed to public by the Institute including RRCs and KVK, Khordha. Also, RRC, Rahara had served food prepared from millets to the farmers/ stakeholders participating in the event.





### Interaction of Hon'ble Prime Minister's with ICAR

Hon'ble Prime Minister Shri Narendra Modi ji inaugurated the National Institute of Biotic Stress Management, Raipur, Chhattisgarh and interacted with the farmers on 28<sup>th</sup> September 2021. He dedicated 35 crop varieties to the nation and awarded "Clean Green Campus Award" to 4 universities. As part of this event, ICAR-CIFA and KVK, Khordha participated and organized interaction meeting with the farmers of Odisha. An awareness camp

for large scale dissemination of climate resilient technologies and methods was also organized. Dr. S. K. Swain, Director, ICAR-CIFA welcomed the farmers and other dignitaries. Dr. P. Swain, Principal Scientist interacted with the farmers about the climate resilient aquaculture technologies. A farmer-scientists interaction meet was also held and the queries related to agriculture and allied sectors were addressed by the KVK scientists. Around 185 participants including 100 farmers and farm women attended this event.





### Vigilance Awareness Week

The Institute observed Vigilance Awareness Week-2021 during 26 October – 1 November, 2021 and all staff members of the Institute took Integrity Pledge. To mark the occasion Sri Saumendra Kumar Priyadarshi, Commissioner of Police (Bhubaneswar-Cuttack) graced the meeting as the Chief Guest on 30 October 2021 and delivered his talk. In continuation to the Vigilance week all staff members of the institute took pledge observing Rastriya Ekta Diwas on 31 October, 2021.



### Visit of Hon'ble Minister for Fisheries, Animal Husbandry & Dairying, GoI

Shri Parshottam Rupala, Hon'ble Minister for Fisheries, Animal Husbandry & Dairying, GoI along with Shri Jatindra Nath Swain, IAS, Secretary, Department of Fisheries, AH&D, GoI and Dr J.K. Jena, DDG (FS), ICAR visited the Institute farm facilities and interacted with scientists and staff members of the



### World Food Day

World Food Day with the theme "Safe Food now for a healthy tomorrow" was observed



by KVK, Khurdha and ICAR-CIFA on 16 October, 2021 at KVK-Khordha, ICAR-CIFA. Eleven progressive farmers from Baliana, Balipatna and Jatni Block of Khordha district were felicitated on this auspicious day for their outstanding contribution in agriculture & allied sector for achieving food security. A total of 62 participants from KVK, Khordha, ICAR-CIFA & progressive farmers from Khordha district attended the programme.

institute during 20-21 November, 2021. Hon'ble Minister also felicitated ICAR-CIFAs progressive farmer Padmashri Batakrushna Sahoo and IARI- awardee farmer Sri Surendra Bhola for their exemplary contribution to fisheries. After plantation in the institute premises and the minister visited CIFA farm facilities. More than 23 different food fish varieties and different aquaculture systems such as pond culture, Bio-floc, Aquaponics





were appraised along with different gadgets, feed formulations, therapeutics developed by the institute. An exhaustive display of different publications was also arranged to showcase the knowledge products of the institute available for the farmers. Dr. J.K. Jena, DDG, Fisheries Science, ICAR & Dr S. K. Swain, Director, ICAR-CIFA briefed the minister about the different technological options

available for the farmers. He also interacted with researchers and motivated them to develop cost-effective technologies that can give more benefits to the fish farmers of the country. The minister appreciated the tremendous efforts of ICAR-CIFA for diversification of freshwater aquaculture in the country.

### Constitution Day

The Institute observed Indian Constitution Day (readout the preamble along with Hon'ble President of India) on 26 November, 2021. All Staff Members of ICAR-CIFA were participated.





### World Soil Day

The KVK, Khordha, ICAR- CIFA in association with Department of Agriculture and Farmer's Welfare, Jatni Block, Paradeep Phosphates Ltd. Bhubaneswar and IFFCO, Bhubaneswar celebrated World Soil Day in the Agriculture Office Campus at Jatni Block on 5 Decembr, 2021. The BDO, Jatni Block presided

over the meeting as Chief Guest. Halt Soil Salinization and Boost Soil Productivity was the theme of the Soil Day Celebration. The participants were provided with NPK Consortia (Biofertiliser) on behalf of IFFCO, Bhubaneswar. Thirty numbers of Soil Health Card were distributed to the farmers and farmwomen on this occasion.



### Interaction Meeting with DG, ICAR

There were two virtual Interactions Meeting with DG ICAR & Secretary, DARE, New Delhi. In the first meeting of all scientists of ICAR

Institutes on 28 October 2021. All scientists of ICAR-CIFA had attended. Again, on 8 December, 2021 all Young Scientists of ICAR-CIFA attended the Interaction Meeting.



## 6. WORKSHOPS/SEMINARS/ MEETINGS ORGANIZED

### **Virtual Workshop on “Improved variety of carps and freshwater prawn for enhancing farmers’ income”**

ICAR-CIFA in collaboration with M/s. Rittwik Fisheries, Murshidabad, West Bengal (a multiplier unit for Jayanti rohu) conducted one virtual awareness workshop under ICAR-WorldFish collaborative project on 15 February, 2021 to sensitize the fish farmers, hatchery owners and other stakeholders on the importance of quality fish seed and adoption of improved fish varieties to enhance the farmer’s income. Sixty farmers from Berhampur, Murshidabad participated in the virtual workshop. Dr. S. K. Swain, Director, ICAR-CIFA, Bhubaneswar in his address stressed the need of such workshop to create awareness on the benefits of genetically improved fish varieties to enhance production and farmers income and encouraged the fish farmers to adopt scientific aquaculture practices. Dr. B. R. Pillai, Head, APED and PI of the project gave a brief overview of the workshop and emphasized on the need for adoption of genetically improved carps and scampi for getting higher production and income. She requested farmers to come forward to sign MoU for Scampi multiplier unit in Murshidabad, West Bengal. Dr. J. K. Sundaray, Principal Scientist and Head, FGBD mentioned about fish seed quality problems in West Bengal and to solve the problem with the help of ICAR-CIFA.

### **National virtual consultation on “Indian Ornamental Fisheries 2.0-The Way Forward”**

ICAR-CIFA in collaboration with DoF, Ministry of Fisheries, Animal Husbandry and

Dairying, New Delhi and NFDB, Hyderabad organised the National Virtual Consultation on “Indian Ornamental Fisheries 2.0 - The Way Forward” was organised during 22-24 April, 2021. Hon’ble MoS, MoFAHD & MSME, Shri Pratap Chandra Sarangi, inaugurated this programme and called for indigenous manufacturing of aquariums and the accessories for an *Atmanirbhar Bharat* and promoting the aquarium hobbying thus increasing the production of ornamental fish to develop the ornamental fisheries sector in the country. Other dignitaries for the inaugural programme were Shri Atul Chaturvedi, IAS, Secretary, Department of Fisheries & Animal Husbandry and Dairying, Dr C. Suvarna, IFS, CE, NFDB, Dr J.K. Jena, DDG, Fisheries Science, Dr J. Balaji, IAS, Jt. Secretary, DoF, Dr Dilip Kumar, Former Vice Chancellor, ICAR-CIFE, Dr S. Felix, Former Vice-chancellor, TNJFU, Dr V.V. Sugunan, Former ADG, ICAR, Dr S. Raizada, Former ADG (Inland Fy), ICAR and many other scientists and top officials from the ministry participated in the event. The three days consultation covered different thematic areas for discussion such as enhancing the domestic ornamental fish production & constraints in marketing, achieving self-reliance in manufacturing of aquarium accessories, quality feed, medicines & aquatic plants, promoting the domestic retail trade of ornamental fish & hobby promotion, boosting ornamental fish exports and issues in imports, biodiversity concerns & policy issues and research & development priorities, & capacity building. Thirty-two key stakeholders from different key segments of the sector participated in the



consultation and shared their opinions and the event was attended by more than 2000 other stakeholders. The concerns raised by the stakeholders were documented properly, compiled and subjected to elaborate discussion during the event. Based on the discussions, a set of draft recommendations were made and circulated for stakeholder opinion. Subsequently a detailed roadmap to be developed for the Ornamental Fisheries Development in India. Dr S.K. Swain, Director, ICAR-CIFA & his team made all the arrangements for the event. **National awareness (Virtual) programme on “ICAR-CIFA-GI Scampi: the genetically improved and fast-growing Strain of Scampi for higher production and income”**

The ICAR-CIFA in collaboration with the DoF, MoF, Animal Husbandry and Dairying, GoI and NFDB, Hyderabad organized a Virtual National Awareness Programme on “ICAR-CIFA-GI Scampi: The Genetically Improved

and Fast-growing Strain of Scampi for Higher Production and Income” 27<sup>th</sup> July, 2021. Shri J.N. Swain, I.A.S., Secretary, Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India marked his presence as the Chief Guest of the occasion. Dr. J.K. Jena, Deputy Director General (Fisheries Science), ICAR; Dr. C. Suvarna, I.F.S, Chief Executive, NFDB, Hyderabad and Shri Sagar Mehra, Joint Secretary (IF), DoF, MoF, Animal Husbandry and Dairying, GoI were among the Guests of Honor during the occasion. The awareness programme was organized under the PMMSY CS Scheme on “Scaling-up of Genetic Improvement Programme of Freshwater Prawn *Macrobrachium rosenbergii* (Scampi)” sanctioned to the ICAR-CIFA, Bhubaneswar. A total of 364 participated including the State Fisheries Department Officials from 9 States, Scampi Hatchery Operators and Farmers, Scientists and Academicians participated in the awareness programme.



### National webinar on selective breeding for sustainable growth of aquaculture and way forward in India”

The Institute organized a national webinar on selective breeding for sustainable growth of aquaculture and way forward in India” on 25 November, 2021 under the aegis of Azadi Ka Amrit Mahostav to discuss the status of genetic improvement programs in India and the way forward in the coming future. The webinar was dedicated to offer tribute to Professor Trygve Gjedrem, pioneer aquaculture geneticist. Dr. J. K. Jena, DDG (FS), ICAR joined the webinar and gave the opening remarks. The Lead Lectures were delivered by Dr K.D. Mahapatra and Dr B.R. Pillai, Principal scientists, ICAR-CIFA. More than 190 participants had joined the webinar.

In the Panel Discussion, Former Director, ICAR-CIFA and former DG, NACA, Dr. A. E. Eknath acted as Chairman and steered the panel discussion with emphasis on scaling up the existing selective breeding programmes in fishes in India. The former Director and Vice-Chancellor of ICAR-CIFE, Mumbai also expressed the education needs for taking ahead the selection programme in fishes. Dr. Y. Basavaraju, Former Dean, College of Fisheries Mangalore, KVAFSU shared his research experiences for the development of Amur Carp. Dr S. Jahageerdar, Principal Scientist, ICAR-CIFE, Mumbai narrated



about the ongoing genetic improvement programmes of Magur and Common Carp. He has also emphasized the strength and weakness of the breeding programs in India and ways and means to improve the situation. Dr. G. Gopikrishna spoke about the selection of heritable genes while developing the improved variety of marine shrimp *Penaeus monodon*. Dr. P. K. Sahoo, National Fellow of ICAR-CIFA, stressed upon selection for disease resistance against *Aeromonas hydrophila* in rohu carp in addition to phenotypic trait of growth performance.

### World Fisheries Day lecture series

The ICAR-CIFA organized a national webinar on the eve of World Fisheries Day (Lecture Series No-5). The gathering was addressed by Dr Kuldeep Lal, Director, ICAR-NBFGR and Prof Victor Martinez Moncada, Director, FAVET-INBIOGEN, Universidad de Chile delivered a lecture on “Challenges and Opportunities in Developing Aquaculture using Genomics”. All scientists and technical officers of the Institute had joined the webinar alongwith the outside participants.





## Other Extension Activities

**Table 39. Radio talks/Television programmes**

Name	Date	Programme
Dr Rajesh Kumar	10 August 2021	Live program on “Machhali Palan” on DD KISAN, New Delhi
Dr. Shailesh Saurabh Dr. S. K. Swain	12 .03.2021	Live Telecast in the DD Kisan Channel, New Delhi on “Munafe ka Sauda: Moti Kee Kheti: Under Vichar Vimarsh Program
Dr. Shailesh Saurabh	21.04.2021	Telecast in the TV Channel “Naxatra News”, Bhubaneswar, Odisha on Freshwater Pearl Culture
Dr. S. Adhikari	11.12.2021	Delivered a talk on ‘Baraf gole jal’ (Barafer Goloner Bipod O Joler Sankat) under Hello-DD Basundhara Programme, Prasar Bharati, Doordarshan Kendra, Kolkata

Dr S.N. Sethi, delivered a talk in All India Radio, AIR, Puri, on “How to enhance income from Aquaculture” on 15-03-2021.

Dr S.N. Sethi, delivered a talk in All India Radio, AIR, Puri, on “Organic Fish Production” on 10-03-2022.

Dr P. K. Sahoo, Pr. Scientist & NF delivered a talk in AIR, Puri on “Disease prevention

in freshwater aquaculture” in Odia in Kisanvani programme which was broadcast on 07.10.2021

Dr P. K. Sahoo, Pr. Scientist & NF delivered a TV talk in Odia on “Fish Health Management” which was telecasted on 13.05.2021 in Naxatra news channel under Disha programme.



## 7. INTERNATIONAL COLLABORATION

1. A one-day online data analysis workshop was organized on 18 November 2021. Dr. Patrik Henrikson was the lead expert in the workshop. There was fruitful interaction between the expert and the ICAR-CIFA team on LCA study.
2. NOFIMA (Indo-Norway Project): Indo-Norge collaborative project Funded by – Research Council of Norway and Department of Science and Technology, India under Bilateral cooperation with India has been initiated. The project is on CRISPR/Cas9 editing to test and control genes implicated in influencing *Aeromonas* disease resistance in carp and salmon. The bilateral project has an objective to use CRISPR/Cas9 gene editing technologies to test whether up- or down-regulation of the expression of specific gene candidates in rohu carp makes the fish more or less susceptible/resistant to *Aeromonas hydrophila* infection.
3. Dr S.K. Swain, Director and Dr P.K. Sahoo, Principal Scientist and National fellow attended the NACA Governing Council Meeting (GCM 31) virtually at NACA, Bangkok during 29-30 Nov, 2021.



## 8. REACHING THE UNREACHED/ LIVELIHOOD DEVELOPMENT PROGRAMME

### NORTH-EASTERN DEVELOPMENT PROGRAMME

Under the North-Eastern Region development programme the following state-wise activities were undertaken by ICAR-CIFA during January-December, 2021. Their queries were attended virtually from time to time and problems were solved by visiting them personally and through the concerned Fisheries Department officials as and when necessary. For sustainability of their livelihood demonstrations and trainings were conducted and the basic aquaculture inputs were provided as and when required by the beneficiaries.

### ARUNACHAL PRADESH

The Technology Park is a unique initiative of the ICAR-CIFA that aims to bring in all the viable aquaculture technologies of the Institute in a single location for better technology demonstration and knowledge dissemination. This is a first of its kind in India. More than 500 farmers from adjacent districts participated in the programme. Shri Tage Taki, Minister for Fisheries, Agriculture, Horticulture & Veterinary, Dairy Development and Fisheries, Government of Arunachal Pradesh inaugurated the *Aquaculture Technology Park* in Papum Pare, Agro Eco, Sonajuli on 7 March 2021. In his address, the Minister lauded the ICAR-CIFA for establishing the Aquaculture Technology Park in a remote place from the mainland. He applauded the Progressive Farmer, Shri Tana for his innovative efforts in aquaculture. He also urged him to encourage other farmers in fish culture enterprise.

### On-site Hands on Training on Freshwater Pearl Farming at Sonajuli

Under Aquaculture Development Program at Arunachal Pradesh, a hand on training on Freshwater Pearl Farming was conducted at Sonajuli, Arunachal Pradesh during 3-4 March, 2021. Total 17 participants comprise Master and Ph.D. students of Rajiv Gandhi University, Itanagar, local farmers and few farmers from Assam. They have experienced practical training on how to produce designer nucleus, implantation of mussel, pond management etc. A training manual was also distributed to the participants. At the end of





the program a certificate was provided to each participant. The program was first of its kind in the North-Eastern states.

**Paddy-cum-fish cultivation** is being carried by the Apatani tribe in Ziro valley at an altitude of 1500 meters above mean sea level in Arunachal Pradesh is a unique and about 43.38% of land of this valley is used for this cultivation. The said tribe, came about 500 years ago, is living in seven villages and believed to practice this unique integrated farming since then. The landscape was listed under tentative list of UNESCO world heritage due to its unique settlement system and man-nature relationship. They were stocking mainly common carp in small pits in paddy fields. From mid of June when plenty of water makes the land up to 15 cm the carps were moving around the whole submerged land. Due to very poor quality of common carp seed, the growth of fish was reported to be very poor. In this context Mr. Tage Taki, the honourable Fishery Minister of Arunachal Pradesh visited ICAR-CIFA on 1<sup>st</sup> April 2021 and requested the Director of the Institute to provide some improved variety of common carp to stock in their high altitude Govt Fish Breeding Farm at Tarin, Ziro for the broodstock development as well as to demonstrate the performance of this improved common carp in another portion in selected beneficiaries' plots to

show and convince them the better growth of the improved common carp varieties. Accordingly, ICAR-CIFA has provided an input support in the form 30, 000 quality Amur carp seeds on 30<sup>th</sup> July 2021. This has created a good response in the region and the Fishery Minister Shri Taki expressed his happiness for this gesture and informed to the Hon'ble C.M. of Arunchal Pradesh Shri Prema Khandu.



### **Awareness Programme on “Freshwater Pearl Culture” for North-East Hill Region**

Under Aquaculture Development Program at Arunachal Pradesh, an awareness programme on Freshwater Pearl Culture was organized at Aquaculture Field School, Sonajuli on 16 December 2021 in association with Rajiv Gandhi University and Papumpare Eco Agro. Prof. S. Kushwaha, Vice-Chancellor, and Prof. D.N. Das, Head, Zoology Department acted as Chief Guest and Guest of Honour. More than





40 participants comprise Master and Ph.D. students of Rajiv Gandhi University, Itanagar, and local farmers attended the program. Theoretical and practical classes were taken. A technical booklet on freshwater pearl culture was released on this occasion. Further, on 17/12/2021 pearl culture training was imparted at Assam Agriculture University, Khanapara with collaboration with APART, DOF, Govt. of Assam. 30 participants have attended the training. They have expressed their gratitude to ICAR-CIFA for organizing the programme.



## ASSAM

### Awareness programme on scientific aquaculture practices

ICAR-CIFA in collaboration with KVK Diphu, Karbi Anglong organized one 'Awareness program on scientific aquaculture' at Growth Centre (agriculture), Diphu, Karbi Anglong, on 18.12.2021. A team of ICAR-CIFA along with, Director, ICAR-CIFA as well as Dr. Subal Maibhansal, Principal Scientist & In-Charge, and Dr. Dutta, SMS, Horticulture, KVK Diphu were present. Mr. Roopsingh Terang, Executive Member, Karbi Anglong Autonomous Council graced the occasion and 130 beneficiaries of two villages attended the programme. On this occasion, 4000 Areca nut saplings were distributed to them. A meeting was organised for the farmers at Kalyani on 18.06.2021 regarding venture of fish culture using ICAR-CIFA technologies at Silchar with Industry. The purpose was to increase availability of quality fishes at Barak Valley, Silchar, Assam.

### ICAR-CIFA team visits fish farm at Raha

The Director and a team of scientists, ICAR-CIFA and Dr. Sanjay Sarma, Fishery Coordinator, ARIAS Society visited Jungal Balahu Fish Farm under Fishery Department, Nogaon. The team had a vivid discussion with the farmers and suggested to adopt scientific aquaculture practices for better production and sustainability. The guidance of ICAR-CIFA was highly acknowledged by Dr. R C Barman, DFDO. He requested the Director, ICAR-CIFA to establish Fish Multiplication Centre at Raha for the benefit of NER.

## NAGALAND

Department of Fisheries & Aquatic Resources (F&AR) in collaboration with ICAR-CIFA



under the project “Mission stunted fingerlings and species diversification for development of fisheries at Ura & Diezephe Village, Dimapur District” distributed seeds of amur carp and singhi to farmers on 2 March 2021 in the presence of Dr S.K. Swain, Director, ICAR-CIFA; Dr P.P. Chakrabarti, Nodal Officer, NEH, ICAR-CIFA and Mr Khriezhatto Nakhro, Sub-divisional Fishery Officer, Dimapur.

A review meeting of the on-going aquaculture activities for which the inputs supply made by ICAR-CIFA was conducted at the Fishery Office, Dimapur, Nagaland on 19.12.2021. A team of scientists, Sr. Administrative Officer and Director, ICAR-CIFA, Additional Director and other government fisheries officials, Govt. of Nagaland, Dimapur; had participated in the discussion. Total 30 beneficiaries attended this review meeting at Dimapur.

### SIKKIM

Dr S.K. Swain, Director and Dr. P.P. Chakrabarti visited several places with Officers, DOF, Sikkim for monitoring the progress of demonstration activities in raceways. An interaction meet with 45 nos farmers were organized at Rongli South Regu, East Sikkim, where Director and other officials, Dept. of Fisheries, Govt of Sikkim were present. A

meeting was organized with the Director, NRC, Orchid and Director, ICAR-CIFA for possibility of initiating SIFS and ornamental fish base orchid culture in farmers’ farms.

### TRIPURA

#### ICAR-CIFA launched livelihood development programme for promoting Scientific Fish Farming in tribal areas

With the motive of livelihood development through scientific fish culture ICAR-CIFA along with Sewa International, a non-profit organization collaboratively launched a livelihood development program for the poor fish farmers in the tribal dominated areas of Tripura. The main aim of this livelihood program is to promote fish based integrated farming system. Fish seeds comprising of IMC fingerlings (rohu, catla and mrigal), floating pelleted feed, lime, MOC, SSP were distributed to the beneficiaries under this livelihood program. A total of 50 fish farmers (30 farmers Kanchanpur and 20 teliamura) belonging to ST and SC community is covered and will be benefitted by the project. The training program was conducted at two places, on 14 February, 2021 at Satnala, Kanchanpur and on 15 February 2021 at Manik Bazar, Teliamura. During the training program, ICAR-CIFA team sensitized and demonstrated the farmers about the scientific based fish farming technique and livelihood generation through integrated fish farming. The ICAR-CIFA team was led by Dr. Partha Pratim Chakrabarti, Principal Scientist & Chairman, ICAR-CIFA NEH activities and Mr. Jackson Debbarma, Scientist. Mr. Ankit Malik, Head, Skill Development and Mr. Vipin Kumar Mongia, Project Coordinator, Tripura from Sewa international were present during the training programs and highlighted the importance of livelihood



development through integrated fish farming. Dr. Atul Debbarma, MLA, Krishnapur constituency graced the event held at Manik bazar, Teliamura on 15<sup>th</sup> February 2021 and emphasized the importance of Blue revolution and fish farming towards food security and livelihood generation. ICAR-CIFA team also visited the farmers fish pond and briefed about the scientific fish culture techniques including integrated fish farming system, pond management, feeding regime and health management.

### **ICAR-CIFA in collaboration with SEWA international conducted training programme on “Fish Culture and its Better Management Practices” for the Tribal fish farmers of Tripura**

With the main objective of livelihood development through scientific fish culture, the ICAR-CIFA along with Sewa International, a Non-profit Organization collaboratively launched a livelihood development programme for the fish farmers in the tribal dominated areas of Tripura to increase the income through fish based integrated farming system. The essential inputs like fish fingerlings (rohu, catla and mrigal), floating pelleted feed, lime, mustard oil cake, single super phosphate, and vegetable seeds were distributed to the beneficiaries under this livelihood programme early this year to 50 ST and SC fish farmers (30 from Kanchanpur and 20 from Teliamura). Further, to boost



the knowledge on scientific fish farming among the beneficiaries, ICAR-CIFA in collaboration with Sewa International organised a training on “Fish Culture and its Better Management Practices” on 5<sup>th</sup> September at Manikbazar, Teliamura, Khowai and on 7<sup>th</sup> September, 2021 at Satnala, Kanchanpur, North Tripura in which 35 farmers took part in the programmes. During the training programmes, Mr. Jackson Debbarma and Mr. Anirban Paul, Scientists of ICAR-CIFA briefed the farmers about the scientific fish farming technique, post stocking management, better management practices, fish health management and livelihood generation through integrated fish farming. The Sewa International team spoke about sustainability and other livelihood development programmes initiated in collaboration with ICAR-CIFA. Medical kits were also distributed to the beneficiaries during these programs. Visit was made to 12 farms and fishes were sampled to observe the growth and health status.

### **TRIBAL SUB-PLAN (TSP)**

#### **Scheduled Tribe Component/ TSP Programme of ICAR-CIFA, Bhubaneswar**

ICAR-CIFA, Bhubaneswar has adopted Tribal Aspirational Districts, such as Nabarangpur, Kalahandi, Koraput and Gajapati of Odisha for implementation of aquaculture and allied technologies among the selected tribal farmers through input supply, training, demonstration and awareness programs.





### Nabarangapur District, Odisha

In Nabarangapur district of Odisha, 22 SHGs comprising of nearly 220 tribal beneficiaries were provided with critical inputs viz. horticulture plants, aluminum handi, crates, mustard oil cake, groundnut oil cake, lime, hand net, fry net, drag net, etc. were distributed in the presence of Mr. Ajit Kumar Mishra, District Collector & DM, Nabarangapur. Further, five SHG members drawn from tribal communities were also provided with inputs pertaining to ornamental fish culture. A programme on awareness cum exposure visit of women SHG on development of ornamental fish cluster was organized during 25-31 July 2021. This programme was chaired and conducted by Dr. Saroj Kumar Swain, Director, ICAR-CIFA, Bhubaneswar. Mr. Ajit Kumar Mishra,

District collector, Mr. Agrawal Akshaya Sunil, Sub-collector of Nabarangpur, Chief Agriculture development officer, District Youth officer, District fisheries officer were also present in the programme. During the programme, a new initiative for development of the ornamental fish cluster was launched by District collector, Nabarangapur and Director, ICAR-CIFA. Around 100 participants attended the programme and interacted with Scientists and other State Government Personnel.



### Koraput District, Odisha

Thirty farmers were adopted and provided with training programme and conducted demonstration and awareness programmes to popularize aquaculture among the tribal farmers. Previous year farmers were also extended technical support. Different programmes conducted are:



- One-day virtual workshop on “BMPs for Quality Fish Seed Production” was organized on 13<sup>th</sup> August 2021 to sensitize 20 tribal fish farmers on better management practices for quality fish seed production. The workshop covered the topics: steps in pond preparation, soil and water quality testing, seed stocking, post stocking management such as pond fertilization, feeding and health management.
- Training & demonstration programme on “Carp Breeding and Culture” was organized during 28-30, August 2021 at Dayanadiguda, Koraput and 34 tribal farmers attended the programme.
- Training on “Carp Hatchery Management & Seed Production” organized at ICAR-CIFA during 16-18 August 2021.
- Freshwater prawn culture was introduced to tribal farmers of Koraput district for the first time. Two days hands on training on “Culture of freshwater prawn with Indian Major Carps” was organized during 09-10 November, 2021 at ICAR-CIFA. The trainees were trained on practical aspects of carp-scampi polyculture starting from identification of selected species, characteristics of healthy seed, pond preparation, nursery and grow out pond management.



Table 40. Details of training conducted

S.N	Title of the training	Duration	No of participant
01	BMPs for Quality Fish Seed Production in virtual mode	13 August 2021	20
02	On farm training on Carp Breeding and Culture	28-30 August 2021	34
03	Fish Seed Packing and transportation at ICAR-CIFA	11-12 October 2021	05
04	Culture of freshwater prawn with Indian Major Carps at ICAR-CIFA	9-10 November 2021	16
05	On field training and demonstration of 'Breeding and seed rearing of carps with special reference to common carp' at Boriguma and Kotpad	24-26 February 2022	37

**Gajapati District, Odisha**

The institute has been involved in Aquaculture based integrated livelihood development in Gajapati district, Odisha during 2021. The Saura and Langia Saura tribals belongs to particularly vulnerable tribal groups (PVTG) settled in hill region of Gajapati district, Odisha. These communities were provided with skill development training and inputs for integrated aquaculture. The programmes were conducted in collaboration and coordination with other agencies like State Fisheries Department, Govt. of Odisha, Soura Development Agency (SDA), Lanjia Soura Development Agency (LSDA), Odisha PVTG Empowerment & Livelihood Improvement Programme (OPELIP). The target groups, mostly covering PVTG tribal women self-help groups were identified with the help of above agencies. Around 59 Tribal SHG groups covering around 620 tribal beneficiaries from Mohana and Gumma block in Gajapati district, Odisha were benefitted.

- A programme entitled “Training, demonstration and distribution of inputs

to Tribal beneficiary SHGs in Gajapati” was held at SDA- Chandragiri, Mohana block, Gajapati on 16.03.2021. The programme was attended by: Mr Banamali Bhuyan, Special Officer-Soura development Agency (SDA), Chandragiri, Govt. of Odisha, Mr Sridhar Kumar Sahoo, Project Manager, OPELIP- Chandragiri, Mr Murali Choudhary, OPELIP-SDA, Chandragiri and Dr S.S.Mishra, PS & Head, FHMD, ICAR-CIFA, Bhubaneswar. Integrated farming inputs were distributed to 21 WSHGs viz. Improved variety of Chicks (Vanraja) 28 days - 1000 nos, Ducklings - 28 days old vaccinated - 1500 nos, Poultry feed - 2000 kg, Fish fingerlings (IMC, 15-20g size) - 15000 nos, Floating fish feed - 2500 kg, Lime - 1000 kg, Hand sanitizer - 200 ml bottles, 60 nos and face masks - 200 nos.

- Another programme was held at Jagannathpur, GP: Kujasing, Block: Gumma, Gajapati on 17.03.2021. Total 120 tribal beneficiaries belonging to 10



WSHGs were given inputs like improved variety of Chicks (Vanraja) 28 days old, 2000 nos, Ducklings, 28 days old, 500 nos, Poultry feed (Hinddita) 2000kg, Fish fingerlings (IMC, 15-20g size), 15000 nos, Floating fish feed, ABIS (28/3) 2500 kg, Lime 1000 kg, Hand sanitizer 200ml bottles, 60 nos and face mask 200 nos were distributed to tribal beneficiaries.

- Another programme “demonstration and distribution of inputs to Tribal beneficiaries” was held at Harabhangi Adivasi Primary Fisheries Cooperative Society in village Padagam, Dumiguda, GP: Adaba, Block: Mohana, Gajapati on 27.03.2021. The programme was attended by Shri Suka Mallick, President, Harabhangi PFCS, Shri Bhabagrahi Behera, Secretary, Harabhangi PFCS, Shri Janani Mallick, Ward member, Vill: Adapanka, GP: Adaba, Shri Pradeep Dalabhehera, Sarapancha, Adba. From CIFA, Dr S.S.Mishra, and Mr Uday Udit, attended the programme. Integrated farming development inputs like Ducklings, 28 days old, 500 nos, poultry feed (Hinddita) 2000 kg and plastic feeder, 20 nos were distributed to 5 Tribal WSHGs.
- Another training of tribal beneficiaries and distribution of inputs for Fisheries development in Gajapati, Odisha was held during 20.12.21 to 23.12.21 at Chandragiri, Mohana, block, Gajapati and during 21.12.21 to 22.12.21 at Bhubani village, Gumma, Gajapati. Total 120 tribal beneficiaries from 14 WSHGs from Mohana block and 90 Tribal beneficiaries from 8 WSHGs from Gumma block, Gajapati, attended the programme. Inputs

like 3 HP Petrol pump (Greaves portable pump set) with accessories & delivery pipe, 10 nos, Solar lantern 3 watt/ 7Ah, 78 nos, USB charger for Solar lantern, 78 nos, Aluminium Handi 125 lits capacity, 62 nos, Fish feed 28/3 mm, 2000 kg, Advanced Fish Fingerlings (10-15g size), 17, 000 nos and Cotton masks, 400 nos were distributed to tribal beneficiaries.





**Table 41. List of 37 Tribal Women SHGs participated in the programme during March 2021 (Total 380 tribal beneficiaries)**

A.	Name of Tribal WSHG, Mohana block, Gajapati, participated in the programme
1.	Santidata WSHG, Dariamba, Bada Sindhaba, Mohana
2.	Jay Maa Santoshi SHG, Suluba, Mohana
3.	Maa Jagat Janani Swayan Sahayak Dal, Vill: Dhadiamba, Dimbirijholi, Mohana
4.	Mahalaxmi Swayam Sahayak Dala, Vill: Labarsingi, GP: Mahendragada, Mohana
5.	Sukanya S.H.G, Vill: Tentulikhunti GP: Jeeranga, Block: Mohana
6.	Om Maa Saraswati SHG, Tentulikhunti, GP: Jeranga, Chandragiri, Mohana
7.	Maa Mangala SHG, Vill: Jalibari, PO: Dhadiamba, Mohana
8.	Indiara Mahila Samiti, Vill: Pejapani, GP: Suluba, Mohana
9.	Maa Tarini Mahila mandal, Vill: Manikpur, GP: Chandiput, Mohana
10	Jay Maa Santoshi SHG, Vill: Dhimirijholi GP: Dhadiamba, Mohana
11	Lokashakti Mahila Mandala, Vill: Kidasingi GP: Dhadiamba, Mohana
12	Indira Gandhi SHG, Vill: Kantasaru, GP: Chandragiri
13	Maa Durga Shakti SHG Vill: Andiragada, GP: Baghamari
14	Jhansirani Mahila Mandala, Vill; Burudiha, GP: Badasindhaba, Mohana
15	Merry Mahila Mandala, Vill; Burudiha, GP: Badasindhaba, Mohana
16	Pragati Mahila Mandala, Vill: Kadamuli, GP: Badasindhaba, Mohana
17	Manini Mahila Shakti, Vill: Ruaamba GP: Badasindhaba, Mohana
18	Merry Mahila Samiti, Vill: Ruaamba GP: Badasindhaba
19	Mahalaxmi Mahila Samiti, Vill: Polabandha, GP: Dhadiamba
20	Maa Santoshi Mahila Mandala, PO: GP: Manipur Mohana
21.	Meris Mahila Mandala, Vill: Sikulipadar, GP: Baghamari
	<b>B. Name of Tribal SHG, Gumma block, Gajapati, participated in the programme</b>
22.	Yamuna SHG, GP: Ajayagada, Gumma block
23	Merium SHG, Vill: Kundeising, GP: Kujasing, Block: Gumma



24	Sidardi SHG, Vill: S.Ragidi, Jagannathpur, GP: Bhubani, PO: Seroingo, Block: Gumma
25	Jiobajiri SHG. Vill: Rudei, GP: Ajayagada, Block: Gumma
26	Maa Saraswati SHG, Vill & GP: Ajayagada, Block: Gumma
27	Saraswati SHG, Vill/ GP: Kujasing, Block: Gumma
28	Subhadra SHG, Vill: Postopur, GP: Kujasing, Block: Gumma
29	Saraswati SHG, Vill: Landahati, GP: Kujasing, Block: Gumma
30	Santi Mahila SHG, Vill: Nuasahi, GP: Kujasing, Block: Gumma
31	Harabhangi Adaivasi PFSC, Vill: Padagaon, Dumiguda, GP: Adaba, Block: Mohana
<b>C.</b>	<b>Tribal SHG, Harabhangi Adivasi Primary Fisheries Cooperative Society in village Padagam, Dumiguda, GP: Adaba, Block: Mohana, Gajapati</b>
32	Biswamaa Sibani SHG, Vill: Dumuguda, Padagan, GP: Adaba Block: Mohana, Gajapati
33	Mother Teresa Mahila Manda, Vill: Dumuguda, Padagan, GP: Adaba, Block: Mohana, Gajapati
34	Maa Tarini Mahila Sangha, Vill: Dumuguda, Padagan, GP: Adaba Block: Mohana, Gajapati
35	Bapuji Kalyan Sangha, Vill: Adapanka, GP: Adaba Block: Mohana, Gajapati
36	Maa Santoshi Nahila Samiti, Vill: Adapanka GP: Adaba, Block: Mohana, Gajapati
37	Tribal SHG, Harabhangi Adivasi Primary Fisheries Cooperative Society in village Padagam, Dumiguda, GP: Adaba, Block: Mohana, Gajapati

**Table 42. List of 22 Tribal Beneficiary SHGs (Total 240 beneficiaries) attended Programme at Chandragiri & Gumma block in Gajapati district, Odisha, during December 2021**

Sl No	Name of Participating Tribal WSHG, Mohanaga block
1.	Maa Jagatjanani SHG, Vill: Dimrijholi, GP: Dhadiamba, Mohana
2.	Mahalaxmi Mahila Samiti, Vill: Polabandha, GP: Dhadiamba
3.	Meris Mahila Swayam Sahayak Dala, Vill: Sikulipadar, GP: Suluba, Mohana
4.	Mahalaxmi Swayam Sahayak Dala, Vill: S. Labarsing, GP: Mahendragada, Mohana
5.	Jay Maa Santoshi SHG, Vill: GP: Suluba, Mohana
6.	Jhansi Rani Mahila Mandal, Vill: Buridiha, GP: Badasindhava, Mohana
7.	Maa Mangala SHG, Vill: Jalibadi, PO: Dhadiamba, Mohana



8.	Indiragandhi SHG, Vill: Kantasaru, Chandragiri, Mohana
9.	Pragati Mahila Group, Village: Kadamuli, PO: Badasindhaba, Mohana
10.	Sukanya Mahila Mandala, Tentulikhunti, PS: Jeranga, GP: Chnadragiri, Mohana
11.	Maa Durgasakti SHG, Vill: Andiragada. GP: Baghamari, Mohana
12.	Lokashakti Mahila Mandal, Vill: Kidasing, GP: Baghamari, Mohana
13.	Manini Mahila Shakti, Vill: Rua Amba, GP: Badasindhaba, Chandragiri, Mohana
14.	Gitajayanti Mahila Samiti, Vill: Konkorada, PO: Chandragiri, Mohana
<b>Name of Tribal WSHGs, Gumma block, Gajapati district, Odisha participated</b>	
15.	Sidardi Mahila Shakti Dala, Vill: S. Ragidi, GP- Bhubani, Block Gumma
16.	Jihobajiri WSHG, Vill: Rudhei, GP- Ajaygada, Block- Gumma
17.	Jamuna WSHG, Vill: Bantilda, GP- Ajaygada, Block- Gumma
18.	Star Shakti Dala, Vill: Kitumba, GP: Bhubani, Gumma
19.	Priya WSHG, Vill: Targi, GP: Bhubani, Block: Gumma
20.	Maa Saraswati Shakti Dal Vill- GP: Ajaygada, Gumma
21.	Dipika SHG, Vill: Bhabani, Gumma
22.	Muardaul SHG, Vill: S. Ragidi, GP: Bhubani, Gumma

### Khordha District of Odisha

A training programme on “Seed production and scientific methods of aquaculture” was conducted by ICAR-CIFA, BBSR in the Odisha Special Armed Police campus (7<sup>th</sup> OSAP Battalion), BBSR, on 19 January 2022. In this meeting 202 tribal police personnel were trained on different aspects of aquaculture. The meeting was attended by Mr. Soumendra Priyadarshi, IPS, Commissioner of Police, Bhubaneswar besides other personnel from ICAR-CIFA viz. Dr. P. Routray, Dr. K.C. Das, Dr. N. K. Barik and Mr. Durga Prasad Rath.





### Kalahandi District of Odisha

Shri Dibya Sankar Mishra, Hon'ble Minister of state for Home, Industry, Energy, MSME of Odisha Capt. invited the Director and team of ICAR-CIFA to visit few places of the Kalahandi district to suggest measures for improvement of the aquaculture in the district. A detailed discussion on the ways and means to improve the fish farming in the district was discussed. ICAR-CIFA team suggested for establishment of the breeding pool and stocking of improved varieties of fish in the hatcheries for better quality seed.

Team of ICAR-CIFA along with Hon'ble Minister visited private fish farm at Chichia Panchayat, Pandkul village in which team interacted with Mr. Pankaj Mund, Ajit Pradhan and many other famers gathered in the occasion. An awareness cum training on freshwater aquaculture was organized in the farm where around 50 farmers participated in the programme. The team made a survey of the nearby ponds found that there is great scope for improving production and productivity of the aquaculture in the area. At present fish productivity is low primarily due to poor quality seed, lack of adequate nutrition, proper health management. Technical support is required to improve the aquaculture in the area.

The team along with Hon'ble Minister also visited Golamunda Fish farm of Government of Odisha. In the farm there is a carp hatchery which is in the dilapidated condition and is not functional since 2014. There are acute shortage of the good quality seed and farmers are dependent on the seeds being brought by traders from West Bengal. The team suggested following action.

- Establishment of 2 cemented carp



hatchery of capacity of 30 lakhs spawn per cycle under STC programme of ICAR-CIFA in the tribal beneficiaries of the district

- Providing two small sinking feed mill to formulate and prepare carp feeds from locally available materials
- Providing soil and water testing kit to test water quality of the ponds
- Provide other assets for aquaculture development in the area.
- Adopt Kalahandi as adopted district under STC programme. Finally, in this Programme 131 Beneficiaries were benefited.



### Media Coverage under TSP

**ଚଙ୍ଗାରିଆ ମହିଳାଙ୍କୁ ମାଛଦାନା ପ୍ରସ୍ତୁତ କରୁ, ସାଆଁଳ ପ୍ରଦାନ**

**କେନ୍ଦ୍ରୀୟ ମତ୍ସ୍ୟ ଚଳ ଚେତନା ଚେତନା କର୍ମକ୍ରମ**

କେନ୍ଦ୍ରୀୟ ମତ୍ସ୍ୟ ଚଳ ଚେତନା କର୍ମକ୍ରମର ଅନ୍ତର୍ଗତ ଭାଗ ଭାବେ ଚଙ୍ଗାରିଆ ମହିଳାଙ୍କୁ ମାଛଦାନା ପ୍ରସ୍ତୁତ କରାଯାଇଛି । ଏହି କାର୍ଯ୍ୟକ୍ରମରେ ଚଙ୍ଗାରିଆ ମହିଳାଙ୍କୁ ମାଛଦାନା ପ୍ରସ୍ତୁତ କରାଯାଇଛି । ଏହି କାର୍ଯ୍ୟକ୍ରମରେ ଚଙ୍ଗାରିଆ ମହିଳାଙ୍କୁ ମାଛଦାନା ପ୍ରସ୍ତୁତ କରାଯାଇଛି ।

**STC Programme of Gol held in DKDA, Chatikona**

STC Programme of Gol held in DKDA, Chatikona. The programme was held in DKDA, Chatikona. The programme was held in DKDA, Chatikona. The programme was held in DKDA, Chatikona.

**ଘରବକୋରେ ଖୋଳିଲା କାବଡ଼ ମାଛ ବଜାର**

ଘରବକୋରେ ଖୋଳିଲା କାବଡ଼ ମାଛ ବଜାର. The market was held in Gharbokore. The market was held in Gharbokore. The market was held in Gharbokore.

**ମାଗାରି ବଣ୍ଟନ କାର୍ଯ୍ୟକ୍ରମ ଶୁଭାରମ୍ଭ**

ମାଗାରି ବଣ୍ଟନ କାର୍ଯ୍ୟକ୍ରମ ଶୁଭାରମ୍ଭ. The program was held in Magari. The program was held in Magari. The program was held in Magari.

**ଧରିତ୍ରୀ ଉନ୍ନତମାନର ମହାପାତ୍ର ଉପରେ ଗୁରୁତ୍ୱ**

ଧରିତ୍ରୀ ଉନ୍ନତମାନର ମହାପାତ୍ର ଉପରେ ଗୁରୁତ୍ୱ. The program was held in Dhriti. The program was held in Dhriti. The program was held in Dhriti.

**ରଞ୍ଜନ ମାଛ ଚାଷ ପ୍ରଶିକ୍ଷଣ**

ରଞ୍ଜନ ମାଛ ଚାଷ ପ୍ରଶିକ୍ଷଣ. The program was held in Ranjan. The program was held in Ranjan. The program was held in Ranjan.

**ରାୟଗଡ଼ା ଜିଲ୍ଲାବାସୀଙ୍କୁ ସ୍ୱାବଲମ୍ବୀ କରିବା ଲକ୍ଷ୍ୟ**

ରାୟଗଡ଼ା ଜିଲ୍ଲାବାସୀଙ୍କୁ ସ୍ୱାବଲମ୍ବୀ କରିବା ଲକ୍ଷ୍ୟ. The program was held in Rayagada. The program was held in Rayagada. The program was held in Rayagada.

**ରଞ୍ଜନ ମାଛ ଚାଷର ଶୁଭାରମ୍ଭ**

ରଞ୍ଜନ ମାଛ ଚାଷର ଶୁଭାରମ୍ଭ. The program was held in Ranjan. The program was held in Ranjan. The program was held in Ranjan.

**ମହିଳାଙ୍କୁ ସ୍ୱାବଲମ୍ବୀ କରି ଆର୍ଥିକ ସ୍ଥିତି ସୁଧାରିବା ଲକ୍ଷ୍ୟ**

ମହିଳାଙ୍କୁ ସ୍ୱାବଲମ୍ବୀ କରି ଆର୍ଥିକ ସ୍ଥିତି ସୁଧାରିବା ଲକ୍ଷ୍ୟ. The program was held in Mahila. The program was held in Mahila. The program was held in Mahila.

**ମାଛ ଜାଆଁଳ ଉତ୍ପାଦନ କେନ୍ଦ୍ର ଉଦ୍ଘାଟିତ**

ମାଛ ଜାଆଁଳ ଉତ୍ପାଦନ କେନ୍ଦ୍ର ଉଦ୍ଘାଟିତ. The program was held in Fish. The program was held in Fish. The program was held in Fish.

**ଭୋକନ କୁଲୋକରୁ କଳାହାଣ୍ଡି ଏବେ ଶ୍ୟାମଶ୍ୟାମଳା କ୍ୟାପଟେନ୍ ଜି ଗୋଳାମୁଣ୍ଡା ବ୍ଲକରେ ମହାପାତ୍ର ସମୀକ୍ଷା**

ଭୋକନ କୁଲୋକରୁ କଳାହାଣ୍ଡି ଏବେ ଶ୍ୟାମଶ୍ୟାମଳା କ୍ୟାପଟେନ୍ ଜି ଗୋଳାମୁଣ୍ଡା ବ୍ଲକରେ ମହାପାତ୍ର ସମୀକ୍ଷା. The program was held in Bhojani. The program was held in Bhojani. The program was held in Bhojani.



## SCSP PROGRAMME

ICAR-CIFA has under taken various livelihood development activities for the scheduled caste community in different states like West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Punjab, etc. during January to December 2021.

### West Bengal

ICAR-CIFA established six Aquaculture Field Schools in South 24 Parganas, Jalpaiguri, Coochbehar, Dakshin Dinajpur and Uttar Dinajpur for transfer of technology through farmer to farmer extension. ICAR-CIFA partnered with Worldwide Fund for Nature (WWF) to develop farmers' collective with



fish farming entrepreneurship initiated at Kumirmari, Gosaba, South 24 Parganas. The initiative intends to benefit 50 schedule caste women representing 5 self-help groups. A portable FRP carp hatchery is being installed in order to create a self-sufficiency of fish seed production. 'Scientist-Farmer Interface on Aquaculture' and Fish Feed Distribution Programme was conducted in West Bengal by ICAR- CIFA, RRC, Rahara among 468 SC farmers during 18-22 October 2021. RRC, Rahara conducted 'Scientist-Farmer Interface on Aquaculture' and lime distribution programme among 568 SC farmers of 19

villages, 3 blocks and from 2 Districts during 03-10 November, 2021 under SCSP scheme in West Bengal. Around 96 SC farmers each were provided 20 kg of lime on 09.11.21 at Goranbose village, Basanti block, South 24 Parganas in collaboration with SSKVK, Sonarpur.

### Odisha

SCSP activities in Balasore, was launched by Hon'ble Member of Parliament Sri Pratap Chandra Sarangi, on 21 August 2021. The meeting was attended by 50 farmers and farm women. Genetically improved carp fingerlings and floating fish feed were distributed to 34 beneficiaries of Nilagiri and Balasore blocks. One two-days residential training programme on ornamental fish breeding and culture for capacity building of women self-help groups was held during 2-3 Sept 2021 at ICAR-CIFA campus. Ornamental Aquaculture Field School at Kochila Nuagaon, Dasa sahi, Cuttack, Odisha



was launched on 4th Sep 2021 under SCSP scheme. This is the first Ornamental AFS in Odisha that would facilitate farmer to farmer extension and promote ornamental fisheries. Interaction with SCSP beneficiaries of Khordha district and imparting training on pre-stocking management measures



were organised in Balipatna block on 20th September 2021. Genetically improved carp fingerlings and floating fish feed were distributed to 150 beneficiaries of Brahmagiri block. Fingerlings, rice bran and GNOC were distributed among the SC beneficiaries of SCSP scheme in Balipatna block of Khordha district. Skill development workshop was organised in Ramakrishna Sevashram of Bhadrak district of Odisha on 16 December 2021 under SCSP scheme. Around 100 fish farmers participated in the programme. One-day awareness camp was organised in Subarnapur, Gop, Puri on 22 Dec 2021 to educate the SC fish farmers about the scientific fish farming.

### Punjab

A Scientists-Farmers Interface under SCSP Scheme was organised on 13 August 2021 at

Bikaner, Rajasthan, Regional Research Station of ICAR-CIFA in collaboration with State Fisheries Department, Punjab organized three days Training cum Input assistance Programme during 27-29 December 2021.



Critical inputs were provided to sixty farmers including 17 women to start ornamental fish farming for livelihood development.

### Rajasthan

Training cum input Assistance Programme for Stunted Carp Fingerling Production in

farm Ponds was conducted during 28-29 September, 2021 at Bikaner, Rajasthan. It was attended by 35 farmers and farm women.

**Table 43. Demonstration of ICAR-CIFA technologies under SCSP 2021**

Demonstration of technologies	State	District	No. of persons benefited
Carp seed production	Odisha	Puri Khordha	45 32
	Punjab Rajasthan	Bhatinda Bikaner	60 35
Grow out carp culture	Odisha	Balasore Kendrapara Puri	71 35 70
	West Bengal	S 24 Paraganas N 24 Paranagas	412 156



	Andhra Pradesh	Guntur	74
		Krishna	52
	Telangana	Suryapet	103
	Karnataka	H D Kote	12
Ornamental fish farming	Odisha	Kendrapara	25
<b>Total</b>			<b>1, 182</b>

### Andhra Pradesh

Input support for fish farming was provided to 74 beneficiaries under SCSP in Venkatapuram village, Krishna and Kuchipudi village, Guntur District of Andhra Pradesh on 20th July 2021. Interactive workshop and awareness programme on scientific fish farming for generation of livelihood and income was organised at Mantripalem village, Krishna District, Andhra Pradesh on 15 Sept. 2021 involving 52 fish farmers.

### Telangana

Interactive Workshop and Awareness Programme on Recent Advances in Carp Culture Practices held at Chilukur, Suryapet District, Telangana on 26th October 2021. Total 103 participants attended the programme. Technical brochure/leaflets were released on Nursery and Grow out carp culture and their pond management on this occasion and distributed to the beneficiaries.

### Karnataka

Training cum input distribution was carried out in H D Kote, Karnataka on 13 December, 2021. Total 12 beneficiaries attended the programme and were supplied with inputs like fish feed, fingerlings etc. Fish fingerlings

were stocked in 10 farmers' pond in Maduranthakam, Tamil Nadu during 2020-21, from which farmers were able to harvest around 3 tonnes of fish and earned revenue of about Rs. 3 Lakhs by selling at retail and local market. Around 50 desi chicks and 1 backyard poultry cage per woman along with feed were provided to 5 SHGs (20 women members/ group). Each woman was able to earn on an average Rs. 9000/- by the sale of eggs and chicken and totally they could earn around Rs 900000.

### Review Meetings

SCSP meeting was held under the chairmanship of Director, ICAR-CIFA in virtual mode to discuss about Schedule Caste Sub Plan of ICAR-CIFA on 3 May 2021, 10 Jun 2021 and 17 July 2021. A half yearly review meeting of SCSP scheme held at ICAR-CIFA, Kausalyaganga, Bhubaneswar on 4th October 2021 at committee room. The purpose of this meeting was to discuss the progress of the SCSP activities during 2021-22. Another review meeting was held on 23rd November 2021 to discuss about the fast track implementation of the SCSP activities during 2021-22 and utilization of funds.



## 9. KRISHI VIGYAN KENDRA (KVK)

### Mandatory activities of KVK, Khordha

Krishi Vigyan Kendra, Khordha during the reporting period carried out the mandatory activities of technology assessment, frontline demonstration, training programmes for capacity building of farmers, farm women and rural youths. In addition, KVK worked on sponsored training programmes funded by other agencies. The below sections provide information on different activities carried out by KVK during the year 2021.

### Technology Assessment (On-farm trial)

A total 10 technologies were identified during the reporting period for assessment in the farmer's field and subsequently large-scale demonstration in the district. The technologies are broadly categorised in the discipline of horticulture, crop production, animal science, fisheries and home science. The details of the technologies assessed during the period are presented below.

**Table 44. Technology assessed**

Sl. no	Title of OFT	No of trials
1	Assessment of paddy variety RNR 15048 (Telengana Sona) under rainfed mid-land situation	7
2	Assessment of INM in sweet corn	7
3	Assessment of intercropping of greater yam with sweet corn	6
4	Assessment of fertilizer management in teasle gourd	7
5	Assessment of growth rate of poultry birds by substituting maize with broken rice in different levels under semi-intensive farming system	5
6	Assessment of Vegaguda chicken breed under backyard farming system	10
7	Assessment of genetically improved catla spawn during nursery phase	6
8	Assessment of 'CIFA carp grower' feed in grow-out culture of carp	6
9	Assessing the performances of chemicals used for controlling competitor moulds in paddy straw mushroom	7
10	Extraction of virgin coconut oil and study of its physico-chemical properties and storage stability.	6



### Front Line Demonstration

The KVK demonstrated 10 proven technologies that were found to be profitable and sustainable to the farmers of

the district, which can be adopted in larger scale for horizontal spread. The details of the demonstrations undertaken are presented below:

**Table 45. Technology demonstrated**

Sl no	Title of FLD	No. of demonstration
1	Demonstration of paddy variety Maudamani	10
2	Demonstration of mechanical rice transplanter	10
3	Demonstration of turmeric variety Rajendra Sonia	10
4	Demonstration of red cabbage variety Ruby Ball	10
5	Demonstration of artificial brooding of improved chicks	30
6	Demonstration of supplementing balanced feed for growing lambs	10
7	Demonstration of carp culture in community ponds	03
8	Demonstration of integrated fish farming	4
9	Demonstration of paddy straw mushroom (OSM -11 & OSM 12)	5
10	Demonstration of Nutri kitchen garden	5

### Mandatory trainings

During this period, KVK conducted 69 mandatory training programmes benefitting

2427 beneficiaries. The trainings were conducted at the farmer's field (off campus) and at KVK (on campus).

**Table 46. Training for practicing farmers/ farm women/ youths**

Number of trainings	Male	Female	Total
69	1150	1277	2427



### Sponsored trainings

Apart from the mandatory training programmes, the KVK has organized 9 numbers of sponsored trainings for 274 beneficiaries.

Table 47. Details of the sponsored trainings

Sl. No	Title	Duration	No. of participants	Sponsoring Agency
	Coconut cultivation technology	08 January 2021	40	Coconut Development Board, Pitapalli, Khordha
	Improved package & practices in vegetable cultivation	30 March 2021	37	ATMA, Begunia Block, Khordha
	Preparation of fish pickle	12 August 2021	21	ICAR-CIFA, Bhubaneswar
	Teasle gourd poly plant production	03 September 2021	26	ATMA, Baliana Block, Khordha
	Friends of Coconut Tree	09-14 October 2021	21	Coconut Development Board, Pitapalli, Khordha
	Integrated Fish Farming	29-30 November 2021	30	ATMA, Jatni Block, Khordha
	Friends of Coconut Tree	18-23 December 2021	19	Coconut Development Board, Pitapalli, Khordha
	Profitable Dairy Farming	20-22 December 2021	40	ATARI, Kolkata
	Backyard Poultry Farming	27-29 December 2021	40	ATARI, Kolkata



## Special Initiatives

### Rural Agricultural Work Experience (RAWE) programme

KVK organised a Rural Agricultural Work Experience (RAWE) training programme of 13 weeks duration for the final year B.Sc. (Agriculture) students from Tirhut College of Agriculture, Dholi, Muzaffarpur under



Dr. Rajendra Prasad Central Agricultural University, Bihar (no. of students 5); Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Allahabad (no. of students 3) and Sri Sri University, Cuttack (no. of students 2). The programme comprised of KVK attachment (5 weeks) and village attachment (8 weeks).

### Two Farmer Producer Company (FPC) established

KVK-Khordha supported the establishment of two Farmer Producer Companies (FPCs) namely Sambalit and Maheera in Horticulture



and Agriculture sector at Balipatna Block of Khordha District, Odisha on 10 March and 9 September, 2021 respectively. The FPCs are spread over 17 Gram Panchayat of Balipatna Block consisting of total 1200 farmers and farm women.

### Formation of Jayadev polyplant production sangathan

KVK-Khordha guided 25 farmers and youths from Balianta and Balipatna block of Khordha district for establishing “Jayadev Chara Utpadaka Sangathan” for production



of quality planting materials of pointed gourd and teale gourd. Under this Sangathan nine commercial nurseries were established and they produced about 1.0 lakh polyplants during 2021, which were supplied to four districts of Odisha.

### Formation of Kalyani Tailoring Training and Production Centre

KVK-Khordha with support from ICAR-CIFA and Maheera Farmer Producer Company Limited, Balipatna motivated 20 Schedule Caste farm women and youth and formed “Kalyani Tailoring Training and Production Centre” at Amanakuda, Balipatna, Khordha for the livelihood and income generation of the members. The inputs like tailoring



instruments and accessories were supplied to the members under SCSP programme of KVK as one time assistance for making the centre operational.

### Entrepreneurial development

Name of youth: Sri Biswajit Sahoo

Address: Taradapada, Garedipanchan, Balipatna, Khordha

Sri Biswajit Sahoo, a rural youth aged about 24 years, completed his education in intermediate and ITI in fitter trade. He opted to be self-employed without seeking any govt. or private job and follow his fathers' occupation in agriculture and allied sector. During his involvement in agriculture, he learned about improved pointed gourd variety "Swarna Alaukik" from KVK-Khordha. He procured few numbers of

60, 000 from 5000 polyplant sapling during 2020. He established "Senapati Nursery" and expanded his business with production of 16, 000 poly plants of pointed gourd and teasel gourd (variety Arka Neelachal Shanti) and earned about Rs1, 92, 000 within a period of 5 months in the year 2021.

Name: Smt. Sukanti Behera

Address: Saratsasan, Balipatna, Khordha

Smt. Sukanti Behera, a housewife of Saratsasan village in Balipatna, Khordha was in search of income generating activity to support her family. She came in contact with KVK-Khordha through Maheera FPC, Balipatna for capacity building programme. She was imparted skill training on coir handicrafts preparation in the year 2020-21. In the same year she established "Mamatamayee Kata silpa" enterprise and procured necessary raw materials and instruments from Coir Board Regional Centre, Bhubaneswar. She started producing and marketing of her products like designed door mats, dolls and ropes in the local market. Now she has engaged five number of skilled manpower for expanding her business and earning a net profit of Rs 18, 000 per month. Due to her sincere effort and achievement, she has been felicitated by ICAR-CIFA on the occasion of Women in Agriculture Day-2021.



polyplants of Swarna Alaukik from ICAR-CHES, Bhubaneswar in 2019, which was very less as per his requirement. The scarcity in the availability of the variety made him to start the production of polyplant material in his own farm. To gain the knowledge on production he contacted KVK during 2020 and seek advice from the expert. KVK came forward and trained him through method demonstration, telephonic advisory and motivational support. With the technological backstopping from KVK, he could earn Rs





## 10. LIBRARY AND INFORMATION SYSTEMS

Dr. Hiralal Chaudhuri Library of the institute has good collection of books and journals on Fisheries and Aquaculture. It has around 7484 books/monographs, 2900 back volume journals and other reference materials. The library has more than 200 members viz., scientists, technical officers and research scholars.

The users of the Library extensively used the Consortium of E-resources on Agriculture (CeRA). In addition to above online access in CeRA, the library is providing Document Delivery services to various institutions (including the SAUs) under the NARS. The library sends the important articles both to the internal users of the Institute as well as scientists and researchers from outside the institute. Remotex software has been subscribed for remote access of the e-resources. Through this software a user can login to the Remotex portal and access to the resources to which they have access to. Through this software a user can access the e-resources subscribed by the institute outside the institute. Remotex training/demo has been given to the scientists, technical officers and the research scholars of the institute. This service was very much helpful to the users of the Institute during COVID-19.

The library is fully automated with Koha Library Management software. The library is proud to be a part one of the partner of the NAIP's e-Granth project. Under this project the institute library implemented the Koha software for the library. For which the necessary software, hardware was provided by the project.

The Library is also a part of IDEAL platform. IDEAL is ready platform for Agricultural Libraries of Indian National Agricultural Research and Education System (NARES) which enables them to adopt Integrated Library management system for their day to day operations of their library functionality. It is a software platform built on "Software as a Service"(SaaS) concept to provide hassle free, ready to use, international standards based on platform for sharing library holdings through an union catalogue (AgriCat). An integrated digital library delivered at the desk of researchers, faculty and students of NARES can definitely boost the quality research output and save time. Libraries can reduce cost incurred in procuring books & other library resources by sharing through this digital system. At present 38 libraries of the NARES as part of e-granth project supported by National Agricultural Innovation Project (NAIP) of the Indian Council of Agricultural Research have endeavor to establish IDEAL which is easily extensible to more libraries covering whole NARES. The library has been recognised as the FAO Depository Library and has a good collection of FAO Publications related to Fisheries and allied agricultural sciences. The library provides services to the Scientists and Technical Officers of Headquarter & Regional centres, and Scientists, Research Scholars, teachers, trainees, students and officials from other organizations. The library mails Institute's publications to all ICAR Institutes, other Research Organisations, State Fisheries Departments, Fisheries Colleges, KVKs, Entrepreneurs and Farmers to keep them abreast with latest developments in Freshwater Aquaculture.



All the major research breakthrough/scientific activity/success stories etc. were duly covered in both electronic and print media (National and Local). The Media presence of the Institute has increased manifold and invariably all important News are also posted in ICAR Website beside our website. The library is also sending the new clippings about the fisheries and aquaculture sector and about the

happenings of the Institute to the internal users. The library also helps in checking the plagiarism of the research articles of the scientists of the Institute. The similarity of research manuscript of the Institute have been checked through the iThenticate software from ICAR-NRRI, Cuttack and other sister ICAR institutes from January 2021 to December 2021.



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- E-publications:**
- Debbarma, J. Sahoo, L., Kumar. R. (2021). *Nucleotide sequence of parasitic leech (Glossiphonia sp. CS1) submitted to NCBI and accession number obtained OL412752*.
- Mohapatra, S., Sundaray, J. K., & Kumar, R. (2021). *Changes in the Hepatosomatic Index (HIS) and Liver Histology of Anabas testudineus on Exposure to Two Agrochemicals*. International symposium on Coastal Agriculture: Transforming Coastal Zone for sustainable Food and Income Security. Abstract book of ISCA-2021: T2S10RAL03, 95-96.



## 12. AWARDS AND RECOGNITIONS

### National Awards

- Dr B.C. Mohapatra, Principal Scientist received Best Scientist Award from “EET CRS Research Wing for Excellence in Professional Education & Industry” in the “9th Academic Brilliance Awards - 21” Ceremony of Educationexpo.tv held at Hyderabad on 7 March 2021.
- Dr B.C. Mohapatra, Principal Scientist received Indian Achievers’ Award 2020-21 in Recognition of Outstanding Professional Achievement & Contribution in Nation Building from Indian Achievers’ Forum, New Delhi.
- Dr B.C. Mohapatra, Principal Scientist received Life Time Achievement Award from the Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut, Uttar Pradesh, India for Outstanding contributions in Fish Breeding. It was conferred in the “International Conference on Innovative and Current Advances in Agriculture & Allied Sciences (ICAAAS-2021)” organized by SSDAT during 19-21 July, 2021 through Virtual Mode.
- Dr Rajesh Kumar, Senior Scientist was awarded “Outstanding Scientist award-2020” by the Agricultural Technology Development Society (ATDS), Ghaziabad, Uttar Pradesh, India on the occasion of 4<sup>th</sup> International Conference Global approaches in Natural Resource Management for Climate-Smart Agriculture (GNRSA-2020) held at Shobhit Deemed University, Modipuram, Meerut during February 26-28, 2021.
- Dr K.N. Mohanta, Principal Scientist received the “Distinguished Researcher Award” from the Venus International Foundation in the 7th Venus International Science and Technology Awards – VISTA 2021 Chennai, Tamil Nadu.
- Dr K.C. Das, Principal Scientist had been awarded “Rastriya Gaurav Award” by India International Friendship Society on 9 April, 2021.
- Dr. S.S. Giri, Principal Scientist and Head, FNPD was awarded with Fellow of the ‘National Academy of Veterinary Science, India’ w.e.f. September 2021.
- Dr N. K. Barik, Dr S.S. Mishra, Dr K. N. Mohanta, Dr Rajesh Kumar and Dr Khuntia Murmu (S & T Project Team of ICAR-CIFA) received the Certificate of Appreciation from the Collector, Nabarangpur, Odisha for contributing significantly for the development of complete value chain in aquaculture towards Pisciculture Development in Nabarangpur- A Blue Revolution under the project “Farm-based Science & Technology intervention for the economic development of Nabarangpur and STC program of ICAR-CIFA in Nabarangpur District Odisha has successfully qualified for Semi-final of SKOCH AWARD at National level in the year 2021

### Academic/Other Accomplishments

- Dr Saroj K. Swain, Principal Scientist and Director (acting) conferred as an Adjunct Professor in M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Parlakhemundi campus w.e.f. 6 December, 2021.
- Dr P. Routray, Principal Scientist was invited as a Keynote Speaker at the International Conference on Agriculture for Sustainable Future” (Agri Vision 2022) held at Ravenshaw University, Cuttack during 6-8 March 2022.
- Dr. S.S. Giri, Principal Scientist and Head, FNPD has joined as Editorial Board Member of the ‘Reviews in Aquaculture, Wiley Journal.
- Dr. S.S. Giri, Principal Scientist and Head, FNPD has served as the Member of the Academy Council of Bihar Animal Science University, Patna.
- Dr.K.N.Mohanta, Principal Scientist served as an Expert Member, Bureau of Indian Standards (BIS), New Delhi.


**Table 48. Student Guidance**

S.N.	Name of the student	Subject and Institute	Guide assigned	Course
1	Anirban Paul	Thesis entitled “Dactylogyrosis in Indian major carps: Understanding host-pathogen interaction towards designing prevention strategy”. ICAR-CIFE, Mumbai.	Dr. P. K. Sahoo	Ph.D. (AAHM)
2	Priyashree Parida	Thesis entitled “Evaluation of a synthetic peptide as vaccine candidate against argulosis in rohu ( <i>Labeo rohita</i> ): immune responses in skin”. Odisha University of Agriculture and Technology, Odisha.	Dr. P. K. Sahoo	M.Sc. (Microbiology)
3	Subhadarshini Parida	Thesis entitled “Selection and validation of reference genes for RT-qPCR analysis in skin tissue from rohu ( <i>Labeo rohita</i> ) during argulosis”. Odisha University of Agriculture and Technology, Odisha.	Dr. P. K. Sahoo	M.Sc. (Microbiology)
4	Priyadarsini Dwibedy	Thesis entitled “Assessment of antimicrobial resistance profile of selected bacterial isolates from freshwater aquaculture system in Khorda district of Odisha”. TNJFU, Tamil Nadu	Dr. S. S. Mishra	M.F.Sc. (Fishery Biotechnology)
5	Anwasha Bhuyan	Thesis entitled “Antibiotic resistance profile of microbial pathogens of public health significance isolated from agriculture system in Puri district Odisha”. Odisha University of Agriculture and Technology, Odisha	Dr. S. S. Mishra	M.Sc. (Microbiology)
6	Sheikh Naim	Thesis entitled “Investigation on the interleukin beta (IL-1 beta) gene expression in the Indian major carp <i>Labeo rohita</i> following its infections with aquatic pathogens”. Odisha University of Agriculture and Technology, Odisha.	Dr. M. Samanta	M.Sc. (Microbiology)
7	Saswati Pani	Thesis entitled “Expressional characterization of signal transducer and activator of transcription 2 (STAT-2) gene in the freshwater carp, <i>Labeo rohita</i> in response to pathogens and pathogens associated molecular patterns (PAMPs)”. Odisha University of Agriculture and Technology, Odisha.	Dr. M. Samanta	M.Sc. (Microbiology)
8	Gopi Krishna	Effect of different biochemical agents on the orientation pattern of sex in <i>Oreochromis niloticus</i>	Dr. P. Routray	M.F.Sc.,
9	Sasmita Mohanty	Thesis entitled “Effect of <i>Tridax procumbens</i> leaf extract on performance survival and nonspecific immune response of rohu <i>Labeo rohita</i> ” Trident Academy of Creative Technology, Bhubaneswar.	Dr. P. Choudhary	M.Sc. (Microbiology)



10	Dushyant Kumar Damle	Gonad Maturation and Induced Breeding of Striped Murrel <i>Channa striata</i> Under Captive Condition During the Pre-Monsoon Period	Dr Rajesh Kumar	Ph.D.
11	Sujata Mahapatra	Impact of monocrotophos and glyphosate on reproductive fitness and liver of <i>Anabas testudineus</i> .	Dr J.K. Sundaray	Ph.D.
12	Gokula krishnan M.	Evaluation of dietary brewer's spent yeast (BSY) on growth and immune responses of climbing perch, <i>Anabas testudineus</i> (Bloch, 1792) fingerlings"	Dr Rajesh Kumar	M.F.Sc
13	Gitanjali Behera	Role of miRNAs, their expression, profiling and identification in gonadal development of <i>Channa striata</i> (Bloch, 1793)	Dr J.K. Sundaray	M.F.Sc
14	Mandakini Das	Cloning and characterization of kiss2 in <i>Channa striata</i> "	Dr Rajesh Kumar	M.Sc.
15	Abhijit Das	Department of Aquatic Animal Health, Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences	Dr. F. Hoque	M.F.Sc
16	Suchismita Nayak	Thesis entitled "Ecology, spawning and culture possibilities of <i>Amblypharyngodon mola</i> " under Utkal University, Bhubaneswar	Dr P. Routray	Ph.D.
17	Mukaddim Mukhsheet Ahmed Hazarika	Registration No. M/FS/AQ/190/2019-20; Thesis titled "Comparative Study on Growth Performance and Survival of Rohu ( <i>Labeo rohita</i> ), Catla ( <i>Gibelion catla</i> ), and GIFT Tilapia ( <i>Oreochromis niloticus</i> ) fingerlings in Recirculatory Aquaculture System		
18	Priyanka Rajesh Zod	Registration no. M/FS/AQ/296/2019-20; Thesis titled "Assessment of the Potential of Banana inflorescence as Dietary Ingredients in the feed for Growth Evaluation of <i>Labeo rohita</i> Fingerlings".		



### 13. HUMAN RESOURCE DEVELOPMENT

**Table 49. Training undergone by the staff members of the Institute**

<b>Scientific Staff</b>				
Sl.No	Name of the Staff	Name of the Training	Duration	Organized by
1	Dr Ajit Chaudhari	Online training programme on Breeding of Freshwater Ornamental Fishes	19 Jan 2021	KVK, AAU, Devataj, Anand
2	Dr B.S.Giri	National Awareness Programme on "Biofloc Culture"	19 June 2021	College of Fishery Science, Jabalpur
3	Dr Ramesh Rathod	Data analysis in Social Sciences Research	04-08 Oct 2021	ICAR-NAARM, Hyderabad
4	Dr Rajesh Kumar Dr D. Panda Dr S. Ferosekhan Dr Sunil Kumar S Ail	International Virtual Training Course on Recirculatory Aquaculture Systems	30 Oct - 20 Nov 2021	Virtual
5	Dr B.R. Pillai Dr D. Panda	LCA data analysis workshop	18 Nov 2021	Virtual
6	Dr Panda	E-learning short course on ASReml-SA 4.2	01-31 Dec 2021	Virtual
<b>Technical Staff</b>				
7	Mr S. Gudipudi	E- Governance Applications in ICAR for Technical Staff	6-10 Sept 2021	ICAR- IASRI, New Delhi (Virtual Mode)
<b>Administrative staff</b>				
8	All the ministerial staff up to the level of AAO & AF&AO	Capacity building and refresher programme for the benefit of staff members working in the Administrative and Finance Units at Hqrs.	8-12 Feb 2021	ICAR-CIFA
9	135 Casual Labour at Hqrs and RRC, Rahara through online	Capacity building training programme for 1/30 <sup>th</sup> Casual Labour	22-26 Mar 2021	ICAR-CIFA



**Table 50. Participation of Scientists/ Technical Officers in Workshops/ Seminars/ Symposia/ Conferences/ Meetings**

Events	Venue	Duration	Participant(s)
Fifth Steering Committee Meeting of TNIAM (Tamil Nadu Integrated Agriculture Modernization) Project organized by Dept. of Fisheries & Fishermen Welfare, Govt. of Tamilnadu	Virtual		Dr P.C. Das
Webinar on Ornamental fisheries North East States under PMMSY programme	Virtual	5 Jan, 2021	Dr S.K. Swain
XVI Workshop of AICRP on Plastic Engineering in Agriculture Structure & Environment Management		8-9 Jan, 2021	Dr B.C. Mohapatra
Inspection of Tilapia Hatchery, Ananda Enterprises (India) Pvt. Ltd	Kovvada, Bhimavaram	9 Jan, 2021	Dr P.V. Rangacharyulu
World Fisheries Day Lecture Series No-5 “Challenges and Opportunities in Developing Aquaculture using Genomics” by Prof Victor Martinez Moncada, Director, FAVET-INBIOGEN, Universidad de Chile and also addressed by Dr Kuldeep Lal, Director, ICAR-NBFGR	Virtual	11 Jan, 2021	All scientist and Tech. Officer
Interaction Meeting of ICAR Fisheries SMD & Fisheries Dept. of Jharkhand	ICAR-CIFA	13 Jan 2021	Dr P. Das Dr B. Seshagiri Dr Ajit Chaudhari
Mr. Sagar Mehera, Joint Secretary, Ministry of Agriculture and Farmers’ welfare, Govt. of India delivered lecture on Extension activities of fisheries and aquaculture through PMMSY	Virtual	13 Jan, 2021	All scientist
Workshop on “ Developing Community-Led Solutions to Antimicrobial Resistance: Building a One Health Approach in Low and Middle Income Countries” organized by UKRI-GCRF: One Health Poultry Hub, UKRI Cluster: CE4AMR - The One Health Approach	Virtual	15 Jan, 2021	Dr. S.S.Mishra
Interaction meet with farmers and entrepreneurs	Durgapur, WB	15 Jan, 2021	Dr S.K. Swain Dr S.S. Giri Dr P.P. Chakrabarti Dr H.K. De
Project evaluation meeting of Sub-committee on Research and Development in Basic & Applied Sciences, Odisha Vigyan Academy	Odisha Vigyan Academy, Bhubaneswar	19 Jan, 2021	Dr Rajesh Kumar
State level technical committee (SLTC) for establishment of New Freshwater finfish hatchery and biofloc culture system/RAS under PMMSY	Directorate of Fisheries, Odisha, Cuttack	22 Jan, 2021	Dr P. Routray



35th IMC meeting of NBFGR, Lucknow	ICAR-NBFGR	28 Jan, 2021	Dr P.K. Sahoo
“Virtual Training on Recirculating Aquaculture System for Intensive Farming of Rainbow Trout”, conducted by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, India.	Webinar	29 Jan, 2021	Dr. S.S.Mishra
Webinar on “Skill corn Technologies LLC, UK, London (Gates Foundation Grant Proposal)	DoF, Govt. of Odisha	1 Feb, 2021	Dr S.K. Swain
Meeting with Agri-Innovate, New Delhi	ICAR- CIFA	2 Feb, 2021	Dr S.K. Swain Dr N.K. Barik
International Conference on “Kerala Looks Ahead”	Virtual	2 Feb, 2021	Dr B.R. Pillai
Annual Review Meeting with Consultative Group on International Agricultural Research Centres (CGIARs)	DARE, ICAR, New Delhi	3-4 Feb, 2021	Dr S.K. Swain Dr B. R. Pillai Dr K.D. Mahapatra
Inauguration of Ornamental fish farmer field school and One-day training programme on Ornamental fish culture	Jalpaiguri, WB	7 Feb, 2021	Dr S.K. Swain Dr S.S. Giri Dr H.K. De Dr B.N. Paul
Meeting with UBKV official and visit to farmers field	West Bengal	8 Feb, 2021	Dr S.K. Swain Dr S.S. Giri Dr H.K. De Dr B.N. Paul
Inaugural function of two Farm Schools (Aquaculture and Livestock) and Farmers meet under KVK, Coochbehar	Sat Mile Coochbehar, North Bengal	9 Feb, 2021	Dr S.K. Swain Dr S.S. Giri Dr H.K. De Dr B.N. Paul
Third meeting of the DBT-NER STAG in the area of Agriculture, Animal, and Allied Sciences for the NER	New Delhi/ virtual/ DBT	9 Feb, 2021	Dr P. K. Sahoo
Monitoring of demonstration activities of ICAR-CIFA in collaboration with DoF, Sikkim under NEH programme	Sikkim	11 Feb, 2021	Dr S.K. Swain Dr P.P. Chakrabarti
Virtual SMART AQUA EXPO INDIA 2021,	Virtual	6-12 Feb, 2021	Dr S.S. Mishra
Virtual “Global Panel Policy Brief Launch: Harnessing Aquaculture for Healthy Diets” conducted by WorldFish, Pinang 11960, Malaysia	Virtual	15 Feb, 2021	Dr S.S.Mishra
Virtual Workshop on Improved variety of carps and freshwater prawn for enhancing farmers’ income	ICAR-CIFA	15 Feb, 2021	Dr S.K. Swain Dr Bindu R. Pillai
Meeting with DDG (Fy) on UK-India Aquaculture Engagement	ICAR	15 Feb, 2021	Dr S.K. Swain



Online meeting on Role of ICAR-Institutes in PMMSY Schemes in A.P	Dept. Of Fisheries Govt. of A.P	16 Feb, 2021	Dr P.V. Rangacharyulu Dr B. Seshagiri Dr Ramesh Rathod Dr Ajit Chaudhari
Convening of the meeting of Sub-Committee on Research and Development in Biotechnology to evaluate R&D Projects in Biotechnology for release of 2nd year grant.	Odisha Bigyan Academy, Bhubaneswar	17 Feb, 2021	Dr J.K. Sundaray
The 26th Extension Council Online Meeting of ICAR-CIFE, Mumbai	Virtual	18 Feb, 2021	Dr S.K. Swain
Udyog Manthan-Webinar on Fisheries, organized by The Ministry of Commerce along with Quality council of India.	Virtual	18 Feb, 2021	Dr S.S. Mishra
Bengal Fishermen Orientation & Exposure Meet 2021 (Bangla Matsyo Sanmelan-o-Prodorshoni)	Govt. of West Bengal and Indian Chamber of Commerce	18-19 Feb, 2021	Dr F. Hoque
Talk on Ornamental Fish Culture virtually for AMITY University (for students and faculties)	Amity Institute of Marine Science and Technology, Amity University, Uttar Pradesh	19 Feb, 2021	Dr S.K. Swain
Lecture delivered on 'Peri-urban Aquaculture' during training	ICAR-CIFE, Kolkata Centre	20 Feb, 2021	Dr S. Adhikari
Training on Baclink component of the WHONET 5 for members of the Indian Network for Fisheries and Animals Antimicrobial Resistance (INFAAR)	Virtual	23 Feb, 2021	Dr S. S. Mishra Dr S. N. Sahoo
Webinar on High value Catfish Farming- An emerging profitable venture in Northern India	ICAR-CIFA RRC, Bhatinda	24 Feb, 2021	Dr S. Ferosekhan Dr S.K. Sahoo
Review meeting of DBT-AEDF project by the 6th TEC Aquaculture & Marine Biotechnology	Virtual	16 Mar, 2021	Dr Rajesh Kumar
26 <sup>th</sup> meeting of the National Committee on introduction of Exotic Aquatic species into Indian waters under the Chairmanship of Joint Secretary (Inland Fisheries)	Department of Fisheries, Animal Husbandry & Dairying Ministry of Fishery, Govt. of India (through Video Conference).	2 Mar, 2021	Dr C.K. Misra



10 <sup>th</sup> Meeting of Technical Advisory Committee (TAC 10) of Technology Development and Utilization Programme for Women (TDUPW)	Dept. of Scientific and Industrial Research, New Delhi (Virtual)	3 Mar, 2021	Dr (Mrs) Prabhati K. Sahoo
ITMC Meeting (Virtual Mode)	ICAR-DMFD	4 Mar, 2021	Dr P. Swain
Visit to Baliyan circle at Papumpare for inspecting composite fish culture demonstration and Inaugural function of the Farm (Technology Park) developed by ICAR-CIFA	Sonajhuli, Arunachal Pradesh	5-7 Mar, 2021	Dr S.K. Swain Dr J.K. Sundaray Dr S. S. Giri Dr P.P. Chakrabarti Dr. S. Saurabh Dr I. Sivaraman Sri I.B. Kumar Sri V. Ganesh Kumar Sri M.D. Das Sri S.K. Rath
BAP Farm Standard Overview	Online/Global Aquaculture Alliance	11 Mar, 2021	Dr B. R. Pillai Dr D. panda Mr J. Debbarma
Meeting with DG, ICAR, New Delhi (RCM-IV)	ICAR, New Delhi	11 Mar, 2021	Dr. S.K. Swain
Webinar on BAP Farm Standard Overview by Global Aquaculture Alliance	Portsmouth	11 Mar, 2021	Mr J. Debberma
Webinar on “UK-India Aquaculture Partnerships event” organised by British High Commission, New Delhi	British High Commission, New Delhi	8-11 March 2021	Dr S.K. Swain Dr P.K. Sahoo Dr P. Das Dr K.D. Mapahatra Dr P.C. Das Dr S. Ferosekhan Dr Pushpa Choudhury Mr Anirban Paul
Workshop on ‘UK-India Aquaculture Partnerships for Research and Innovation’ and nominated to present a talk on ‘Disease resistance and immunity research in India’ on 09 March 2021 on behalf of all ICAR Institutes	Virtual	8-11 Mar, 2021	Dr P.K. Sahoo
XXV meeting off RCM-VI	Virtual	13 Mar, 2021	Dr S.K. Swain
Awareness Program on PMMSY at Chandipur, Balasore	Fisheries Division NCDC, New Delhi	14 Mar, 2021	Dr S.N. Sethy Dr. P.K. Tiwari Dr. I. Sivaraman
Scientific Advisory Committee (SAC) meeting of KVK, Khordha	KVK-Khordha	17 Mar, 2021	Dr. S.K. Swain



International Symposium on Coastal Agriculture: Transforming Coastal Zone for Sustainable Food and Income Security through virtual mode	ICAR-CSSRI, Canning Town/ Indian Society of Coastal Agricultural Research	16-19 Mar, 2021	Dr S.K. Swain Dr R.N. Mandal
Meeting with Secretary, ICAR, New Delhi regarding budget utilization	ICAR-IIWM, Bhubaneswar	19 Mar, 2021	Dr S.K. Swain Sri I.B. Kumar Sri Rishikant Singh
Project Review Committee (PRC) meeting for the project entitled "Adding Value to Fish - A Potential Livelihood option for Rural Women of Odisha" undertaken by ICAR —CIWA, Baramaunda, Bhubaneswar under the TDUPW Program of A2K+ Scheme of DSIR	DSIR, New Delhi	19 Mar, 2021	Dr (Mrs) Prabhati K. Sahoo
DLRAC/PMC meeting of Rama Krishna Mission Samaj Sevak Sikhan Mandir	Virtual	19 Mar, 2021	Dr S. Adhikari
Inaugural function on the Workshop on Water day (Value of water) through VC	ICAR-NCIPM, New Delhi	22 Mar, 2021	Dr S.K. Swain
5 <sup>th</sup> Central Standing Committee (CSC) meeting	Department of Fisheries, AH&D, Govt. of India, New Delhi	23 Mar, 2021	Dr S.K. Swain
Virtual 14th Meeting of the Fish, Fisheries and Aquaculture Sectional Committee, FAD 12	BIS, New Delhi	24 Mar, 2021	Dr S.K. Swain Dr K.N. Mohanta Dr P.C. Das
Webinar on Freshwater Pearl Farming	Krishi Vigyan Kendra, Jalna, Maharashtra	5 April, 2021	Dr. S. Saurabh
National Webinar on Freshwater Pearl Farming	ICAR-CIFE, RRC, Kolkata Centre, Kolkata	6 April, 2021	Dr. S. Saurabh
Virtual meeting on Fish Farming program	Sewa International, New Delhi	7 April, 2021	Mr. J. Debberma
"Pre-Conference Webinar - ICFA 2021" organized by The International Institute of Knowledge Management, Pitakotte, Sri Lanka	Virtual	9 April, 2021	Dr S.S. Mishra
Six monthly review meeting of RCM-II (chaired by DDG (FS), ICAR)	Virtual	12 April, 2021	Dr P.V. Rangacharyulu Dr P.K. Sahoo



Review meeting of RCM-VIII	Virtual meeting with ICAR-CMFRI and ICAR-NRRI	12 April, 2021	Dr S.K. Swain Dr P.K. Sahoo Dr Hemaprasanth
Webinar under PMMSY Programme “AZADI KA Amrit MAHOTSAV”	Dept. of Fisheries, Animal Husbandry and Dairying, Govt. of India	12 April, 2021	Dr S.K. Swain
FAO-NORAD online “Technical Seminar on Aquaculture Biosecurity: Understanding Antimicrobial Resistance (AMR) in Aquaculture	FAO-NORAD	13 April, 2021	Dr P.K. Sahoo
FAO-NORAD online “Technical Seminar on Aquaculture Biosecurity: Understanding Antimicrobial Resistance (AMR) in Aquaculture”,	Virtual	13-14 April, 2021	Dr S.S. Mishra Dr P.K. Sahoo
Bharat Ka Amrit Mohatsav ICAR Lecture Series #5 Aquaculture : Avenue for Assuring Fish (Food Security, Income growth, Social Upliftment & Healthy Life delivered by Dr. J. K. Jena, DDG (Fy)	ICAR New Delhi	16 April, 2021	All scientists and Technical Officers
National level virtual stakeholder consultation on “Indian ornamental fisheries 2.0 – The way forward”	ICAR-CIFA in collaboration with MoF&AHD and NFDB	19-20 April, 2021	Dr S.K. Swain Dr B.R. Pillai Dr G.S. Saha Dr I. Sivaraman Dr Sunil K. Ail Dr Mukesh Bairwa Dr S. Ferosekhan
AFS-FHS virtual webinar on “Pathogen-free: Non-infectious diseases and disorders of aquatic animals	AFS-FHS	21 April, 2021	Dr P.K. Sahoo
“National Stakeholder Consultation on “Indian Ornamental Fisheries 2.0 - The Way Forward” - Day 1”. (VIRTUAL MODE)	ICAR-CIFA	22 April, 2021	Dr P. Swain
Webinar on “In-Pond Raceway Aquaculture”	Auburn University, USA	23 April, 2021.	Dr S. Ferosekhan
MASHAV webinar on “Mental Health and Community Resilience” organized by Embassy of Israel	Virtual	26 April, 2021	Dr B. C. Mohapatra
Delivered a lecture in the webinar on “Scientific and Technical Inputs on Breeding of locally important Catfish Species of North-East” under the training programme of “Breeding of locally important fish species of North-East India”	NFDB, NERC-Guwahati	27 April, 2021	Dr S. Ferosekhan Dr S. K. Sahoo



5 <sup>th</sup> meeting of State Level Technical Committee (SLTC) on PMMSY	Virtual DoF, Govt. of Odisha	5 May, 2021	Dr B.C. Mohapatra
Extension Advisory Council Meeting of College of Fisheries, Agartala, Tripura	Virtual	5 May, 2021	Dr H.K. De
SLTC Meeting 'Establishment Of Need Base Brackish Water Hatchery' & 'Construction Of Fish Kiosks'	Dept of Fisheries, Govt. of Odisha Online meeting	5 May, 2021	Dr B.R. Pillai
Webinar on "Design and Construction of Magur Hatchery" under the training programme of "Construction of breeding units for locally important fish species in North East India"	NFDB, NERC-Guwahat	11 May, 2021	Dr S.K. Sahoo Dr S. Ferosekhan
Briefing Meeting to Secretary, DoF, GoI on Ornamental Fisheries	Virtual	12 May, 2021	Dr S.K. Swain
Developing Operational and Economically Sustainable Bio-village in Socially Backward Khammam District, Telangana State"	DBT, GOI, NewDelhi	14 May, 2021	Dr B. S. Giri
Steering Committee meeting for presentation of project proposal	DBT, MoS&T, Govt. of India (virtual mode)	14 May, 2021	Dr B.S. Giri
Gene Editing Workshop: Application to Aquaculture"	Aquaculture Research Collaborative hub, UK	20 May, 2021	Dr Lakshman Sahoo
WorldFish Webinar -Transforming food systems with aquatic foods: Scaling up sustainable production solutions	Virtual	20 May, 2021	Dr S.S.Mishra
Webinar - Antimicrobial Resistance Awareness Programme (ARAP) organized by Microbiologist Society, India and MicroJiviTalks	Virtual	22 May, 2021	Dr S.S. Mishra
SFC presentation	ICAR	24-25 May, 2021	Dr S.K. Swain Dr P.K. Sahoo
Lecture on "Nature and Environment" by Padma Bhushan Dr. Anil P. Joshi, Environmentalist under 'Azadi Ka Amrit Mahotsav'	ICAR	25 May, 2021	Dr S.K. Swain
Webinar on "Application of Sensors in Precision Aquaculture"	Swansea University, UK	25 May, 2021	Dr S. Ferosekhan



USAID Project closure workshop on “Scaling Nutrition-sensitive and Innovative Fisheries Technologies through Partnerships in Odisha, India”	World Fish	28 May, 2021	Dr S.K. Swain Dr B.R. Pillai Dr J.K. Sundaray Dr K.D. Mohapatra Dr P.C. Das Dr D. Panda Dr K. Murmu
Dedication of ICAR Technologies, Varieties to the Farmers and Hackathon Award Ceremony	ICAR	31 May, 2021	Dr S.K. Swain
NACA Webinar on culture-based fisheries for rural development	NACA, Bangkok (Virtual)	31 May, 2021	Dr S.K. Swain Dr S.S. Mishra Dr J.K. Sundaray Dr P.P. Chakrabarti Dr B.S. Giri Dr Rajesh Kumar Mrs P.C. Nandanpawar Dr S. Mohanty Dr B.C. Mohapatra Dr U.L. Mohanty
Lecture on “Food and Dietary concepts of Ayurveda-Indian traditional wisdom of food for better nutrition and Health” by Dr. SK Sharma	ICAR	1 June, 2021	All staff members
“Stakeholder Consultation on the Ban on Culture of African Catfish/Thai Magur <i>Clarias gariepinus</i> ” under the Chairmanship of Shri Sagar Mehra, Joint Secretary (Inland Fisheries), GoI.	ICAR (through VC)	4 June, 2021	Dr S.K. Swain Dr B.R. Pillai Dr S.K. Sahoo Dr S. Ferosekhan
Online Stakeholder Consultation on the Ban on Culture of African Catfish/Thai Magur <i>Clarias gariepinus</i>	Department of Fisheries, Gov. of India	4 June, 2021	Dr B.R. Pillai Dr S.K. Sahoo Dr S. Ferosekhan
Workshop on EFC presentation and preparation through VC	ICAR, New Delhi	4 June, 2021	Dr S.K. Swain
Virtual Conference on “Sustainable Environment	AIMST University, Malaysia	5 June, 2021	Dr B.S. Giri
Virtual programme on “Ecosystem Restoration”	ICAR-CIFRI	5 June, 2021	Dr B.S. Giri
SFC discussion of 3 schemes of Fisheries	SMD, ICAR, New Delhi	5 June, 2021	Dr S.K. Swain Dr P.K. Sahoo
61 <sup>st</sup> Foundation Day of ICAR-CIFE, Mumbai through Zoom	ICAR-CIFE, Mumbai	6 June, 2021	Dr S.K. Swain
Webinar on “Skretting India – Aquacare Launch”		8 June, 2021	Dr B.S. Giri
Meeting on CII Farm2Fork	CII, Odisha	11 June, 2021	Dr N.K. Barik



Interface meeting for enhancing preparedness for Agricultural contingencies during Kharif 2021 for Odisha State	Dept. of Agri & Farmers Welfare, Govt. of Odisha	11 June, 2021	Dr H.K. De
Consultation meeting with ICAR-CIFE team on hatchery production of <i>M. rosenbergii</i> seed	ICAR-CIFE, (Virtual)	15 June, 21	Dr B.R. Pillai Dr D. Panda
Webinar on “Fish4 Thought: sustainable, accessible fish feeds for small-scale fish farmers”	WorldFish Centre, Kuala Lumpur, Malaysia	17 June, 2021	Dr S.K. Swain
ITMC-meeting, ICAR-Directorate of Foot and Mouth Disease by Virtual Mode	ICAR-DMFD	17 June, 2021	Dr P. Swain
Farmers’ Awareness Meeting on Balanced use of Fertilizers in Freshwater Aquaculture	Virtual	18 June, 2021	Dr G.S. Saha Dr H.K. De Shri D.P. Rath Shri S. Gudipudi
The Launch of Customized Crash Course for Healthcare Workers by Hon’ble Prime Minister organized by Ministry of Skill Development and Entrepreneurship, Government of India	Virtual Ministry of Skill Development and Entrepreneurship, GoI	18 June, 2021	All scientific and administrative staff
“Farmers’ Awareness Meeting on Balanced Use of Fertilizers in Freshwater Aquaculture”	ICAR-CIFA and KVK-Khordha, (Virtual)	18 June, 2021	All Scientists and Technical Officers
National Awareness Programme on “Biofloc Culture”	College of Fishery Science, Jabalpur	19 June, 2021	Dr B.S. Giri
Virtual meeting on Fish seed stocking	Government of Telangana	19 June, 2021	Dr B.S. Giri Dr Ajit Chaudhari
Online lecture on Publication in International Journals delivered by Bhagirath Singh Chauhan, Professor (Weed Science), The University of Queensland, Australia	Virtual CCSHAU, Hisar	23 June, 2021	Dr K.N. Mohanta
Webinar on ‘Brood stock Management of Genetically improved Fish Species’	Virtual	23 June, 2021	Dr B.R.Pillai
Fish Nutrients - Launching an innovative new tool to help address malnutrition, launch with Dr. Daniel Paul, and Dr. Shakuntala Thilsted, the 2021 World Food Prize Laureate.	Virtual	23 June, 2021	Dr S.S.Mishra
Webinar on ‘Brood stock Management of Genetically improved Fish Species’	NFDB-NFFBB, Virtual	23 June, 2021	Dr B.R.Pillai



Webinar on Freshwater Pearl Farming	E-Matsya Choupal KVK, Nalanda, Bihar	25 June, 2021	Dr S. Saurabh
Expert participation in Webinar on 'Fish Cognition' organized by Federation of Indian Animal Protection Organizations (FIAPO),	Virtual	25 June, 2021	Dr S.S.Mishra
Meeting on 'Promotion of scampi culture in India'	Dept of Fisheries, Gov. of India (Virtual)	27 June, 2021	Dr B.R. Pillai
Meeting on 'Procurement of Goods using GEM'	Virtual	30 June 2021	Dr K.N.Mohanta, Dr K.C.Das, Dr Siddaiah GM, Mrs Rakhi Kumari
ICAR Directors' Conference	ICAR, New Delhi	2 July, 2021	Dr S.K. Swain Shir I.B. Kumar
Webinar/motivational talk on "Principles to make a synergy amongst physical, mental and spiritual health: A way forward to mitigate stress and positive thinking in work life" by Swami Atmapriyananda, Pro-Chancellor, RKMVERI, Belur Math, Kolkata	ICAR-NDRI	3 July, 2021	All staff members of ICAR-CIFA
Interaction Meeting on 'Promotion of Scampi Polyculture in Cluster Approach'	Virtual	3 July, 2021	Dr B.R.Pillai
Virtual meeting with Fisheries Officials and Leading farmers of Odisha, Jharkhand, Chhattisgarh and Madhya Pradesh on promotion of scampi culture with cluster approach (Chaired by Joint Secretary (Inland Fisheries), Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying)	Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, New Delhi	3 July, 2021	Dr B.R. Pillai
Prospects of Catfish Farming in Punjab	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana	10 July, 2021	Dr. S.K. Sahoo Dr S. Ferosekhan
National Fish Farmers Day Dr.Shakuntala Haraksingh Thilsted, 2021 World Food Prize Laureate - Chief Guest Dr. J.K. Jena, DDG(FS), ICAR- Guest of Hounour	ICAR-CIFA	10 July, 2021	Director & all Staff Members
Fish Seed Committee Meeting	Govt. of Telangana, Hyderabad	10 July, 2021	Dr B.S. Giri



Prospects of Catfish Farming in Punjab'	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana	10 July, 2021	Dr S.K. Sahoo Dr S. Ferosekhan
National webinar on "Harnessing Aquaculture Delivered a talk on "Indigenous ornamental fishes: A possible Game Changer for India Ornamental Fisheries	Dr. Jayalalitha Fisheries University, Ponnerie, Tamil Nadu	14 July, 2021	Dr S.K. Swain
National Seminar on 'Strategies for enhancing quality of fish seed from freshwater hatcheries'	CoF, Dholi, Bihar (Virtual)	14 July, 2021	Dr P.K. Sahoo
Towards new feed for sustainable aquaculture" in virtual mode	NAHEP-CAAST, ICAR-CIFE, Mumbai	15 July 2021	Mr N.K. Chandan Mrs Rakhi Kumari Dr Siddiaiah, G.M.
Brainstorming meeting on "Valuation of Technologies of Induced Fish Breeding and Carp polyculture"	DDG (FS), ICAR, New Delhi	15 July, 2021	Dr S.K. Swain Dr Bindu R. Pillai Dr K.D. Mahapatra Dr P.K. Sahoo Dr P. Routray Dr P.C. Das Dr N.K. Barik
Participated in the NFDB Online training on "Biofloc Technology & its applicability in North East India"	NFDB, Hyderabad	15-16 July, 2021	Dr. S. Ferosekhan
93 ICAR Foundation Day Secretary, DARE & DG, ICAR interact with all Padmashree Awadee	ICAR, New Delhi	16 July, 2021	Director and all scientific and technical officer
Invited lecture on the Webinar on Advancement in Finfish seed production for SMART Aquapreneurship	College of Fisheries, Agartala, Tripura	13-17 July 2021	Dr S.K. Sahoo Dr S. Ferosekhan Dr Rajesh Kumar
"Advancement in Finfish seed production for SMART Aquapreneurship	College of Fisheries, Agartala, Tripura	13-17 July, 2021	Dr S.K. Sahoo and Dr S. Ferosekhan
National Awareness Programme on Entrepreneurship Development opportunities in Ornamental Fishery" as Keynote Speaker	Netaji Deshmukh Veterinary Science University, Jabalpur, MP	19 July, 2021	Dr S.K. Swain



Fisheries - PMMSY - SLC meeting	Dept. of Fisheries, Andhra Pradesh	19 July, 2021	Dr P.V. Rangacharyulu
International symposium on 'Harnessing the potentials of genome editing tools to augment the productivity and health of farm animals' organized by NDRI, Karnal	Virtual	19-20 July, 2021	Dr P.K. Sahoo
Organic fish farming meeting	Dept. of Fisheries, Andhra Pradesh	20 July, 2021	Dr P.V. Rangacharyulu Dr Ramesh Rathod
Delivered Lecture State Level Webinar on celebration of "Youth Skill-Week" on "How Rural Youth can be entrepreneur by freshwater aquaculture"	Nehru Yuva Kendra Sangathan, Orisha and NGO in collaboration with UNICEF - Odisha	20 July, 2021	Dr S.K. Swain
Delivered lecture on the topic 'Importance and conservation of mangroves' in the National Webinar 'Mangroves- The coastal guard'	IQAC, Bangabsi Morning College, WB	20 July, 2021	Dr R.N. Mandal
Meeting with DDG (FS) & all Fisheries Institute Directors Agenda: To extend the support to Bihar State	DDG (FS), ICAR, New Delhi	20 July, 2021	Dr S.K. Swain Dr P.C. Das
Online Meeting of District Level RSETI Advisory Committee (DLRAC) / Project Monitoring Committee (PMC) of Ramakrishna Mission Samaj Sevak Sikshan Mandir for the quarter ending June 2021	Ramakrishna Mission Samaj Sevak Sikshan Mandir, Belur Math	22 July, 2021	Dr S. Adhikari
Fisheries and entrepreneurship opportunities as a part of ICAR-NRRI organised programme		23 July, 2021	Dr H.K. De
APICOL 71st Board of Directors Meeting	APICOL, Bhubaneswar	23 July, 2021	Dr S.K. Swain
National Awareness program on genetically improved freshwater prawn 'CIFA-GI Scampi'	Virtual	27 July 2021	Dr.K.N.Mohanta
Zonal Workshop on Aquaculture Technologies	Zone IX, Jabalpur	28 July, 2021	Dr H.K. De
Invited as an Expert to deliver a talk on "Seed Production of Catfishes in India with special reference to desi Magur"	Department of Fisheries, Ministry of FAH&D, New Delhi, Gol	29 July, 2021	Dr S. Ferosekhan Dr S. K. Sahoo



National Webinar on “Precision Techniques in Protected Cultivation” organized by AICRP on PEASEM, Dept. of Soil Water Engineering, CTAE, MPUAT, Udaipur, Rajasthan	Virtual	29 July, 2021	Dr B. C. Mohapatra
FAO Virtual Training Course on Surveillance and Monitoring of Antimicrobial Resistance in Aquaculture	Virtual	26-30 July, 2021	Dr S. S. Mishra Mr S. N. Sahoo
22 nd meetings of Scientific Panel on Genetically Modified Organisms and Foods	FSSAI, Govt. of India	3 Aug, 2021	Dr H.K. Barman
NASF – Hilsa Project Meeting	ICAR-CIFRI, Barackpore	3 Aug, 2021	Dr S.K. Swain Dr D.N. Chatopadhyay
Platinum Jubilee Lecture Series of ICAR-CIFRI, Barrackpore Speaker: Dr. S.Ayyappan, Former DG, ICAR	ICAR-CIFRI, Barackpore (Virtual)	3 Aug, 2021	All staff members of ICAR-CIFA
Virtual meeting of the SAARC regional consultation meeting on “Cross-learning for Thematic Regional/ Sub-regional Challenges in Aquaculture and Fisheries”	Virtual	3-4 Aug, 2021	Dr P.C. Das
Participated Fish Health Section, Asian Fisheries Society Webinar on “Fish vaccination: Theory, Innovations and Application”	Virtually in Bangkok, Thailand	4 Aug, 2021	Dr S.S.Mishra Dr P.K. Sahoo
CAS meeting of ICAR-CCARI	ICAR-CCARI, Goa	5 Aug, 2021	Dr S.K. Swain
Delivered a lecture on freshwater pearl culture technology in the webinar	Agriculture Information, Vadamalai Media Group, Bengaluru	5 Aug, 2021	Dr S. Saurabh
Webinar on Fish 4 thought	World fish Centre Malaysia	12 Aug, 2021	Dr S.K. Swain
ASSOCHAM’s Webinar on “Severe Acute Malnutrition”	ASSOCHAM, New Delhi	12 Aug, 2021	Dr B.C. Mohapatra
Inauguration of one day virtual workshop on BMPs for quality Fish Seed Production”	ICAR-CIFA	13 Aug, 2021	Dr S.K. Swain
Meeting regarding technical guidance to ECRICC Project with Key Members of ECRICC Project, SPMU, Odisha	ICAR-CIFA	13 Aug, 2021	De S.K. Swain Dr B.R. Pillai Dr S. Saurabh Dr Sunil Ail
Webinar on Freshwater Ornamental Fish Breeding & Shrimp Culture of <i>L. Vannamei</i>	Marsco& Manage, Hyderabad	13 Aug, 2021	Dr Ramesh Rathod



Delivered expert lecture on “Genetically upgraded aquaculture” in the Virtual Lecture workshop on Sustainable Aquaculture Technologies (SAT 2021) sponsored by RUSA (MHRD) Govt of India, New Delhi	Bharatidasan University, Tamil Nadu	14 Aug, 2021	Dr J.K. Sundaray
National training programme on “Statistical tools in research and data analysis”	College of Veterinary and Animal Science, Parbhani, Maharashtra	9-14 August, 2021	Dr Laxshman Sahoo
23rd meetings of Scientific Panel on Genetically Modified Organisms and Foods	FSSAI, Govt. of India	17 Aug, 2021	Dr H.K. Barman
Meeting on status of pangasius breeding and culture	NFDB, Hyderabad	17 Aug, 2021	Dr S. Ferosekhan Dr B. S. Giri Dr A.K. Chaudhari
Presented a lecture in the virtual meet on “Breeding and seed rearing of <i>Pangasianodon hypophthalmus</i> ”	NFDB, Hyderabad	17 Aug, 2021	Dr S. Ferosekhan Dr B.S. Giri
29 <sup>th</sup> Meeting of National Committee on Introduction of Exotic Aquatic species into Indian waters	DAHDF, New Delhi	19 Aug, 2021	Dr S. Ferosekhan
Delivered a special lecture on “Quest of DNA Signature: PIN code for Species Identification” during the online Faculty Development Program on “The Heterogenous Perspectives of Life Sciences”	Holy Cross College, Tiruchirappalli (in collaboration with Career College, Bhopal)	19 Aug, 2021	Dr P.K. Meher
XXVI meeting of ICAR-Regional Committee Meeting-VII	ICAR, New Delhi	25 Aug, 2021	Dr S.K. Swain
Presented an invited talk on “Major disease problems in freshwater aquaculture and its management” in a special webinar conducted during Bharat ki Azadi ka Amrit Mahostava Celebration	DoF, Ministry of FAHD, Gol	28 Aug, 2021	Dr P.K. Sahoo
Inception meeting “Blue transformation in inception meeting”	NACA, Bangkok, Thailand	30 Aug, 2021	Dr S.K. Swain
National Campaign on System Diversification in Aquaculture	Virtual	01 Sept, 2021	Dr P. Choudhary
<i>Azadi Ka Amrit Mahotsav</i> System Diversification in Aquaculture	ICAR-CIFA	1 Sept, 2021	Scientists and Technical staff
Meeting with Dean, College of Agriculture, Narayanpur, Chhatisgarh	ICAR-CIFA	2 Sept, 2021	Dr S.K. Swain Dr S. Saurabh Dr Sunil Ail
CAS Meeting	ASRB, New Delhi	10 Sept, 2021	Dr P. Das



Technology Entrepreneurship Development Programme - Biofloc & Innovative Fish Farming Technology (Sponsored by Department of Science & Technology, Govt of India)	AIC- Bihar Vidyapith	13 Sept, 2021	Dr K.N. Mohanta
Regional Committee Meeting –VIII	ICAR-CMFRI, Cochin	14 Sept, 2021	Dr P. Das Dr Hemaprasanth
Board of Studies meeting at KBN college, Vijayawada	KBN College, Vijayawada	14 Sept, 2021	Dr Ramesh Rathod
FICCI Meeting	FICCI, New Delhi	15 Sept, 2021	Dr I. Sivaraman
Blue Transformation inception Meeting	NACA, Bangkok, Thailand	15 Sept, 2021	Dr S.K. Swain
Delivered an Invited talk on the topic of Freshwater Fisheries and Freshwater Aquaculture for Sustainable Development	Fisheries Technocrat Forum, Chennai	15 Sept, 2021	Dr J.K. Sundaray
Webinar on “Stock Improvement of Indian Major carps for quality seed production”	NFFBB, Kausalyaganga	16 sept, 2021	Dr P. Routray
Delivered talk on Disease management in Freshwater Aquaculture	SIFT, Kakinada, AP	17 Sept, 2021	Dr S.S. Mishra
“Nutricereals Multi-stakeholders Mega Convention, and Poshan Vatika and Tree Plantation Campaign Event for International Year of Millets 2023” organized by ICAR-IIMR-Hyderabad	Virtual (ICAR-IIMR-Hyderabad)	17 Sept, 2021	Dr S.S.Giri Dr K.N.Mohanta Dr K.C.Das Dr Siddaiah GM Mrs. Rakhi Kumari Mr N.K.Chandan Dr U.L. Mohanty
Technology Entrepreneurship Development Programme - Biofloc & Innovative Fish Farming Technologies (Virtual)	AIC-Bihar Vidyapith (Supported By Atal Innovation Mission, NITI Aayog, GOI)	17 Sept, 2021	Dr S. Saurabh
Rashtriya Poshan Maah 2021-Webinar “Fish As Nutritional Food”	NFDB and Ministry of Fisheries, Animal Husbandry and Dairying, GoI	17th September 2021	Scientists and Technical Officers
AP Fisheries - PMMSY - SLAMC meeting organized by Dept. of Fisheries, Vijayawada, AP.	Dept. of Fisheries, Vijayawada, AP	21 Sept, 2021	Dr P.V. Rangacharyulu



Virtual Meeting to finalize the fish feed standard	BIS, New Delhi	21 Sept, 2021	Dr S.S.Giri Dr K.N.Mohanta Dr Siddaiah GM Mrs Rakhi Kumari
Interface Meeting of Odisha (Instt's-SAUs-State Departments)	ICAR-NRRI, Cuttack	22 Sept, 2021	Dr J.K. Sundaray
Valedictory session of TEDP - Biofloc & Innovative Fish Farming Technologies AIC- B V Foundation	AIC- BV Foundation, Bihar	22 Sept, 2021	Dr S.K. Swain Dr P.C. Das
Presented an invited lecture on "Health management in freshwater prawn culture" in National Online Training Program on "Breeding, seed production and culture of freshwater prawn"	Virtual (ICAR-CIFA)	21-23 Sept, 2021	Dr P.K. Sahoo
30th Meeting of National Committee on Introduction of Exotic Aquatic Species into Indian Waters	Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, New Delhi	23 Sept, 2021	Dr P.C. Das
ASSOCHAM Meeting	Associate Chambers of Commerce, New Delhi	24 Sept, 2021	Dr S.K. Swain
Preparatory meeting of SFC	DDG (FS), ICAR, New Delhi	27 Sept, 2021	Dr S.K. Swain Dr P.K. Sahoo
Guest lecture in the Webinar on "Domestic Fish Consumption: Supporting Food & Nutritional Security in the North Eastern States of India"	NFDB Regional Centre, NIRD Campus, Guwahati	27 Sept, 2021	Dr P.C. Das
National Webinar on "Emerging challenges of aquaculture"	Vyasnagar Autonomous College, Jajpur, Odisha	29 Sept, 2021	Dr P. Routray
ITMC meeting	ICAR-CIFA & Virtual platform	29 Sept, 2021	Dr N.K. Barik
ISEE National Seminar	BHU, Varanasi	4-6 Oct, 2021	Dr H.K. De
Foundation Stone laying of multi facility training complex, vertical extension of Institute main building and ICPM facility at ICAR-CIFRI, Barrackpore in the presence of Dr. Trilochan Mohapatra, Honorable Director General, ICAR and Secretary DARE; Dr. J. K. Jena, DDG (FY) and Dr. B. K. Das, Director, CIFRI	ICAR- CIFRI, Barrackpore	6 Oct, 2021	All scientists of RRC, ICAR-CIFA, Rahara



Delivered guest lecture on Culture of commercial important freshwater fishes in plastic lining farm pond	Krishi Fisheries Agro pvt ltd. and Growel feeds ltd., Dist. Aurangabad, Maharashtra	7 Oct, 2021	Dr A.K. Chaudhari
Attended Review and Sensitization Workshop (NAIF Scheme) for ICAR Fisheries Institutes organized virtually by IPTM unit of ICAR	ICAR-CIFT	08 Oct, 2021	Dr P.K. Sahoo Dr P. Swain
Sectional Committee on Fisheries Sciences of NAAS, New Delhi	Virtual	09 Oct, 2021	Dr P.K. Sahoo
Participated as Expert Lecture in the Fisheries Officers Workshop	GADVASU, Ludhiana	9 Oct, 2021	Dr S.K. Swain
Delivered guest lecture on Basics of fish rearing techniques to tribal people of Palghar District of Maharashtra	BIAF Institute for Sustainable Livelihoods and Development, Jawhar District Maharashtra	11 Oct, 2021	Dr A.K. Chaudhari
Interaction meeting with ICAR-CIFA Scientists and Investor (CYAN Fisheries)	ICAR-CIFA, Bhubaneswar	12 October 2021	Dr S.K. Swain Dr B. R. Pillai Dr S. K. Sahoo Dr P. C. Das Dr Rajesh Kumar Dr S. Saurabh
Ph.D. Viva-voce of student of ICAR-CIFE, Mumbai	ICAR-CIFE, Mumbai	13 Oct, 2021	Dr S.K. Swain
World Food Day workshop. Topic: "Monosex tilapia: Emerging candidate species for food security"	Krishi Vigyan Kendra, Khordha, Odisha.	16 Oct, 2021	Dr P. Routray
Sensitization Workshop (virtual mode) on ARMS and Monthly Reporting in ICAR-Institutions	ICAR-IISWC	18 Oct, 2021	Dr K.C. Das
ICAR W3 2021 Work and progress Meeting	World Fish Centre, Malaysia	22 Oct, 2021	Dr S.K. Swain Dr B.R. Pillai Dr K.D. Mahapatra Dr B.S. Giri Dr D. Panda Dr K. Murmu Sh Avinash Rasal
NAAS Journal Score Committee meeting as a Member	Virtual	22 Oct, 2021	Dr P.K. Sahoo



13 <sup>th</sup> Annual Meeting of Proteomics Society, India and International Virtual Conference (OMICS-2021) on theme 'Omics in Redefining Biology'	Proteomics Society, India (PSI) in collaboration with CSIR-CCMB & CCMB Science Foundation	21-23 Oct, 2021	Dr J. Mohanty
Interactive Workshop and Awareness Programme on Recent Advances in Carp Culture Practices	RRC-CIFA, Vijayawada at Chilkur, Suryapet District, Telangana	26 Oct, 2021	Dr P.V. Rangacharyulu Dr H.K. De Dr B.S. Giri Dr Ramesh Rathod Dr Ajit K. Chaudhari
Review Meeting on Special campaign Chaired by Hon'ble Agriculture Minister	ICAR, New Delhi	27 Oct, 2021	Dr S.K. Swain Shri I.B. Kumar Shri N.K. Chandan
Virtual Interaction meeting of DG, ICAR with scientists of ICAR	Virtual	28 Oct, 2021	Dr S.S.Giri Dr K.N.Mohanta Dr K.C.Das Dr Siddaiah GM Mrs Rakhi Kumari Mr N.K. Chandan
Interaction Meeting with DG ICAR & Secretary, DARE with Scientists of ICAR Institutes	ICAR, New Delhi	28 Oct, 2021	All Scientists of ICAR-CIFA
Platinum Jubilee Virtual Lecture Series on "Indian Fisheries-Introspection to Course Correction"	Virtual	28 Oct, 2021	Dr K.N.Mohanta
4th Annual Review Meeting of INFAAR	Virtual	29 Oct, 2021	Dr S. S. Mishra Dr P. Swain Mr S. N. Sahoo
Virtual Interaction meeting of DG, ICAR with scientists of ICAR	Virtual	3 Nov, 2021	All Scientist of ICAR-CIFA
Second meeting of the Committee to review the Establishment and Operation of shrimp Nucleus Breeding Centers (NBCs) and Broodstock Multiplication Centers (BMCs) in the country conducted by Coastal Aquaculture Authority & DoF, GoI	Virtual	5 Nov, 2021	Dr P.K. Sahoo
Participated in the Sensitization and interaction session with farmers on Integrated Model of Orchid and Fish Culture under NEH programme at ICAR-NRC on Orchids, Sikkim	ICAR-CIFA under NEH Programme	8-9 Nov, 2021	Dr S.K. Swain Dr P.P. Chakraborti Dr P. Routray



Participated in ICAR Lecture series Speaker: Dr. C.D. Mayee	DDG (Agril. Extension), ICAR, New Delhi	11 Nov, 2021	Dr S.K. Swain
Webinar on Talent Search for Manning Agriculture TREE (teaching, research and extension education)	Virtual	11 Nov, 2021	Dr B.R.Pillai
District Level RSETI Advisory Committee (DLRAC) / Project Monitoring Committee (PMC) Meeting of Ramakrishna Mission Samaj Sevak Sikshan Mandir for RSETI activities for the quarter ending September 2021	Ramakrishna Mission Samaj Sevak Sikshan Mandir, Belur	11 Nov, 2021	Dr S. Adhikari
Invited lecture on “Waste to Wealth for Food Production” in the Online induction program for newly admitted engineering students of Aliah University, Kolkata	Institute Induction Program Cell (IIPC), Aliah University, Kolkata	11 Nov, 2021	Dr Farhana Hoque
Expert member for review of Research and Development in Odisha	DST, Govt Odisha	11-12 Nov, 2021	Dr J.K. Sundaray
International Virtual Inception Workshop on Taking nutrition-sensitive Carp-SIS polyculture technology to scale	Virtual	16 Nov, 2021	Dr B.R. Pillai
Lecture on ‘Farm made Feed’ in the Training program on ‘Feed technology for sustainable aquaculture’ for the officers of Kerala state Fisheries Department	ICAR-CIFA HQ	16 Nov, 2021	Dr B.N. Paul
National Webinar on Antimicrobial Resistance (AMR) & One Health	ICAR-CIFA, Bhubaneswar Virtual	18 Nov 2021	Scientists and technical staff
FAO-FAVA World Antimicrobial Awareness Week event, organized by Food and Agriculture Organization, of the United Nations (FAO), Regional Office for Asia and the Pacific (RAP), Bangkok 10200 THAILAND	Virtual	18 Nov, 2021	Dr S.S.Mishra
ICAR Steering Committee meeting on Network Project on Precision Agriculture (NePPA)	IIWM, Bhubaneswar	19 Nov, 2021	Dr S.K. Swain Dr P. Routray Dr S. Ferosekhan Dr Sunil Ku. S Ail
International Symposium on “Sustainable Fisheries: Revolution in Blue Economy (ISSF-2021)	Amity University, Noida	20-21 Nov, 2021	Dr P. Das Dr L. Sahoo Mrs P. Nandanpawar
National Seminar on Overcoming the challenges: Role of Science and technology	Ravenshaw University, Cuttack	20-21 Nov, 2021	Dr J.K. Sundaray



World Fisheries Day (organized by NFDB, Hyderabad and Dept. of Fisheries, Govt. of Odisha)	Rail Auditorium, Bhubaneswar	21 Nov, 2021	Dr S.K. Swain Dr B.R. Pillai Dr K.D. Mahapatra Dr I Sivaraman Dr S. Ferosekhan Dr Sunil Ku. Ail Dr Avinas Rasal
Virtual YouTube Live Phone-in programme and providing solutions to the queries of fish farmers on the occasion of World Fish Day, 2021	Reliance Foundation, Odisha	21 Nov, 2021	Dr C.K. Misra
Webinar on “Antimicrobial Resistance in Fish”	ICAR-CIFE, Mumbai	22 Nov, 2021	Mr J. Debbarma
Participated in the ICAR Lecture Series “Emerging diseases and our immunity” Speaker- Dr. Chandrima Shaha, President - Indian National Science Academy, New Delhi	DDG (Agril. Extn), ICAR, New Delhi	23 Nov, 2021	Director and other staff members of the Institute
ITMC Meeting	Virtual mode	23 Nov, 2021	Dr N.K. Barik
ICAR Lecture Series “Emerging diseases and our immunity” (Speaker- Dr. Chandrima Shaha, President - Indian National Science Academy, New Delhi )	DDG (Agril. Extn), ICAR, New Delhi	23 November 2021	Dr S.K. swain Dr P. Choudhary Mr J. Debberma Dr U.L. Mohanty
TCP/RAS/3702 “Support Mitigation of Antimicrobial Resistance Risk Associated with Aquaculture in Asia”	Zoom	23-24 Nov, 2021	Dr S.S. Mishra Dr S.N. Sahoo
Webinar on “The relevance of constitution in our life”	ICAR, New Delhi	25 Nov, 2021	All the staff members of ICAR-CIFA
National Webinar on “Selective breeding for sustainable growth of aquaculture and way forward in India”	Webinar (virtual Mode)	Nov 25, 2021	All scientific and technical staff members
Webinar on Mitigating Antimicrobial Resistance in One Health	NITTE, Delhi University	26 November 2021	Dr S. K. swain Dr S.S. Mishra Dr P.K. Sahoo Dr P. Choudhary Dr U.L. Mohanty
NACA Governing Council Meeting (GCM 31)	NACA, Bangkok	29-30 Nov, 2021	Dr S.K. Swain Dr P.K. Sahoo
Attended 5th DBT-NER Scientific and Technical Appraisal and Advisory Group (STAG) in the area of Agriculture, Animal and Allied Sciences for North East Region as Expert Member	Virtual	30 Nov, 2021	Dr P.K. Sahoo
APICOL Board of Directors Meeting	APICOL, Bhubaneswar	1 Dec, 2021	Dr S.K. Swain



Joint Official Language Conference	Dibrugarh, Assam	8 Dec, 2021	Dr D.H. Verma
Interaction meeting of DG, ICAR with Young Scientists of ICAR	ICAR, New Delhi	8 Dec, 2021	Young Scientists of ICAR-CIFA
Virtual Hindi workshop subject : Use of simple Hindi in official work”	ICAR-Central Institute of Women in Agriculture, Bhubaneswar.	8 Dec, 2021	Dr D.K. Verma
Meeting with DDG (FS), ICAR and ADG (I.Fy), ICAR, New Delhi for finalization of SFC, Budget utilization under SCSP/TSP scheme. Discussed with ITPM Cell, ICAR regarding Technology commercialization	ICAR, New Delhi	9 Dec, 2021	Dr S.K. Swain
Regional Committee Meeting-III (RCM-III)	ICAR, New Delhi	11 Dec, 2021	Dr S.K. Swain Dr P.P. Chakraborti Dr P. Das
IBSC meeting of IIT, Bhubaneswar as DBT Nominee	IIT, Bhubaneswar	14 Dec, 2021	Dr P.K. Sahoo
Awareness Workshop on “Genetically Improved Variety of Carps and Freshwater Prawn for Higher Production and Income”	ICAR-CIFA in Collaboration with Kalong Kapili in Sonarpur, Assam	15 Dec, 2021	Dr B.R.Pillai Dr K.D.Mahapatra Mr Avinash Rasal
Valedictory function of Vibrant Gujarat Summit addressed by Hon’ble Prime Minister of India	VC live streaming	16 Dec, 2021	All the staff members
Joint Official Language Conference and Prize Distribution Ceremony of East and North Eastern Regions, Dibrugarh, Assam on 18th December, 2021	Dibrugarh, Assam	18 Dec, 2021	Dr D.K. Verma
Awareness Workshop on “Genetically Improved Variety of Carps and Freshwater Prawn for Higher Production and Income”	ICAR-CIFA in Collaboration with Sasya Shyamala KVK, Sonarpur	18 Dec, 2021	Dr S. Adhikari Dr F. Hoque Dr K. Murmu Dr D.Panda Dr S. Sarkar
Attend one day review meeting –cum workshop on on-going fisheries development activities in Nagaland	ICAR-CIFA in association with Directorate of Fisheries, Govt. of Nagaland	19 Dec, 2021	Dr S.K. Swain Dr P.P. Chakraborti Dr K.C. Das Dr S. Saurabh Shri I.B. Kumar Shri Arabinda Das



## 14. DISTINGUISHED VISITORS

### *Kausalyaganga, Bhubaneswar*

- Dr J.K. Jena, DDG (FS), ICAR, New Delhi visited ICAR-CIFA and interact with all scientists during 6-8 February, 2021.
- Dr. Sanghamitra Pati, Director, ICAR-RMRC, Bhubaneswar and Dr. Swapnita Hota, Asst. Professor (O&G), Hi-Tech Medical College and Hospital delivered talks on “COVID crisis management in Odisha” and “Gynecological issues and its management” respectively on 6 March, 2021 on the eve of International Women’s Day, 2021.
- Dr J.K. Jena, DDG (FS), ICAR, New Delhi visited ICAR-CIFA and interacted with the scientists on 15 March, 2021.
- Dr. C. Suvarna, Chief Executive, NFDB, Hyderabad visited the Institute on 25 March, 2021.
- Dr J. K. Jena, DDG (FS), ICAR, New Delhi had visited the Institute during 6-8 September, 2021 and interacted with Scientists, Technical Officer and Administrative Staff.
- Dr J. K. Jena, DDG (FS), ICAR, New Delhi had visited RRC, Rahara and Moyna, Purba Medinipur fish farming hub in West Bengal on 9 October 2021.
- Interaction meeting of team from French Development Agency (FDA), New Delhi with Director and expert scientists of ICAR-CIFA on 20 October, 2021.
- Dr B.P. Mohanty, Assistant Director General (In.Fy), ICAR visited the Institute farm facilities and interacted with scientists during 8-9 November, 2021.
- Shri Jatindra Nath Swain, IAS, Secretary, Department of Fisheries, AH&D, GoI and Dr J.K. Jena, DDG (FS), ICAR visited the Institute farm facilities and interacted with scientists and staff members of the Institute during 20-21 November, 2021.





## 15. FLAGSHIP SCHEMES OF GOVT. OF INDIA

### MEGA GAON MERA GAURAV SCHEME

Under MGGM, six programmes in Balianta and Balipatna block of Khordha district were conducted during 2021. Multidisciplinary team of scientists visited the selected villages and advised farmers on production related problems. The scientist team also educated the farmers about scientific practices of fish farming and different vegetable crops like thermo insensitive variety of cauliflower var. *Fujiyama*, bush type french bean var.

*Falguni* etc. Around 124 farmers and farm women were benefitted from the scientists-farmers interfaces. These interfaces were organised to create awareness regarding the importance of adopting scientific practices for higher production and to maintain the quality of the produce. Farmers made aware about lime and manure application through soil & water analysis and application of feed by body mass measurement. Farmers were also provided with relevant extension literature.



### SWACHH BHARAT

ICAR-CIFA is actively implementing the Swachh Bharat Abhiyan programme since implementation of the same by Government of India.

### Swachhta Pakhwada

The institute had observed the Swachhta Pakhwada (16-31 December 2021), which

was initiated taking pledge by all the staff of the institute on 16 December 2021. During this fortnight many cleanliness activities were made at different villages around ICAR-CIFA awareing the villagers regarding maintaining cleanliness for healthy life. The different competitions were organised among the school and college students.





## 16. PROMOTION OF OFFICIAL LANGUAGE

### CELEBRATION OF HINDI PAKHWADA

Hindi Pakhwada Celebrations were organized in ICAR-CIFA, Bhubaneswar from 14<sup>th</sup> to 28<sup>th</sup> September, 2021. Prof. Prakash Chandra Agrawal, Principal, Regional Institute of Education, Bhubaneswar was invited as a chief guest on the occasion of the inauguration of Hindi Pakhwada celebration on 14 September 2021. While addressing the gathering, Prof. Prakash Chandra Agrawal stressed upon the use of Hindi along with regional language in daily life. Hindi Diwas

celebrations were started with the ICAR song. Shri V Ganesh Kumar, Administrative Officer, ICAR-CIFA presented welcome address on this occasion and in his address he urged all the employees to use more and more techniques to make use of Hindi conveniently in office work. On this occasion, Shri I.B. Kumar, Senior Administrative Officer, ICAR-CIFA said in his address that on the occasion of Hindi Diwas, all of us should take a pledge that we will make continuous efforts for the overall progress of Hindi.





During this 15-day event, various types of competitions such as debate, essay writing in Hindi, Hindi typing in Unicode on computer, Hindi poetry recitation, Hindi aashubhashan, etc. were organized to make people aware to do official work in Hindi. was done. During the Pakhwada celebrations, an exhibition of books published by the institute in Hindi was organized in the library of the institute during 18-21 September, 2021, which was inaugurated by Dr. Saroj Kumar Swain, Director on 18 September, 2021. He appreciated this book exhibition and said that this step will play an important role in the spread of official language. He stressed on the need of technical books in official language Hindi, so that availability of books in Hindi to the aquaculture farmers will enable him to contribute to the Blue Revolution by enhancing technical knowledge.

On 25<sup>th</sup> September, 2021 the Hashya Kavi Sammelan was also organized, in which the scientists, technical officers and administrative officers of the institute mesmerized the audience by presenting humorous poems. The closing ceremony of Hindi Pakhwada was organised on 28 September 2021 under the chairmanship of Dr. Saroj Kumar Swain, Director of the Institute and prizes were distributed to the winners of various Hindi competitions by the Director of the institute. He congratulated all the winners of various Hindi competitions and urged the people to try to do their official work in the official language as much as possible. Dr. D.K. Verma, Rajbhasha Adhikari, ICAR-CIFA played an important role in the successful conduct of the 15-day Hindi Pakhwada program and presented a detailed report of various programs organized during the concluding ceremony. A large number of scientific, technical officers, administrative

officers of the institute participated in the Hindi Divas celebration program.

## **HINDI WORKSHOP ORGANIZED**

### **Rajbhasha Quarterly Workshop (Q-1)**

ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar organized Hindi workshop in the conference Hall following the guidelines of Covid 19 on 12th March 2021 to promote the progressive use of Official Language Hindi and to comply with the Acts, Rules and Orders related to Official Language. The theme of the workshop was “Incentive Schemes and Online Registration for Hindi Training”. A large number of officers and employees participated in this workshop. The program started with the ICAR song. Dr D K Verma, Rajbhasha Adhikari presented the welcome address and coordinated the programme.

Dr. Saroj Kumar Swain, Director, ICAR-CIFA in his presidential address said that it is our constitutional obligation to work in the official language and stressing on the importance of such programs, emphasizing on doing maximum work through the medium of Hindi language. The Chief Administrative Officer stressed on the use of simple, comprehensible and easy words in his official work and said to ensure compliance of the orders related to the official language. During the workshop, the in-charge official language made a presentation on promotion schemes and online registration of Hindi training. He provided brief information about the financial incentives to the employees of the Central Government and training programs like online, correspondence etc. of various courses to be run in the year 2021 in Central Hindi Training Institute, New Delhi, Sub Institutes and Sub Centers. Shri

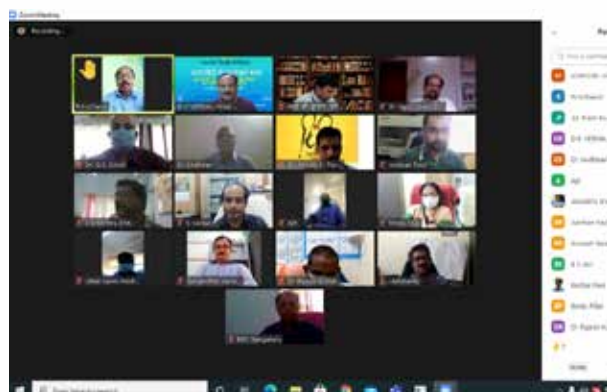


V. Ganesh Kumar, Administrative Officer, ICAR-CIFA presented a demonstration for online registration of various courses run by the Central Government on online, correspondence training etc. The workshop was very useful and purposeful. The program ended with vote of thanks to the guests and participants.



### Rajbhasha Quarterly Workshop (Q-2)

The Institute organized a quarterly official language workshop on "An art of letter writing in simple Hindi " on 25 June 2021 to promote the use of Official Language Hindi in official functions. Almost all scientists, technical officers, administrative staff attended this workshop. Shri Rabindra Kumar Chand, Retired Hindi Officer, Accountant General's Office, Bhubaneswar was invited as the Chief speaker on this occasion. Mr. Indra Bhushan Kumar, Senior Administrative Officer, ICAR-CIFA welcomed the guests and participants and emphasized



to use more and more techniques to do official work easily in Hindi . On this occasion, guest speaker, Hon'ble Shri Rabindra Kumar Chand, presented a presentation on an art subject of letter writing in simple Hindi through virtual mode. He made a special discussion on the different types of writing of official letters in simple Hindi. He told that this official language is very simple and with the use of techniques, we can easily do the daily official work. This workshop was very beneficial for the officers/employees of the institute. The program concluded with vote of thanks by Dr. D.K. Verma, Rajbhasha Adhikari, ICAR-CIFA.,

### Rajbhasha Quarterly Workshop (Q-3)

Institute organized a quarterly official language workshop on September 17, 2021 on the topic "Grammatical errors and remediation" to promote the use of official



language Hindi in official work. Almost all the scientists, technical officers, administrative staff participated in the workshop in this institute. The Chief Guest Speaker on this occasion was Shri Ajay Kumar Patnaik, Retired Hindi Professor, Ravenshaw University, Cuttack. The workshop was inaugurated by the dignitaries with lighting the lamp and ICAR song. Shri Indra Bhushan Kumar, Senior Administrative Officer, ICAR-CIFA welcomed the guests and participants and stressed on using techniques more and more to make use of Hindi easily in office work. Shri Ajay Kumar Patnaik, the chief guest speaker, discussed in detail the frequently occurring grammatical mistakes in Hindi writing and its solutions so that working in the official language Hindi can be made easy. He said that this language is very simple and inclusive and with the use of techniques we can easily do our daily office work in Hindi medium. Dr. Saroj Kumar Swain, Director, ICAR-CIFA stressed on the compliance of the policies of the official language by all the scientists, technical officers and other staff of the institute to promote the use of Hindi in the institute so that most of the office work can be done in the official language. He urged to use Hindi language as an effective medium to take the techniques of CIFA to the masses so that our farmers can take maximum

advantage of it. The quarterly workshop was coordinated by Dr. D.K. Verma, Rajbhasha Adhikari. The program ended with vote of thanks to the guests and participants.

### Rajbhasha Quarterly Workshop (Q-4)

In order to promote the progressive use of Official Language Hindi and to comply with the Acts, Rules and Orders related to Official Language, Hindi Workshop was organized through the virtual medium on 21st December 2021 in ICAR-CIFA, Bhubaneswar. The theme of the workshop was “Deliberation: Indian Constitution”. Dr. Saroj Kumar Swain, Director, ICAR-CIFA in his presidential address said that it is our constitutional obligation to work in the official language and stressed on doing maximum work through the medium of the Hindi language. On this occasion, the invited keynote speaker, Shri Ram Dayal Sharma, Deputy Director (Official Language), ICAR RC for NEH Region, Meghalaya presented his presentation on the topic “Deliberation -Constitution of India” through online. He described in detail the compliance of the Acts, rules and orders related to the official language. Almost all the scientists, technical officers, administrative staff participated in the workshop. The program concluded with a vote of thanks by Dr. D. K. Verma, Rajbhasha Adhikari, ICAR-CIFA.





## 17. BUDGET

**Table 51. Provision from the ICAR (2021-2022)**

Exp. As on 31.03.2022 (Rs. in lakhs)

Sl.No.	Sub-head	Govt. grant	Exp. out of Govt. grant
1	2	3	4
1.	Capital Exp.	-	-
a)	Land	-	-
b)	Building	176.05	176.05
c)	Equipments	32.54	32.54
d)	Furniture/Fixture	16.13	16.13
e)	Info. Tech.	35.42	35.42
f)	Vehicle/Vessels	7.21	7.21
g)	Library Books	2.65	2.65
h)	Others	-	-
2.	Revenue Exp.		
a)	Estt. Charges	2954.50	2954.50
b)	Wages	-	-
c)	OTA	-	-
d)	Pension & Other Retirement benefits	181.57	181.57
3.	Loans & Adva.	41.78	41.78
4.	TA	9.67	9.67
5.	Other Charges	-	-
a)	Res. Expenses	159.26	159.26
b)	Operational Expenses	563.22	563.22
c)	Admn. Expenses	290.41	290.41
d)	Misc. Expenses	26.37	26.37
6.	HRD	1.07	1.07
7.	NEH (capital + revenue)	52.74	52.74
8.	TSP (capital + revenue)	67.50	67.50
9.	SCSP (capital + revenue)	125.00	125.00
	<b>TOTAL</b>	<b>4743.09</b>	<b>4743.09</b>



## 18. PERSONNEL *(as on 31.12.2021)*

### **Director (Acting)**

Dr S. K. Swain

### **Head of Division (Acting)**

Dr Bindu R. Pillai

Dr J. K. Sundaray

Dr S. S. Mishra

Dr S. S. Giri

### **ICAR National Fellow**

Dr P. K. Sahoo

### **Principal Scientist**

Dr Hemaprasanth

Dr P. Das

Dr K. D. Mohapatra

Dr P. P. Chakrabarti

Dr P. V. Rangacharyulu

Dr S. Adhikari

Dr G. S. Saha

Dr P. Swain

Dr (Mrs) Prabhati K. Sahoo

Dr S. K. Sahoo

Dr Samiran Nandi

Dr P. Routray

Dr B. C. Mohapatra

Dr J. Mohanty

Dr B. N. Paul

Dr H. K. Barman

Dr P. C. Das

Dr K. N. Mohanta

Dr S. Mohanty

Dr K. C. Das

Dr H. K. De

Sri P. K. Meher

Dr R. N. Mandal

Dr Ashis Saha

Dr D. N. Chattopadhyay

Dr M. Samanta

Dr Gangadhar Barlaya

Dr B. S. Giri

Dr Satyanarayan Sethi

Dr Chandra Kanta Misra

### **Senior Scientist**

Dr Shailesh Saurabh

Dr Rajesh Kumar

Dr Lakshman Sahoo

Dr Khuntia Murmu

Dr. D.Panda

Dr. Ramesh Rathod

Dr Subhas Sarkar

Sri A. S. Mahapatra

Dr N. K. Barik

Dr B. S. Anand Kumar

### **Scientist**

Dr Pankaj Kumar Tiwari

Dr S. Ferosekhan

Dr Siddaiah G. M.

Sri Anantharaja K.

Mrs Rakhi Kumari

Dr (Mrs) Puspha Choudhary

Sri Nitish Ku. Chandan

Mrs Snatashree Mohanty

Sri Rakesh Das (study leave w.e.f. 12.09.2019)

Sri Uday Kumar Udit

Sri Arabinda Das

Dr I. Sivaraman

Dr Mukesh Ku. Bairwa

Sri Badhe Mohan Ramesh

Mrs Priyanka C. Nandanpawar

Dr Ch. Ajit Keshav

Dr Sunil Kumar S. Ail

Sri Ajmal Hussan



Dr Farhana Haque

Sri Jackson Debbarma

Sri Avinash R. Rasal

Sri Satyanarayan Sahoo

Dr Anirban Paul

**Programme Coordinator & Head (I/C),  
KVK**

Sri A. K. Dash (KVK)

**Chief Technical Officer**

Dr B. K. Banja (KVK)

Sri Surendra Singh(KVK)

**Asst. Chief Technical Officer**

Ms Sukanti Behera(KVK)

Dr D. K. Verma

Dr (Mrs) U. L. Mohanty

Sri P. R. Sahu (KVK)

Dr Bibhudatta Mishra

**Senior Technical Officer**

Sri S. K. Mohanty

Sri P. B. Bhakat

Sri D. P. Rath

Sri Santosh Ku. Nayak

Dr (Smt) Harapriya Nayak (KVK)

**Technical Officer**

Sri S. Mahali

Sri Sovan Sahoo

Sri Suratha Ku. Naik

Sri Aruna Ku. Behera

Sri Lingaraj Muduli

Sri Dukhia Majhi

Sri Rabindra Das

Sri C.H. Raghavandra

Sri J. K. Ghosh

Sri Aurobinda Patra (Compounder)

**Senior Technical Assistant**

Sri Bhagabat Ch. Das (Mike Operator)

Sri Affcer Mohamad (Powertiller Operator)

**Technical Assistant**

Sri Anarpit Das

Sri Bhaskara Rao Vazragiri

Sri Jayanta Swain

Sri Pramod K. Sahoo

Sri Srinivasulu Gudipudi

**Driver**

Sri Trinath Behura (Sr. Tech. Assistant)

Sri K. C. Das (Sr. Tech. Assistant)

Sri S. C. Panda (Technician Asst.)

Sri D. Pradhan (Technician Asst.) (KVK)

Sri S. P. Behera (Technician Asst.) (KVK)

**Chief Administrative Officer**

Sri B. K. Sinha

**Sr. Administrative Officer**

Sri I. B. Kumar

**Finance and Accounts Officer**

Sri S. S. Mohapatra

**Security Officer**

Sri Debabrata Sahoo

**Private Secretary**

Sri M. D. Das

Ms Singa Soren

**Personal Assistant**

Mrs Smita Acharya

**Assistant Administrative Officers**

Ms Golap Bhanja

Sri S. Nandi

Sri Birabar Amanta

Sri A. K. Prusty

Sri Jitendranath Jena

Sri T. K. Mishra

**Assistant**

Sri Manoj Ku. Mohapatra

Sri Loknath Senapati

Sri Swamiji Sen

Sri S. K. Rath



Sri Niranjan Behera

Sri Sukanta Sarkar

**Upper Division Clerk**

Sri Sukhendu Biswas

Sri Arijit Panda

Sri Prakash Ch. Parida

**Lower Division Clerk**

Sri Manas Ku. Muduli

Sri Pradiumna Behera

Sri Bhikari Charan Bhoi

Sri Dusmanta Ku Sahu

Sri Bikram Kishore Kahali

Sri Simachal Behera

**Jr. Stenographer-III**

Sri Ganesh Sankar

**Skilled Support Staff**

Sri Pasupati Das

Sri Siddaraju

Sri Rabindra Kumar Nath

Sri Asit Kumar Pal

Sri Saroj Kumar Parida

Sri Sarat Ch. Barik

Ms Manju Singh

Sri Gopal Ch. Mohapatra

Sri Gouriguru Sibananda Bhuyan

Sri Baikuntha Nayak

Sri Manoj Kumar Jena (KVK)

Sri Ch. M. Rao

Sri Budhia Behera (KVK)

Sri Bauri Bandhu Pradhan

Sri Aruna Kumar Muduli

Sri Tanay Balav Barik

Sri Prasanna Ku. Behera

Ms Sonali Adhikari

Ms Kalyani Mondal

Ms Kiron Oraon

Sri Premananda Bisoi

Sri Sanatan Pradhan

Sri B. K. Deo

Sri Sarat Ch. Barik (E)

Sri Mahendra Behera

Sri J. K. Palai

Sri Kalandi Charan Biswal

Sri Baja Muduli

Sri P. K. Mohapatra

Sri Rabindra Nath Biswal

Sri Tapan Kumar Routray

Sri Basanta Kumar Mallick

Smt. Bilasi Nayak

Sri Goutam Mallick

Sri Babuli Samal

Sri Krushna Chandra Sethy

Sri Nabin Jena

Sri Dwarika Nath Nayak

Sri Kalandi Behera

Sri Purna Ch. Behera

Sri Birabara Mallick

Sri Laxmidhar Behera

Sri Debendra Bhoi

Sri Abhiram Behera

Sri Pramoda Khatua

Sri Maheshwar Bhoi

Sri Judhistira Das

Sri Anadi Charan Bhoi

Sri Sridhar Bhoi

Sri Girish Ch. Upadhyay

Smt. Mungli Sardar



## 19. LIST OF APPROVED ON-GOING PROJECTS

**Table 52. Institute-based projects**

Sl. No.	Institute Project Code	Project title	Project personnel (PI/Co-PIs)	Duration
1	I-88	<b>Integrated disease management in freshwater aquaculture</b> e) Development of suitable prophylactic and control measures for health management in challenged freshwater aquaculture systems in India	S.S. Mishra (PI) P. Swain Rakesh Das P. Choudhary Anirban Paul J. Debbarma S. N. Sahoo Snatashree Mohanty C. K. Misra Ananda Kumar B.S Ramesh Rathod Farhana Hoque	1.4.2018- 31.3.2022
2		f) Identification and characterization of organic compounds from medicinal plants for the control of diseases in freshwater	M. Samanta (PI) P. Choudhary R. N. Mandal	1.4.2018- 31.3.2022
3	I-98	<b>Species diversification in aquaculture</b> c) Effect of Zinc and Iron Enrichments on Freshwater Plankton Productivity and growth of improved Rohu ( <i>Labeo rohita</i> H.)	P.K. Tiwari (PI)	1.4.2018- 31.3.2022
4		d) Protocol development for control of noxious algal bloom in culture ponds	Snatashree Mohanty (PI)	1.4.2018- 31.3.2022
5	I-99	Genetic improvement of rohu ( <i>Labeo rohita</i> ) for growth and disease resistance against <i>A. hydrophila</i> and its effective dissemination	K. D. Mahapatra (PI) P.K. Sahoo P.K. Meher K. Murmu Rasal P. Nandanpawar	1.4.2018- 31.3.2022
6	I-101	Protocol development for breeding and seed rearing of <i>Mystus cavasius</i> in captivity	S.K. Sahoo (PI) S.S. Giri S. N. Sahoo S. Ferosekhan B. Mishra	1.4.2019- 31.3.2022
7	I-102	Impact of Exotic fish species farming on sustainability of carp culture in Andhra Pradesh	Ramesh Rathod (PI) P.V. Rangacharyulu S. Giri A.K. Chaudhari	1.4.2019- 31.3.2022



8	I-103	Optimization of seed rearing protocol for commercially important freshwater fishes in salt affected regions	Mukesh Ku. Bairwa (PI) Priyanka C. Nandanpawar P.P. Chakrabarti Rajesh Kumar	1.4.2019- 31.3.2022
9	I-104	Implication of fat accumulation on gonadal maturation in <i>Catla catla</i>	Uday Ku. Udit (PI) S. Nandi K.D. Rasal P. K. Meher N.K. Chandan	1.4.2019- 31.3.2022
10	I-105	Isolation and characterization of heterotrophic ammonia oxidising bacteria (AOB) and their application in aquaculture	Pushpa Choudhary (PI) S.N. Sahoo P. C. Das	1.4.2019- 31.3.2022
11	I-106	Solid State Fermentation (SSF) of mahua oil cake as fish feed ingredient for Indian Major Carps (IMC)	K.C. Das (PI) K.N. Mohanta S. C. Rath (upto Oct 2020) P. Swain S.K. Nayak	1.4.2019- 31.3.2022
12	I-107	Enhancing larval survivability of climbing perch through dietary intervention	N.K. Chandan (PI) Rajesh Kumar K. N. Mohanta Rakhi Kumari Uday Ku. Udit	1.4.2019- 31.3.2022
13	I-108	Inducing sterility in carps and tilapia using different biochemical agents	P. Routray (PI) K.C. Das D.K. Verma	1.4.2020- 31.3.2023
14	I-109	Standardization of broodstock development and seed rearing of striped murrel, <i>Channa striata</i> in recirculatory aquaculture system	Rajesh Kumar (PI) J. Debbarma Subash Sarkar Rakhi Kumari P.B. Bhakat (Associate)	1.4.2020- 31.3.2023
15	I-110	Development of protocol for organic fish farming: A sustainable production approach in freshwater ecosystems	Satyanarayan Sethi (PI) P.C. Das P.K. Tiwari S.N.Sahoo K.N. Mohanta	1.4.2020- 31.3.2023
16	I-111	Species diversification in peninsular aquaculture: Strategies for mass seed production of peninsular carps and their successful introduction to aquaculture system	Hemaprasanth (PI) P.C. Das Gangadhar B. B.S. Anand Kumar Raghavendra CH (Associate)	1.4.2020- 31.3.2023



17	I-112	Aqua-mimicry for sustainable aquaculture production of Indian major carps	A.K. Chaudhari (PI) C.K. Misra Ramesh Rathod B.S. Giri P.V. Rangacharyulu	1.4.2020– 31.3.2023
18	I-113	Identification of SNPs linked to body weight trait in genetically improved rohu, 'Jayanti'.	P. Das (PI) L. Sahoo K.D. Mahapatra P. C. Nandanpawar K. Murmu	1.4.2020– 31.3.2023
19	I-114	Utilisation of insect larval meal as protein source in the diet of <i>Channa striata</i> and <i>Anabas testudineus</i> production system	G.M. Siddaiah (PI) Rajesh Kumar Rakhi Kumari	1.4.2020– 31.3.2023
20	I-115	Effect of dietary micronutrients supplementation on gonadal development of Indian major carp and catfish	Ashis saha (PI) S.S. Giri S.K. Sahoo S. Ferosekhan G.M. Siddaiah	1.4.2020– 31.3.2023
21	I-116	Exploring potential probiotic gut bacteria from peninsular carp species and their application in improving fish health and growth	B.S. Anandkumar Gangadhar B. Raghavendra CH (Associate)	1.4.2020 – 31.3.2023
22	I-117	Development of index for measuring women's empowerment in aquaculture.	H.K. De (PI) G.S.Saha A.S. Mahapatra U.L. Mohanty D.P. Rath	1.4.2020 – 31.3.2023
23	I-118	Farmers' producers organization in freshwater Aquaculture- a critical assessment.	G.S. Saha (PI) H.K. De A.S. Mahapatra G. Sreenivasulu	1.4.2020 – 31.3.2023
24	I-119	Optimization of freshwater pearl mussel culture technology through dietary and environmental intervention for greater adoptability to the farming communities	S. Saurabh (PI) Rajesh Kumar P.K. Tiwari	1.4.2021- 31.3.2024
25	I-120	Ecological engineering in pond aquaculture for intensive fish production system	S. Sarkar (PI) P.K. Tiwari D. Panda	1.4.2021- 31.3.2024



26	I-121	Breeding, seed rearing and culture of barred spiny eel, <i>Macrognathus pancalus</i> (Hamilton, 1822).	S. Adhikari (PI) P.P. Chakrabarti D.N. Chattapadhyay R.N. Mandal B.N. Paul Arabinda Das F. Hoque A. Hussan	1.4.2021– 31.3.2024
27	I-122	Production performance of peninsular carps in biofloc based seed rearing system	K. Anantharaja (PI) Hemaprasanth Gangadhar Anand Kumar Raghavendra CH (Associate)	1.4.2021– 31.3.2024
28	I-123	Study on the effect of change in dietary protein concentration on product quality in grow out carp culture	K. N. Mohanta (PI) K.C. Das N.K. Chandan	1.4.2021– 31.3.2024
29	I-124	Level and pattern of genetic variabilities in carp hatcheries of Odisha and West Bengal	C.K. Misra (PI) P.K. Meher K. Murmu Ajmal Hussan	1.4.2021– 31.3.2024


**Table 53. Externally funded projects**

Sl. No	Project code	Title	Funding Agency	PI/Co-PIs	Duration
1	E-03	AICRP on Plastic Engineering in Agriculture Structure & Environment Management Centre at ICAR-CIFA	ICAR-AICRP on PEASEM	B.C. Mohapatra	Continuous (from May 1988)
2		Development of economically viable and farmer-friendly aquaponic systems for fish and plant biomass production		B.C. Mohapatra (PI) N.K. Chandan B.R. Pillai S.S. Giri P.P. Chakrabarti Ajmal Hussan	1.4.2020–31.3.2023
3		Development of user friendly biofloc fish rearing facility		B.C. Mohapatra (PI) N.K. Chandan B.R. Pillai S.K. Swain	1.4.2021-31.3.2024
4		Design and development of transportable scampi seed production system		Panda (PI) B.C. Mohapatra B.R. Pillai	1.4.2021-31.3.2024
5	E-71	Development of novel immunopotentiator molecules from fish host and pathogens for broad spectrum disease control in freshwater aquaculture	ICAR National Fellow Scheme	P.K. Sahoo (PI)	8 April, 2011-April, 2021 (5 yrs extn)
6	E-86	National Surveillance programme on Aquatic animal diseases	NFDB-NBFGFR	P.K. Sahoo (PI) A. Paul	Apr 2013-March, 2018 (extn upto Mar 2022)
7	E-93	Intellectual Property and Technology Management (IP & TM) (renamed as “National Agriculture Innovation Fund (NAIF)”)	ICAR- NAIF	P. Swain (PI) K.D. Mahapatra P. Das P. Routray K. C. Das S. Mahapatra N. K. Barik	April, 2015 – Sept, 2017 Phase-II(Oct 2017-Mar 2022)
8	E-95	Consortia Research Platform on water: CIFA component 3.2: Water budgeting and enhancing water productivity by multiple use of water in different aquaculture production system	ICAR (XIIth Plan) IWM and CIFA ICAR- ACRP on Water	P.C. Das (PI) Rajesh Kumar S. Ferosekhan I. Sivaraman C.K. Misra	December, 2015 – March, 2017 (Extn upto March 2021)



9	E-97	Novel approaches towards vaccine development against argulosis in carps	ICAR (CRP on vaccines and diagnostics)	J. Mohanty (PI) P.K. Sahoo M.R. Badhe	August, 2015 – Mar, 2017) (Extn. up to Mar 2021)
10	E-99	All India network project on fish health	AINP on Fish Health	S.S. Mishra (PI) Rakesh Das P. Choudhary P. Swain S. N. Sahoo J. Debbarma	July 2015 – March 2017 (Extn. upto June, 2025)
11	E-105	Promoting Improved Agriculture and allied Sector Technologies in Khordha district through Farmer First Approach	FFP of the KVK Scheme of ICAR	H.K. De (PI) Prabhathi K. Sahoo P.C. Das S.C. Rath S. Sarkar I. Sivaraman J. Debbarma S. Gudipudi (Associate)	October 2016 – Mar 2022
12	E-110	Molecular screening, cell culture based isolation and characterization of fin fish and shellfish viruses and establishment of National Repository	DBT	P.K. Sahoo (PI) J. Mohanty	July 2017 – Mar 2021
13	E-112	Genetic enhancement of economically important freshwater fish <i>Catla catla</i> using genetic and molecular approaches	DBT-CoE	J.K. Sundaray (PI) P. Das S. Nandi L. Sahoo K.D. Mahapatra H. K. Barman K. D. Rasal Uday K. Udit P. Nandanpawar P. K. Meher Mohan Badhe Avinash Rasal K. Murmu P.Routray J. Mohanty	Dec 2017 – Jun 2021
14	E-113	Network program on assessment of antimicrobial resistance (AMR) in microorganisms associated with fisheries and aquaculture in India	Network Program on AMR	S.S. Mishra (PI) P. Swain Rakesh Das S.N. Sahoo R. Rathod B.S. Giri	Jan 2018 – March 2021 (exten upto Mar 2025)



15	E-114	Bioprocessing of fish wastes for productive end users	DST, Govt. of Odisha	Sriprakash Mohanty (PI) B.C. Mohapatra	Feb 2018 – Feb 2022
16	E-115	Dissemination of minor carp production technology and its refinement for greater adoptability by the aquaculture farmers	NFDB, Hyderabad	P.C. Das (PI) Prabhathi K. Sahoo Pankaj Tiwari H. K De G. M. Siddaiah Snataashree Mohanty	April, 2018 – March, 2021
17	E-116	Demonstration of efficacy of carp brood stock diet “CIFABROOD™” in increasing quality seed production of Indian Major Carps in selected states of India	NFDB, Hyderabad	S. Nandi (PI) J. K. Sundaray (upto Mar 2020) P. Routray N. K. Barik G. S. Saha S. Adhikari P. P. Chakrabarti P. N. Ananth (upto Jan 2021) K. Anantharaja	April, 2018 – March, 2021
18	E-117	Upscaling and demonstration of nursery and grow out carp feeds developed by ICAR-CIFA, Bhubaneswar	NFDB, Hyderabad	K.C. Das (PI) K. N. Mohanta S. C. Rath N.K. Barik G. M. Siddaiah S. Sarkar	April, 2018 – Sept, 2021
19	E-118	Capacity building of knowledge intermediaries and primary stakeholders in freshwater aquaculture through virtual learning approach	NFDB, Hyderabad	I. Sivaraman (PI) S. Mahapatra H. K. De R. Pillai Rakesh Das K. N. Mohanta Avinash Rasal	April, 2018 – June 2021 (extn upto Mar 2022)
20	E-119	Regulatory roles of kisspeptin and neurokinin B in gonadal maturation of farmed carp <i>Labeo rohita</i>	Science and Engineering Research Board (SERB)	Ashis Saha (PI)	March 2018 – March 2021
21	E-120	Establishment of captive breeding protocol and value additions to selected indigenous ornamental fishes from North-east India	DBT’s Program for the NE	H.K. Barman (PI) J.K. Sundaray	March 2018 – March 2021



22	E-121	Improving broodstock management and quality seed production of <i>Ompok bimaculatus</i> through application of molecular endocrinology	DBT under Twinning Programme for NER (inter-institutional project with CoF, Lembucherra)	J.K. Sundaray (PI) PP Chakrabarti Farhana Hoque Arabinda Das	June 2018 – June, 2021
23	E-122	To elucidate the unique biochemical adaptational strategies that allow to airbreathing catfishes ( <i>Clarias batrachus</i> and <i>Heteropneustes fossilis</i> ) to survive in ammonia enriched toxic waste (PI-NEHU)	NASF, ICAR	H.K. Barman (PI)	August 2018 – Jan 2022
24	E-123	Network project on Ornamental fish breeding and culture (NPOFBC) CIFA Component: Breeding and culture of freshwater ornamental fishes, <i>Trichogaster chuna</i> and <i>Dawkinsia assimilis</i>	Network Project	S.K. Swain (PI) M.K. Bairwa Sunil Kumar Ail	July 2018 – March 2025
25	E-124	Ecological assessment of the exotic sailfin catfishes in the Indian freshwater systems and developing a species specific molecular tool to measure their detection in the wild	Science and Engineering Research Board (SERB)	J. K. Sundaray (PI) Ajmal Hussan	March, 2019 – March, 2022
26	E-125	New extension methodologies and approaches (NEMA)	Network project ICAR Institutes and 11 ATARIs	H. K. De (PI) G. S. Saha S. Mahapatra S. Gudipudi (Associate)	7 March, 2019 – June, 2021
27	E-126	Strengthening fisheries and aquaculture for food security and nutrition (India-WorldFish collaborative project; ICAR-CIFA, ICAR-CIFT and ICAR-CIFRI): Development of sustainable aquaculture practices through life cycle analysis (LCA) of selected aquaculture production systems and performance evaluation of improved varieties of carps and freshwater prawn (ICAR-CIFA Component)	ICAR-WorldFish	Bindu R. Pillai (PI) K. D. Mahapatra H. K. De P. C. Das B.S. Giri Panda S. Sarkar K. Murmu Avinash Rasal Sovan Sahu	January 2019 – December, 2024



28	E-128	Harmonized one health trans-species and community surveillance for tackling antibacterial resistance in India	BIRAC-DBT with INCLIN Trust International, New Delhi	S. S. Mishra (PI) S. N. Sahoo P. Swain	Sept 2019 – June 2021
29	E-129	C.R.Edit – Crispr/Cas9 edition to test and control genes implicated in influencing <i>Aeromonas</i> disease resistance in carp and salmon	DST (Indo-Norway Project) NOFIMA	P. K. Sahoo (PI) K. D. Mahapatra J. K. Sundaray Avinash Rasal S. Kirankumar (SRM University)	23 December, 2019 – December, 2022
30	E-130	Assessment of endocrine disruption in fish reproduction	DBT (collaborative project)	J.K. Sundaray (PI) L. Sahoo Rajesh Kumar Sudipta Maitra (Santiniketan)	December 2019 – December 2022
31	E-131	Estimation of production and utilization pattern of milk and milk products in India	NSO, Ministry of Statistics and Programme Implementation, Govt. of India	N.K. Barik (Coordinator for Eastern Region) ICAR-NDRI, Karnal	January 2020 – December 2021
32	E-132	Development of Bio-floc based technology (BFT) for production of freshwater fish and demonstration for peri-urban fish farmers and rural youth	RKVY	P.C. Das (PI) S. N. Sethi S. Sarkar Rakhi Kumari Pushpa Choudhury S. Ferosekhan	April 2021 – March 2024
33	E-133	Investigation of key transcripts and regulatory network associated with reproductive biology and medicinal value of striped murrel ( <i>Channa striata</i> ) using Omics approaches	DBT-CABIN, Phase-III	J.K. Sundaray (PI) L. Sahoo Rajesh Kumar J. Debbarma	Oct 2020 – Mar 2025
34	E-134	Scaling up of Genetic Improvement Programme of Freshwater Prawn <i>Macrobrachium rosenbergii</i> (Scampi)	PMMSY	B.R. Pillai (PI) K.D. Mahapatra P.K. Sahoo Panda R. Rathod F. Hoque	Feb 2021 – Jan 2024
35	E-135	Captive breeding of hilsa, <i>Tenualosa ilisha</i> : Phase-II	NASF	D.N.Chattopadhyay (CCPI) S. Adhikari S. Nandi Arnab Das	Feb 2021 – Feb 2024



36	E-136	Strengthening quality freshwater fish seed supply chain through 'Cluster seed villages' approach in Odisha	PMMSY	P. C. Das (PI) Prabhati K. Sahoo S.K. Sahoo K.N. Mohanta H.K. De S. Sarkar	Mar 2021 – Mar 2024
37	E-137	Development of vaccines against Tilapia lake virus (TiLV) and Cyprinid herpesvirus-2 of fish in Indian aquaculture system	DBT	P. K. Sahoo (PI) Anirban Paul J. Mohanty	9 July 2021- Mar 2024
38	E-138	Deciphering the role of NLRs, TLRs and RLRs-signal transduction pathways in <i>Labeo rohita</i> brood female in enhancing broadly acting material innate immunity for the prevention of infection and mortality of larvae	DBT	M. Samanta (PI) Ashis Saha	Mar 2021 – Mar 2024
39	E-139	Network programme on Precision Agriculture (NePPA) (ICAR-CIFA Lead Institute and collaborating Institutes: ICAR-CIFRI & CIFE)	ICAR Network Programme	S.K. Swain (PI) P. Routray S. Ferosekhan Subhas Sarkar Sunil Ku S. Ail Sivaraman Pramod K. Sahoo (Associate)	Oct, 2021 – Mar 2026
40	-	Agri-Business Incubation (ABI) program at ICAR-CIFA	Agri-Business and Innovation Platform-ICAR	N. K. Barik P. Routray, P. Swain, K.C. Das	March 2016 -continue
41	-	Establishment of incubation center for micro enterprises in freshwater aquaculture for Odisha	RKVY	N. K. Barik	April 2018 – July 2021
42	-	Establishment of Aquaculture Farm School	RKVY	N. K. Barik	July 2018 – March 2021
43	-	Farm Based S&T interventions for socio-economic development in the aspirational district of Nabarangpur, Odisha	RKVY	N.K. Barik (PI) S.S.Mishra, K.N. Mohanta, Rajesh Kumar, K. Murmu	July 2019 – March 2022


**Table 54. Contract Research**

Sl. No.	Title	Funding Agency	Pr. Investigator	Duration
1.	Tank Based Tilapia Culture in Bio-Floc System for weaker section under CSR	M/s IREL (India) Limited (GoI undertaking, Dept. of Atomic Energy) Matikhalo, Po: Matikhalo, Ps: Chatrapur, Dist: Ganjam (Odisha)	P. Routray	05.10.2021

**Table 55. Women Scientist Scheme (DST, Govt. of India)**

Sl. No.	Title	Funding Agency	Pr. Investigator	Duration
1.	Encapsulated adherent putative lactic acid bacteria as dietary probiotic supplement with optimized feeding regime for Indian major carp, <i>Labeo rohita</i>	BIOCARE Scheme of the DBT for Women Scientist	Usha Jyoti Maji S. Mohanty (Mentor Scientist)	March 2019 - March 2022

**Table 56. Emeritus Scientist Scheme**

Sl. No.	Title	Funding Agency	Emeritus Scientist	Duration
1	Characterization of gut microbiome of <i>Labeo rohita</i> : A step towards manipulation of bacterial communities for enhancement of productivity in aquaculture system	ICAR	N. K. Maiti	July 2018- July 2021
2	Enhancing gonadal maturation through interactive influence of nutrients sources with digestive enzyme complement for mass scale seed production of <i>Hypselobarbus pulchellus</i> by re-circulatory hatchery system	ICAR	N. Sridhar	Oct 2020 – Oct 2023



## 20. SUPERANNUATIONS AND APPOINTMENTS

### SUPERANNUATION

- Shri Debendra Tarai, T-4 w.e.f. 31 May, 2021
- Shri P. C. Mohanty, T-5 (Driver) w.e.f. 31 October, 2021
- Shri Alekha Nayak, T-5 (Driver) w.e.f. 31 October, 2021

### APPOINTMENTS

Dr. P.V. Rangacharyulu, Principal Scientist appointed as SIC of RRC Vijayawada w.e.f.18.01.2021

### PROMOTION

- Dr Bibhudatta Mishra, T-6 promoted to T-7-8 w.e.f. 4 January, 2019
- Shri Sukanta Sarkar, UDC promoted to Assistant w.e.f. 30th July, 2021.
- Miss Singa Soren, Personal Assistant promoted to Private Secretary w.e.f. 30th July, 2021.
- Shri Tapas Kumar Mishra, Assistant promoted to Assistant Administrative Officer w.e.f. 30th July, 2021.
- Shri Dusmanta Sahoo, SSS promoted to LDC w.e.f.23rd August, 2021.
- Shri Bikram Kishore Kahali, SSS promoted to LDC w.e.f. 23rd August, 2021.
- Shri Bhikari Charan Bhoi, SSS promoted to LDC w.e.f. 23rd August, 2021.
- Shri Simachal Behera, SSS promoted to LDC w.e.f. 23rd August, 2021.
- Shri Ajay Kumar Dash, ACTO promoted to CTO w.e.f. 30th August, 2021.
- Shri Surendra Singh, ACTO promoted to CTO w.e.f. 30th August, 2021.
- Shri Affcer Mohamed, T-4 promoted to T-5 w.e.f. 29 June, 2021
- Shri P. C. Mohanty, T-3 promoted to T-4 w.e.f. 29 June, 2016 and to T-5 w.e.f. 29 June, 2021

- Shri Dinabandhu Pradhan, T-2 promoted to T-3 w.e.f. 16 December, 2019
- Shri Suresh Chandra Panda, T-2 promoted to T-3 w.e.f. 02 June, 2019
- Shri Sibho Prasad Behera, T-2 promoted to T-3 w.e.f. 25 December, 2019
- Shri Jayanta Kumar Ghosh, T-4 promoted to T-5 w.e.f. 28 December, 2015
- Shri Debendra Tarai, T-4 promoted to T-5 w.e.f. 16 May, 2021
- Shri Alekha Nayak, T-3 promoted to T-4 w.e.f. 29 June, 2016 and to T-5 w.e.f. 29 June, 2021

### TRANSFER

- Mrs Sweta Pradhan, Scientist transferred from ICAR-CIFA to ICAR-CIFE, Regional Station, Kolkata w.e.f. 31.01.2021 (AN)
- Dr. P. N. Ananth Sr. Scientist & Head KVK, Khordha (ICAR-CIFA) transferred from ICAR-CIFA to KVK, ICAR-CMFRI, Lakshadweep on 05.01.2021(AN)
- Shri V. Ganesh Kumar, Administrative Officer relieved on promotion as Senior Administrative Officer on 13 October, 2021 to join at ICAR-NRRI, Cuttack
- Shir Rishi Kant Singh, Finance and Accounts Officer relieved on 16 November, 2021 to join at ICAR-NRRI, Cuttack

### OBITUARY

- The ICAR-CIFA family deeply mourns the demise of Sri Maheswar Bhoi, SSS on 26th August, 2021.
- The ICAR-CIFA family deeply mourns the demise of Sri Samir Das, SSS on 31 December, 2021.



## 21. WOMEN EMPOWERMENT

### International Women's Day 2021

ICAR-CIFA organised International women's day on 8 March 2021 with the theme of Women in Leadership: Generation Equality. On the eve of the International Women's day a lecture series was organized on 6th March 2021. Dr. Sanghamitra Pati, Director, ICMR-Regional Medical Research Centre (ICMR-RMRC) was the Chief Guest and delivered a lecture on "COVID crisis management in Odisha" highlighting the symptoms, risk factors, principles of diagnosis, types of COVID 19 tests and molecular platforms for its diagnosis. Dr. Swapnita Hota, Assistant Professor, Dept. of Obstetrics & Gynaecology, Hi-Tech Hospital

& Medical College, Bhubaneswar, delivered presentation on "Gynaecological issues and its management". She stressed on the gynaecological issues commonly faced by women, types and signs of cancer and its prevention strategies. Different competitions like essay writing, debate and drawing on the theme of "The International Women's Day-2021" were also held on this occasion. Dr. P. Das, Director (I/C), ICAR-CIFA welcomed the dignitaries and mentioned that the Institute had operated a number of sponsored projects with women as beneficiaries. In his address he emphasized the contribution of ICAR-CIFA in empowering women through aquaculture technologies like carp seed production, carp



Guests on International Women's Day 2021



Eminent medico personalities for lecture Series



Felicitation to Progressive farm women





poly culture, ornamental fish farming and value addition of carp fish etc. which were disseminated among women for uplifting their socio-economic status. Mrs. Vidya Das, Joint Director, “AGRAGRAMEE” a leading NGO working towards empowerment of under privileged women was the guest of honour and narrated her experiences about the difficulties faced by the unorganized women in different states. She also shared her experiences for working for the women’s economic development in Odisha. Ms. Mamata Samantaray, Chairperson, State Progressive Women’s Forum graced the function as Chief Guest. She spoke about the significance of International Women’s Day and the challenges being faced by women in today’s society. She encouraged all the women participants to take a pledge on this International Women’s Day to become empowered women. During the occasion, Dr (Mrs) Kanta Das Mahapatra, Principal Scientist and Chairperson of Internal Women Complaint Committee (ICC), ICAR-CIFA, highlighted the challenges of working women in India. She urged women aquafarmers to start nursery management of fishes and ornamental fish culture as the best entrepreneurial venture to create a niche in Aqua-entrepreneurship. Dr. Bindu R. Pillai, Head, APED told that COVID-19 was very well managed by women across the world. In Aquaculture sector women entrepreneurs are doing well. To mark the occasion, scientist-farm women interactions meet emphasizing on Women Leadership in Agriculture: Entrepreneurship, Equity and Empowerment (3E’s) was held, moderated by Dr. N. K. Barik and Dr. P.K. Tiwari, Scientists of ICAR-CIFA. The women entrepreneurs from agriculture and aquaculture field were

felicitated and the winners of the competitions were given away prizes. The Women SHGs exhibited their products for sale on this occasion. The women SHG groups and Entrepreneurs were also felicitated on this occasion. The programme was coordinated by Mrs. Snatashree Mohanty, Scientist and ended with vote of thanks proposed by Dr. Utkal Laxmi Mohanty, ACTO, ICAR- CIFA.

### **Mahila Kisan Diwas**

The KVK-Khordha, ICAR-CIFA organized Mahila Kisan Diwas on the theme “Equity and Empowerment of Farmwomen” on 15 October, 2021 to commemorate the outstanding contribution of women in agriculture at Bhakarsahi village, Balipatna Block of Khordha District. A total of 50 farmwomen from Maa Tarini Mahila Krushak Sangathan and different SHGs of Balipatna Block of Khordha District and officials of KVK-Khordha, ICAR-CIFA participated in the Programme.

### **Women in Agriculture Day**

The Institute observed Women in Agriculture Day on 4 December, 2021.



All Staff Members of ICAR-CIFA and KVK, Khordha had participated. The progressive women Farmers were felicitated for their contributions in agriculture and other allied sectors.







## 23. SPECIAL REPORT

### ICAR-CIFA celebrates Azadi Ka Amrit Mahotsav



To commemorate 75 years of India's Independence (*Azadi Ka Amrit Mahotsav*), ICAR-CIFA, Bhubaneswar organized several programmes including campaigns, webinars, speeches and a host of public outreach programmes.

The Institute in association with other Fisheries Research Institutes organised National Campaign on "System Diversification in Aquaculture" on 1 Sept 2021. Launching the campaign, Dr. J. K. Jena, Deputy Director General (Fisheries Science), ICAR stressed on incorporating modern tools and Artificial Intelligence for enhancing the Aquaculture production. Hi-end novel technologies like RAS, Biofloc, Aquaponics, FIMTA and Flow-through, etc., are increasingly attracting the attention of Young Entrepreneurs, added Dr Jena. The Lead Speaker of the occasion, Dr. S. Felix, Former Vice-Chancellor, TNJFU discussed about the "Technological forefront for face lifting the Indian Aquaculture system". On 10 July 2021, the institute and its regional research stations organized a campaign "Ecosystem management for sustainable fisheries." The events conducted at regional stations were in vernacular languages. Over 500 farmers and other stakeholders took part in the campaign. An webinar on

Antimicrobial Resistance & One Health was organized at ICAR-CIFA, Bhubaneswar on 18 Nov, 2021. Three eminent speakers, including Dr. Rajesh Bhatia, Former Director, Department of Communicable Diseases at WHO, Regional Office for South-East Asia spoke on the occasion.

Besides a number of outreach activities were conducted during the year wherein the glorious history of the country, its people, culture and achievements were shared with farmers and other stakeholders.





## GLIMPSES OF **SWACHHATA ABHIYAN**





## WOMAN AWARENESS PROGRAMME

AT ICAR-CIFA





# ICAR-Central Institute of Freshwater Aquaculture

(An ISO 9001 : 2015 Certified Institute)

(Indian Council of Agricultural Research)

Kausalyaganga, Bhubaneswar-751 002, Odisha, India

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