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ICAR-DIRECTORATE OF COLDWATER FISHERIES RESEARCH

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प्रस्तावना

मछली और अन्य जलीय जीव को व्यापक रूप से कार्यात्मक भोजन के रूप में मान्यता दी गई है और पोषण सुरक्षा के लिए इसे 'अपूरणीय' भोजन भी माना जाता है। यह दुनिया की अधिकांश आबादी, खासकर विकासशील देशों में आहार का एक महत्वपूर्ण घटक है। पिछले कुछ दशकों से जलीय कृषि उत्पादन लगातार बढ़ रहा है और अब यह समुद्री उत्पादन से आगे निकल गया है। शीतजल मत्स्य पालन और मात्स्यिकी, जो मुख्य रूप से भारत के हिमालयी क्षेत्रों तक सीमित है, ने भी इस अवधि में प्रगति की है। आईसीएआर-डीसीएफआर ने भारतीय हिमालयी क्षेत्रों में अनुसंधान, विस्तार और कौशल विकास कार्यक्रमों के माध्यम से काम किया है और उत्पादन और उत्पादकता में वृद्धि के लिए क्षमता निर्माण, बुनियादी ढांचे के विकास और प्रौद्योगिकी के हस्तांतरण के लिए विभिन्न हितधारकों को तकनीकी सहायता प्रदान की है। हालाँकि, प्रगति के साथ, नई समस्याएँ भी चुनौतियाँ पेश कर रही हैं जिन्हें अनुसंधान और विकासात्मक समर्थन के माध्यम से संबोधित करने की आवश्यकता है। निदेशालय ने निस्संदेह उन चुनौतियों को स्वीकार किया है और क्षेत्र के मत्स्य किसानों को व्यावहारिक समाधान प्रदान कर रहा है।

निदेशालय ने अरुणाचल प्रदेश के मत्स्य संसाधनों का एक डेटाबेस सफलतापूर्वक विकसित किया है और जलीय कृषि स्थल उपयुक्तता के लिए एक जीआईएस आधारित मानचित्र भी तैयार किया है। यह जानकारी पूर्वोत्तर हिमालय में मत्स्य पालन और जलीय कृषि की योजना और विकास के लिए उपयोगी है। मध्य हिमालयी नदियों के प्राकृतिक वातावरण और स्वास्थ्य का आकलन किया गया है और जल गुणवत्ता सूचकांक भी मानकीकृत किया गया है। इसके अतिरिक्त प्रजातियों के वितरण को प्रभावित करने वाले हाइड्रोबायोलॉजिकल मापदंडों का भी अध्ययन किया गया है। ये निष्कर्ष प्राकृतिक संसाधन प्रबंधन और उनके सतत उपयोग के लिए मॉडल विकसित करने में मदद करते हैं। इकोटूरिज्म को आजीविका और आय सृजन के लिए एक महत्वपूर्ण क्षेत्र के रूप में मान्यता दी गई है। निदेशालय ने गोल्डन महासीर के आखेट की स्थिति दर्ज की है और बड़े पैमाने पर मत्स्य आधारित इकोटूरिज्म विकसित करने के लिए प्रमुख हॉटस्पॉट की पहचान की है। साथ ही आणविक उपकरणों का उपयोग करके विभिन्न महाशीर प्रजातियों का स्टॉक सत्यापन किया गया है जो लुप्तप्राय मत्स्य प्रजाति पहचान और संरक्षण में सहायक हैं। विभिन्न परीक्षणों के माध्यम से गोल्डन महाशीर की प्रजनन क्षमता को बढ़ाने के प्रयास भी किए जा रहे हैं। गोल्डन महाशीर लार्वा के लिए एक लार्वा आहार और आहार रणनीति भी तैयार की गई है जिसके बहुत उत्साहजनक परिणाम मिले हैं। कृतिम रूप से पर्यावरणीय बदलाव के माध्यम से चॉकलेट महाशीर (नियोलिसोचिलस हेक्सागोनोलेपिस) की प्रजनन क्षमता को बढ़ाने के लिए भी परीक्षण किए गए। सजावटी मत्स्य पालन में पहाड़ी निवासियों के लिए लघु-स्तरीय उद्यम विकसित करने की काफी संभावना है। निदेशालय सजावटी मूल्य वाली देशी मत्स्य प्रजातियों के प्रजनन के लिए बहुत ठोस प्रयास कर रहा है।

हिमालय क्षेत्र में रेनबो ट्राउट पालन एक व्यावसायिक उद्यम बन गया है। रेनबो ट्राउट की सघन खेती के लिए, एक मिनी-आरएएस मॉडल सफलतापूर्वक विकसित किया गया है और अमोनिया के कुशल निष्कासन के लिए विभिन्न बायोफिल्टर सब्सट्रेट का परीक्षण किया गया है। रेनबो ट्राउट इयरलिंग्स के लाइव परिवहन के लिए सुरक्षित लोडिंग घनत्व को अनुकूलित करने की दृष्टि से एक क्षेत्रीय अध्ययन आयोजित किया गया था जो किसानों के स्थानों पर ट्राउट बीज के सुरक्षित परिवहन और भंडारण में मदद करेगा। इसके अलावा, निदेशालय द्वारा एक कुशल रेनबो ट्राउट ब्रूडस्टॉक फीड भी विकसित किया गया है जो ट्राउट ब्रूडर की आहार क्षमता में सुधार करने में मदद करता है। साथ ही, विभिन्न स्थानों पर प्रदर्शन के साथ-साथ प्रजातियों की आनुवंशिक पृष्ठभूमि के संबंध में अध्ययन करने के लिए ट्राउट फीड का तुलनात्मक मूल्यांकन किया गया है। सिस्टम विविधीकरण कार्यक्रम के

तहत, मध्य-पहाड़ी हिमालय में पायलट-पैमाने पर मछली-सब्जी उत्पादन के लिए एक स्थायी एक्वापोनिक्स मॉडल ने आशाजनक परिणाम दिए हैं। हालाँकि, अंतिम उपयोगकर्ताओं तक पहुँचने से पहले इसमें और सुधार की आवश्यकता है।

मत्स्य स्वास्थ्य प्रबंधन और रोग निगरानी जलीय कृषि गतिविधियों का एक अभिन्न अंग है और निदेशालय ट्राउट और कार्प के स्वास्थ्य स्थिति के मूल्यांकन और परीक्षण में सतत् प्रयासरत है। मत्स्य रोगजनकों के निस्तारण के लिये संभावित रोगाणुरोधी एजेंटों को डिजाइन और विकसित करने के प्रयास किए जा रहे हैं। हैचरी में बीज उत्पादन के दौरान ट्राउट के नुकसान से जुड़े स्वास्थ्य विकारों की विस्तृत जांच से विभिन्न प्रेरक एजेंटों और कारकों की पहचान के साथ-साथ उपचारात्मक उपायों को विकसित करने में मदद मिली है। विभिन्न हिमालयी राज्यों के ट्राउट फार्मों में विभिन्न एंटीबायोटिक दवाओं के खिलाफ मछलियों में रोगाणुरोधी प्रतिरोध की जांच की गई। इसके अलावा, गोल्डन महाशीर में परजीवी-विरोधी दवाओं का परीक्षण किया गया। इसके अलावा, सैप्रोलेग्निया के कारण होने वाले उभरते संक्रमणों के खिलाफ दो अलग-अलग नैनोइमल्शन तैयार किए गए। दोनों नैनोइमल्शन ने एंटीसैप्रोलेग्निया, एंटीऑक्सीडेंट और इम्यूनोस्टिमुलेटरी गतिविधियां दिखाईं। निदेशालय मत्स्य सेल लाइनों का उपयोग करके इन-विट्रो मांस विकसित करने पर भी काम कर रहा है। टोर पुतिटोरा के लिंग-संबधित जीन का आणविक लक्षण वर्णन किया गया है जो इस लुप्तप्राय प्रजाति में लिंग निर्धारण की प्रक्रिया को समझने में उपयोगी है। एक GnRH पेप्टाइड एनालॉग को प्रयोगशाला में संश्लेषित किया गया था। पेप्टाइड हार्मोन का उपयोग करके, विभिन्न मछलियों में अंडे देने के लिए प्रेरित करने में इसकी प्रभावकारिता के लिए एक इंजेक्शन फॉर्मूलेशन तैयार किया गया और इसका परीक्षण किया गया। प्रारंभिक अध्ययन से पता चला है कि फॉर्मूलेशन में स्पॉनिंग को प्रेरित करने की क्षमता है।

एनईएच, टीएसपी और एससीएसपी कार्यक्रम के तहत आईसीएआर-डीसीएफआर ने विभिन्न कार्यक्रम आयोजित किए हैं और मछली पालन और आजीविका सुरक्षा के लिए लक्षित समुदायों को आवश्यक जलीय कृषि इनपुट भी प्रदान किए हैं। इन कार्यक्रमों के तहत, विभिन्न हिमालयी राज्यों में मछली किसानों के कई समूह विकसित किए गए हैं। क्षेत्र में रेनबो ट्राउट बीज की आवश्यकता को पूरा करने के लिए मेनचुका, अरुणाचल प्रदेश और लेह और लद्दाख (यूटी) के ठंडे रेगिस्तान सहित विभिन्न हिमालयी राज्यों में हैचरियां बनाई गईं। निदेशालय ने केंद्रशासित प्रदेश लेह और लद्दाख में मत्स्य पालन के सतत विकास के लिए एक रोड मैप भी तैयार किया है। इस अवधि के दौरान, निदेशालय ने किसानों के बीच जागरूकता बढ़ाने के लिए क्षेत्र दिवस, जागरूकता अभियान, प्रदर्शन यात्राएं, क्षेत्र दौरे जैसे विभिन्न विस्तार कार्यक्रम भी आयोजित किए। अन्नदाता देवो भव पर एक राष्ट्रीय अभियान और प्राकृतिक खेती पर एक अभिविन्यास कार्यशाला भी आयोजित की गई। निदेशालय ने अपना 35वां स्थापना दिवस मनाया और भीमताल में 'आजीविका और पोषण सुरक्षा के लिए मत्स्य पालन और जलीय कृषि' पर एक राष्ट्रीय संगोष्ठी का भी आयोजन किया। निदेशालय ने 'स्वच्छता अभियान' और आईसीएआर और भारत सरकार द्वारा आयोजित विभिन्न राष्ट्रीय अभियानों में भी भाग लिया है।

अंत में, मैं आश्वस्त करना चाहूंगा कि निदेशालय अपने वैज्ञानिक कार्यबल के साथ नई चुनौतियों का मुकाबला करने के लिए तैयार है। निदेशालय भारतीय हिमालयी क्षेत्र की वंचित आबादी की पोषण सुरक्षा की दिशा में लगातार काम कर रहा है। मैं डॉ. हिमांशु पाठक, सचिव, डेयर, भारत सरकार और महानिदेशक, आईसीएआर और डॉ. जे.के. जेना, उप महानिदेशक (मत्स्य विज्ञान) को उनके निरंतर समर्थन और मार्गदर्शन के लिए तहे दिल से धन्यवाद देता हूँ। डॉ. बी.पी. मोहंती एडीजी (अंतर्देशीय मत्स्य पालन) से मिला सहयोग का आभार व्यक्त करता हूँ। हमारे अनुसंधान कार्यक्रमों में हमारा मार्गदर्शन करने के लिए मैं आरएसी के अध्यक्ष और सदस्यों का आभारी हूँ। मैं आईसीएआर-डीसीएफआर के सभी वैज्ञानिकों और कर्मचारियों को वर्ष के दौरान उनके प्रभावशाली काम के लिए बधाई देता हूँ और वार्षिक रिपोर्ट में आईसीएआर-डीसीएफआर की वैज्ञानिक उपलब्धियों और गतिविधियों को संकलित करने और प्रस्तुत करने में उनके श्रमसाध्य प्रयासों के लिए वार्षिक रिपोर्ट 2022 की संपादकीय समिति की सराहना करता हूँ।

(प्रमोद कुमार पांडे)
निदेशक

PREFACE

Fish and other aquatic animals have been widely recognized as a functional food and also considered as an 'irreplaceable' food for nutritional security. It is also an important component of the diets of majority of world's population, particularly in developing countries. Since last few decades the aquaculture production is continuously increasing and now outpaced marine production. Coldwater fisheries and aquaculture, largely confined to the Himalayan regions of India have also gained momentum in this period. The ICAR-DCFR has worked sincerely through research, extension, and skill development programmes in the Indian Himalayan regions and provided technical support to different stakeholders for their capacity building, infrastructure development and transfer of technology for the augmentation of production and productivity. However, with the advancement, new problems are also posing challenges which need to be addressed through research and developmental support. The directorate has undoubtedly accepted those challenges and has been providing practical solutions to the fish farmers of the region.

The directorate has successfully developed a database of fishery resources of Arunachal Pradesh and also prepared a GIS based map for aquaculture site suitability. The information is useful for planning and development of fisheries and aquaculture in northeastern Himalayas. The habitat and health assessment of the Central Himalayan Rivers have been completed and water quality index has also been standardized. The hydrobiological parameters which influence species distribution have also been studied. These findings help in developing models for the natural resource management and their sustainable utilization. Ecotourism has been recognized as an important area for livelihood and income generation. The directorate has recorded angling status of golden mahseer and identified major hotspots for developing fish-based ecotourism at large scale. At the same time stock validation of different mahseer species using molecular tools has been taken up which are helpful in the identification and conservation of the endangered fish fauna. Efforts are also made to enhance the fertility traits of golden mahseer through different trials. A larval feed and feeding strategy for golden mahseer larvae has also been prepared which has given very encouraging results. Trials were also made to enhance the reproductive competence of the chocolate mahseer (*Neolissochilus hexagonolepis*) through environmental manipulation. The ornamental fishery has considerable scope in developing small-scale enterprise for hill dwellers. The directorate is making very concerted efforts for the breeding of indigenous fish species having ornamental value.

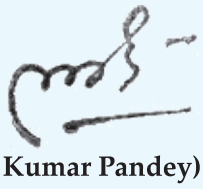
Rainbow trout farming has become a commercial venture in the Himalayan region. For the intensive farming of rainbow trout, a mini-RAS model has successfully been developed and different biofilter substrates for efficient removal of ammonia have been tested. A field study was conducted with a view to optimise safe loading density for live transportation of rainbow trout yearlings that will help in the safe transportation and stocking of trout seed at farmers' locations. In addition, an efficient rainbow trout broodstock feed has also been developed by the directorate which helps in improving the feeding competency of trout brooder. Apart from this, a comparative evaluation of trout feed has been conducted to study the performance at different locations as well as with respect to genetic background of the species. Under the system diversification programme, a sustainable aquaponics model for pilot-scale fish-

vegetable production in mid-hill Himalaya has given promising results. However, it needs further refinement before reaching to the end users.

Fish health management and disease surveillance is an integral part of aquaculture activities and the directorate is involved in the assessment and evaluation of health status of coldwater aquaculture based on trout and carps. Efforts are being made to design and develop potential antimicrobial agents against fish pathogens. A detailed investigation of health disorders associated with trout loss during seed production in hatcheries helped in the identification of different causative agents and factors as well as the developing remedial measures. Antimicrobial resistance in fishes against different antibiotics were screened across trout farms of different Himalayan states. Further, anti-parasitic drugs were tested in golden mahseer. In addition, two different nanoemulsion against emerging infections, caused by *Saprolegnia* sp., was formulated. Both the nanoemulsion showed antisaprolegnia, antioxidant and immunostimulatory activities. The directorate is also working to develop *in-vitro* meat using fish cell lines. Molecular characterization of sex-linked genes of *Tor putitora* has been carried out which is useful in understanding the process of sex determination and differentiation in this endangered species. A GnRH peptide analogue was synthesized in the laboratory. Using the peptide hormone, an injectible formulation was prepared and tested for its efficacy in inducing spawning in different fishes. The preliminary study showed that formulation has the potential to induce spawning.

Under the NEH, TSP and SCSP programme the ICAR-DCFR has organized various programmes and also provided necessary aquaculture inputs to the targeted communities for fish farming and livelihood security. Under these programmes, a number of clusters of fish farmers have been developed in different Himalayan states. Hatcheries were created in various Himalayan states, including Menchuka, Arunachal Pradesh, and in the cold desert of Leh and Ladkah (UT) to meet the need for rainbow trout seed in the area. The directorate has also prepared a road map for the sustainable development of fisheries in UT of Leh and Laddakh. During the period, the directorate also organized various extension programmes such as field days, awareness campaigns, demonstration trips, field tours, to raise awareness among farmers. A national campaign on Annadata Devo Bhava and an orientation workshop on Natural Farming were also organized. The directorate celebrated its 35th foundation day and also organized a national symposium on "Fisheries and Aquaculture for Livelihood and Nutritional Security" at Bhimtal. The directorate also participated in 'Swachhata Abhiyan' and also in different National campaigns organized by ICAR and Government of India.

At the end, I would like to assure that the directorate is ready to combat new challenges with its scientific workforce. The directorate is continuously working towards nutritional security of the underprivileged population of the Indian Himalayan region. I sincerely thank Dr. Himanshu Pathak, Secretary, DARE, GOI and Director General, ICAR and Dr. J. K. Jena, Deputy Director General (Fisheries Science) for their constant support and guidance. Support received from Dr B.P. Mohanty, ADG (Inland Fisheries) is gratefully acknowledged. I am thankful to the chairman and members of the RAC for guiding us in our research programs. I congratulate all the scientists and staff of ICAR-DCFR for their impressive work during the year and my appreciation to the editorial committee of the annual report for their painstaking efforts in compiling and presenting the scientific achievements and activities of the ICAR-DCFR in Annual Report 2022.



(Pramod Kumar Pandey)
Director

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ANNUAL REPORT 2022

कार्यकारी सारांश

हिमालयी पारिस्थितिकी तंत्र न केवल अपनी जलवायु की स्थिति बल्कि अपनी जैव विविधता के मामले में भी अद्वितीय है। भारतीय हिमालय क्षेत्र कई नदियों और झीलों का स्रोत है। इन जल निकायों में स्थानिक मत्स्य प्रजाति पाई जाती हैं जो पहाड़ी निवासियों के निर्वाह के लिये मत्स्य प्रदान करते हैं। हालांकि, विदेशी ट्राउट की शुरुआत के साथ, हिमालयी क्षेत्रों में शीतजल मात्स्यिकी ने प्रगतिशील विकास दिखाया है। इसके अलावा, रेनबो ट्राउट की खेती के लिए आईसीएआर–डीसीएफआर के निरंतर प्रयास से निश्चित रूप से उत्पादन बढ़ाने में मदद मिली है। इसके अलावा, भारतीय कृषि अनुसंधान परिषद (ICAR) के तत्वावधान में शीतजल मत्स्य अनुसंधान और विकास के लिए एक नोडल संस्थान के रूप में भाकृअनुप–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने बुनियादी, रणनीतिक, विस्तार गतिविधियाँ, पहाड़ी क्षेत्रों में मत्स्य पालन और संसाधन मूल्यांकन के क्षेत्रों में अत्यधिक योगदान दिया है। इसके अलावा, किसानों, मत्स्य अधिकारियों, फार्म प्रबंधकों, छात्रों और संकायों के लिए नियमित आधार पर आवश्यकता आधारित प्रशिक्षण, कौशल विकास और क्षमता निर्माण कार्यक्रम आयोजित किए जाते हैं। वर्ष के दौरान, निदेशालय ने विभिन्न अनुसंधान परियोजनाओं को सफलतापूर्वक पूरा किया है और वर्ष 2022 में संस्थान की अनुसंधान उपलब्धियां संक्षेप में निम्नानुसार हैं:–

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- ड्रेनेज नेटवर्क, लैंड यूज लैंड कवर, डिजिटल एलिवेशन मॉडल, स्लोप और एक्वाकल्चर के लिए अंतिम साइट उपयुक्तता पर एक डिजिटल डेटाबेस ArcGIS v 10.8 के स्थानिक विश्लेषण उपकरण द्वारा सैटेलाइट डेटा, जियो रेक्टिफाइड SOI टोपोशीट्स, स्थानिक और गैर–स्थानिक डेटा का उपयोग करके अरुणाचल प्रदेश, एनईएच क्षेत्र, भारत के लिए विकसित किया गया।
- मध्य हिमालयी नदी सरयू, उत्तराखंड की मत्स्य जैव विविधता और स्वास्थ्य मूल्यांकन किया गया है।
- मध्य हिमालय, उत्तराखंड में स्थित नदी लधिया में मछलियों की उपस्थिति के पैटर्न एवं स्वास्थ्य की स्थिति और हाइड्रोबायोलॉजिकल विविधताओं का प्रभाव पर अध्ययन किया गया। लधिया नदी के लिए जल गुणवत्ता सूचकांक का मानकीकरण किया गया।
- ईको–टूरिज्म और संरक्षण के लिए कुमाऊं क्षेत्र में महाशीर पकड़ने की स्थिति का आंकलन करने का काम किया गया है। महासीर के संरक्षण पर मछली पकड़ने के प्रभाव का विश्लेषण करने के लिए अतीत और वर्तमान की मछली पकड़ने की स्थिति पर डेटा दर्ज किया गया।
- कुमाऊँ क्षेत्र में महाशीर पकड़ने की स्थिति का आकलन करने के लिए छह जिलों में मछली पकड़ने की स्थिति, मछली पकड़ने का लाइसेंस, मछली पकड़ने के स्थलों के हॉटस्पॉट, संरक्षण स्थल, मछली प्रजाति–विशिष्ट संभावित धाराएँ, मछली पकड़ने के संचालकों का एक वृत्तचित्र, मछली लैंडिंग डेटा और इकोटूरिज्म बीट कुमाऊँ क्षेत्र का डेटा जमा किया गया है। इसके अलावा, संभावित एंगलिंग साइट और स्पोर्ट फिश उपलब्धता को उजागर करने के लिए एक डिजिटल मैप तैयार किया गया।
- भारत के मध्य और पूर्वी हिमालयी क्षेत्र से महासीर प्रजातियों (टोर और नियोलिसोचिलस) की प्रजातियों और स्टॉक सत्यापन पर नेटवर्क कार्यक्रम के तहत महाशीर के नमूने विभिन्न नदियों, झीलों से एकत्र किए गए। उत्तराखंड के पौड़ी और हरिद्वार जिलों में नयार नदी (व्यासघाट) और गंगा नदी (लकसर) से महाशीर जननद्रव्य एकत्र करने के लिए खोजपूर्ण सर्वेक्षण किए गए। मॉर्फोमेट्रिक और मेरिस्टिक पैरामीटर

एकत्र किए गए और विभिन्न जल निकासी से एकत्र की गई प्रजातियों की बारकोडिंग के लिए डीएनए आइसोलेशन किया गया।

- पश्चिमी और पूर्वी हिमालयी क्षेत्र की मछली प्रजातियों की IUCN खतरे की स्थिति का आकलन करने के लिए ICAR-DCFR और मणिपुर विश्वविद्यालय की एक सहयोगी परियोजना शुरू की गई है। पश्चिमी हिमालय की मछलियों के खतरे की स्थिति और वितरण पर पिछले आईयूसीएन आकलन की परियोजना समीक्षा के तहत किया गया था। सहयोगी संस्थान के रूप में मणिपुर विश्वविद्यालय द्वारा पूर्वी हिमालयी क्षेत्रों से मछली प्रजातियों के लिए जैविक डेटा एकत्र किया गया।
- कैप्टिव परिस्थितियों में नर गोल्डन माहशीर ब्रूडर के थर्मल और आकार पर निर्भर उर्वरता गुणों को खोजने पर परियोजना के तहत नर ब्रूडर के अधिकतम आकार को समझने के लिए आकार पर निर्भर प्रजनन गुणों पर एक प्रयोग शुरू किया गया है।

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- चॉकलेट महाशीर, (नियोलिसोचिलस हेक्सागोनोलीपिस) के बीज उत्पादन को बढ़ाने के लिए, ब्रूडर के प्रजनन प्रदर्शन पर प्रकाश स्पेक्ट्रा के साथ–साथ विभिन्न फोटोपीरियोड शासनों के प्रभाव का अध्ययन करने के लिए प्रयोग शुरू किया गया है।
- स्वदेशी सजावटी मछली के प्रजनन प्रोटोकॉल के विकास के तहत बेरिलियस वगरा का सफल प्रजनन किया गया है।
- छोटे पैमाने पर शीतजल में मछली उत्पादन के लिए मिनी आरएएस विकसित किया गया है। इसके अलावा, छोटे पैमाने के जलीय कृषि के लिए विभिन्न बायोफिल्टर सबस्ट्रेट्स में अमोनिया हटाने की उपयुक्तता और दक्षता का मूल्यांकन किया गया है। इसके अलावा, बिना किसी पूर्व–उपचार के आरएएस जल में नाइट्रेट के आकलन के लिए एक सीधी विधि का मानकीकरण किया गया है। यह विधि उच्च नाइट्रेट और निम्न नाइट्राइट स्तर वाले पानी के नमूनों के लिए उपयुक्त है, जैसे कि एक्वाकल्चर पानी को फिर से प्रसारित करना।
- सुपर–ऑक्सीजन युक्त पानी के प्लास्टिक बैग में रेनबो ट्राउट मछली के लाइव परिवहन के लिए सुरक्षित लोडिंग घनत्व का मूल्यांकन करने के लिए एक क्षेत्र अध्ययन किया गया। यह अनुशंसा की गई है कि पर्याप्त आहार–विहीन और हल्के बेहोश करने की क्रिया के बाद 10°C पर 10 घंटे से अधिक, प्लास्टिक की थैलियों में रेनबो ट्राउट वार्षिकियों के लाइव परिवहन के लिए 230 g/L का लोडिंग घनत्व सुरक्षित है।
- पहली बार एक शीतजल के एक्वापोनिक्स मॉडल को स्वदेशी रूप से डिजाइन और विकसित किया गया। प्रायोगिक प्रजातियों के रूप में रेनबो ट्राउट और लेट्यूस का उपयोग करके मॉडल को लो–टेक बैकयार्ड मॉडल के रूप में पायलट पैमाने पर परीक्षण किया गया है। एक्वापोनिक्स मॉडल की तकनीकी–आर्थिक व्यवहार्यता के आधार पर एक आकलन ने रेनबो ट्राउट के लिए 22.3 kg/m^3 और लेट्यूस के लिए 4.22 kg/m^3 की उत्पादकता की क्षमता दिखाई।

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- सुनहरी महासीर (टोर पुटिटोरा) की प्रजनन क्षमता और लार्वा गुणवत्ता गुणों में सुधार के लिए, एक कृत्रिम लार्वा आहार तैयार किया गया है और उसका मूल्यांकन किया गया है। विभिन्न आहार व्यवस्थाओं के तहत लार्वा के प्रदर्शन का मूल्यांकन उनकी वृद्धि, उत्तरजीविता और फिटनेस के संदर्भ में किया

गया। मिश्रित आहार के तहत लार्वा ने उच्च वृद्धि और उत्तरजीविता दिखाई।

- रेनबो ट्राउट के लिए एक कुशल ब्रूड स्टॉक फीड विकसित किया गया तथा निजी और सार्वजनिक दोनों क्षेत्रों में परीक्षण किया गया। फीड को अब व्यावसायीकरण के लिए तयार किया जा रहा है, और भविष्य में यह पूरे देश में मांग पर उपलब्ध होगा।
- पोषक रूप से संतुलित रेनबो ट्राउट फीड का तुलनात्मक मूल्यांकन एक उपयुक्त और पोषक रूप से पर्याप्त ट्राउट फीड का पता लगाने के लिए किया गया।
- रेनबो ट्राउट में स्टॉकिंग घनत्व और आहार संरचना के अंतः क्रियात्मक प्रभावों का मूल्यांकन किया गया। कुल मिलाकर, निष्कर्षों से संकेत मिलता है कि परीक्षण किए गए आहार मछली भोजन सामग्री की तुलना में स्टॉकिंग घनत्व का वृद्धि, चयापचय और ट्राउट के कल्याण के विश्लेषण किए गए मार्करों पर अधिक स्पष्ट प्रभाव पड़ता है, जिसमें बहुत कम अंतः क्रियात्मक प्रभाव होते हैं।

- जेनेटिक बैकग्राउंड के संबंध में रेनबो ट्राउट ग्रो–आउट फीड प्रदर्शन का मूल्यांकन किया गया है। विभिन्न आनुवंशिक पृष्ठभूमि से संबंधित दो समूहों ने रूपमितीय विशेषताओं में महत्वपूर्ण अंतर दिखाया, इस प्रकार आनुवंशिक पृष्ठभूमि और फीड प्रदर्शन के बीच संबंध का संकेत दिया। इसके अलावा, रामगढ़ में विभिन्न कृषि स्थितियों के तहत फीड प्रदर्शन का क्लस्टर सत्यापन भी किया गया।

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- "पानी के बिना मछली" परियोजना के तहत रेनबो ट्राउट मांसपेशियों से मायोसाइट्स को अलग करने की प्रक्रिया को घनत्व ढाल सेंट्रीफ्यूगेशन का उपयोग करके मानकीकृत किया गया। बोए जाने पर केवल कुछ मायोसाइट्स टिशू कल्चर फ्लास्क में संलग्न होते हैं। अधिकांश कोशिकाएँ निलंबन में रहीं और निलंबन में कोशिकाएँ एक सप्ताह के भीतर पतित हो गईं। मायोसाइट्स के विकास को बढ़ावा देने के लिए और प्रयोगों की आवश्यकता है।
- स्वदेशी ठंडे पानी की मत्स्य प्रजातियों और इसके फाइलोजेनी का पूर्ण माइटोकॉन्ड्रियल जीनोम द्वरा प्रजातियों की पहचान और संरक्षण के लिए अधिक विश्वसनीय और उपयोगी डेटा के लिए एनजीएस पद्धति का उपयोग करके अध्ययन शुरू किया गया।
- पॉलिमर और सेल–पेनेट्रेटिंग पेप्टाइड्स (सीपीपी) के सहक्रियात्मक प्रभाव का अध्ययन करने के लिए, जैव सूचना विज्ञान उपकरणों का उपयोग करके आठ नए सीपीपी की पहचान की गई है। डिजाइन किए गए सेल–पेनेट्रेटिंग पेप्टाइड ने मछली कोशिकाओं के अंदर अपनी जीन–वहन क्षमता के लिए आशाजनक परिणाम दिखाए।
- गोल्डन महासीर (टोर पुटीटोरा) में लिंग विभेदन और लिंगानुपात पर विभिन्न तापमानों के प्रभाव के मूल्यांकन के लिए एक अध्ययन शुरू किया गया है। प्रारंभिक अध्ययन में यह देखा गया कि ऑन्टोजेनिक विकासात्मक चरणों को आणविक सेक्स भेदभाव चरणों और हिस्टोलॉजिकल सेक्स भेदभाव चरणों में विभाजित किया जा सकता है। इसके अलावा, थर्मल स्ट्रेस से संबंधित जीन (टीएसजी) और हाउस–कीपिंग जीन (एचकेजी) की भी विशेषता थी।
- एक GnRH पेप्टाइड एनालॉग को प्रयोगशाला में संश्लेषित किया गया। पेप्टाइड हार्मोन का उपयोग करते हुए, एक इंजेक्टेबल फॉर्मूलेशन तैयार किया गया और विभिन्न मछलियों में स्पॉनिंग को प्रेरित करने में इसकी प्रभावकारिता के लिए परीक्षण किया गया। प्रारंभिक अध्ययन से पता चला है कि सूत्रीकरण में स्पॉनिंग को प्रेरित करने की क्षमता है।

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- मछली रोगजनकों के खिलाफ संभावित रोगाणुरोधी एजेंटों के विकास के लिए इन सिलिको ड्रग डिजाइनिंग विधियों के लिए, एरोमोनास सालमोनिसिडा, स्यूडोमोनास

एरुगिनोसा, एडवर्डसिएला टार्डा और ए. सोब्रिया जैसे मछली रोगजनकों के खिलाफ मोरिन की जीवाणुरोधी गतिविधियों का सूक्ष्म–कमजोर पड़ने की विधि का उपयोग करके परीक्षण किया गया। मोरिन ने सभी चार मछली रोगजनकों के खिलाफ विकास निरोधात्मक प्रभाव दिखाया।

- बीज उत्पादन के दौरान ट्राउट फार्मों में मृत्यु दर से जुड़े सामान्य स्वास्थ्य विकारों से संबंधित जांच को लक्षित किया गया। उत्तराखंड के रुद्रप्रयाग, चमोली, बागेश्वर, नैनीताल और चंपावत जिलों से फार्म और हैचरी से महामारी संबंधी जानकारी एकत्र की गई। ट्राउट के विकास के विभिन्न चरणों में सामान्य रोग समस्याओं का दस्तावेजीकरण किया गया।
- सप्रोलेग्निय के रोक थाम के लिये दो विभिन्न नैनो इमल्सन सूत्रबद्ध किया गया। दोनों नैनोइमल्शन ने एंटीसैप्रोलेग्निया, एंटीऑक्सिडेंट और इम्यूनोस्टिमुलेटरी के विरूध गतिविधि दिखाई।

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- मछलियों में रोगाणुरोधी प्रतिरोध (एएमआर) पर नेटवर्क कार्यक्रम के तहत, उत्तराखंड से एरोमोनास समूह (एन=98) के रोगाणुरोधी प्रतिरोध ने सेफॉक्सिटिन (56%) के खिलाफ अधिकतम प्रतिरोध प्रदर्शित किया। उत्तराखंड से एस्चेरिचिया कोलाई आइसोलेट्स (एन=65) ने एम्पीसिलीन (58%) के खिलाफ अधिकतम प्रतिरोध दिखाया। उत्तराखंड से स्टैफिलोकोकस आइसोलेट्स (n=65) पेनिसिलिन जी (73%) के लिए प्रतिरोधी थे।
- जलीय पशु रोग के लिए राष्ट्रीय निगरानी कार्यक्रम के तहत शीतजल की मछली रोगों की निगरानी (NSPAAD), नैनीताल और बागेश्वर के ट्राउट फार्मों से निर्धारित प्रारूप के अनुसार सात रेनबो ट्राउट फार्मों, रेसवे और हैचरी से बेसलाइन डेटा एकत्र किया गया।
- मछली स्वास्थ्य पर अखिल भारतीय नेटवर्क परियोजना के तहत सुनहरी महाशीर में परजीवी रोधी दवा एमामेक्टिन बेंजोएट के अवशिष्ट प्रभाव का परीक्षण किया गया।
- निक्रा परियोजना के तहत, आरएएस (RAS) में रेनबो ट्राउट की उच्च इकाई उत्पादकता के लिए पालन स्थितियों और संस्कृति प्रथाओं का अनुकूलन प्रगति पर है। वर्तमान उत्पादन परिदृश्य के आधार पर, प्रति किलोग्राम मछली उत्पादन में पानी का उपयोग सौ गुना (700 लीटर प्रति किलोग्राम मछली) कम हो गया है। तेजी से विकास दर और कुशल फ़ीड रूपांतरण के कारण इष्टतम पालन स्थितियों के तहत संवर्धन अवधि को घटाकर 5–6 महीने कर दिया है।
- इसके अलावा शारीरिक इष्टतम से ऊपर के तापमान पर थर्मल सुरक्षा मार्जिन और रेनबो ट्राउट की अनुकूलन क्षमता को बढ़ाने के लिए एंटीऑक्सिडेंट के विभिन्न आहार पूरक स्तरों की प्रभावशीलता का मूल्यांकन करने के लिए 8 सप्ताह का फीडिंग परीक्षण किया गया।
- इंद्रधनुष ट्राउट में थर्मल अनुकूलन के तीन संभावित उपन्यास बायोमार्कर, अर्थात् तनाव प्रेरित फॉस्फोप्रोटीन (एसटीआईपी1), हाइपोक्सिया अप–रेगुलेटेड प्रोटीन (एचयूयू1) और हीट शॉक प्रोटीन–40 परिवार के सदस्य सी16 (डीएनएजेसी16) की विशेषता बताई गई।
- रेनबो ट्राउट के विकासात्मक आकारिकी में तापमान पर निर्भर परिवर्तन का भी अध्ययन किया गया है।

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- डीबीटी प्रायोजित परियोजना के तहत देशी मछली जीवों का प्रजनन और बीज उत्पादन किया गया। स्नो ट्राउट के बीज का उत्पादन किया गया। एक हार्मोन के साथ उत्प्रेरण, पर्यावरणीय हेरफेर और मलमल के कपड़े से ढकी बजरी की क्यारी प्रदान करके स्वैच्छिक अंडजनन सफलतापूर्वक प्राप्त किया गया।

vkÃihvkj vkj çkS|ksfxdh fodkl

- आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल, उत्तराखंड द्वारा 'कैप्टिव मैच्योरिटी एंड मल्टीपल ब्रीडिंके ऑफ गोल्डन महशीर' के प्रौद्योगिकी हस्तांतरण के लिए त्रिपक्षीय समझौते के

ज्ञापन (एमओए) पर आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल, उत्तराखंड, मैसर्स दास और कुमार्स प्राइवेट लिमिटेड, वाराणसी और आईसीएआर–एग्रीनोवेट, नई दिल्ली द्वरा हस्ताक्षर किए गए।

- वर्ष के दौरान आईसीएआर–डीसीएफआर ने तीन पेटेंट आवेदन दायर किए हैं, तीन ट्रेडमार्क पंजीकृत किए हैं और एक कॉपीराइट पंजीकरण किया है।
- इसके अलावा, व्यावसायीकरण के लिए एग्रीनोवेट इंडिया लिमिटेड के माध्यम से तीन तकनीकों का विज्ञापन किया गया है।
- वर्ष के दौरान आईसीएआर–डीसीएफआर ने आपसी लाभ के लिए निजी उद्योग, मत्स्य विभाग और जलविद्युत विकासकर्ताओं के साथ समझौता ज्ञापन पर हस्ताक्षर किए।

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- राष्ट्र का 73वां गणतंत्र दिवस 26 जनवरी 2022 को ध्वजारोहण समारोह के साथ मनाया गया, जिसमें निदेशालय के सभी वैज्ञानिकों और कर्मचारियों ने भाग लिया।
- 5 मार्च 2022 को आईसीएआर–डीसीएफआर द्वारा लेह में 'रीसर्क्युलेटिंग एक्वाकल्चर सिस्टम (आरएएस) आधारित रेनबो ट्राउट हैचरी और उच्च ऊंचाई में नर्सरी प्रबंधन' पर एक प्रशिक्षण–सह–प्रदर्शन कार्यक्रम आयोजित किया गया।
- संस्थान कि आरएसी बैठक का आयोजन 21–22 मार्च, 2022 को डॉ डब्ल्यू.एस. लकड़ा, पूर्व निदेशक और कुलपति आईसीएआर–सीआईएफई, मुंबई की अध्यक्षता में किया गया। ।
- शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल ने 23 मार्च 2022 को प्राकृतिक खेती सह किसान मेला पर एक उन्मुखीकरण कार्यशाला का आयोजन किया।
- 23–24 अप्रैल, 2022 को अन्नदाता देवो भवः पर राष्ट्रीय अभियान को भारत की स्वतंत्रता के 75 वर्ष पूरे होने के उपलक्ष्य में आजादी का अमृत महोत्सव के रूप में मनाया गया। डॉ. राजेंद्र सिंह, एक भारतीय जल संरक्षणवादी और पर्यावरणविद, जिन्हें "भारत के जलपुरुष" के रूप में जाना जाता है, ने इस अवसर पर मुख्य अतिथि के रूप में शिरकत की।
- 15वीं आईआरसी बैठक 24 से 25 मई 2022 को डॉ. प्रमोद कुमार पांडे, निदेशक, आईसीएआर–डीसीएफआर की अध्यक्षता में आयोजित की गई। संस्थान के वैज्ञानिकों ने चल रहे अनुसंधान कार्यक्रमों की प्रगति प्रस्तुत की।
- "महसीर के डीएनए बारकोडिंग और डेटा के जैव सूचना विज्ञान विश्लेषण" पर व्यावहारिक प्रशिक्षण माहसीर नेटवर्क प्रोजेक्ट के तहत 20–28 मई, 2022 के दौरान आयोजित किया गया।
- आईसीएआर–डीसीएफआर भीमताल में 6 जून, 2022 को विश्व पर्यावरण दिवस समारोह मनाया गया।

- 21 जून, 2022 को निदेशालय और उसके प्रायोगिक फील्ड सेंटर, चंपावत के सभी कर्मचारियों और शोधार्थियों द्वारा 8वां अंतर्राष्ट्रीय योग दिवस मनाया गया। अंतर्राष्ट्रीय योग दिवस 2022 के लिए संयुक्त राष्ट्र का विषय "मानवता के लिए योग" है।
- 11 जुलाई, 2022 को आजादी के अमृत महोत्सव–75वें स्वतंत्रता दिवस के तहत राष्ट्रीय मत्स्य किसान दिवस के दिन "उभरती जलीय कृषि प्रणालियों और प्रथाओं" पर राष्ट्रीय अभियान और किसानों की बैठक का आयोजन किया।
- आईसीएआर स्थापना दिवस पर 16 जुलाई 2022 को प्रायोगिक मत्स्य फार्म, चंपावत में वृक्षारोपण कार्यक्रम आयोजित किया गया।
- आईसीएआर–डीसीएफआर, भीमताल ने 27 जुलाई 2022 को आजादी का अमृत महोत्सव समारोह के तहत "गैर–पारंपरिक एक्वाकल्चर सिस्टम पर राष्ट्रीय अभियान" के एक भाग के रूप में "इंटीग्रेटेड मल्टी–ट्रॉफिक एक्वाकल्चर सिस्टम्स (आईएमटीए)" पर एक आभासी व्याख्यान का आयोजन किया।

- आजादी का अमृत महोत्सव समारोह और आईसीएआर मत्स्य प्रभाग के 'स्वास्थ्य और समृद्धि के लिए मछली' पर राष्ट्रीय अभियान के एक भाग के रूप में, 1 अगस्त, 2022 को भीमताल में एक विशेष कार्यक्रम आयोजित किया। विश्व स्तर पर प्रसिद्ध जलीय कृषि और पोषण वैज्ञानिक, प्रो. सदाशिवम कौशिक (पूर्व निदेशक, INRA, फ्रांस और ULPGC, स्पेन के यूरोपीय अनुसंधान क्षेत्र अध्यक्ष) ने इस अवसर पर मुख्य अतिथि के रूप में शिरकत की।
- आईसीएआर–डीसीएफआर, भीमताल ने 1–3 अगस्त 2022 तक "ठंडे पानी की मछली की गहन खेती के लिए एक्वाकल्चर रीसर्क्युलेटिंग सिस्टम" पर तीन दिवसीय व्यावहारिक प्रशिक्षण आयोजित किया।
- 76वां स्वतंत्रता दिवस ध्वजारोहण समारोह के साथ मनाया गया जिसमें निदेशालय के सभी वैज्ञानिकों और कर्मचारियों ने भाग लिया।
- हिंदी पखवाड़ा का आयोजन 1 से 15 सितंबर, 2022 तक किया गया। इस अवसर पर विभिन्न कार्यक्रमों जैसे वाद–विवाद, प्रश्नोत्तरी, आसान प्रतियोगिता, हिंदी टाइपिंग और हिंदी अनुवाद का आयोजन किया गया।
- मत्स्य पालन निदेशालय, झारखंड ने राज्य के उन किसानों और उद्यमियों के लिए जो वर्तमान में आरएएस में मछली पालन शुरू करने की योजना बना रहे हैं, 13–15 सितंबर 2022, मत्स्य किसान प्रशिक्षण केंद्र, रांची में तीन दिवसीय प्रशिक्षण का आयोजन किया।
- आईसीएआर–शीतजल मत्स्य, अनुसंधान निदेशालय, भीमताल ने 24 सितंबर 2022 को अपना 35वां स्थापना दिवस मनाया। प्रोफेसर आदित्य कुमार मिश्रा, पूर्व अध्यक्ष, एएसआरबी, नई दिल्ली ने इस अवसर पर मुख्य अतिथि के रूप में शिरकत की।
- आईसीएआर–डीसीएफआर, भीमताल ने 29 सितंबर– 01 अक्टूबर, 2022 के दौरान "हैचरी प्रबंधन और सुनहरी महासीर के बीज उत्पादन पर व्यावहारिक प्रशिक्षण" पर तीन दिवसीय प्रशिक्षण कार्यक्रम का आयोजन किया।
- निक्रा परियोजना के तहत, निदेशालय ने 10–11 अक्टूबर, 2022 के दौरान 'जलवायु भेदी ट्राउट खेती' पर दो दिवसीय कार्यशाला का आयोजन किया।

- आईसीएआर–डीसीएफआर, भीमताल में "एग्री स्टार्टअप कॉन्क्लेव और प्रदर्शनी" का सीधा प्रसारण देखा गया। माननीय प्रधान मंत्री ने 17 अक्टूबर 2022 को "पीएम किसान सम्मान सम्मेलन 2022" नामक दो दिवसीय कार्यक्रम में कृषि स्टार्टअप कॉन्क्लेव और प्रदर्शनी का उद्घाटन किया।
- सतर्कता जागरूकता सप्ताह 31 अक्टूबर से 6 नवंबर, 2022 तक मनाया गया।
- कोल्डवाटर फिशरीज सोसाइटी ऑफ इंडिया (CFSI) के सहयोग से भीमताल में 18–19 नवंबर, 2022 के दौरान दो दिवसीय "राष्ट्रीय संगोष्ठी" आजीविका और पोषण संबंधी आवश्यकताओं के लिए मत्स्य पालन और एक्वाकल्चर पर आयोजित किया है। पदम भूषण डॉ. आर.एस. परोदा, पूर्व सचिव, डेयर और महानिदेशक आईसीएआर, नई दिल्ली ने मुख्य अतिथि के रूप में समारोह की शोभा बढ़ाई।
- निदेशालय ने 21 नवंबर, 2022 को विश्व मत्स्य दिवस मनाया। इस अवसर पर कुमाऊं क्षेत्र के विभिन्न गांवों के मत्स्य पालकों ने कार्यक्रम में भाग लिया।
- विश्व मृदा दिवस 05 दिसंबर, 2022 को मनाया गया।
- आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल ने 5–9 दिसंबर, 2022 तक "मछली की गहन खेती के लिए रीसर्क्युलेटिंग एक्वाकल्चर सिस्टम" पर पांच दिवसीय व्यावहारिक प्रशिक्षण आयोजित किया।
- विशेष स्वच्छता अभियान– 2 से 31 अक्टूबर, 2022 (विशेष अभियान 2.0– लंबित मामलों का निस्तारण) का आयोजन किया गया।
- स्वच्छता पखवाड़ा 16-31 दिसंबर, 2022 को भीमताल और चंपावत में आयोजित किया गया।
- 22 वीं संस्थान प्रबंधन समिति (IMC) की बैठक 28 दिसंबर, 2022 को आयोजित की गई।

1. Executive Summary

Himalayan ecosystem is not only unique in terms of its climatic condition but also in its biodiversity. The Indian Himalayan region is the source of many rivers and lakes. These water bodies support endemic fish fauna which provides subsistence fishery to the hill dwellers. However, with the introduction of exotic trout, the coldwater fisheries in the Himalayan regions have shown progressive growth. Furthermore, the continuous effort of ICAR-DCFR for rainbow trout farming has definitely helped in increasing the production. Apart from this, the ICAR-Directorate of Coldwater Fisheries Research, Bhimtal as a nodal institute for coldwater fisheries research and development under the aegis of Indian Council of Agricultural Research (ICAR) has immensely contributed in the areas of basic, strategic and applied research, extension activities, hill aquaculture and resource assessment. In addition, need based training, skill development and capacity building programmes are conducted on regular basis to farmers, fishery officers, farm managers, students and faculties. During the year, the directorate has successfully completed different research projects and the research accomplishments of the institute in the year 2022 are summarized as follows:

Resource assessment and management

- A digital database on Drainage network, land use land cover, digital elevation model, slope and final site suitability for aquaculture were developed by spatial analysis tool of ArcGIS v 10.8 using the Satellite data, geo rectified SOI toposheets, spatial and non-spatial data for the Arunachal Pradesh, NEH Region, India
- Ichthyofaunal diversity and health assessment of Central Himalayan River Saryu, Uttarakhand has been completed.
- Health status and influence of hydrobiological variations on fish assemblages pattern in River Ladhiya Central Himalayas, Uttarakhand was completed. Water quality index was standardized for river Ladhiya.
- Work has been done to assess the angling status of mahseer in Kumaun region for eco-tourism and conservation. Data on angling status of past and present were recorded for analyzing the impact of angling on conservation of mahseer.
- To assess the angling status of mahseer in Kumaun region information on angling catch status, angling licensing, hotspots of angling sites, conservation sites, fish species-specific potential streams, a documentary of angling operators, fish landing data and ecotourism beets in six districts of the Kumaon region has been generated. In addition, a digital map was prepared to highlight the potential angling site and sport fish availability.
- Under the network programme on species and stock validation of mahseer species (*Tor* and *Neolissochilus*) from central and eastern Himalayan region of India. Different rivers, lakes were sampled and specimens of mahseer were collected. Exploratory surveys were carried out to collect mahseer germplasm from the Nayar River (Vyasghat) and Ganga River (Lakshar) in Pauri and Haridwar districts of Uttarakhand. Morphometric and meristic parameters collected and DNA isolation was done for barcoding of the species collected from different drainages.

- A collaborative project of ICAR-DCFR and Manipur University was started to assess the IUCN threat status of the fish species of

western and eastern Himalayan region. Under the project review of the previous IUCN assessment on the threat status and distribution of freshwater fishes of the Western Himalayas was done. From Eastern Himalayan Regions, biological data were collected for fish species by Manipur University as collaborating institute.

Aquaculture oriented research and development

- An experiment on size-dependent fertility traits has been initiated to understand the optimum size of male brooders for maximizing hatchery output under the project on finding thermal and size-dependent fertility traits of male golden mahseer brooders in captive conditions.
- For upscaling of the seed production protocol of chocolate mahseer, *Neolissochilus hexagonolepis*, experiment has been started to study the effect of different photoperiod regimes along with the light spectra on the reproductive performance of brooders.
- Under the development of breeding protocol of indigenous ornamental fish, successful breeding of *Barilius vagra* has been successfully done.
- Mini RAS for small scale coldwater fish production has been developed. Further, suitability and efficiency of ammonia removal in different biofilter substrates for small-scale aquaculture has been evaluated. In addition, standardisation of a direct method for estimation of Nitrate in RAS water without any pre-treatment has been done. This method is suitable for water samples having high nitrate and low nitrite levels, such as recirculating aquaculture water.
- A field study was conducted to evaluate the safe loading density for live transportation of rainbow trout yearlings in plastic bags of super-oxygenated water. It has been recommend that a loading density of 230 g/L is safe for live transportation of rainbow trout yearlings in plastic bags, over 10 hours at ~10°C, following adequate starvation and mild sedation.
- For the first time a novel coldwater aquaponics model was indigenously designed and developed or sustainable farming in hills. The model has been tested on pilot scale as low-tech backyard model using rainbow trout and lettuce as experimental species. An assessment on techno-economic feasibility of the aquaponics model showed the potentiality of the system with productivity of 22.3 kg m^{-3} for rainbow trout and 4.22 kg m^{-2} for lettuce.

Fish nutrition and feed development

- For improving reproductive competence and larval quality traits of golden mahseer, *Tor putitora* an artificial larval diet has been prepared and evaluated. The performance of the larvae under different feeding regimes was assessed in terms of their growth, survival and fitness. Larvae under mixed feeding showed higher growth and survival.
- An efficient brood stock feed for rainbow trout has been developed and tested in field condition at different locations both in private and public sector farms. The feed is now being considered for commercialization, and in future, it will be available throughout the country on demand.
- Comparative evaluation of a nutritionally balanced rainbow trout feed was done to find out a suitable and nutritionally adequate trout feed.
- Interactional effects of stocking density and diet composition in rainbow trout has been evaluated. Overall, the findings indicate that stocking density has a more pronounced effect on the analysed markers of growth, metabolism and welfare of rainbow trout, as compared to the tested dietary fish meal content, with very less interactional effects.
- Rainbow trout grow-out feed performance with respect to genetic background has been evaluated. The two groups belonging to different genetic background showed significant differences in morphometric features, thus indicated the relationship between genetic background and feed performance.
- Furthermore, cluster validation of feed performance under different farm conditions at Ramgarh was also done.

Molecular genetics and biotechnology

- Under the project "Fish without water" the procedure for the isolating myocytes from rainbow trout muscles was standardized using density gradient centrifugation. Only a few myocytes attach in the tissue culture flasks when seeded. Most of the cells remained in suspension and the cells in suspension degenerated within a week. Further experiments are required to promote the growth of myocytes.
- Complete mitochondrial genome characterization of indigenous coldwater species and its phylogeny was started using NGS method for more reliable and useful data for molecular systematic, species identification, and conservation.
- To study the synergistic effect of polymer and cell-penetrating peptides (CPPs), eight novel CPPs have been identified using bioinformatics tools. The designed cell-penetrating peptide showed promising results for its gene-carrying capacity inside fish cells.
- A study has been started for evaluation of the effect of different temperatures on the sex differentiation and sex ratio in golden mahseer (*Tor putitora*). In preliminary study it was observed that ontogenic developmental stages can be divided into molecular sex differentiation stages and histological sex differentiation stages. In addition, thermal stress-related genes (TSG) and house-keeping genes (HKG) were also characterized.
- A GnRH peptide analogue was synthesized in the laboratory. Using the peptide hormone, an injectible formulation was prepared and tested for its efficacy in inducing spawning in different fishes. The preliminary study showed that formulation has the potential to induce spawning.

Disease surveillance and health management

- For the *in silico* drug designing methods for development of potential antimicrobial agents against fish pathogens, the antibacterial activities of morin against fish pathogens such as *Aeromonas salmonicida, Pseudomonas aeruginosa, Edwardsiella tarda*, and *A. sobria* were tested using the micro-dilution method. The morin showed growth inhibitory effects against all four fish pathogens.
- Investigations related to common health disorders associated with mortality in trout farms during seed production was targeted. Epidemiological information from farm and hatchery were collected from Rudraprayag, Chamoli, Bageshwar, Nainital, and Champawat districts of Uttarakhand.
- Two different nanoemulsion against emerging infections caused by *Saprolegnia* sp. was formulated. Both the nanoemulsion showed the antisaprolegnia, antioxidant and immunostimulatory activity.

National Network programmes

- Under the Network programme on antimicrobial resistance (AMR) in fishes, the antimicrobial resistance of *Aeromonas* group (n=98) from Uttarakhand demonstrated maximum resistance against Cefoxitin (56%). *Escherichia coli* isolates (n=65) from Uttarakhand showed maximum resistance against ampicillin (58%). *Staphylococcus* isolates from Uttarakhand (n=65) were resistant to penicillin G (73%).
- Under the National surveillance programme for aquatic animal disease-Surveillance of coldwater fish diseases (NSPAAD), baseline data from seven rainbow trout farms, raceways, and hatcheries was collected as per the prescribed format from trout farms of Nainital and Bageshwar.
- Under the All India network project on fish health anti-parasitic drug emamectin benzoate in golden mahseer was tested for its residual effect.
- Under the NICRA project, the optimization of rearing conditions and culture practices for higher unit productivity of rainbow trout in RAS is in progress. Based on the current production scenario, water use per kilogram fish production has been reduced by hundred-fold (~700 L per kg fish). Culture duration has been reduced to 5-6 months under optimal rearing conditions, due to faster growth rates and efficient feed conversion.

- Further an 8-week feeding trial to evaluate the effectiveness of different dietary supplementation levels of antioxidants to enhance the thermal safety margins and acclimation capacity of rainbow trout, at temperatures above the physiological optimum was carried out.
- Three potentially novel biomarkers of thermal adaptation in rainbow trout, namely stress induced phosphoprotein (*stip1*), hypoxia up-regulated protein (*hyou1*) and heat shock protein 40 family member C16 (*dnajc16*) were characterized.
- A temperature-dependent change in developmental morphology of rainbow trout has also been studied.

Externally funded projects

- Under DBT sponsored project, breeding and seed production of native fish fauna was done. The seed of snow trout were produced. Voluntary spawning was achieved successfully by inducing with a hormone, environmental manipulation and providing gravel bed covered with muslin cloth.

IPR and technology development

- Tripartite Memorandum of Agreement (MoA) was signed by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, Uttarakhand, with the M/s Das and Kumars Pvt. Ltd, Varanasi and the ICAR-Agrinnovate, New Delhi for the technology transfer of 'Captive Maturation and Multiple Breeding of Golden Mahseer.
- During the year ICAR-DCFR filed three patent applications, registered three trademarks and one copyright registration.
- In addition, three technologies have been advertized through Agrinnovate India Limited for commercialization.
- The ICAR-DCFR during the year signed MoU with private industry, fisheries department and hydroelectric developers for mutual benefits.

Important events, extension activities, trainings and other programmes

- The 73rd Republic Day of our nation was celebrated with flag hoisting ceremony on 26th January 2022, with the participation of all the scientists and staff of the Directorate.
- On 5th March 2022, a training-cum-demonstration programme on 'Recirculating Aquaculture System (RAS) based rainbow trout hatchery and nursery management in high altitude' was organised by ICAR-DCFR at Leh.
- The institue's RAC was held on 21-22nd March, 2022 under the Chairmanship of Dr W.S. Lakra, Former Director and Vice-Chancellor ICAR-CIFE, Mumbai.
- The ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised an orientation workshop on Natural farming cum Kisan Mela on 23rd March 2022.
- National Campaign on Annadata Devo Bhava on 23-24th April, 2022 was celebrated to commemorate 75 years of India's independence being observed as Azadi Ka Amrut Mahotsav. Dr Rajendra Singh, an Indian water conservationist and environmentalist known as the "Waterman of India," graced the occasion as chief guest.
- The 15th IRC meeting was held on 24th to 25th May 2022 at ICAR-DCFR, Bhimtal under the Chairmanship of Dr Pramod Kumar Pandey, Director, ICAR-DCFR. Scientists of the institute presented the progress of the ongoing research programmes.
- Hands-on training on "DNA barcoding of mahseer and bioinformatics analysis of data." Was organised during 20–28th May, 2022 under the network project on Mahseer
- World Environment Day celebration was celebrated on 6th June, 2022 at ICAR-DCFR Bhimtal.
- The 8th International Yoga Day was celebrated by all the staff and research scholars of the Directorate and its Experimental Field Centre, Champawat on 21st June 2022 with the United Nations theme for International Day of Yoga 2022 being "Yoga for humanity".
- ICAR-DCFR celebrated national campaign on "Emerging Aquaculture Systems and Practices" and farmers' meet on National Fish farmers' day on 11th July 2022 under Azadi ka Amrut Mahotsava-75th year of celebration of Independence.

- On ICAR Foundation day, 16th July 2022, a tree plantation programme was organised at Experimental Fish Farm, Champawat.
- ICAR-DCFR, Bhimtal, organized a virtual lecture on "Integrated Multi-trophic Aquaculture Systems (IMTA)" as a part of "National campaign on Non-Conventional Aquaculture System" under Azadi Ka Amrut Mahotsav celebration on 27th July, 2022.
- As a part of the Azadi Ka Amrit Mahotsav celebration and ICAR Fisheries Division's national campaign on 'Fish for Health and Prosperity', CAR-DCFR organised a special event on 1st August 2022 at Bhimtal. Globally renowned aquaculture and nutrition scientist, Prof. Sadasivam Kaushik (Former Director of Research, INRA, France and European Research Area Chair of ULPGC, Spain) graced the occasion as the chief guest.
- ICAR-DCFR, Bhimtal, conducted three days hands-on training on "Recirculating aquaculture system for intensive farming of coldwater fish" from 1-3rd August, 2022.
- The 76th Independence Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate.

- Hindi Pakhwara was organized ICAR-DCFR, Bhimtal from 1st to 15th September 2022. On this occasion different events such as debate, quiz, easy competition, Hindi typing, and Hindi translation were organized.
- ICAR-DCFR organized five days workshop on "Assessment of IUCN threat status and distribution of the fishes of Eastern Himalayan Freshwater Biodiversity Hotspot and Western Himalayan of India" from 5th to 9th September 2022, in collaboration with Manipur University at Department of Zoology, Manipur University, Manipur.
- The Directorate of Fisheries, Jharkhand, organised a three days training for the farmers and entrepreneurs of the state who are presently involved or planning to start fish farming in RAS. The programme was organised during 13-15th September 2022, at the Fish Farmers Training Centre, Ranchi.
- ICAR-Directorate of Coldwater Fisheries Research, Bhimtal celebrated its 35th foundation day on 24th September 2022. Professor Aditya Kumar Misra, Former Chairman, ASRB, New Delhi, graced the occasion as chief guest.
- ICAR-DCFR, Bhimtal organized a three-day training programme on "Hands-on-training on hatchery management and seed production of golden mahseer" during 29th September-01st October, 2022.
- Under NICRA project, the Directorate organised a two-day workshop on 'Climate resilient rainbow trout farming during 10-11th October 2022.
- ICAR-DCFR, Bhimtal organized live telecast of Agri Startup Conclave and Exhibition. Honorable Prime Minister inaugurated the Agri Startup Conclave and Exhibition at a two-day event titled "PM Kisan Samman Sammelan 2022" on 17th October 2022.

- Vigilance Awareness Week was celebrated from 31st October to 6th November 2022.
- ICAR-DCFR in collaboration with Coldwater Fisheries Society of India (CFSI) has organized two days "National Symposium on Fisheries and Aquaculture for Livlihood and Nutritional security"during 18-19 November, 2022 at Bhimtal. Padam Bhushan Dr R.S. Paroda, Former Secretary DARE & Director General ICAR, New Delhi graced the ocassion as Chief Guest.
- The directorate celebrated World Fisheries Day on 21st November, 2022. On this ocassion fish farmers of the different villages of Kumaun region participated in the programme.
- World Soil Day was celebrated on 05th December, 2022
- ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, conducted five days of hands-on training on "Recirculating Aquaculture System for Intensive Farming of Fish" from 5-9th December 2022.
- Special Cleanliness Drive -2nd to 31st October, 2022 (Special Campaign 2.0 - Disposal of pending matters) was organized.
- Swachhta Pakhwara - 16-31st December, 2022 was organized at Bhimtal and Champawat.
- 22nd Institute Management Committee (IMC) meeting was held on 28th December, 2022.

2. Introduction

2.1. Brief history

The research on coldwater fisheries commenced with the establishment of Coldwater Fisheries Research Centre of CIFRI in the year 1963 at Harwan, Jammu & Kashmir as a scheme under 3rd Five year Plan. Initially the centre assisted in providing the research inputs related with departmental trout hatcheries and other trout related problems to the State of Himachal Pradesh and Jammu & Kashmir. The activities of the centre increased rapidly and it carried out significant amount of investigation on coldwater fishery resources of the country. Thus, it was realized that coldwater fisheries as an important sector has a potential in generating rural income and providing food security to the economically underprivileged population residing in Indian uplands. To utilize the available resources and opportunities in the coldwater fisheries, the involvement of Indian Council of Agricultural Research in this sector started during late sixties and subsequently culminated in the creation of ***National Research Center on Coldwater Fisheries*** **(*NRCCWF*)** as an independent Research Center on 24th September 1987 during the 7th Five Year Plan. This is the only national facility in the country to take up the research investigation on capture and culture aspects on coldwater with a focus on exotic and indigenous fish species. Since its inception, the NRCCWF in spite of constraints in terms of manpower and infrastructure has made significant contribution for proper appraisal of coldwater fishery resources and developed suitable technologies to propagate important coldwater fish species in hills. Thus, keeping in view the ever-expanding activities of NRCCWF, and the greater potential of coldwater fisheries in different Himalayan states, in a significant decision during the 11th Five Year plan it was upgraded to ***Directorate of Coldwater Fisheries Research*** **(DCFR).** The basic objective was to develop location, situation and system specific technologies by utilizing and augmenting resources in all the Himalayan states from Jammu and Kashmir to Arunachal Pradesh.

At present, the Directorate is ISO certified (ISO 9001:2015) nodal research centre focussed on endemic as well as exotic coldwater fishes. In the last 35 years, the directorate has been working untiringly to address issues and challenges of coldwater fisheries through use of modern techniques and biotechnological tools. The directorate has developed different need based technologies and popularized various models of fish breeding and culture in Himalayan region. In recent years, development of efficient and cost-effective trout feed, disease surveillance and health management, molecular characterization, development of breeding and seed production protocols for food and ornamental species as well as conservation and consultancy services are a few areas among a long list of activities undertaken by the Directorate. The Directorate has also contributed in human resource development and skill development programme for creating trained manpower for the overall development of the sector. The ICAR-DCFR is on its glorious path of virtually actualizing its vision by imparting boon of quality research in sustainable coldwater fisheries production, management and conservation.

2.2 Location

The headquarters of ICAR-DCFR is located at Bhimtal (29°19'52.647"N 79°33'18.083"E), at an altitude of 1470 m asl in the district of Nainital of Uttarakhand state. The nearest airport is at Pantnagar which is about 55 km from Bhimtal. The closest railway station is Kathgodam, around 22 km from Bhimtal and about 280 km from Delhi. Bhimtal can also be reached from Delhi via Haldwani by bus. ICAR-DCFR has an experimental fish farm center at Chirapani in Champawat district (29°17'55.537"N

80°6'8.915"E) of Uttarakhand, which is about 150 km from Bhimtal.

2.3 Vision

Coldwater fisheries and aquaculture to be an important economic activity in upland region for livelihood security and ecotourism

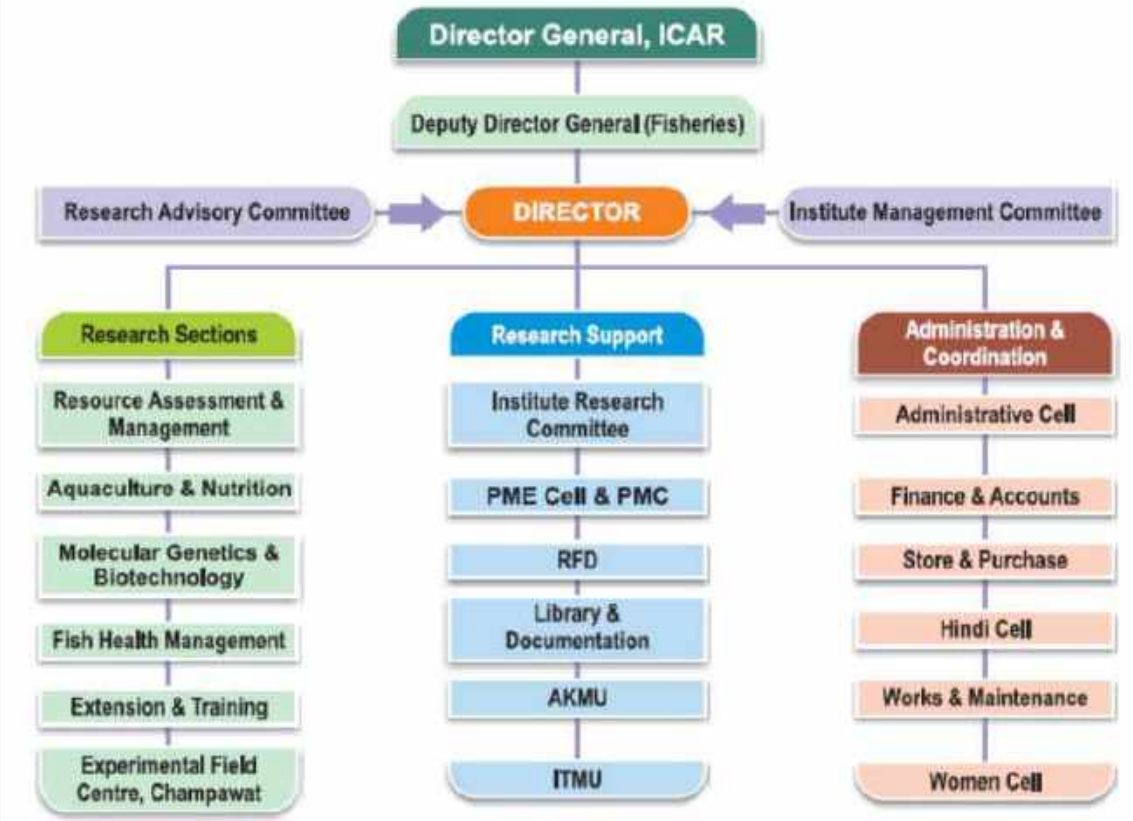
2.4 Mission

To become a Centre of excellence for assessing and managing coldwater fishery resources, development technologies and models of hill aquaculture and formulating strategies for holistic growth of the sector

2.5 Mandate

- To conduct basic, strategic and applied research in coldwater fisheries and aquaculture
- To act as repository of hill fisheries resources
- Human resource development through training, education and extension

2.6 Organizational set-up



2.7 Management

In order to fulfil the mandate, the institute is pursuing its research activities through a setup of research management instituted by the Indian Council of Agricultural Research. As per rules and by laws of Indian Council of Agricultural Research, a Research Advisory Committee (RAC) consisting of eminent scientists, experts, Director and one senior level scientist as member secretary review the research achievements in of the institute. The committee also suggests research programmes based on national and global context in the thrust areas within the mandate of the institute.The RAC also guides in development of skills for presentation and efficient writing of reports, highlighting outputs and impact, commercialization, and innovative approaches for handling IPR and biosafety issues. Similarly, the Institute Management Committee (IMC)

monitors administrative and financial aspects of the Directorate, under the chairmanship of the Director. A number of other internal committees such as Institute Research Committee (IRC), Project Monitoring and Evaluation Committee (PME) and Institute Joint Staff Council (IJSC) are also in place for the smooth functioning and proper management of the institute.

2.8 Infrastructure

ICAR-DCFR Building Complex

The main office complex of ICAR-DCFR is located at Bhimtal. The facilities available at main complex are different laboratories, library, AKMU cell, wet laboratories, flow-through raceways, recirculatory aquaculture system, hatchery, museum andwell maintained aquarium open for public, guest house, committee rooms and auditorium. A functional mahseer seedproduction unit is also available at a different site in Bhimtal. The Directorate has an Experimental Field Centre at Chhirapani, Champawat, Uttarakhand. The field centre has a trout hatchery, cemented nursery and grow-out raceways with water recirculation system, ponds, tanks for conducting experiments, laboratories, check dam, reservoir, meeting hall, guest houseand staff quarters.

Main office building of ICAR-DCFR, Bhimtal

Mahseer hatchery at ICAR-DCFR, Bhimtal

Guest House of ICAR-DCFR, Bhimtal

Experimental Field Centre of ICAR-DCFR at Champawat

Laboratory facilities

The Directorate has well equipped laboratories to support research on geo-informatics, environmental fish biology, nutritional physiology, molecular genetics and biotechnology, fish biochemistry, cell culture, diagnostic bacteriology and fish mycology and parasitology. There is also a well maintained wet laboratory facility used for conducting research experiments in coldwater fishes. A feed mill installed in the main campus of the directorate is functional to meet the basic requirement of fish feed in the experimental farm.

Laboratory facilities at ICAR-DCFR, Bhimtal

2.9 Support services

***Prioritisation, Monitoring and Evaluation* Cell**

Prioritization Monitoring and Evaluation cellof the institute monitors the implementation and progress of research projects. The PME cell is responsible for maintaining the records of project reports through RPP system and for dealing with all the associated technical matters. The cell also keeps a record of publications, deputation and participation of scientists in seminars, symposia, workshop and conferences, training programmes attended as well as conducted. PME cell also organizes the annual meeting of Institute Research Committee (IRC) and Research Advisory Committee (RAC) to evaluate the progress made in each research project to approve the work programme for the following year. New research proposals are also approved by the IRC after thorough evaluation of the objectives, technical programme, practical utility, manpower and financial involvement.

Agriculture Knowledge Management Unit

Agricultural Knowledge Management Unit (AKMU) of this Directorate provides the facilities for scanning and printing and internet access (BSNL) to all scientists and other staff members. It also serves as network administrator and monitors the LAN connectivity of around 50 computers at this Directorate. In AKMU cell, desktop computer and internet facilities are also available for research scholars and students working under various project/programmes. Internet facilities at the experimental field centre, Champawat is provided through BSNL. Electronic mail and messaging solutions (mail server) are also maintained at this Directorate for secure communication via webmail.

The website of the Directorate (http://www.dcfr.res.in) has been modified as per Guidelines for Indian Government Website (GIGW) and certified for Standardization Test Quality Certification (STQC). The website is also being regularly updated as per the ICAR guidelines, under the AGROWEB project. The site presents information about the Directorate's manpower, mandate, research projects, major achievements, technology generated and consultancy services. Further, the conduct of training programmes, seminars, symposia, recruitments and tender notices are being notified in the website. The Directorate's website is also linked to the website of Indian Council of Agricultural Research (http://www.icar.org).

AKMU unit of ICAR-DCFR, Bhimtal

Library and Documentation Unit

The Directorate has a library and documentation unit which acts as a repository of literature and information. It is accessible to all the scientists, staff members, research scholars, students and other individuals from neighbouring institutes interested in scientific literature on coldwater fisheries and allied

subjects. All scientific books have been catalogued with barcoding. The library also provides the facility to access free online publications and articles of many international and national journals through www.cera.jccc.in.

Library and Documentation unit at ICAR-DCFR, Bhimtal

The library maintains active reprography services by producing departmental publications and supplying required photocopies to the scientists and research scholars. An inventory of e-journalscomprising more than 35,000 soft copies of important fisheries research articles has been developed. The documentation section is entrusted with the responsibility of publishing scientific bulletins, brochures, pamphlets, annual report and newsletters. Publications like annual reports, technical bulletins and special publications published from time to time are mailed to about 250 organizations, institutions, fishery agencies for exchange and sharing of knowledge with other research organizations.

Institute Technology Management Unit

The Institute Technology Management Unit has been constituted under the chairmanship of Director, for dealing with the patentable issues and other intellectual property rights of the Directorate. It is also responsible for safe transfer of technologies and for providing information about ICAR guidelines on IPR issues. Training and guidance are provided to the concerned scientists with respect to IPR issues. The ITMU cell observes World Intellectual Property day on 26th April every year and organizes a special workshop to create awareness on intellectual property rights.

2.10 Staff strength (as on 31.12.2022)

Category	Sanctioned	Filled	Vacant
Director (RMP)	01	01	-
Scientific	30	24	06
Technical	14	11	03
Administrative	18	11	07
Supporting	12	05	07
Total	75	52	23

2.11 Financial statement for the year 2021-22 and 2022-23

(*Rs. in lakh*)

S.No.	Head	Expenditure 2021-22	Expenditure 2022-23	ICAR share's
CAPITAL				
1.	Works			
	A. Land			
	B. Office Building	1.700	0.370	
	C. Residential Building			
	D. Minor works			
2.	Equipments	26.225	27.141	
3.	Information Technology	29.251	21.339	
4.	Library Books & Journals	1.347	1.829	
5.	Vehicle & Vessels	-	7.495	
6.	Livestock			
7.	Furniture & Fixtures	2.321	2.825	

8.	Others	-	-	
	Total Capital	**60.844**	**60.999**	**0.00007**
Grants in Aid- Salaries (Revenue)				
	Establishment Expenses			
	A. Salaries	783.649	930.000	-
	B. Arrear of Scientific staff	-	-	-
	Total	**783.649**	**930.000**	
Grants in Aid- General (Revenue)				
1.	Pension & other Retirement Benefit	27.892	55.419	
2.	**Travelling Allowance**			
	Domestic TA/Transfer TA	20.000	24.117	0.005
3.	**Research & Operation Expenses**			
	A. Research Expenses	103.073	48.298	15.355
	B. Operational Expenses	95.595	78.578	3.824
	Total- Research & Operation Expenses	**198.668**	**126.876**	**19.179**
4.	**Administrative Expenses**			
	A. Infrastructure	110.099	105.665	
	B. Communication	0.977	0.771	
	C. Repair & Maintenance			
	i) Equipments, Vehicle & Others	1.1241	5.665	
	ii) Office Building	27.555	37.955	12.750
	iii) Residential Building			
	iv) Minor Works	-	0.136	
	D. Other (excluding TA) (instt.)	81.346	91.612	9.189
	Total Administrative Expenses	**221.101**	**241.803**	**28.658**
5.	**Miscellaneous Expenses**			
	A. HRD within India	1.505	1.805	
	HRD (Abroad)	**-**		
	B. Other Items (Fellowship)	**-**		
	C. Publicity & Exhibition	4.249	0.788	
	D. Guest House Maint.	0.296	1.853	
	E. Other Miscellaneous	4.001	2.758	0.005
	Total Misc. Expenses	**10.051**	**7.204**	**0.005**
	NEH (Capital)	16.907	14.998	
	NEH (Revenue)	34.961	34.998	
	Total NEH	**51.868**	**49.996**	
	TSP (Capital)	9.995	9.998	
	TSP (Revenue)	19.955	25.000	
	Total TSP	**29.950**	**34.998**	
	SCSP (Capital)	20.400	30.000	
	SCSP (Revenue)	49.937	46.999	
	Total SCSP	**70.337**	**76.999**	
	Total Revenue (Grants in Aid-Salaries + Grants in Aid- General)	**1413.517**	**1547.412**	**47.847**
	Total Revenue + Capital	**1474.361**	**1608.411**	**47.847**

3. Research Achievements

A. Institutional projects

3.1 Resource Assessment and Management

Project: CF-6	**Ecosystem assessment and mapping of aquatic resources in Indian Himalayan regions**
Sub project 5:	**GIS based digital database on coldwater fishery resources of Arunachal Pradesh in North East Himalayan (NEH) region**
Period:	**April 2018 – March 2023**
Personnel:	**P. A. Ganie (PI), Kishor Kunal**
Funding Support:	**Institutional, ICAR-DCFR**

A digital database on drainage network, land use land cover, digital elevation model, slope and final site suitability for aquaculture were developed by spatial analysis tool of ArcGIS v 10.8 using the Satellite data, geo rectified SOI toposheets, spatial and non-spatial data for the Arunachal Pradesh, NEH Region, India

Development of digital elevation model (DEM) database: Using satellite data (ASTER, SRTM, CARTOSAT) and the spatial analyst tool of ARCGIS 10.8, the Arunachal Pradesh Digital elevation model database was created. The objective was to examine the elevational gradients of Arunachal Pradesh in order to determine the elevational regimes that can be considered when designing suitable fish farming locations for the different fish species.

Fig. Digital elevation model of the Arunachal Pradesh

Development of slope database: Using satellite data (ASTER, SRTM, CARTOSAT) and the spatial analyst tool of ARCGIS 10.8, the slope database of Arunachal Pradesh was created. The objective was to examine the different slope gradients of Arunachal Pradesh in order to determine the slope gradients that can be considered when designing suitable fish farming locations for the different fish species.

Fig. Slope of Arunachal Pradesh

Development of Aquatic Resources Database: A database of aquatic resources, namely riverine network, upland lakes and existing ponds and tanks of Arunachal Pradesh has been developed. For that, DEM, LISS III and spatial analyst tools of ArcGIS 10.8 were employed. Stream network of each district was extracted using D8 point methodology and Strahler's stream ordering nomenclature was followed in assigning the orders, upland lakes, reservoirs and ponds were identified using the basic supervised and NDVI techniques. The aim was to identify and demarcate the aquatic resources such as stream network of the districts and identify the streams that can be considered in selecting the final aquaculture suitable sites.

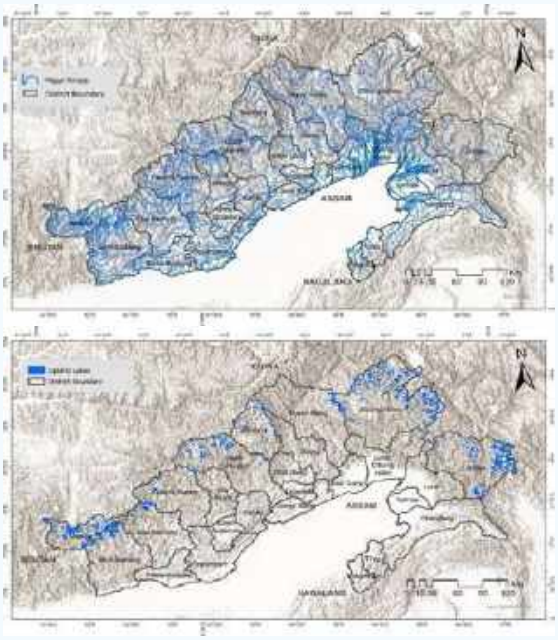


Fig. Aquatic resources of Arunachal Pradesh

Fig. Infrastructure related to aquaculture development of Arunachal Pradesh

Development of infrastructural facilities database: A database on infrastructure resources required for development of fish farming in the Arunachal Pradesh has been developed. the data in terms of available fish markets (local), fishery offices and existing fish farms were marked using hand held GPS (Garmin) and through literature. The data on road network of the region wad digitised suing the basemaps (satellite image) of ArcGIS 10.8 software.

Development of Land Use Land Cover (LULC) database: A database of land use land cover for the entire Arunachal Pradesh has been developed. Each district's LULC maps were created using LISS III satellite data, the spatial analyst tool of ARCGIS 10.8, and the standard technique of NRSA, 1995. For the districts, eight LULC groups were identified: agricultural land, built up, forests, grassland and grazing land, wastelands, Water bodies, shifting cultivation, and snow/glacier area (fig.4). The underlying objective was to have a better knowledge of the land availability and land utilisation methods in the districts. In each and every district, forest cover dominates land use.

Fig. LULC of Arunachal Pradesh

Development of Decision support framework for final aquaculture suitability: The selection was made using a variety of input parameters based on the district's topographic features (3 criteria), infrastructure features (4 criteria), soil qualities (3 criteria), and water quality (8 criteria). In the context of AHP, these input criteria were placed via pair-wise comparison in order to create a set of relative weights for each parameter. The decision model for determining the relative value of each criterion included preferences for fisheries development in relation to the evaluation criteria. Typically, the definition of preferences is a value assigned to an evaluation criterion that reflects its significance in relation to other factors being taken into account. The final site suitability equation was developed based on the weights determined for each criterion. which resulted in the classification of districts into several zonation's, including high potential zones and moderate potential zones.

Fig. Final aquaculture site suitability of Arunachal Pradesh

Project: CF-6	**Ecosystem assessment and mapping of aquatic resources in Indian Himalayan regions**
Sub project 6:	**Ichthyofaunal diversity and health assessment of Central Himalayan River Saryu, Uttarakhand**
Period:	**April 2020 – March 2023**
Personnel:	**Kishor Kunal (PI), P.A. Ganie, Ms. Garima**
Funding Support:	**Institutional, ICAR-DCFR**

The Saryu River originates from south of Nandakot Mountain in Bageshwar district in Uttarakhand, India. It flows through Kapkot, Bageshwar, and Seraghat towns before joining the Sharda River at Pancheshwar at the India–Nepal border. Stations were selected which were Kapkot, Bageshwar, Seraghat, Ghat, Panar and Pancheswar along the stretch of river from its origin to end. Altitude of different stations ranged from 426-1677 masl along the river stretch. Sampling was done bimonthly which was further categorized into four seasons. The seasons were classified as pre-monsoon (March to May), monsoon (June-September), post-monsoon (October- Early November), and winter (Late November- February).

Morphometric parameters characterisation of Saryu basin

The river basins hydrological response behaviour can be elucidated by studying its various morphometric parameters with geographic information system (GIS) tools. The Saryu River, is one of the major tributaries of the Ganga River system, was analysed for detailed study using Advanced Spaceborne Thermal Emission and Reflection (ASTER-30 m) data and topographic sheets of Survey of India. Nineteen (nineteen) watersheds were identified within the basin for calculating the morphometric parameters in the linear, areal and relief directions. The total drainage area of the basin is 754.23 km^2. The drainage pattern is dendritic to sub-dendritic, and its topography, the underlying geology, and the rainfall all influence it. The study area is designated as a 6th order basin having 3070 streams with a cumulative length of 2912.44 km. The bifurcation ratio varies from 0.50 to 10, while the drainage density ranges from 0.94 to 1.33 km/km^2. The physiography and the lithology of the region profoundly impacts its stream order. The shape index, shape factor, and compactness coefficient indicate that the basin has moderate tectonic activity with moderate basin lag times and will take longer for the occurance of a peak flow. In light of the study area's relief characteristics, it has moderate to steep slopes, consequently experiencing low to moderate soil erosion.

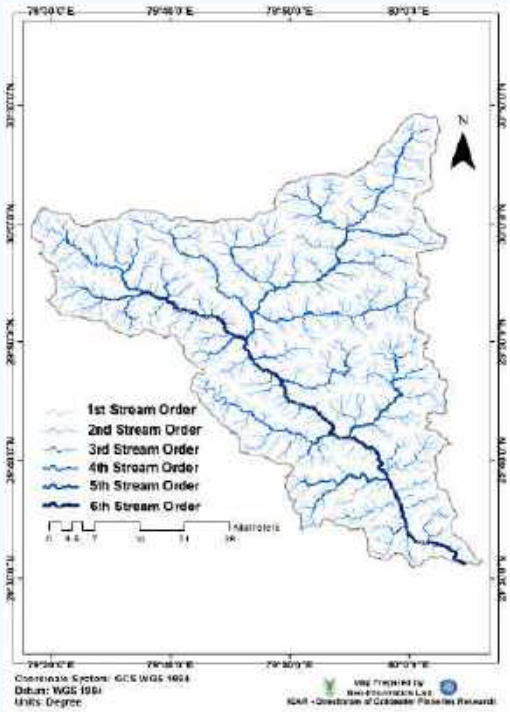


Fig. Drainage pattern of Saryu basin

Extraction of stream network by D8 point methodology

In this study, D8 method (multi-direction method) was used to delineate the hierarchical orders of the drainage network by using hydrology tool in ArcGIS software from the ASTER DEM (30 m). DEM precision was improved by removing pixel-based errors, such as sinks and peaks, which also eliminated drainage discontinuities Strahler's stream ordering system was used for extracting the stream segments from the filled DEM. A series of GIS functions were used to map relatively

high-accuracy drainage networks from the DEM, including filling pixels, computing flow direction and accumulation, and lastly estimating the contributing area. The drainage pattern dependability was assessed using the Survey of India's topographical map, and a threshold value of z= 200 used for the DEM grid for drainage pattern extraction from the DEM.

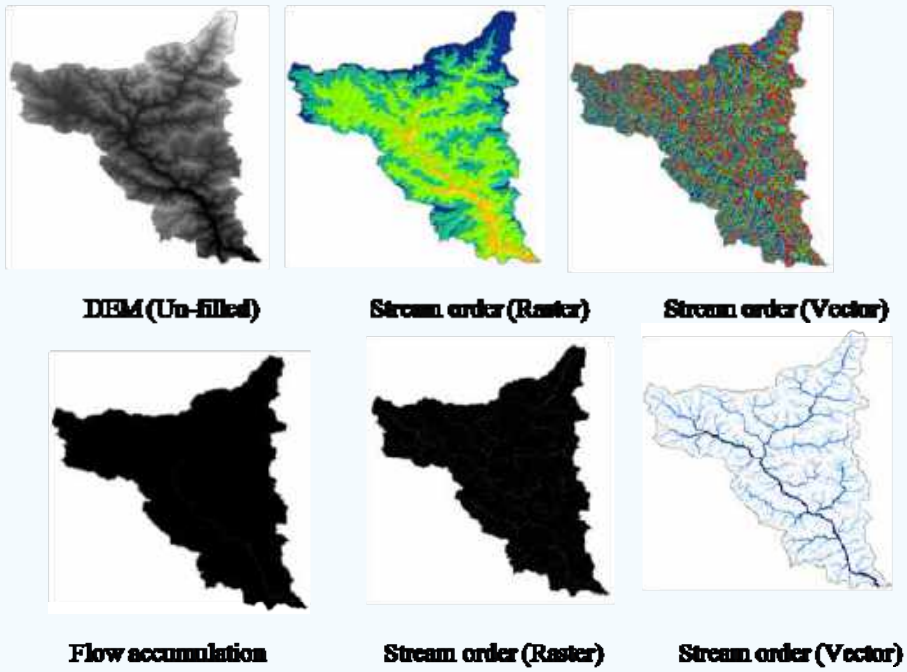


Fig. Extraction of drainage layer of the Saryu basin

Physiographic indices of Saryu basin

Slope

Geomorphic slope is a key attribute that provides information about how much of a basin incline towards the horizontal surface, and it is one of the most important factors for developing a watershed and making morphometric analyses. Morpho-climatic processes mainly control it, having different types of rocks with varying rock resistances. The degree of slope in the Saryu basin varies from <0.02° to >68°. According to Wentworth's (1930), erodibility of a basin is directly proportional to its average slope, provided all other factors are constant, i.e., areas with a higher slope will have higher erosion and vice versa. As a result, the higher the slope degree, the faster the runoff and the higher the erosion rate, while the contrary is true for lower slope degrees. Slope (>20) dominates the basin, with the exception of the basin's western, eastern, and south western extremities, where a 5-20-degree slope predominate.

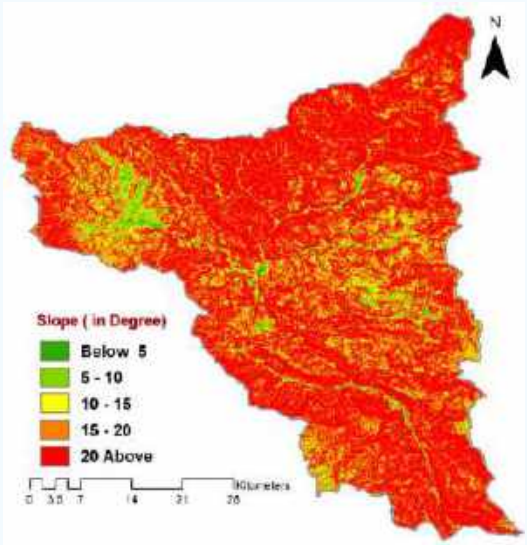


Fig. Slope of the Saryu basin

The steep to moderate slope found throughout the basin indicates a moderate infiltration rate and drainage density. It also suggests that the basin is in the later stages of growth, from youth to maturity.

Aspect

The aspect of a slope determines which way it faces about the horizontal plane. Different microclimatic conditions are formed in the landscape depending on the slope aspect, with differing soil qualities and nutrient concentrations. Temperature, moisture, humidity, and evaporation all alter as a result, impacting plant dynamics and soil qualities. Furthermore, the aspect direction has a significant impact on the local climate, as north-facing slopes between 30 and 55 degrees latitude receive less direct sunshine than their southern counterparts. According to Magesh and coworkers 2011, a pixel value in the output raster dataset denotes the aspect's compass direction. Although the basin's slopes face in all directions, the south facing slopes, particularly the south western and south eastern slopes, are the most dominant.

Habitat assessment

Habitat assessment in Saryu River was carried out based on the locations of sampling stations, weather conditions, stream characterization, watershed features, riparian vegetation, in-stream features, in-stream sediment and substrate features, physicochemical characteristics of water, phytoplankton, periphyton and zooplankton diversity distribution. Different physicochemical and biological parameters were studied to assess the drainage habitat. The water quality index was analyzed to find out the level of pollution in the area. The value of the water quality index (31.02-95.05) shows the condition of water quality from good to poor based on its physicochemical characteristics.

Ichtyodiversity of the River

Fifteen fish species were identified with *Schizothorax plagiostomus, S. richardsonii, S. progastus, S. esocinus, Gylptothorax telchitta, G. alkanandi, Naziritor chelynoides, Tor putitora, Barilius bendelisis, B. vagra, B. barila, Garra gotyla, Bagarius bagarius, Osparius barna* and *Nemacheilus corica.* The maximum fish diversity was recorded at Pancheswar where Saryu meets Kali River, while minimum at Kapkot, the highest point and nearest to the origin of the Saryu River. Maximum fish abundance was recorded at Seraghat while the minimum at Kapkot.

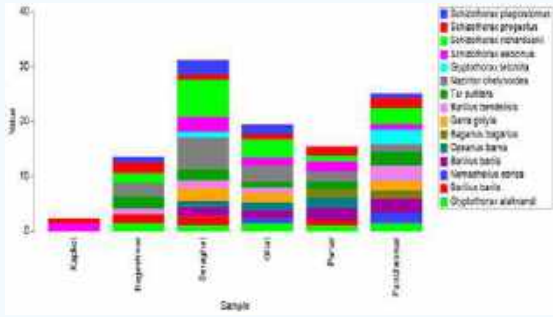


Fig. Bar plot showing the distribution of fish at different sampling stations

Phytoplankton Diversity of the River

41 species of phytoplankton under three major groups Bacillariophyceae Chlorophyceae and Cyanophyceae were identified with dominant genera *Cymbella, Nitzschia, Navicula, Stigeoclonium* and *Oscillatoria.* Maximum diversity and abundance were recorded at Seraghat where the slope is gentle and river flow with minimum velocity compared to other stations. Huge numbers of pools filled with juveniles were recorded at this station. Pielou's evenness index (J'), Shannon -Weiner's diversity index H'(loge) and Simpson's diversity index (1-lambda) value indicate the no pollution in the river. Temporal variation was more dominant than spatial.

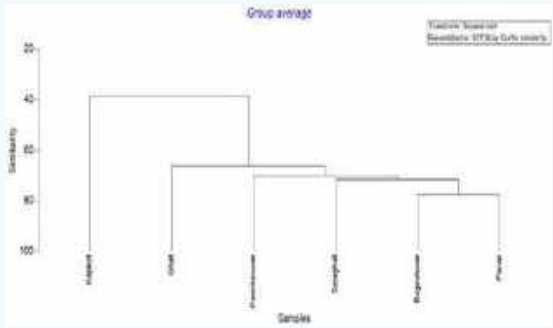


Fig. Bray-Curtis similarity among stations based on phytoplankton diversity and abundance

Seventeen periphyton were identified with a density of 187-1670 individuals/cm^2. The density of the plankton and periphyton at different sampling stations showed negative correlation with water or stream velocity. Based on the similarity, the periphyton of Kapkot was least similar to other stations. Ten zooplankton genera were identified with the density of 70-370 individual/liter.

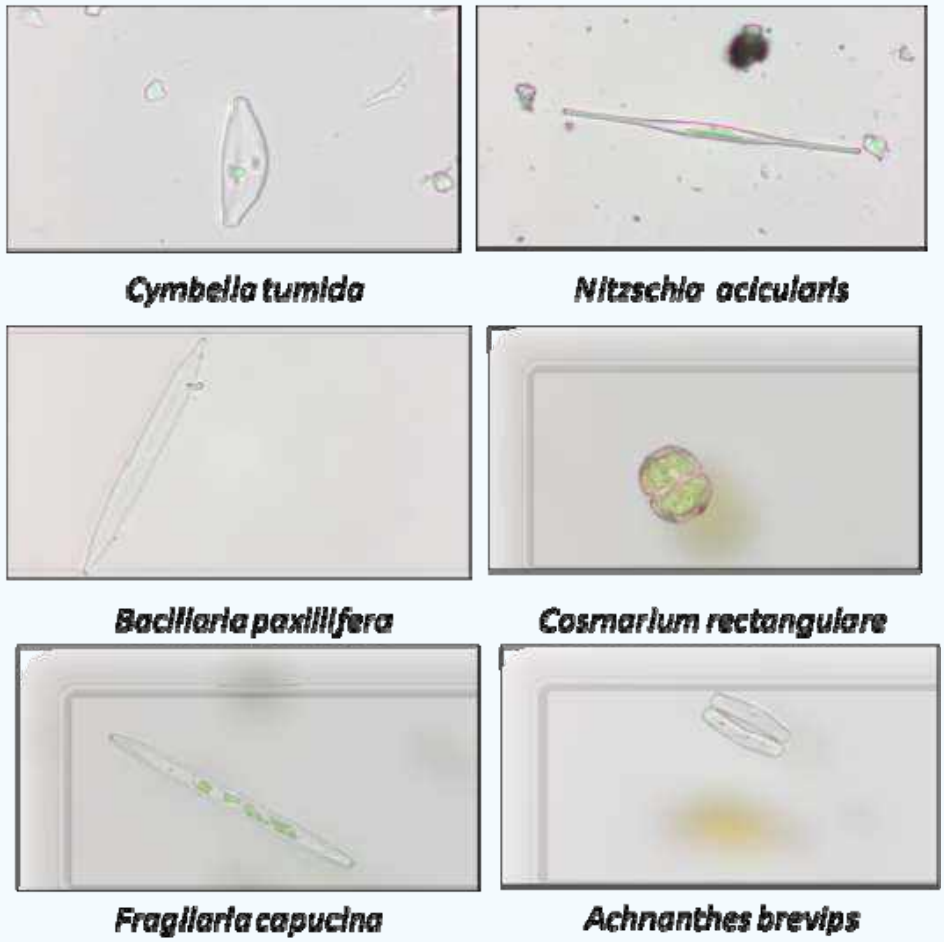


Fig. Plankton diversity

Project: CF-6	**Ecosystem assessment and mapping of aquatic resources in Indian Himalayan regions**
Sub project 7:	**Assessment of health status and influence of hydrobiological variations on fish assemblages pattern in River Ladhiya Central Himalayas, Uttarakhand**
Period:	**April 2020 – March 2023**
Personnel:	**P.A. Ganie (PI), K. Kunal, Ms. Garima**
Funding Support:	**Institutional, ICAR-DCFR**

Among the most endangered ecosystems in the world are the rivers and streams. They have fundamental values not subject to human choice or control, as well as ecological, spiritual, artistic, cultural, economic, and social worth. These river values are dependent on how well they are doing. Anthropogenic activities have badly overexploited and put strain on India's rivers, particularly the Himalayan rivers. Various stressors, including nutrient enrichment, pollution, sediment buildup, erosion, changes in stream hydrology, and habitat changes, threat to the ecological integrity and health of streams. A periodic examination of their health is necessary to determine rivers' and streams' actual conditions and rate of change.

Sampling area: The field sampling was carried out at six different locations of the river Ladhiya (Sunnegoan, Sunnkot, Reetha sahib, Baelkheth, Chalthi and Chukka) for recording and collection of species and hydrobiological data.

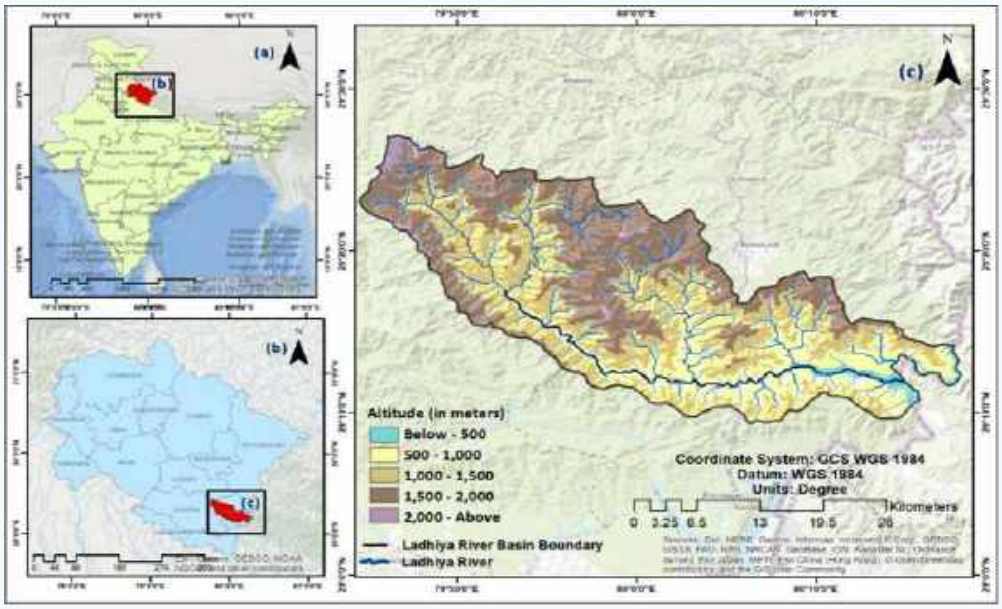


Fig. Location map of river Ladhiya

Estimation of biotic parameters of the river Ladhiya

Biotic parameters namely Phytoplankton, Zooplankton and Periphyton were estimated using the standard procedures. 36 species of phytoplankton, belonging to three major groups: Bacillariophyceae, Chlorophyceae, and Cyanophyceae were identified from the river. The most dominant genera observed were *Nitzschia*, *Navicula*, *Synedra*, and *Cymbella*. The study found that the highest diversity and abundance of phytoplankton were observed at Belkhet, where the river's slope was gentle and with minimal flow velocity compared to other stations. The density of phytoplankton ranged from 320-2680 cells per liter. To assess the pollution level of pollution in river, Pielou's evenness index (J'), Shannon -Weiner's diversity index H'($\log_e$) and Simpson's diversity index (1-lambda) value was used. The results indicated that the river was not polluted.

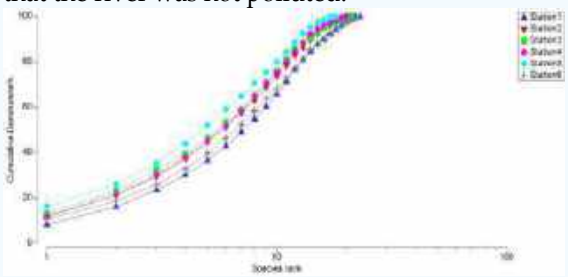


Fig. Dominance plot among stations based on phytoplankton diversity and abundance

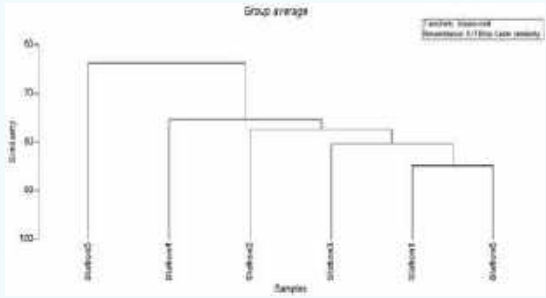


Fig. Bray Curtis similarity among stations based on phytoplankton diversity and abundance

Periphyton assemblage of the river was also studied for qualitative and quantitative analysis, as it is one of the major food sources for hill stream fishes. There are 17 periphyton species with a density of 388-2045 individuals/cm^2. Among the periphyton, filamentous algae like *Stigeoclonium* and *Spirogyra* were dominant.

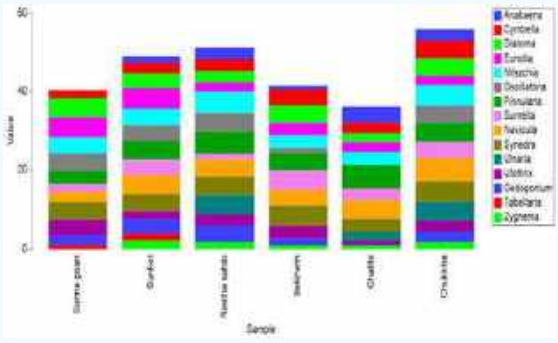


Fig. Bar plot showing the distribution of periphyton at different station

The study found that the abundance and diversity of primary producers, such as phytoplankton and periphyton, were greatly regulated by the physicochemical characteristics of water. Finally, 12 zooplankton genera with a density of 125-480 individuals per litre were also identified. Overall, this study provides important insights into the ecology of freshwater systems and highlights the need for further research to understand better the relationships between primary producers and the physicochemical characteristics of water.

Water quality index of river Ladhiya: For assessing the health of the river, the water quality index was standardised for river Ladhiya based on the methodology developed by Brown et al (1972). Based on this assessment, it was found that river water varied from being of poor quality to very poor quality along its entire stretch rendering it fit only for irrigation. This might be probably because of more habitation and agricultural activities going on in the river's catchment.

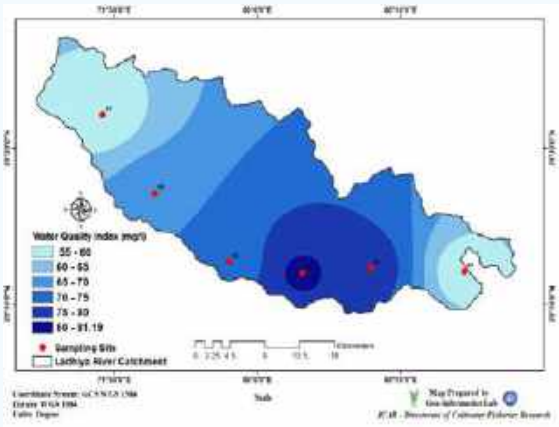


Fig. Water quality index of river Ladhiya

Ichthyodiversity and assemblage

Five species of fish, namely *Schizothorax richardsoni, Barilius bendelesis, Tor putitora, Barilius vagra, and Garra gotyla*, have been identified in the riverine region. It was discovered that *Barilius bendelesis* was the most dominant fish species and *Garra gotyla* was the least dominant. The distribution of fish along the Chalthi and Chukkha exhibited the highest degree of similarity, followed by Retha Sahib and Belkhet in terms of fish diversity and abundance.

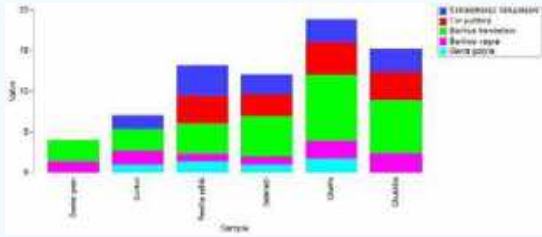


Fig. Bar plot showing the distribution of fishes

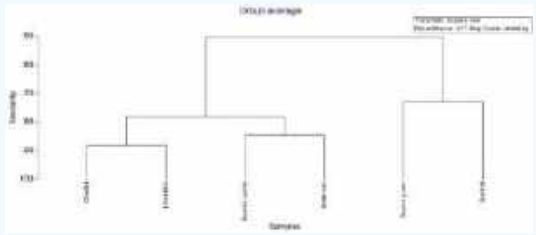


Fig. Bray Curtis similarity among stations based at different station on fish diversity and abundance

Morphometric parameter characterisation of Ladhiya basin

The hydro-morphological parameters of the Ladhiya basin were elucidated by employing Shuttle Radar Topography Mission (SRTM-30 m) data and topographic sheets of Survey of India by applying remote sensing and GIS tools. Twenty-five (25) watersheds were delineated for studying the hydrological parameters in linear, aerial and relief directions. The total drainage basin area was estimated to be 754.23 km^2 with dendritic to sub-dendritic drainage patterns, influenced by the topography, underlying geology and rainfall. The study area was designated as 5th-order basin with 347 stream segments, having a length of 548.654 km. The physiography and the lithology of the region profoundly impact its stream order. The slope ranged from 0.04 to 56.62^o, indicating the youth stage of basin development.

Fig. Drainage pattern of river Ladhiya

The bifurcation ratio ranged from 1.83 to 14 km/km², implying moderate to larger infiltration and structural complexities within the basin. Drainage density varied from 0.20 to 0.95 km/km² inferring the basin of coarser drainage texture. The shape index, shape factor, and compactness coefficient indicate that the basin has moderate tectonic activity with moderate basin lag times and will take longer for peak flow. It has moderate to steep slopes, consequently experiencing low to moderate soil erosion.

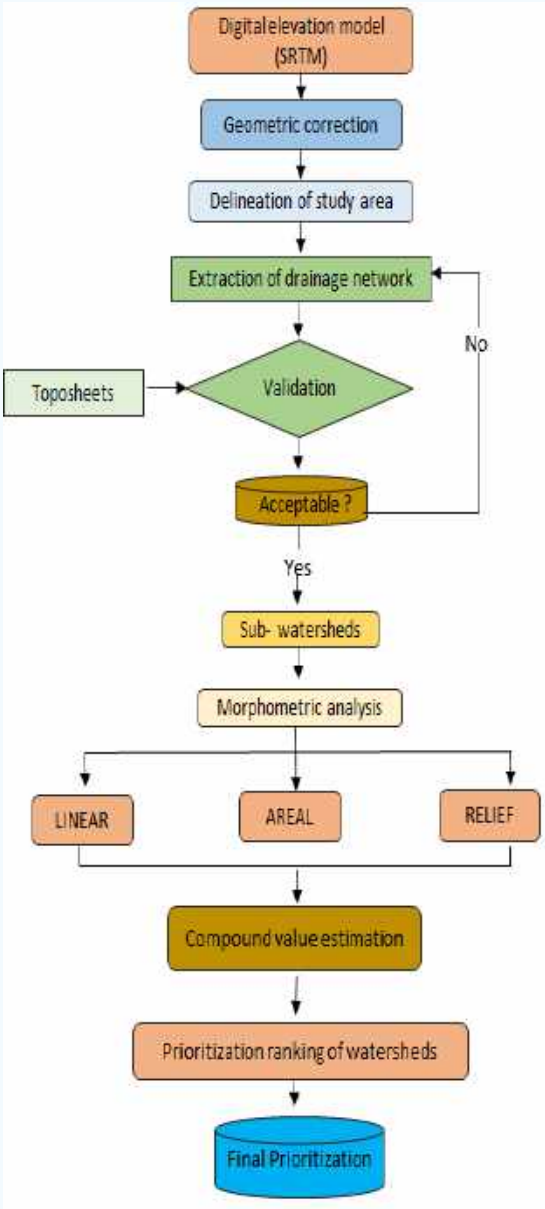


Fig. Model framework for prioritization of watersheds of Ladhiya basin

Prioritization of sub-basins of Ladhiya basin:

In the context of watershed management strategies, identifying the critical watershed is an important issue in natural resources management because different watersheds exhibit distinct hydrological behaviours based on their morphometric and topo-hydrological properties. So, the model framework for prioritization of sub-basins of river Ladhiya has been standardised and developed using the compound factor approach- a more straightforward and efficient approach. Eleven morphometric variables were selected for the compound factor approach's priority assessment. Prioritization ranking was carried out for selected morphometric variables according to their susceptibility to erosion. A composite number for each sub-ranking was then determined by averaging the rankings for all morphometric factors in each sub-watershed. The obtained compound value was then used to rank the sub-watersheds from highest to lowest. Additionally, the prioritisation rank ranges showed that five distinct classes of prioritisation apply to the Ladhiya basin: the highest priority (WS16, WS5, WS24, WS12, WS25 and WS17); the very high priority (WS18, WS13, WS23 and WS14); the high priority (WS12, WS22, WS20, WS4 and WS3); moderate priority (WS11, WS7, WS1 and WS2) and low priority (WS19, WS6 and WS10). As a result of integrating spatial analysis with statistical methods, the compound factor approach was shown to be a useful and effective way of prioritisation, especially in areas with limited data availability.

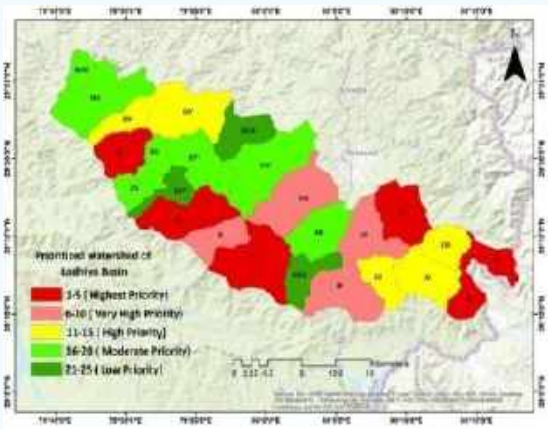


Fig. Watershed prioritization categorisation of Ladhiya basin

Project: CF-7	**Angling, ecotourism and conservation**
Sub project 1:	**Angling status of mahseer in Kumaun region for Eco-tourism and conservation**
Period:	**April 2020 – March 2023**
Personnel:	**R.S. Patiyal (PI), N.N. Pandey**
Funding Support:	**Institutional, ICAR-DCFR**

Sports fishery has immense potential for fish-based eco-tourism generating sufficient employment opportunities for local inhabitants. Mighty golden mahseer is a world-famous sport fish and has been the icon of sport fisheries in the Kumaon region of India. The Britishers introduced recreational fishing of mahseer during the post 19th century. It has been estimated that over a million anglers are engaged in both subsistence and recreational fishery in the world. Anglers are spread across India, even in the remote villages. Angling is a fishing method using an angle or hook for recreational fishing. Professional anglers maintain the record of their catches, care for their surroundings, and keep the angling spots clean and presentable. They have a very positive attitude towards the golden mahseer to save and care in the nature for supporting fun or sport and always perform "Catch and Release" strategy for sustainability. Hence, recreational fishing induces social bonding, provides livelihood opportunities among local people, and promotes awareness among the local people for conservation. Literature on historical perspectives of mahseer angling is limited and scattered with only a few references.

Kumaon region in Uttarakhand has the world's most potential hot spot for mahseer angling, and thousands of international and national anglers are frequent visitors of the Kumaon region. However, there is a need for strategy and guidelines for organized programs, coordination, and compilation of status reports. In this context, a project was conceived with the objectives of database creation on the angling status in the Kumaon region, digital mapping of conservation sites and angling hotspots and developing advisory for linking angling ecotourism and conservation towards livelihood security of local people. However, ICAR-Directorate of Coldwater Fisheries Research, Bhimtal has been instrumental with consistent efforts for the conservation of endangered golden mahseer for several years through ranching of hatchery-produced fry and fingerlings into rivers, lakes, and natural waters of the Himalayan region.

Achievements & progress report:

- We have generated information on angling catch status, angling licensing, hotspots of angling sites, conservation sites, fish species-specific potential streams, a documentary of angling operators, fish landing data and ecotourism beets in six districts of the Kumaon region viz Almora, Udham Singh Nagar, Champawat, Bageshwar, Pithoragarh and Nainital.
- Interacted with ten international and other anglers and seven angling operators and collected data on angling frequency, species available, angling sites, conservation efforts and other activities for the promotion of sport fishery.
- Collected information on the historical perspective of angling data in the Kumaon region from secondary sources and consulted four books. There is a meager information in the literature. However, a booklet on "Angling in the Kumaon region, 1888" written by Dr W. Walker, M.D. gives a first account of angling in the Kumaon region. He started visiting the lake of Nainital during the year 1863 and recorded six species angled in the lake. He also angled fishes from the Gola River, the Naukuchiyatal Lake, the Malwatal and the Sattal. Jim Corbet also caught a mahseer in the Nainital and recorded a weight of 50 lbs.
- Compiled data on the mahseer catch size and fish size collected from angling operators and on licensing revenue generation collected from the Department of Forest, Department of Fisheries, and beet operators.
- Data on landing of mahseer and other fishes from Ladhiya River has been generated. Data reveal the two main hotspots for angling are Pancheswar and Marchoola.

- There are seven rivers in the Kumaon region where Mahseer and Goonch are available for angling. The maximum weight of entangled Goonch from W. Ramganga was 88 kg and 115 kg. Moreover, a mahseer of the weight of 83 Lbs was caught from the Kali river.

Fig. Data collection from professional anglers of Kumaun region

- A questionnaire was prepared to share the experience and knowledge of anglers, and feedback was taken from the anglers. During the reporting period, 118 anglers were enlisted and interviewed including 15 international anglers. Initially, limited personal interviews could be organized due to the Covid pandemic, however, on-line information was collected.
- Anglers shared their vast experience of field conditions. They responded that most of the anglers have experience of a minimum of 10 years and up to 25 years.
- As per feedback from anglers *Tor putitora* and Goonch (*Bagarius* sp.) is available in plenty in the streams. They prefer the autumn season for angling during April to November, when water in the streams remains transparent.
- Most of the anglers (99%) follow the catch-and-release practice. Anglers do love angling mahseer for fighting behavior and Gooch for attractive size.
- Most of the anglers reported three types of mahseer in Kumoan rivers viz Red fin mahsee, Golden mahseer, and Black mahseer. Even though they found many ambiguities in shape, size, color, and other morphometric parameters of mahseer, some of the anglers are of the opinion that there are few more species of mahseer in streams of Kumaon.
- Respondent anglers gave interesting insights about the natural environment, and they provided feedback on declining patterns size-wise 70% and number-wise 50%. According to the active anglers the decline of mahseer and Goonch catch is due to illegal fishing (45%), habitat loss (25%), overfishing (15%), natural calamities (10%) and others reasons (5%).
- Most of the anglers suggested the priorities for the awareness program and involvement of local people in conservation and ecotourism programs; however, they emphasized the online permit system, policy framing, and organising ranching programs.

Angling camps organized at river site and prized catch of mahseer

- During the reporting period, one ranching program was organized with district administration and released 10000 fingerlings in Nainital Lake.
- A digital map was prepared to highlight the potential angling site and sport fish availability.
- Advisory was given to the anglers, beet operators and provided guideline to Uttarakhand government for the promotion of sport fishery and fish based eco-tourism in Adarsh district Champawat.

Fig. Mahseer angling and fishing camps sites at Kumaun region

Project: CF-8	**Subproject 1: Network programme on Mahseer -Species and stock validation of mahseer species of genus *Tor* and *Neolissochilus* from central and eastern Himalayan region of India**
Period:	**August 2020 – March 2023**
Personnel:	**D. Sarma (Coordinator), N. Shahi (PI), R.S. Haldar**
Funding Support:	**Institutional, ICAR-DCFR**
Collaborating institute	**Department of Aquatic Environment Management, College of Fisheries, Assam Agricultural University, Raha, Assam** **Department of Zoology, Manipur University, Imphal, Manipur** **Department of Fisheries and Biotechnology, St. Anthony's College, Shillong, Meghalaya** **Department of Zoology, D.M. College of Science, Imphal, Manipur**

Exploratory surveys were carried out to collect mahseer germplasm from the Nayar River (Vyasghat) and Ganga River (Lakshar) in Pauri and Haridwar districts of Uttarakhand, India. The collected specimens were identified by classical taxonomy using morphometric and meristic characters and, by nucleotide sequence of the PCR amplified *coxI, cytb and ATPase 6&8* mitochondrial genes. More than 70 nucleotide sequence of the mahseer species were submitted in NCBI's Genbank and Bankit portals and accession number of respective sequences were obtained. The total number of sequences submitted by DCFR is 264. More than 30 voucher specimens are preserved and labelled with respective museum id in DCFR museum.

Fig. Sampling of mahseer specimens in Nayar river, Pauri, Uttarakhand

College of Fisheries, Raha, Assam carried out sampling in three rivers namely Jia Bhoroli, Diyung, and Dhansiri from January to December 2022. Data about mahseer population of these rivers along with surface water quality parameters and riparian zone were collected during this period. Moreover, samples of 52 mahseer specimens were analysed and preserved in the Fish Museum of the Department of Aquatic Environment Management, College of Fisheries, Raha.

Fig. Submitted specimen in DCFR repository

Data related to morphometric and meristic counts are recorded from 35 specimens. Mahseer

fin clippings were stored in 100% alcohol for DNA barcoding. The accession numbers received for six more mahseer sequences from NCBI brought it to 29.

Fig. Sampling and genomic DNA extraction done at CoF, Raha

D.M. College of Science, Imphal carried out sampling in the Chindwin watershed of Nagaland on the Teithung river of the Tuensang District; the Zungki river of Kiphire District and the Tizu river of Phek District. Sixteen sequences of ATPase 6 & 8 were submitted to NCBI's BankIt portal.

Fig. Sampling site and morphometric analysis in Nagaland

St. Anthony's College, Shillong conducted mahseer sampling in the streams that drain into the Umngot river. Out of the 79 mahseer sampled collected from the stream, three samples had prominent mentum and continuous labial fold. The presence of distinct mentum and continuous labial fold are *Tor*'s morphometric features. Morphometric and meristic traits were recorded from all the specimens. DNA extraction followed by PCR amplification and sequencing of *coxI, Cytb* and *ATPase* 6 & 8 gene fragments of thirty-two specimens collected from the Umngot river. Processing and GenBank submission of the 140 sequences was initiated in December 2022.

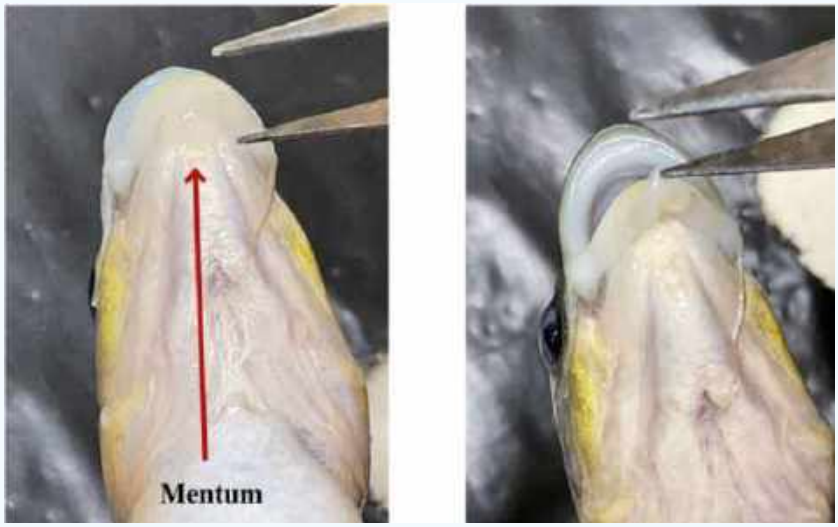


Fig. Prominent mentum shown in Tor species

Project: CF-8	**Sub project 2: Assessment of IUCN threat status and distribution of freshwater fishes of the eastern and western Himalaya**
Period:	**April 2022 – March 2024**
Personnel:	**S. K. Mallik, (PI), Pramod Kumar Pandey, Co-PI** **Dr Rameshori Yumnam Assistant Professor (PI),** Department of Zoology, Manipur University Imphal
Funding Support:	**Institutional, ICAR-DCFR**
Collaborating institute	**Manipur University**

In the present study, we reviewed the previous IUCN assessment completed in 2010 on the threat status and distribution of freshwater fishes of the Western Himalayas. The data collected from the IUCN assessment on the threat status of 170 fish species in Western Himalaya are subjected to different threat statuses as listed in the Table 1.

Table 1: Showing IUCN assessment on threat status of fishes in Western Himalaya, 2010.

Critically endangered	Endangered	Data Deficient	Vulnerable	Least Concern	Not assessed
2	3	7	12	123	23

In the study, the biological data about 178 fish species from Western Himalaya Regions are collected presently. The fish under the major genus and species under each genus are listed in table 2. The data will be analyzed in the IUCN software 'Species Information System (SIS)' to store and manage species accounts and assessments for publication in the IUCN Red List.

Table 2: Showing the major genus of fish and number of species available under each genus

S.No.	Genus	Species	S.No.	Genus	Species
1	*Chitala*	1	**42**	*Channa*	5
2	*Salmostoma*	2	**43**	*Mastacembelus*	1
3	*Cabdio*	1	**44**	*Amblyceps*	1
4	*Barilius*	2	**45**	*Clarias*	1
5	*Opsarius*	5	**46**	*Heteropneustes*	1
6	*Raiamas*	1	**47**	*Aplocheilus*	1
7	*Rasbora*	2	**48**	*Ophichthys*	1
8	*Labeo*	8	**49**	*Chanda*	1
9	*Chagunius*	1	**50**	*Badis*	1
10	*Cirrhinus*	2	**51**	*Rhinomugil*	1
11	*Cyprinus*	1	**52**	*Minimugil*	1
12	*Puntius*	4	**53**	*Awaous*	1
13	*Schizothorax*	9	**54**	*Glossogobius*	1
14	*Psilorhynchus*	1	**55**	*Anabas*	1
15	*Balitora*	1	**56**	*Devario*	2
16	*Botia*	5	**57**	*Garra*	4
17	*Lepidocephalichthys*	3	**58**	*Esomus*	1
18	*Nemacheilus*	1	**59**	*Xenentodon*	1
19	*Paraschistura*	2	**60**	*Glyptothorax*	14
20	*Schistura*	11	**61**	*Triplophysa*	9
21	*Sperata*	1	**62**	*Parambassis*	1
22	*Mystus*	4	**63**	*Macrognathus*	2
23	*Pachypterus*	1	**64**	*Systomus*	1
24	*Ompok*	2	**65**	*Tariqilabeo*	2

25	*Wallago*	1	**66**	*Carassius*	2
26	*Ailia*	1	**67**	*Schizopygopsis*	2
27	*Clupisoma*	2	**68**	*Osteobrama*	1
28	*Eutropiichthys*	1	**69**	*Schizopyge*	1
29	*Silonia*	1	**70**	*Diptychus*	1
30	*Bagarius*	1	**71**	*Ptychobarbus*	1
31	*Osphronemus*	1	**72**	*Rita*	1
32	*Tor*	4	**73**	*Amblypharyngodon*	1
33	*Naziritor*	1	**74**	*Chela*	1
34	*Pethia*	4	**75**	*Danio*	1
35	*Bangana*	2	**76**	*Laubuka*	1
36	*Paracanthocobitis*	1	**77**	*Oncorhynchus*	1
37	*Parachiloglanis*	1	**78**	*Salmo*	1
38	*Pseudecheneis*	1	**79**	*Gagata*	1
39	*Pseudolaguvia*	1	**80**	*Glyptosternon*	1
40	*Ctenopharyngodon*	1	**81**	*Hypophthalmichthys*	1
41	*Hypophthalmichthys*	1	**82**	*Nandus*	1
			83	*Trichogaster*	1
			84	*Gambusia*	2

From Eastern Himalayan Regions, biological data were collected for 510 fish species by Manipur University as our collaborating institute. The biological data of 100 fish species from Eastern Himalayas have been submitted to IUCN Species Information Service (SIS) for validation by IUCN experts.

Biological data was collected for about 177 fish species from the Western Himalayan Region and 510 fish species from the Eastern Himalayan Region to assess the IUCN threat status and distribution of freshwater fishes. One-training -cum- IUCN threat assessment workshop was organized during September 5-9, 2022 at Department of Zoology, Manipur University, Manipur.

3.2 Aquaculture Oriented Research and Development

Project: AQ-16	**Captive management of golden mahseer in perspective to aquaculture and conservation**
Sub project 6:	**Unravelling thermal and size-dependent fertility traits of male golden mahseer brooders in captive conditions**
Period:	**April 2022 – March 2025**
Personnel:	**M.S. Akhtar (PI), Ciji A., S. Ali, P. Sharma, Siva C.**
Funding Support:	**Institutional, ICAR-DCFR**

To address the challenge of achieving captive maturation (particularly of females) and breeding endangered golden mahseer, ICAR-DCFR, Bhimtal, has developed the captive maturation and multiple breeding technology after concerted research efforts over several years and recently commercialized this technology. As far as male golden mahseer brooders are concerned, they complete testicular development in pond/captive conditions. Still, their reproductive efficiency needs to be better assessed and quantified, and so far, attention has been given to female brooders. Hence, an experiment on size-dependent fertility traits has been initiated to understand the optimum size of male brooders for maximizing hatchery output. There are three size treatment groups (250 - 350g, 500 -600g, and 900 - 1200g), each containing eight male brooders and being reared in 1000L circular FRP maturation tanks. Three milt samplings were carried out, and seminal plasma was isolated. Milt samples from different size groups were also collected in liquid nitrogen for gene expression studies. Size-dependent sperm count and sperm morphology are being assessed. Initial results are indicative of comparatively higher reproductive efficiency among the mid-size group. However, the conclusion can only be drawn once all the required samplings are completed.

Fig. Milt collection from golden mahseer

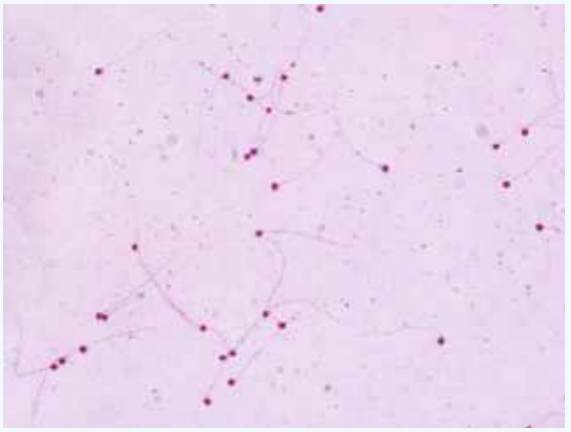


Fig. Sperm morphology - small size group

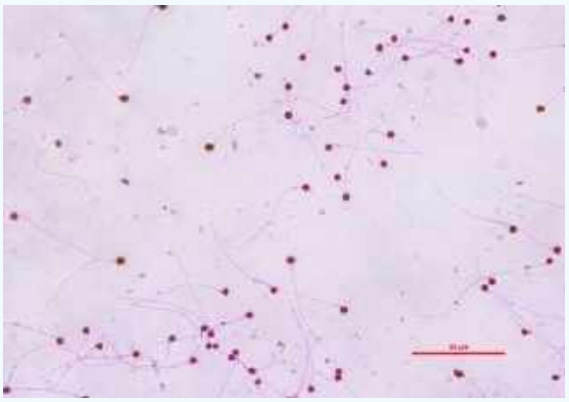


Fig. Sperm morphology - medium size group

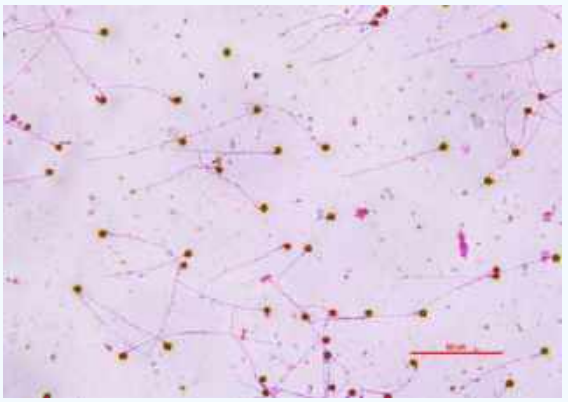


Fig. Sperm morphology - large size group

Project: AQ-19	**Domestication, biology and breeding of selected species for species diversification in mid-hill aquaculture**
Sub project 4:	**Upscaling of the seed production protocol of chocolate mahseer, *Neolissochilus hexagonolepis* for technology dissemination**
Period:	**April 2022 – March 2025**
Personnel:	**P. Dash (PI), Ciji A., R.S. Tandel, Siva C.**
Funding Support:	**Institutional, ICAR-DCFR**

Photoperiod is an important environmental cue, effects of which on gonadal development have been well investigated in several fishes but yet to be envisaged in chocolate mahseer. In previous studies chocolate mahseer brooders were maintained at 12hL: 12hD but the effect of different photoperiod regimes along with the light spectra on the reproductive performance of brooders is yet to be envisaged. Around 18 females and 12 males were equally distributed to six FRP tanks with three treatment groups (12hL: 12hD, 16hL: 8hD, 8hL: 16hD) in duplicate. Milt samples were analyzed to assess sperm viability, sperm morphology and spermatocrit % and sperm abnormality index. In 8hL: 16hD treatment sperm viability index is lower whereas the abnormality index is higher showing poor milt quality compared to other treatments. Periodical blood samplings of female brooders are being carried out for immune and antioxidant parameters analysis. Specific primer pairs for target immune and antioxidant genes were designed using the sequences of congeneric species with Primer-Blast Database.

Fig. Broodstock experimental setup with photoperiod treatments of chocolate mahseer

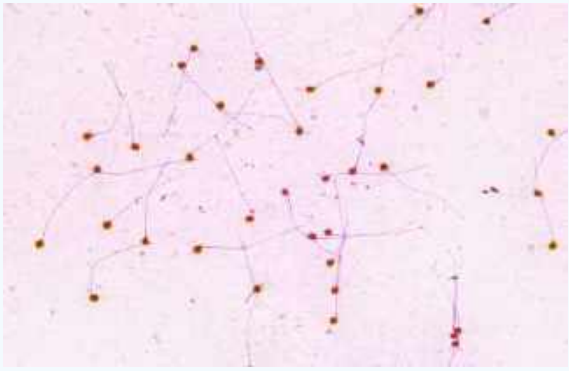


Fig. Assessment of sperm morphology

Project: NPOFBC	**Network project on Ornamental fish breeding and culture (NPOFBC): ICAR- DCFR component: Development of breeding protocol and larval rearing technique of the selected indigenous hill stream ornamental loaches, suckers and hill trout**
Period:	**April 2018 – March 2023**
Personnel:	**P. Dash (PI), D. Sarma, A.K. Giri**
Funding Support:	**ICAR-CMFRI &ICAR-DCFR**

Breeding success in *Barilius vagra*

Around 100 *Barilius vagra* fish collected during September 2021 to April 2022 were maintained in captivity in two flow-through tanks equipped with under gravel filter and temperature of 22-23°C. Fish were fed with commercial feed consisting of 40% protein, 6% lipid and tubifex worms. Females (8-15g) and males (3-6g) were assessed for their maturation status and transferred to the aquarium tanks for induced trials. Males were identified with the tubercles on their lower jaw and when pressed milt could be seen but not freely released. Females were releasing a few eggs when pressed. Four different ovatide doses were administered by intramuscular injection to 16 pairs of males and females (1:1). Spawning pair

response, spawning fecundity, fertilization, and hatching percentage were significantly higher in one of the ovatide dosage groups. No spawning was recorded when a high dose was administered and 70% fish mortality was noted. Fertilized eggs were transparent, spherical, and demersal. 50% hatching rates were completed by 57-58 hours post fertilization. Yolk-sac absorbed larvae were fed with infusorians for four days and egg yolk for 20 days.

Fig. Adult B. vagra in aquarium tank

Fig. Full grown larvae of B. vagra

Project: AQ-22	**Culture system diversification**
Sub project 1:	**Engineering validation of an affordable mini-RAS for small scale coldwater fish production**
Period:	**April 2020 – March 2023**
Personnel:	**Rajesh, M. (PI), B.S. Kamalam, R.S. Patiyal**
Funding Support:	**Institutional, ICAR-DCFR**

Suitability and efficiency of ammonia removal in different biofilter substrates for small-scale aquaculture

The right proportion of biofilter for removing ammonia and nitrite is essential for the success of small-scale RAS. In commercial RAS, well-designed biofilters consisting of engineered plastic media (MBBR) to remove ammonia and nitrite efficiently are generally used. However, these medias are expensive and mostly imported. Therefore, we have tried to utilise the locally available media such as gravel, sand, and expanded clay aggregates of different size grades. We devised the experimental set-up to test their volumetric nitrification rate (VNR) efficiency.

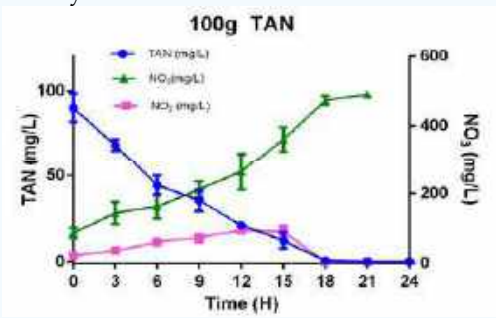


Fig. Ammonia and nitrite removal efficiency of gravel bed filter at 20^{O}C when dosed with 100 g of total nitrogen as ammonium bicarbonate.

The initial results suggest that crushed gravels had VNR of ~300 g TAN /day/m^3, while currently; we are testing other biofilter media, such as lightweight expanded clay aggregates.

Standardisation of a direct method for estimation of Nitrate in RAS water without any pre-treatment

Current methods indirectly determine nitrate levels in the water, i.e., nitrates are first converted to nitrite, and then detected with the help of Griess reagent. These methods are suitable for samples containing less than 20 mg/L of nitrate. Further reduction of nitrate is achieved by toxic heavy metals such as cadmium and vanadium or using Devarda's alloy. The nitrate level in recirculating aquaculture systems may exceed 200 mg/L. Therefore, we have tried to standardise a direct method by utilising the absorption spectra of nitrate under the ultraviolet range. Based on our initial assay, 220 nm seems to be a suitable wavelength for estimating nitrate. This method can be advantageous as no chemical is required for the assay and only water filtration is sufficient. However, interference from the other compounds dissolved in water (ex: nitrite) needs to be tested. This method is suitable for water

samples having high nitrate and low nitrite levels, such as recirculating aquaculture water.

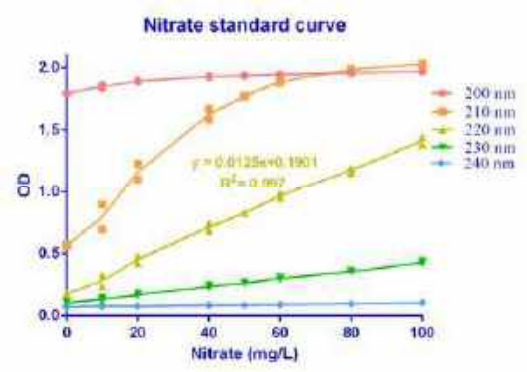
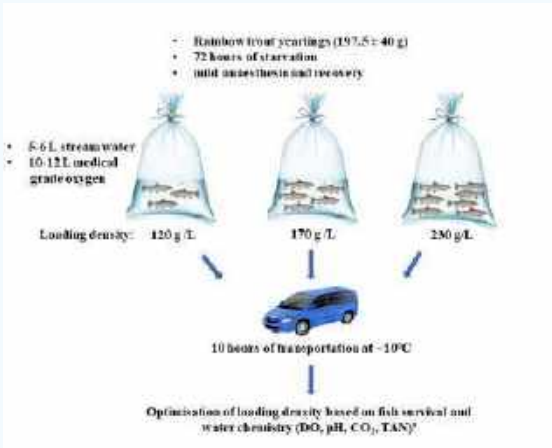


Fig. Standard curve of nitrate solution (0-100 mg/L) under different ultraviolet wavelengths (200- 240 nm).

Field study on optimisation of safe loading density for live transportation of rainbow trout yearling

A field study was conducted to evaluate the safe loading density for live transportation of rainbow trout yearlings in plastic bags of super-oxygenated water. Three different loading densities of live rainbow trout (130, 170, 230 g/L) were packed in plastic bags containing 5-6 L of stream water and 10-12 L of medical-grade oxygen gas. Six replicate bags per loading density were then subjected to ten hours of transportation by road, at ~10°C. On arrival at the destination, important water quality indicators and fish survival were recorded from each plastic bag. Based on the above indictors, we recommend that a loading density of 230 g/L is safe for live transportation of rainbow trout yearlings in plastic bags, over 10 hours at ~10°C, following adequate starvation and mild sedation.



Project: AQ-22	**Culture system diversification**
Sub project 2:	**Development of a sustainable aquaponics model for pilot scale fish-vegetable production in mid-hill Kumaun Himalaya**
Period:	**April 2020 – March 2023**
Personnel:	**A. K. Giri (PI), N.N. Pandey, S. K. Mallik, P. Dash**
Funding Support:	**Institutional, ICAR-DCFR**

For sustainable farming in hills, for the first time a novel coldwater aquaponics model was indigenously designed with multipurpose components, fabricated with low-cost locally available materials. The research validation was undertaken for the low-tech backyard model and the technology for grow-out production was developed using rainbow trout and lettuce as experimental species. The seeds of rainbow trout and saplings of lettuce were cultivated @ 2.8 kg m^{-3} and 42 no. m^{-2} respectively. The plants attained harvestable size in a period of one and half a month, while the fish took about five months to achieve table size. Hence, the model can afford the production of three crops of salad greens in a single fish crop. An assessment on techno-economic feasibility of the aquaponics model showed the potentiality of the system with productivity of 22.3 kg m^{-3} for rainbow trout and 4.22 kg m^{-2} for lettuce. The calculated total feed consumption for the entire crop cycle was ~ 22.76 kg m^{-3} i. e. 0.168 kg m^{-3} day^{-1} with FCR close to one. In this model, the water pump was used to drive water through one loop only whereas the water current of the other loop was channelized with gravity-driven flow, making the system energy efficient. The estimated energy consumption was 10.27 Kwh Day^{-1} and for the production of 1.0 kg rainbow trout and 0.85 kg lettuce, ~ 20.75 KWh energy will be used.

The indigenous low-cost aquaponics model was used for the sustainable grow-out production of common carp and grass carp and leafy vegetables such as Swiss chard and pak

choy in a low-tech manner with minimal use of mechanical implements. Validation was done with repeated experimental trials on carps and leafy vegetables and the grow-out production technology was standardized. The seeds of salad greens were sown in plastic and egg trays and kept inside a fabricated multitier unit, where the seeds germinated and grown up to sapling stages. The low-tech recirculating system was cultivated with stockable size of carps with salad greens plantlets @ 1.035 kg m^{-3} for common carp, 0.105 kg m^{-3} for grass carp and 45 m^{-2} for leafy vegetables. The fishes were fed with commercial pelleted floating feed but to cut down the feed cost, an indoor unit for the culture of Hydrilla and Azolla was also developed so as to feed the experimental fishes. Insect and pest infestations on plants were controlled with one-week foliar application of homemade medicated organic preparation, composed of rock salt and neem extract at an optimized ratio of water: neem leaf: rock salt @ 125:12.5:1. Common carp and grass carp were recorded with a productivity of 35.2 kg m^{-3} and 18.4 kg m^{-3} respectively in six months. The salad greens like Swiss chard and pak choy displayed a productivity of 3.32 kg m^{-2} and 2.58 kg m^{-2} respectively within a crop duration of two months. To produce table-size carps, the feed consumption rate was ~ 44.73 kg m^{-3} with FCR ~ 1.67. The system utilizes energy @ ~ 7.312 Kwh Day^{-1} and the approximate total energy consumed to produce 1 kg carp and 0.496 kg salad vegetable was about 16.37 KWh. The model was efficient enough to conserve energy as it was not operated only with energy-driven but also with gravity-driven water flow. The resource use and production potential were worked out, which signifies the techno-economic feasibility of the model for livelihood support and socio-economic upliftment of the hill beneficiaries of the country.

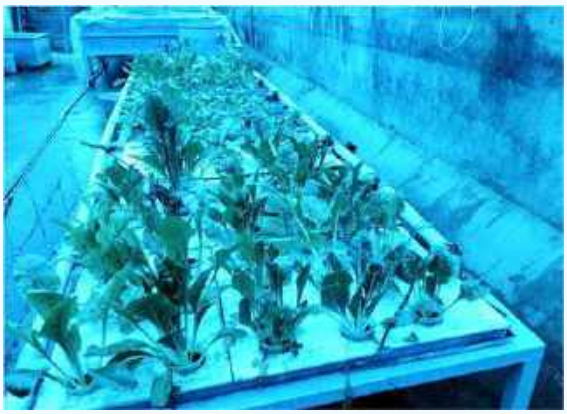


Fig. Harvestable size of salad vegetables in aquaponics unit

Fig. A haul of carp in aquaponics unit

3.3 Fish Nutrition and Feed Development

Project: AQ-21	**Coldwater fish nutrition and feed development**
Sub project 2:	**Nutritional intervention for improving reproductive competence and larval quality traits of golden mahseer, *Tor putitora* in captivity**
Period:	**April 2020 – March 2023**
Personnel:	**Ciji, A. (PI), M.S. Akhtar, B.S. Kamalam, Rajesh, M., P. Sharma**
Funding Support:	**Institutional, ICAR-DCFR**

One of the major challenges in the successful rehabilitation and conservation efforts of endangered golden mahseer is the unavailability of a suitable artificial diet for their early larval stages. It is generally accepted that the success of any ranching program depends on the size (as bigger ones are less vulnerable to predation) and the quality of the young ones released. The quality and fitness of larvae are influenced by their nutrition at the first feeding stage. Currently, in the ICAR-DCFR hatchery, macerated goat liver is used to feed the early larval stages of golden mahseer. However, it is an old practice giving comparatively lower growth rates.

Fig. Golden mahseer fry under different feeding regimes for 45 days (GL: fed with goal liver for 45 days; LF: fed with larval feed for 45 days; MXC: under mixed feeding (GL+LF) for 45 days; MX-LF: mixed feeding for first 15 days and then switched to larval feed for next 30 days).

In this milieu, an artificial larval diet has been prepared and evaluated. For this, triplicate groups of golden mahseer larvae, after their yolk sac absorption, were fed with goat liver alone, or in combination with an artificial larval diet (mixed feeding), and artificial larval diet alone for 60 days. Then the performance of the larvae under different feeding regimes was assessed in terms of their growth, survival and fitness. Larvae under mixed feeding showed higher growth (in length and weight; see figure) and survival. Importantly, golden mahseer larvae, under mixed feeding for 45-60 days, showed significantly increased upper thermal tolerance limits as evidenced by higher CT_{max} values. However, mixed feeding for the first 15 days had no significant effect on upper thermal tolerance limits. On the other hand, mixed feeding (15-60 days) significantly reduced the lower thermal tolerance limit (CT_{min}). Further, the larvae under different treatments have been collected, and various biochemical and gene expression analyses are in progress.

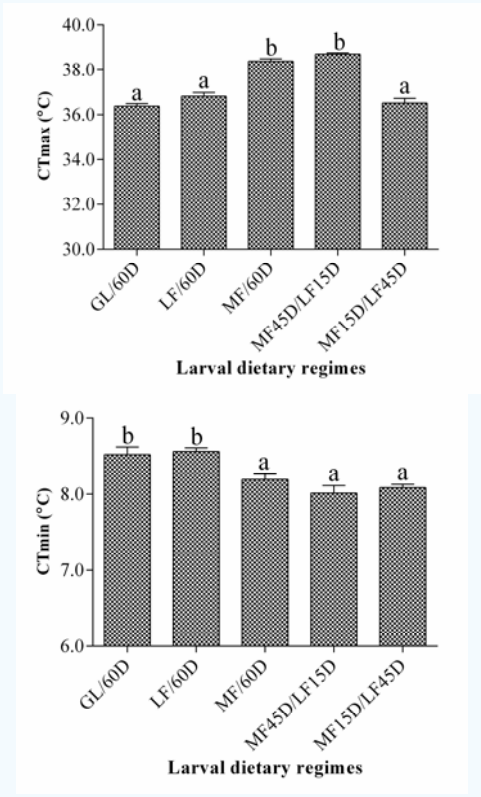


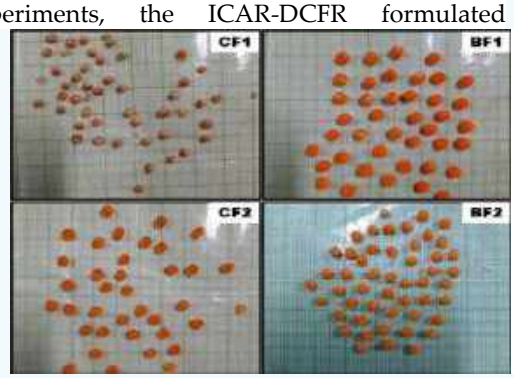
Fig. Thermal tolerance (CT_{max} & CT_{min}) of golden mahseer larvae under different feeding regimes

Project: AQ-21	**Coldwater fish nutrition and feed development**
Sub project 3:	**Formulation, development and validation of efficient brood stock feed for rainbow trout**
Period:	**April 2020 – March 2023**
Personnel:	**P. Sharma (PI), B.S. Kamalam, Rajesh, M., Ciji A., K. Kunal**
Funding Support:	**Institutional, ICAR-DCFR**

Rainbow trout farming in India is a profitable business, provided quality seed and cost-effective feed are available adequately when required. So far, the quality and sufficient seed production is concerned, the farmers are facing various problems like mortality at the embryonic and larval stages, spawning failures, asynchrony in gonadal development, or developmental incompetency. The main reasons for these seed production-related problems are inappropriate nutritional and reproductive health of brooders. The potential solution to overcome this issue was the improvement of brooder feed and feeding management. Therefore, these studies on rainbow trout brooder feed were conducted, in two phases, using two parallel diets, one with contemporary commercial feed, and the other was the same diet supplemented with an admixture of micronutrients and pigment (both diets were commercially prepared by Growel Feeds Pvt. Ltd.). The first experiment was conducted at ICAR-DCFR Experimental Field Center, Champawat, to test the effectiveness of the newly prepared brooder feed. The second was carried out in two ways; one was for re-confirming the consistent effectiveness of feed in improving spawning and quality seed production, and the other was field evaluation in five private and public farms located at Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Kerala. In both in-house experiments, the ICAR-DCFR formulated brooder feed consistently improved the gonadal development, synchrony in gonad developmental pattern, spawning capacity, fecundity, fertilization rate, and larval development. It exhibited uniformity in their development, especially at eyed ova formation, hatching and yolk sac absorption. The farmers who participated in field trials also reported similar responses, like improvement of spawning, seed quality, larval development, and improvement of growth and fitness of the fry. Overall, the intervention of ICAR- DCFR through this improved brooder feed has helped the rainbow trout hatchery operators to obtain superlative seed production compared to earlier breeding cycles. The feed is now being considered for commercialization, and in future, it will be available throughout the country on demand.

Table 1. Feed-dependent brooders' response: (Summarization of In-house trail I and III)

Variables	Control feed	Brooder Feed
Female responders	41-47%	51-52%
Relative fecundity	877-1431	1398-1696
Fertilizationtal rate	90-95	95-99
Developmental rate	Slow	Fast ~3 days
Hatching Window	Protracted	Synchronized
Yolk absorption rate	Protracted	Synchronized
Egg Size	Lower	Higher
Carotenoids content	Lower	Higher



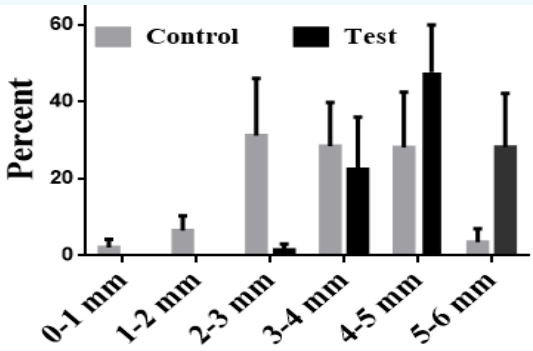


Fig. 1 and 2. Comparative follicular analysis from randomly selected rainbow trout females from control feed (CFs) fed group and brooder feed fed (BFs) group.

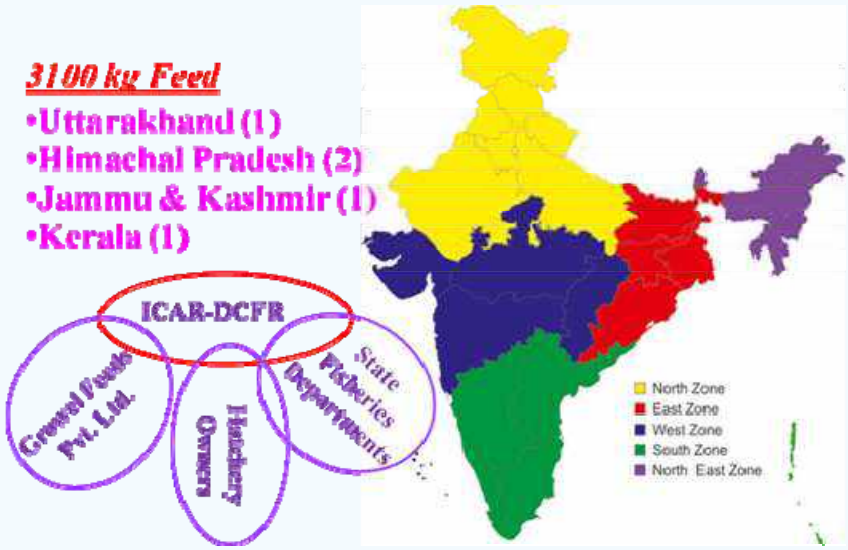


Fig 3. Field demonstration of rainbow trout brooder feed

Project: AQ-21	**Coldwater fish nutrition and feed development**
Sub project 4:	**Development of a nutrient sensitive and effective package of feeds and feeding strategies for augmenting rainbow trout production**
Period:	**June 2021 – March 2024**
Personnel:	**B.S. Kamalam (PI), Rajesh, M., Ciji A., P. Sharma, N.N. Pandey, K. Kunal**
Funding Support:	**Institutional, ICAR-DCFR (Feed support through the MoU with Growel Feeds Pvt. Ltd., Andhra Pradesh)**

Considering the critical role of feed and feeding in the success of rainbow trout farming, this project was aimed at developing high-performance rainbow trout grower feeds and effective feed management strategies. We partnered with Growel Feeds Pvt. Ltd., Andhra Pradesh, through a research and development memorandum of understanding for commercial relevance. Subsequently, we conducted a series of laboratory-scale and farm-scale feeding trials to evaluate the performance efficiency of a high-energy rainbow trout grower feed with respect to diet composition (protein, lipid and fish meal inclusion), husbandry practices (stocking density and fish grading) and genetic background of the fish.

Comparative evaluation of a nutritionally balanced rainbow trout feed

Firstly, we scientifically developed a high protein-lipid grower feed based on the nutritional requirements of rainbow trout. Subsequently, we comparatively evaluated the performance of this rainbow trout specific feed (RBT: 45% protein and 18% lipid) and a generic carnivorous feed (GEN: 40% protein and 10% lipid), under experimental and farm conditions. Both feeds were prepared in the commercial feed manufacturing unit of Growel Feeds Pvt. Ltd., Andhra Pradesh. After a 10-week feeding trial, under controlled conditions at 15±2°C, the RBT fed juvenile fish outperformed the GEN feed group in terms of final mean weight (+20%), thermal growth coefficient, feed conversion efficiency (FCR was -20%) and protein efficiency ratio, with relatively less feed intake (18 *vs.* 22 g/kg fish/day). The body condition was similar, but the hepato-somatic index and the viscero-somatic index were high in the RBT group. Whole body lipid was higher in RBT group, but protein and ash content were similar. There were no significant differences in blood indices (haemoglobin and haematocrit), plasma metabolite (glucose, protein and albumin) levels and enzyme activities (aspartate and alanine aminotransferase), except for triglycerides and alkaline phosphatase which were higher in the RBT group. Concerning hepatic mRNA levels,

igf1 expression correlated with the growth trend; conversely, *fas* and *cat* were up-regulated in GEN group. The relative expression of other biomarkers related to growth, intermediary metabolism, immunity and welfare showed no significant differences. To validate these findings under farm conditions, we conducted a nine-month production trial in outdoor flow-through raceways at Anantnag, Jammu and Kashmir, across a seasonal water temperature range of 2-19°C. Corresponding to our experimental findings, RBT feed resulted in significantly higher growth (40%; 405 *vs.* 290 g) and unit productivity (16 *vs.* 11 kg/m^3), concomitantly with lower FCR (-31%), cost of feeding (-12%), culture period reduction (2 months) and associated water foot print (-39%). Overall, these results validated the necessity of a nutritionally adequate trout feed.

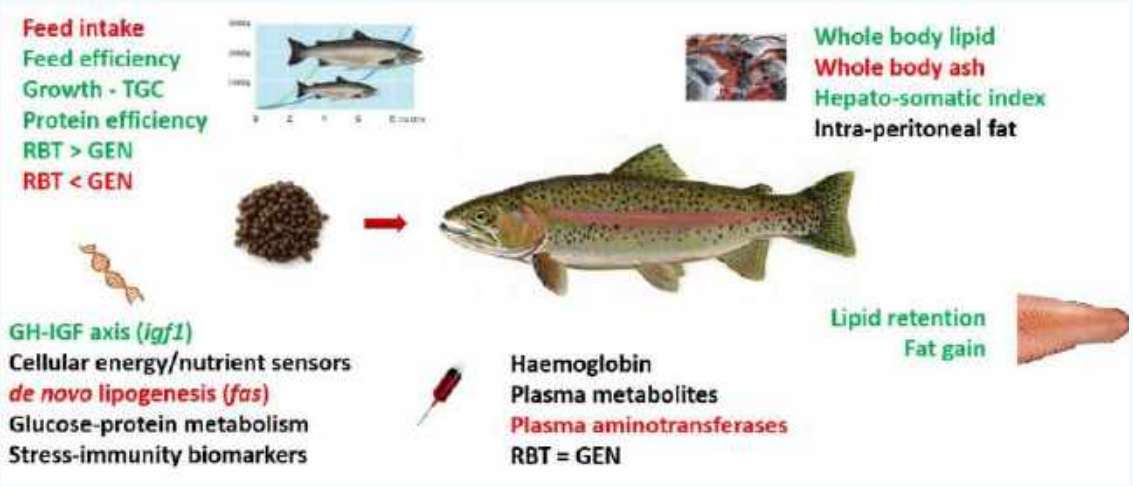


Fig. Summary of the comparative performance of trout-specific and generic feed

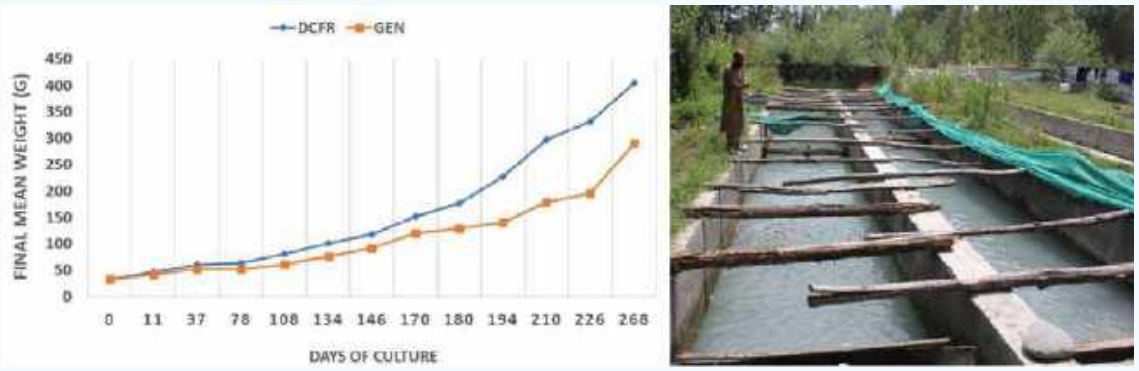


Fig. On-farm validation of the performance efficiency of nutritionally balanced trout feed

Evaluating the interactional effect of dietary fish meal content and stocking density

Hitherto, there is no information on the possible interactional effects of stocking density and diet composition in rainbow trout. In this context, applying a 2×2 factorial design, we conducted a 12-week feeding trial using juvenile rainbow trout to evaluate the effect of dietary fish meal content (high, HFM: 30% and low, LFM: 15%) and stocking density (low, LSD: 3-15 kg/m3 and high, HSD: 6-25 kg/m3) on growth response, feed utilisation, tissue indices, plasma metabolites, routine metabolic rates, antioxidant capacity, and transcriptional regulation of growth and metabolism-related biomarkers in liver and muscle. At the whole animal level, the HSD group showed significantly higher routine metabolic rate and feed intake, but lower feed efficiency and growth, when compared to the LSD group. HSD group fish had lower viscera-somatic index and relative gut length, but higher hepato-somatic index than LSD fish. Plasma glucose and alkaline phosphatase levels were lower in HSD, but had elevated albumin levels.

In the liver, the mRNA levels of growth-axis markers (*igf1*, *igf2* and *ghr*) and cellular nutrient-energy sensors (*mtor* and *ampk1*) were down-regulated in HSD. Contrarily, hepatic g6pd and muscle ubiquitin-proteosomal pathway (*fbx32* and *murf1*) was up-regulated in HSD. With respect to diet composition, a reduction in fish meal content was found to decrease growth, but conversely enhanced plasma triglyceride levels and the sensory appearance of flesh. There were no significant interactional effects except for hepatic *ampk1* expression. Overall, our findings indicate that stocking density has a more pronounced effect on the analysed markers of growth, metabolism and welfare of rainbow trout, as compared to the tested dietary FM content, with very less interactional effects.

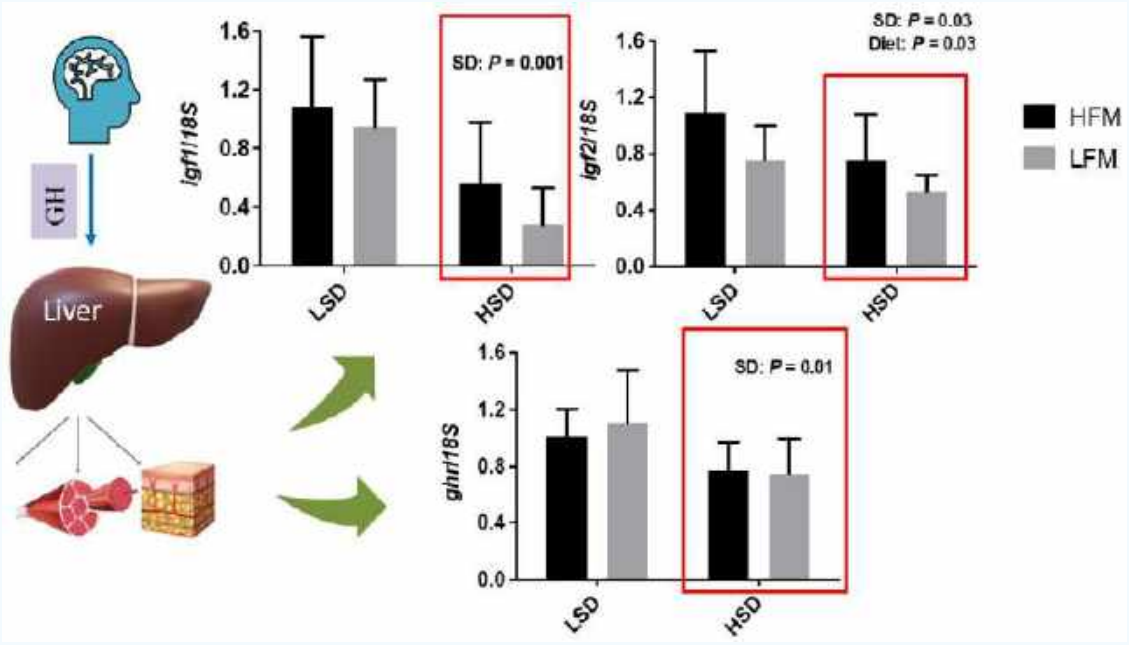


Fig. Effect of stocking density and diet on mRNA expression of GH-IGF axis markers in liver

Evaluation of grow-out feed performance with respect to genetic background

In another on-farm experiment, we compared and evaluated the performance of a high-energy rainbow trout feed in two families of fish sourced from different locations, namely Jammu and Kashmir (JK) and Champawat (CWT). The seven-month trial was carried out at the Directorate's experimental fish farm, Champawat. Initially, 625 trout juveniles (of initial mean weight 63.3 g - JK and 85.5 g - CWT) from both families were randomly stocked in 25 m^3 raceways, in replicates. At the end of the trial, the CWT fish (642 g) was significantly heavier than the JK fish (535 g) and this was reflected in the mRNA expression of *igf1* and *igf2*. Corresponding to the higher body weight, body condition factor and carcass yield (71.8 *vs.* 68.4 %) were also higher in CWT fishes. However, the feed conversion ratio was equally good in both groups, regardless of the genetic background. On the contrary, JK fishes showed higher lipid retention, nitrogen gain, plasma total protein / albumin, cardio-somatic index, blood haemoglobin levels and hepatic mRNA levels of *lmo2*. The two groups also showed significant differences in morphometric features such as dorsal / anal / caudal fin dimensions, jaw length and body depth. Other carcass nutritional composition and sensory characteristics of steaks was not significantly different between the two groups.

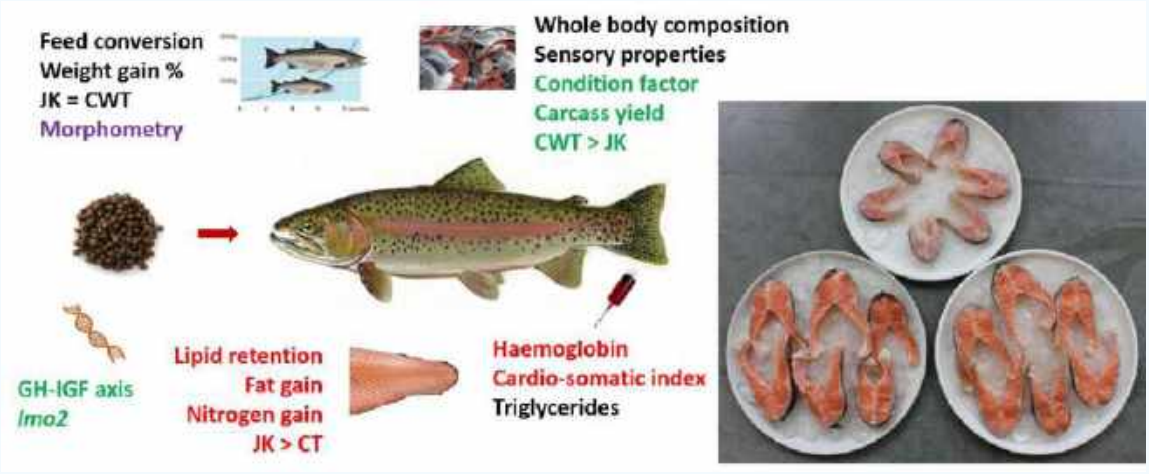


Fig. Summary of the performance of DCFR grower feed in two different trout families

Cluster validation of feed performance under different farm conditions at Ramgarh

To ascertain and better understand the effect of different farm environmental conditions and husbandry factors on the performance efficiency of nutritionally balanced trout feeds, we are carrying out an on-farm production trial cum demonstration in a rainbow trout farming cluster in Ramgarh, Nainital district, Uttarakhand. This feeding-growth trial is conducted in six raceways / tank units in the farms of Mr. Prithaviraj Singh Darmwal, Mr. Naveen Lal Sah and Mr. Abhishek Harnwal. The farms were geo-tagged and the fish for experimentation (rainbow trout fry of 0.5-1 g average size) were provided by ICAR-DCFR and stocked in April 2022. The adopted farmers were given a record-keeping schedule and regularly provided ICAR-DCFR rainbow trout feed for the trial. Regular updates of daily water temperature, feed utilisation and fish growth were obtained. The ICAR-DCFR team periodically visited the farms to monitor the important water quality parameters and fish growth. Based on the preliminary observations, it was evident that water flow rate, dissolved oxygen availability, water temperature and stocking density are critical factors that influence feed performance.

Fig. Rainbow trout seed-feed supply and water quality monitoring in Ramgarh trout farms

3.4 Molecular Genetics and Biotechnology

Project: AQ18	**Fish without water: *In vitro* meat**
Sub project 6:	
Period:	**June 2021 – March 2024**
Personnel:	**Amit Pande (PI), K.V. Chanu**
Funding Support:	**Institutional, ICAR-DCFR**

A cell line developed from snow trout muscle cells, SRM-1 was transfected using Viafectin (Promega) and a plasmid capable of expressing green fluorescent protein (GFP). It was observed that SRM-1 cells could not be transfected well as the EPC cells when transfected under similar conditions with the same reagents. The results suggest that the transfection of SRM-1 cells may require conditions that may not be furnished by Viafectin and several studies have shown that fish cells are difficult to transfect.

Further, the optimum number of cells required for resazurin assay was standardized and $2x10^5$ cells were found to be adequate to measure the absorbance after three hours. Cell seeding efficiency was determined by the static method along with the scaffolds. Moreover, it was observed that under different seeding and treatment conditions there was no significant difference in the way the cells were seeded along with the treated or untreated scaffolds Further, the data revealed that out of 60000 cells, up to 74% could attach to the scaffolds.

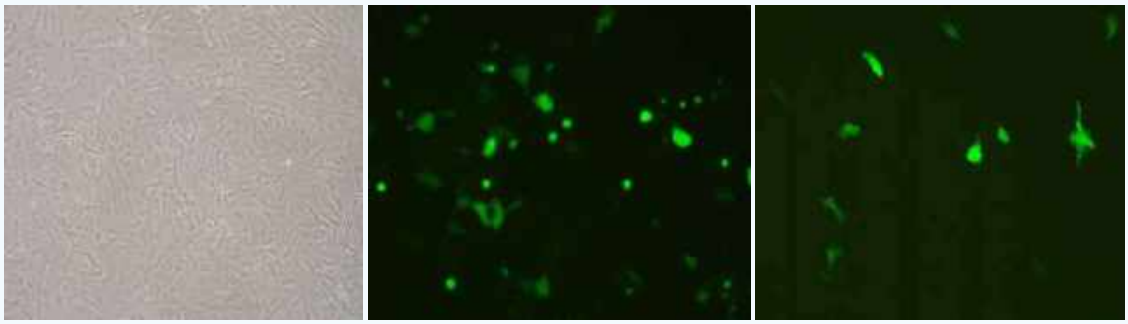


Fig. SRM 1 *EPC-2* *SRM-1*

The procedure for the isolating myocytes from rainbow trout muscles was standardized using density gradient centrifugation. Only a few myocytes attach in the tissue culture flasks when seeded. Most of the cells remained in suspension and the cells in suspension degenerated within a week. However, the attached cells could not be propagated as they degenerated. Further experiments are required to promote the growth of myocytes.

Fig. 3

Project: AQ18 **Sub project 7:**	**Development of complete mitochondrial genome and phylogeny of selected coldwater fish species**
Period:	**June 2021 – March 2024**
Personnel:	**Shahnawaz Ali (PI), Siva, C., N.N. Pandey**
Funding Support:	**Institutional, ICAR-DCFR**

Fish identification is traditionally based on morphological features. However, in many cases, due to high diversity and morphological plasticity, fish and their diverse developmental stages are difficult to identify using morphological characteristics alone. DNA-based identification techniques have been developed and proven to be analytically powerful. DNA barcoding identification systems have been widely advocated as a standardised and universal method to identify species and uncover biological diversity. Keeping in view the diversity and endemism of coldwater fish species, it is necessary to characterize them at molecular level for ascertaining its correct taxonomic position as well as phylogenetic relationship with other species. With the advent of next-generation sequencing technology (NGS) and the availability of different high throughput sequencing platforms, it has been possible to sequence entire mitochondrial genomes from almost any eukaryotic species for which total DNA can be easily, quickly and assembled. Therefore, species characterization of fish species based on a complete mitochondrial genome using NGS technology will provide more reliable and useful data for molecular systematic, species identification, and conservation.

Fish samples of the target species namely *Barilius vagra, Channa bipuli, Lepidocephalus thermalis*, and *Naziritor chelynoides* were collected. Genomic DNA was isolated from 50mg muscle tissue sample by the phenol-chloroform procedure (Sambrook et al., 1989). The concentration and purity were measured using NanoDrop® 2000 (Thermo Fisher Scientific, Wilmington, USA), and its integrity was visualized using agarose gel electrophoresis. The total genomic DNA of the targeted species has been stored for further analysis.

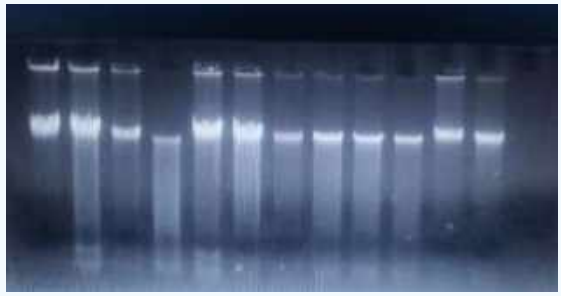
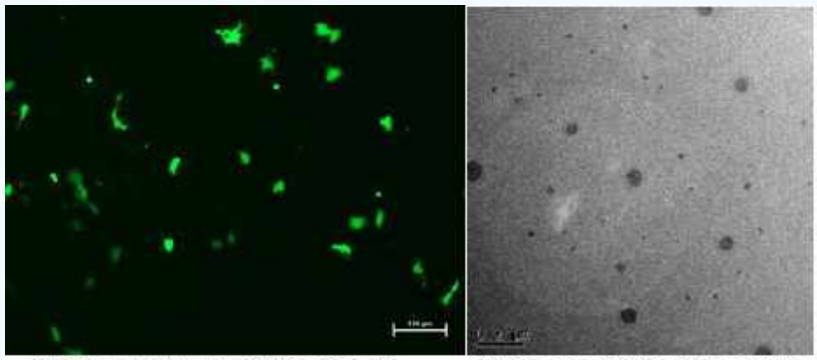


Fig. Genomic DNA of targeted species

Project: AQ18 **Sub project 8:**	**Polymer based approach for *in vitro* transfection in fish cells**
Period:	**June 2021 – March 2024**
Personnel:	**D. Thakuria (PI), Amit Pande, K.V. Chanu**
Funding Support:	**Institutional, ICAR-DCFR**

Computational prediction and designing of novel cell-penetrating peptides (CPPs) for gene delivery

To study the synergistic effect of polymer and CPPs, eight novel CPPs have been identified using bioinformatics tools. These CPPs have been predicted using CellPPD and C2Pred web servers. One of the predicted CPP, along with NLS (Nuclear localization signal) was used to design a novel chimeric CPP. It contains hydrophilic and hydrobhobic amino acids required for successful translocation. Also, an endosomolytic peptide linker has been introduced in between hydrophilic and hydrophobic domain to accelerate the endosomal escape properties of the chimeric peptide. The designed chimeric peptide was further checked using CellPPD and C2Pred web servers for its cell-penetrating ability. The designed cell-penetrating peptide showed promising results for its gene-carrying capacity inside fish cells. The results were comparable with that of commercially available lipofectamine transfection reagent.



GFP gene delivery by CPP in EPC cells | TEM image of CPP-pDNA complex

Project: AQ18 **Sub project 9:**	**Evaluation of the effect of different temperatures on the sex differentiation and sex ratio in golden mahseer (*Tor putitora*)**
Period:	**July 2022 – March 2025**
Personnel:	**Shahnawaz Ali (PI), Siva C., Prakash Sharma, M.S. Akhtar**
Funding Support:	**Institutional, ICAR-DCFR**

The golden mahseer *Tor putitora*, a valuable fish species under *Cyprinidae* family and *Cyprininae* subfamily, is described as the 'king of the Indian aquatic system' are amongst the largest scale carp available in the Southeast (SE) Asian region. *Tor putitora* has been placed under endangered species on the IUCN red list. The alarming decline in the number and size of mahseer populations, especially from Mountain Rivers of the subcontinent; has been attributed to various anthropogenic factors including growth and recruitment overfishing. In addition to this, the differential and skewed sex ratio has also been observed and reported in golden mahseer natural population where males are mostly predominant than females. Further, global climate change poses many threats to biodiversity and altering the physical, chemical, and biological characteristics of freshwater habitats, with concomitant effects on freshwater and diadromous fishes. The skewed sex ratio in golden mahseer might be a response to environmental stress, as temperature plays an important role in sex determination and also identified as an important factor in determining sex ratios in many other species of fishes, amphibians, and reptiles. It is widely accepted that phenotypic plasticity is a characteristic of most living organisms and it can aid population persistence during periods of rapid environmental change. Gene expression regulation is a flexible mechanism for adjusting rapidly to the local environment, but it can also be associated with long-term evolutionary response. Thus, studying gene expression may provide information about the importance of plasticity in the early stages of adaptation.

In our preliminary study we found that the sex differentiation in *Tor putitora* takes about 180 to 230 days post hatching (dph). The ontogenic developmental stages can be divided into molecular sex differentiation stages where different sex-related gene expressions are evident and histological sex differentiation stages in which development of sex-related changes in germ cell and somatic cell takes place. Further, to characterize aspects of sex differentiation at the morphological and mRNA level in this species, the present study is proposed to examine developmental changes in gonad morphology and gene expression in males and females post-hatch (dph) ontogenic period and the effect of different temperatures on the sex differentiation and sex ratio in golden mahseer.

A survey on sex related genes in different fishes have been conducted and a battery of genes playing a role in sex differentiation and sex determination were identified. Nucleotide sequences of these genes were downloaded for closely related species such as *Cyprinus carpio* and *Danio rerio*. Downloaded nucleotide sequences were blasted against the transcriptome assembly of golden mahseer.

Transcripts with high similarity were extracted from the assembly. ORF of the identified transcripts were identified using the ORF finder tool. Nucleotide sequences were translated in to amino acid sequences using Expasy tool Nucleotide sequences of the following genes were submitted to the NCBI database. Multiple sequence alignments of these proteins with the related fish species revealed that dmrt proteins are relatively conserved in golden mahseer during the evolutionary process.

Sl.No	Gene	NCBI ID/GenBank Acc. No.
1	AMH	OP776394
2	BMP5	OP776395
3	CTNNB1	OP776396
4	CYP19a	OP776397
5	CYP19B	OP776398
6	DMC1	OP776399
7	Dmrt1	OP776400
8	DMRT2a	OP776401
9	DMRT2B	OP776402
10	DMRT3	OP776403
11	FIGla	OP776404
12	FOXL2	OP776405
13	HSD17b7	OP776406
14	SF1	OP776407
15	SOX3	OP776408
16	SOX9A	OP776409
17	SYCP3	OP776410
18	VASA	OP776411
19	ZAR1	OP776412

Fig. Amino acid sequence alignments of dmrts

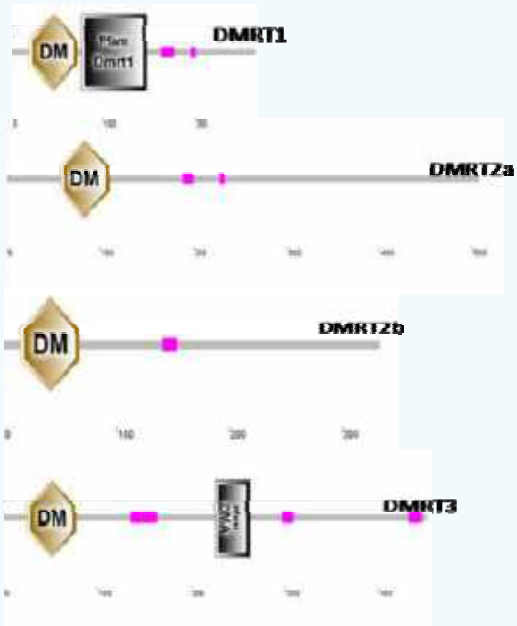


Fig. Secondary structure prediction revealed that all of them contained DM domain, with DMA domain only identified in dmrt3

Table: Sequence statistics & Domain compositions of dmrts

Gene	Transcript ID	Accession Number	CDS length Nucleic Acid (bp)	Amino acids
dmrt1	TRINITY_DN3507_c0_g1_i4	OP776400	798 bp	266
dmrt2a	TRINITY_DN48789_c0_g1_i1	OP776401	1320 bp	440
dmrt2b	TRINITY_DN77483_c0_g1_i4	OP776402	1002 bp	334
dmrt 3	TRINITY_DN61706_c0_g1_i4	OP776403	1356 bp	**452**

In addition, thermal stress-related genes (TSG) and House-keeping genes (HKG) were also characterized. We have also identified suitable genes for qPCR normalization for thermal stress and ontogenic development.

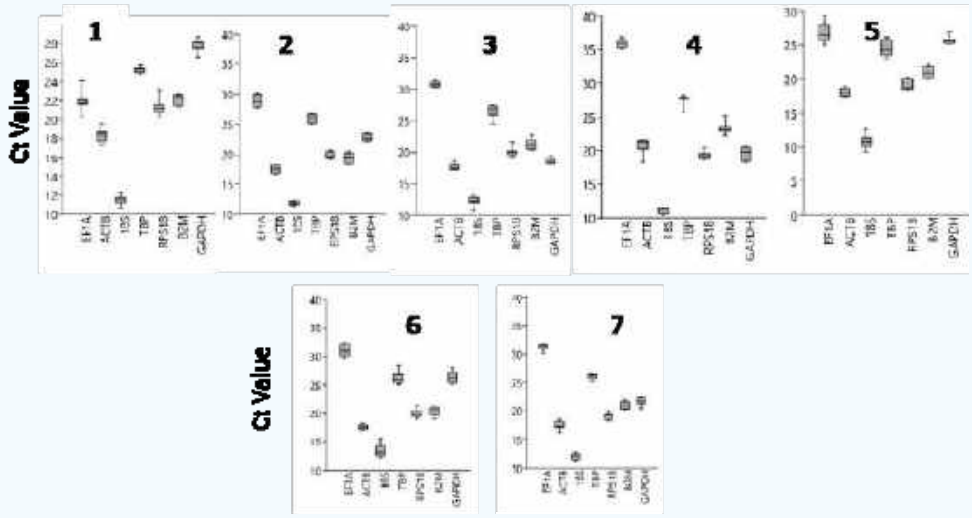


Fig. The range of expression (Ct) of the candidate reference genes (1-Unfertilized 2- Fertilized 3-30dph 4-60 dph 5-90 dph, 6-120 dph 7-150 dph)

Project: AQ18 **Sub project 10:**	**Design and production of GnRH analogue as an inducing agent for spawning in fish**
Period:	**April 2022 – March 2024**
Personnel:	**K. V. Chanu (PI), N.N. Pandey, D. Thakuria, P. Dash, A.K. Giri**
Funding Support:	**Institutional, ICAR-DCFR**

A GnRH peptide analogue was synthesized in the laboratory. Using the peptide hormone, an injectable formulation was prepared and tested for its efficacy in inducing spawning in different fishes, Common carp (*Cyprinus carpio*), *Bangana dero*, *Labeo dyocheilus*, Jayanti Rohu (*Labeo rohita*). The hormone was injected at the rate of 0.5 and 0.3 ml/ kg body weight of males and females respectively. The preliminary study showed that formulation has the potential to induce spawning. Future work will be on modification of the peptide sequence to make it more potent.

GnRH analog Fertilized eggs from Jayanti rohu

3.5 Disease Surveillance and Health Management

Project: AQ-20	**Development of diagnostic & therapeutic measures for rainbow trout pathogens**
Sub project 4:	**Integration of *in silico* drug designing methods for development of potential antimicrobial agents against fish pathogens**
Period:	**April 2020-March 2023**
Personnel:	**Raja Aadil H. Bhat (PI), R.S. Tandel, K. Kunal, P.A. Ganie**
Funding Support:	**Institutional, ICAR-DCFR**

The present study is aimed to develop a computational framework that can be used to identify potential target proteins and their inhibitors for drug designing. The framework was designed to use various computational methods to analyze large datasets of biological and chemical information to identify proteins and small molecules that could be used as drug targets and inhibitors. About 255 ligands were downloaded from Pubchem, which followed

Lipinski's "rule of five" for drug-likeness. The ligands and protein receptor were prepared and converted to pdbqt file format by using AutoDock Vina MGL tools, and AutoDock Vina software was used to simulate the ligand into the meta pocket sites of the receptor for estimating the binding affinities of the ligand-receptor complexes. The software predicted nine poses of the ligand-receptor complex, and several ligands showed good interactions with the aerolysin, including morin and magnolol. The antibacterial activities of morin against fish pathogens such as *Aeromonas salmonicida, Pseudomonas aeruginosa, Edwardsiella tarda*, and *A. sobria* were tested using the micro-dilution method. Morin showed growth inhibitory effects against all four fish pathogens, with MIC ranging from 7.8 to 125 µg/ml. We also studied the minimum bactericidal concentrations (MBC) and killing kinetics of morin. We found that it has antimicrobial activity against all tested bacteria with lower values for *A. sobria* at 50 µg/ml. Morin was found to bind with aerolysin, reducing the virulence of *A. salmonicida* (fig. 1), and was reported to compromise the integrity of the bacterial cell membrane, leading to leakage of cytoplasmic contents (fig. 2), ultimately causing bacterial cell death. We also evaluated the antioxidant activity of morin using various methods. We reported significant differences in DPPH, Alkaline DMSO, hydrogen peroxide, and ABTS radical scavenging activities in treatment groups as compared to the control. Finally, nitric oxide production by leukocytes incubated with different morin concentrations varied significantly compared to the control.

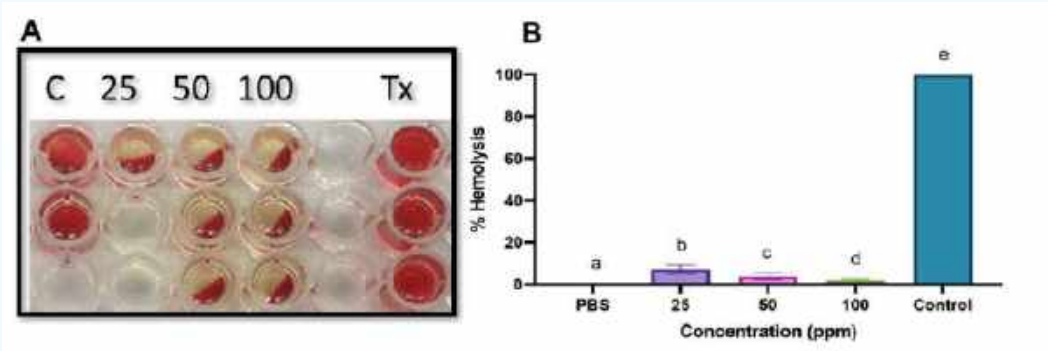


Fig. 1A: Microtiter plate showing hemolytic activities of the A. salmonicida supernatants co-incubated with sub-lethal concentrations of morin. The untreated bacterial culture was taken as a control and Tx: triton X as a positive control

Fig. 1B. Haemolytic activities of the A. salmonicida supernatants co-incubated with sub-lethal concentrations of morin

Fig. 2. Release of cytoplasmic DNA from the bacterial cells (A. salmonicida) at different concentrations of morin

Project: AQ-20	**Development of diagnostic & therapeutic measures for rainbow trout pathogens**
Sub project 5:	**Investigation on health disorder associated with trout loss during seed production in hatcheries and suitable remedial measures for their mitigation**
Period:	**April 2020-March 2023**
Personnel:	**S. Chandra (PI) and S.K. Mallik**
	Institutional, ICAR-DCFR

Timely detection and early response to fish health disorders are key factors for achieving better fish survival and production. Under the project objectives, epidemiological detail, including physicochemical parameters in selected trout hatcheries and brooder raceways, was collected to isolate and characterize the causative agent(s) through laboratory investigations and develop suitable remedial measures for mitigation. One hundred and four trout raceways and six hatcheries, including three government hatcheries, located in the Uttarakhand districts of Rudraprayag, Chamoli, Bageshwar, Nainital, and Champawat were covered during the period under report. Samples from fertilized eggs, eyed ova, alvein fry, juveniles, and brooders were collected and the water quality parameters of the source water and the farms were also recorded.

The Bairgna trout hatchery, in Uttarakhand and the main source of trout seed for fish farmers, is situated on the bank of snow-fed Balkhila River which originates in the Lal Mati glaciers and flows through Mandal Valley. Altogether, thirty-eight raceways and two hatcheries are being used for the rearing of eggs, fry, juveniles, and brooders. There are currently approximately 2,000 brooders available, with approximately 4.4 lakh fry produced. Another trout hatchery at Talwari receives water from the sub-tributary of the Pindar River. It has about 28 raceway units for rearing the brooders and one hatchery facility that can produce 100,000 eggs. The produced seed fully meets the requirements of the Dewal, Taal, and Wan trout farmers as presented in Table-2. Among the government farms, Bairgana trout hatchery produced maximum fry of about 4.4 lakhs and among private fish farms Wana trout hatchery produced maximum of 1,48,400 fry.

Major problems in brooder raceways were ulceration and whitening of the anal fins, enlargement of the abdominal cavity, hemorrhages in the alimentary canal and pyloric ceca, presence of undigested feed in dead trout brooders (3–5%), over-ripening and whitening of eggs during peak breeding months, smaller eggs (3–4 mm), and higher mortality in the summer months. Reddening of the intestine and obstruction of the mature eggs at the genital aperture in 20-30% rainbow trout brooders and per day mortality of 0.5 to 0.8% has been reported from different farms. The stripping response from the studied brooders ranged from 60.00 to 77.69%. Despite the smaller egg size, egg realization per kg of brooder ranged from 1000 to 1363 eggs, a reduction of 24.64% from the normal range of 1500-1600 nos. /kg of trout.

Fig. Bairgana trout farms sampling

Fig. Trout eggs at Gadgu(Ukhimath)

Fig. Dharkudi trout farm

Fig. Local snow trout catch at Bageshwar from Saryu River

From fertilized eggs to one-month-old fry, the cumulative loss range was between 36 and 57%, with an average of 44.17%, the first 24 hours after fertilization witness the most egg loss. Compared to egg damage at various stages of incubation, the ratio of fertilized eggs to yolk sac fry was 2.3–4.5 fold higher until 30 days old. The cause is a combination of poor egg handling and an inherent flaw in stripped eggs. The four-year-old female brooders in the 1.0 to 2.0 kg size range were highly responsive in terms of both egg quality and quantity. Although older female brooders lay larger eggs, fluid accumulation and loosening of the genital aperture allow outside fluid to enter the body cavity, resulting in a lower fertilization rate. *Saprolegnia parasitica* is a common fungus isolated from white eggs. Survival during larval stages was found to be heavily dependent on the water quality and volume, along with water temperature. The trout farms receive silt-loaded water, which has a negative impact on egg incubation in the hatchery and creates asphyxiation. During incubation, along with temperature, dissolved oxygen also plays an important role. The Talwadi State Department Farm has the highest fertilised egg survival rate till fry of approximately 64%, followed by Wana at 62% and Deval at 61%. The higher survival at the Talwadi hatchery is probably due to the optimum water temperature range of 8–11°C.

During this period, ich disease, or "white spot" (*Ichthyophthirius multifiliis*), was frequently observed in nurseries, resulting in large-scale mortality of up to 58%. Temperature stress, and rearing conditions were found to be important factors in infection multiplication. In some of the farms studied, the fry death was a result of whirling disease-like symptoms.

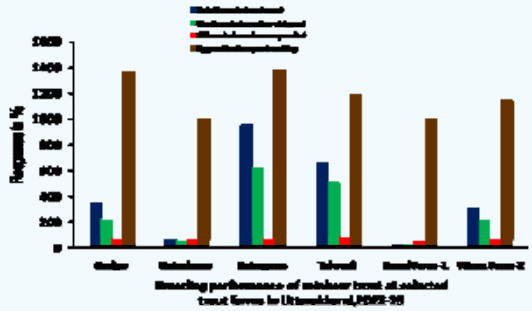


Fig.1. Breeding performance of rainbow trout at selected trout farms in Uttarakhand

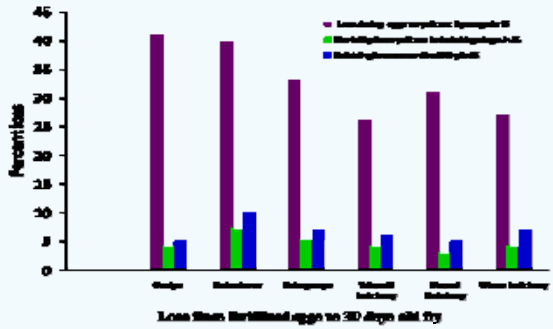


Fig 2. Total loss from fertilized egg stage to 30 days old trout fry

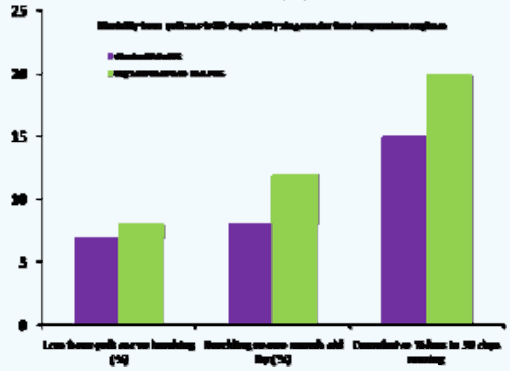


Fig. 3. Percent egg loss from yolk sac fry to one month old trout fry

Table: Field level water quality parameters

S. No.	Farm Name	GPS coordinate/ altitude (feet)	TDS (mg/L)	Conductivity (µS/cm)	pH	Ammonia (mg/L)	Nitrite (mg/ L)	Nitrate (mg/ L)	Total alkalinity (mg/L)
1.	Dharkudi	N 30.29.678 E 078.54.982 (5883)	28.0-35.5	58.0-62.7	7.1-7.5	0.0-0.01	6-10	10-20	15-25
2.	Jagthana	N 29 59 086 E 079.48.653 (5607)	180.5-213.8	220.3-257.2	7.5 8.2	0.0-0.02	15-18	10-20	150-170
3.	Gadgu (water source)	N 30.32.800 E 079 09 080 (4879)	32.0-42.3	62.4-70.3	7.0-7.2	0.0-0.10	8-10-	8-10	10-20
4.	Gadgu (raceways)	N 30.32.800 E 079 09 080 (4874)	50-56	66.7-75.5	6.8-7.8	0.22-0.10	8-12	10-15	10-20
5.	Koteshwar farm	N30 26 830 E 079.16.930 (4706)	40.0-44.9	45-54	7.2-7.8	0.0-0.10	7.0-10.0	8-10	10-20
6.	Talwadi		18.5-25.0	18.5 -22.9	6.9-7.2	00.0-0.10	10-14	6-10	10-15

Project: AQ-20	**Development of diagnostic & therapeutic measures for rainbow trout pathogens**
Sub project 6:	**Immunomodulatory potential of nano composition and effect of immunization towards *Saprolegnia* infections in rainbow trout**
Period:	**June 2021-March 2024**
Personnel:	**R.S. Tandel (PI), P. Dash, Siva, C., R.A.H. Bhat, K. Kunal**
	Institutional, ICAR-DCFR

The project aims to develop a nano formulation against emerging infections caused by *Saprolegnia* sp. Based on low-energy emulsification techniques, two protocols for the preparation of nano-emulsions of selected natural compounds were optimised. A mixture of essential oil, carrier medium-chain triglyceride, MCT oil, and nonionic surfactant formed these nano-emulsions. The prepared nano-emulsions were outsourced for additional zeta potential effectiveness and particle size analysis. The entrapment efficiency (EE) was measured to determine the encapsulation efficiency of the nano-emulsion formulation. The anti-saprolegnia efficacy and long-term stability of selected nano-emulsions were evaluated via the minimum inhibitory concentration, mycelium growth inhibition, spore germination inhibition, and colonisation test. To evaluate the immunostimulatory potential of compounds, nitric oxide production, leukocyte proliferation, and myeloperoxidase activity were measured in peripheral blood leukocytes of rainbow trout, *Oncorhynchus mykiss*. DPPH radical scavenging activity, alkaline DMSO radical scavenging activity, hydrogen peroxide radical scavenging assay, 2,2-azino-bis (3-ethylbenzthiazole-6-sulphonic acid) radical cation (ABTS+•) and cell viability assay were used to evaluate the antioxidant property of nano-emulsions. Both the nano-emulsion showed the anti-saprolegnia, antioxidant and immunostimulatory activity. The work is in progress for evaluation of the effect of immunization on rainbow trout against *Saprolegnia* sp.

Project: AMR	**Network programme on antimicrobial resistance (AMR) in fishes under INFAAR**
Period:	**April 2021-March 2024**
Personnel:	**S.K. Mallik (PI), N. Shahi and Raja Adil H. Bhatt**
Funding Support:	**Nodal Agency -ICAR-NBFGR (ICAR-FAO Network Programme on AMR)**

Development of antimicrobial resistance profile of *Aeromonas* group, *Escherichia coli* and *Staphylococcus* group isolated from farms in coldwater aquaculture

Aeromonas group

During the period 346 samples (water and fish) were collected from Uttarakhand (158), Jammu & Kashmir (63) and Sikkim (125). All the samples were processed aseptically as per the set guidelines of the project. The total numbers of bacteria isolated from both fish and water samples were 496 (Uttarakhand n=228, Jammu & Kashmir n=131, Sikkim =137). The numbers of *Aeromonas*, *Escherichia* and *Staphylococcus* isolates recovered were 221, 100 and 175 respectively. The isolates recovered were subjected to the development of an antibiotic resistance profile against panels of antibiotic selected under the study.

The results showed that the isolates of *Aeromonas* group (n=98) from Uttarakhand demonstrated maximum resistance against Cefoxitin (56%) followed by Cephalothin (44%), Cefotaxime (16 %) and ampicillin-sulbactam (16%) (Figure 1), In contrast, *Aeromonas* isolates (n=60) from Jammu & Kashmir showed maximum resistance against Cephalothin (80%) followed by Cefoxitin (65%), ampicillin-sulbactam (30%) and Ceftazidime (30%) (Figure 2). However, *Aeromonas* group (n=63) from Sikkim exhibited a different resistance pattern against the panel of antibiotics tested. The isolates exhibited maximum resistance against Cefoxitin (72%) followed by ampicillin-sulbactam (44%) and Amoxicillin Clavulanic acid (15%) (Figure 3).

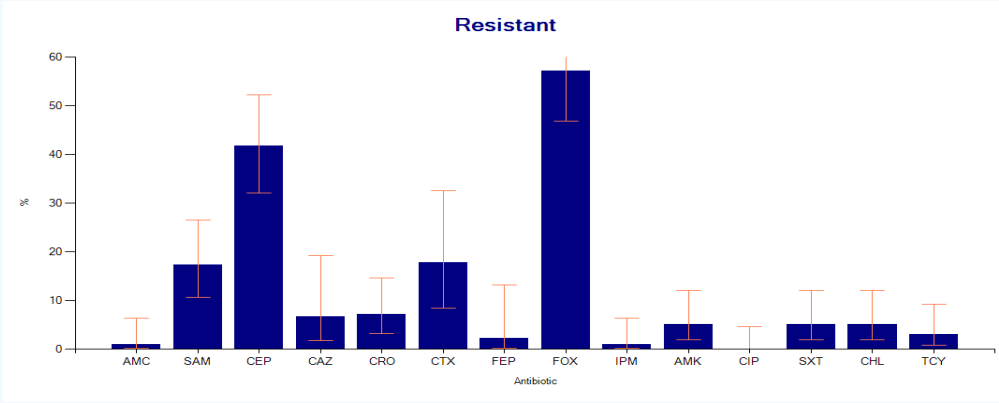


Fig. 1: Antibiotic resistance pattern of Aeromonas spp. (n=98) isolated from Uttarakhand

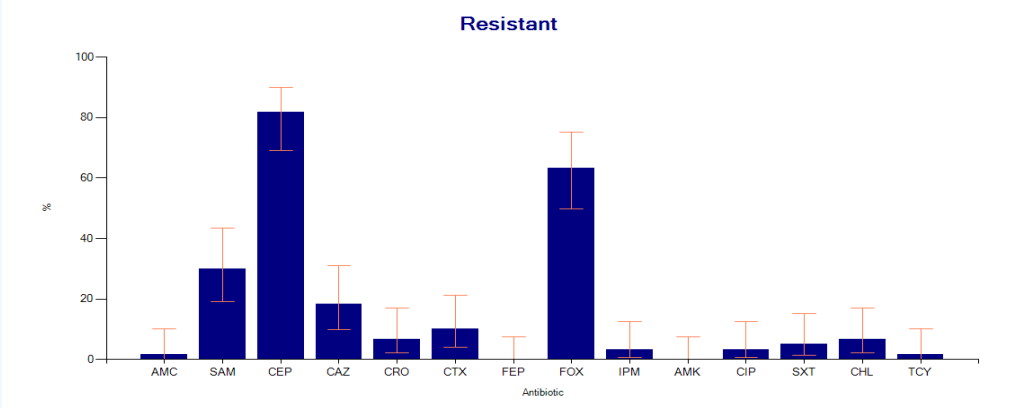


Fig. 2: Antibiotic resistance pattern of Aeromonas spp. (n=60) isolated from J & K

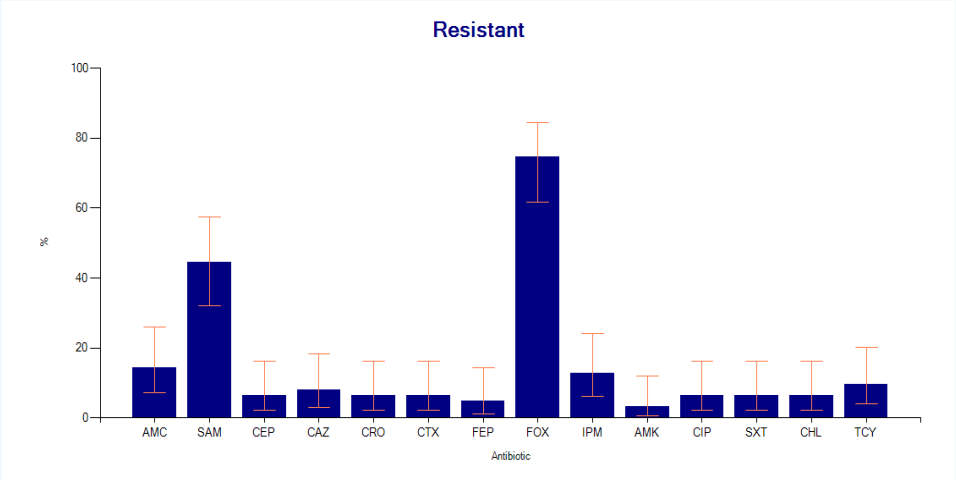


Fig. 3: Antibiotic resistance pattern of Aeromonas spp. (n=63) isolated from Sikkim

Escherichia coli

Escherichia coli isolates (n=65) from Uttarakhand showed maximum resistance against ampicillin (58%) followed by cefoxitin (40%) and cefotaxime (14%) (Figure 4). In the case of Jammu & Kashmir, the percentage of isolates of *E. coli* (n=19) showing maximum resistance against ampicillin, cefoxitin and cefotaxime were 68, 48 and 30% respectively (Figure 5). *E. coli* recovered from Sikkim exhibited the maximum resistance against ampicillin (62%) followed by cefoxitin (30%) (Figure 6).

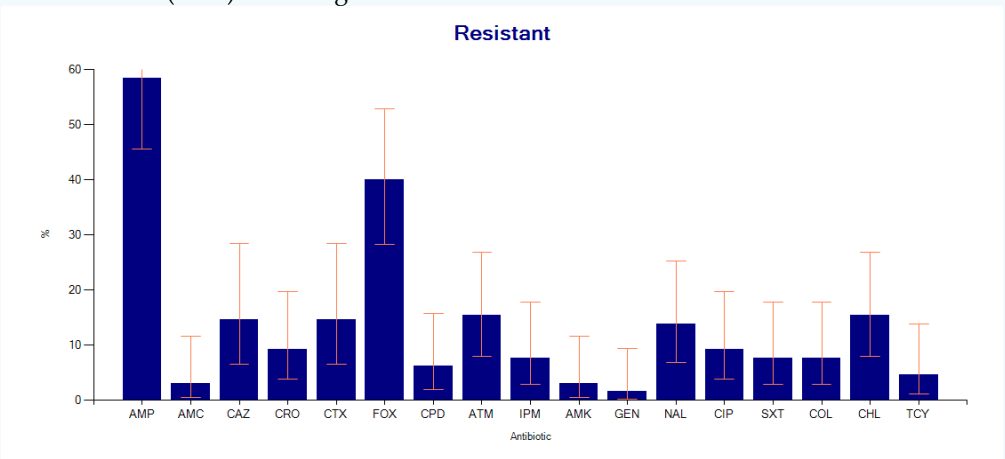


Fig. 4: Antibiotic resistance pattern of Escherichia coli (n=65) isolated from Uttarakhand

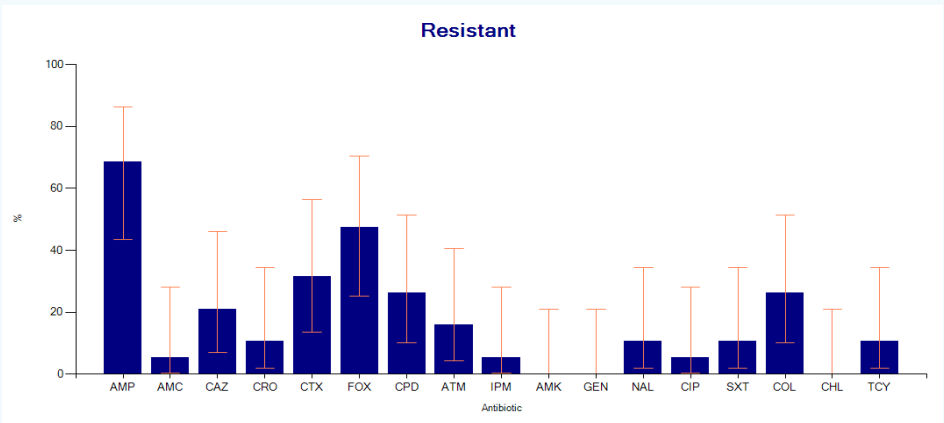


Fig 5: Antibiotic resistance pattern of E.coli (n=19) isolated from Jammu & Kashmir

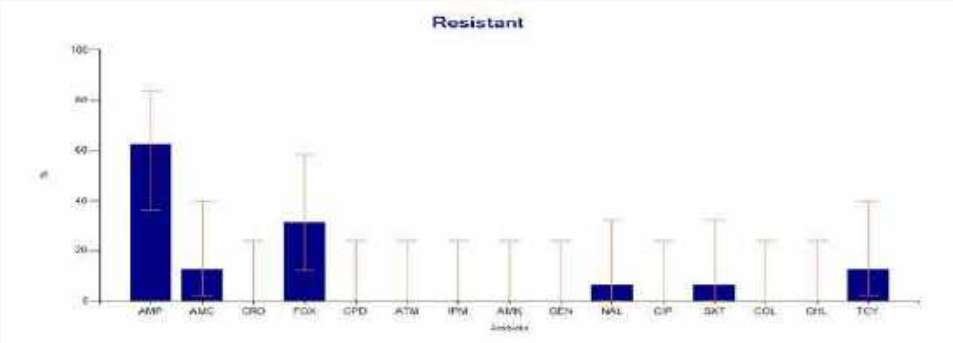


Fig. 6: Antibiotic resistance pattern of E. coli (n=16) from Sikkim

***Staphylococcus* spp**

Staphylococcus isolates from Uttarakhand (n=65) were resistant to penicillin G (73%), oxacillin (42%), cefoxitin (42%) and erythromycin (42%) (Figure 7). In case of Jammu & Kashmir, the resistant pattern shown by *Staphylococcus* spp (n=52) were penicillin G (85%), oxacillin (43%), cefoxitin (43%) and erythromycin (58%) (Figure 8), whereas *Staphylococcus* isolates (n=58) from Sikkim showed maximum resistance against penicillin G (98%), oxacillin (30%), cefoxitin (30%) and erythromycin (23%) (Figure 9).

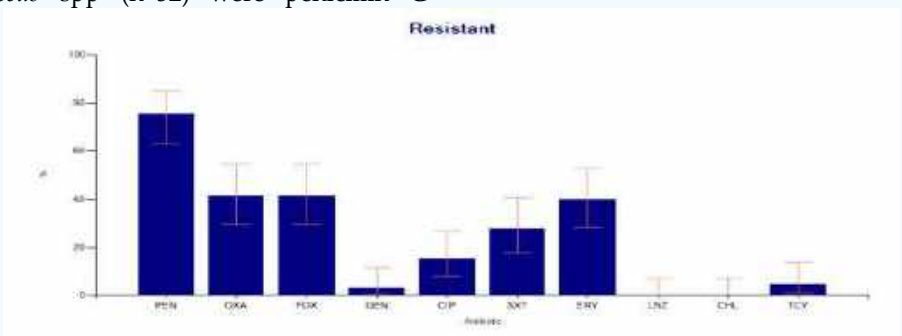


Fig. 7: Antibiotic resistance pattern of Staphylococcus spp (n=65) isolated from Uttarakhand

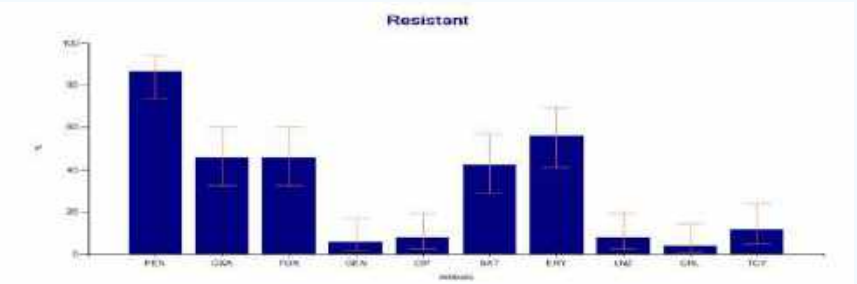


Fig. 8: Antibiotic resistance pattern of Staphylococcus spp (n=52) isolated from Jammu & Kashmir

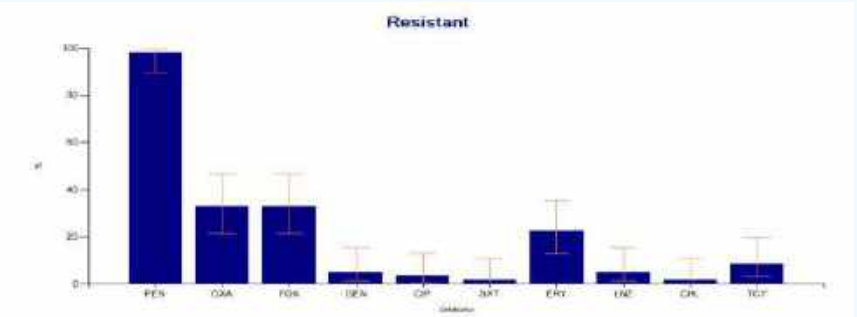


Fig. 9: Antibiotic resistance pattern of Staphylococcus spp (n=58) isolated from Sikkim

3.6 Externally Funded Projects

Project: NSPAAD	**National surveillance programme for aquatic animal disease-Surveillance of coldwater fish diseases in Himachal Pradesh and Uttarakhand (NFDB funded multi-institutional project)**
Period:	**April 2021-March 2024**
Personnel:	**Amit Pande (PI), R.S. Tandel**
Funding Support:	**Amit Pande (PI), R.S. Tandel**

Baseline data from seven rainbow trout farms, raceways, and hatcheries (ICAR-DCFR) was collected as per the prescribed format from trout farms of Nainital and Bageshwar. Seven farms were visited by the investigators that included fourteen raceways. Baseline data of a private fish farm established in 2020 at Gattigarh, Bhimtal, Nainital was also collected. Rainbow trout, carps, and ornamental fish are raised alongside vegetables and other plants in this farm. Baseline data from was also collected seventy-four raceways and hatcheries from a clusters of trout farms from the village of Jagthana, Kapkot block of Bageshwar district. Moreover, an awareness program on Fish Health was conducted at village Harinagar, District Nainital, Uttarakhand.

Fig. Some of the farms visited for the collection of baseline data

Fig. Awareness program on Fish Health organized at Harinagar, District Nainital

Project: AINP	**All India Network Project on Fish Health- AINP-FH**
Period:	**April 2021-March 2026**
Personnel:	**S.K. Mallik (PI), N. Shahi, R.S. Tandel**
Funding Support:	**Nodal Agency-ICAR-CIBA**

Experimental trial on - Biosafety, histological alterations and residue depletion of feed administered anti-parasitic drug emamectin benzoate in golden mahseer, *Tor putitora* (Hamilton, 1822)

In the experiment, an attempt has been made to study the biosafety, toxicity, residue depletion and drug tolerance of graded doses of emamectin benzoate (EB) in juveniles of golden mahseer, *Tor putitora* as a model candidate fish for sport fishery and conservation in temperate waters through an extended medicated feeding. The graded doses of EB viz., 1× (50 µg/kg fish/day), 2× (100 µg/kg fish/day), 5× (250 µg/kg fish/day) and 10× (500 µg/kg fish/day) were administered to golden mahseer juveniles (average size 20.8+2.4 cm and average body weight 78.6+10.65 g) through medicated diet (table 1) for 21 days at a water temperature of 18.6 ºC. The higher doses of EB did not cause any mortality during and 30 days after the end of the medication period, but considerable variations in feeding and behaviour were observed (table 2). Severe histological alterations observed after EB-diets (5× and 10×) were vacuolation, pyknotic nuclei, melano-macrophage centre and necrosis in the liver; Bowman's capsule dilation, degenerated renal tubules in the kidney; myofibril disintegration, muscle oedema, splitting of muscle fibres, migration of inflammatory cells in muscle; and abundant goblet cells, dilated lamina propria and disarrangement of mucosa in intestine tissues (Figure 1-6) The residual concentrations of EB metabolites Emamectin B_{1a} and B_{1b} were analyzed using muscle extracts and were found elevated during medication period followed by gradual depletion in post-medication period (Figure 7A-B). The outcome of this study showed that the Emamectin B_{1a} residual concentration in fish muscle in 1×, 2×, 5× and 10× EB treatment groups were 1.41+0.49, 1.2+0.7, 9.7+3.3 and 37.4+8.2 µg/kg at 30 days of the post-medication period, respectively, which falls under the maximum residue limits (MRLs) of 100 µg/kg. The results support the biosafety of EB at the recommended dose of 50 µg/kg fish/day for seven days. As residue of EB is recorded falling within the MRL, no withdrawal period is recommended for golden mahseer.

Table 1: Feed composition for golden mahseer juveniles (crude protein: ~35%; crude lipid: ~8.7% of feed).

Sl. No.	Feed ingredients	g per kg of diet except for EB				
		Control	1× (50 µg/kg)	2× (100 µg/kg)	5× (250 µg/kg)	10× (500 µg/kg)
1.	Fish meal	300.00	300.00	300.00	300.00	300.00
2.	Soyabean meal	200.00	200.00	200.00	200.00	200.00
3.	Wheat flour	430.00	430.00	430.00	430.00	430.00
4.	Soy oil	50.00	50.00	50.00	50.00	50.00
5.	Fish oil	10.00	10.00	10.00	10.00	10.00
6.	Vitamin/Mineral mix*	10.00	10.00	10.00	10.00	10.00
7.	EB#	0.0 mg	2.5 mg	5.0 mg	12.5 mg	25.0 mg

*Composition of vitamin-mineral mix (quantity/kg mix):

Vitamin sources: Thiamin hydrochloride, 1.0 g; riboflavin, 1.5 g; pyridoxine hydrochloride, 1.0 g; cyanocobalamine, 0.002 g; nicotinic acid, 1.0 g; folic acid, 0.2 g; myo-inositol, 50.0 g; D-biotin, 0.1 g; calcium pantothenate, 2.0 g; L-ascorbyl-2-triphosphate, 50.0 g; retinal acetate, 0.075 g; cholecalciferol, 0.006 g; cellulose 393.117 g, tocopherol acetate, 0.1 g and choline chloride, 1.0 g.

Mineral sources: Calcium carbonate, 50 g; magnesium oxide, 124.0 g; $CaHPO_4.2H_2O$, 200.0 g; ferric citrate, 20.0 g; potassium iodide, 0.4 g; zinc sulphate, 4.0 g; copper sulphate, 3.00 g;

manganese sulphate 3.0 g, KH_2PO_4, 300.0 g; cobalt sulphate, 0.2 g; sodium selenite, 0.3 g; sodium chloride, 40.0 g; CMC, 255.1 g.

#EB is calculated according to treatment dose per kg of fish biomass and mixed with feed of 2% body weight per kg for each treatment groups.

Table 2: Rating of feeding behaviour of golden mahseer juveniles administered with graded doses of EB (1× to 10×) and control fish fed with normal feed.

Sr. No.	Treatment Group	Acclimatization period (15 days)	Medication period (EB diet for 21 days)		Post-medication period (EB-free diet for 30 days)		
			0-11	12-21	22-31	32-41	42-51
1.	Control	4.0 + 0.0	4.0 + 0.0	4.0 + 0.0	4.0 + 0.0	4.0 + 0.0	4.0 + 0.0
2.	1×(50 µg/kg)	4.0 + 0.0	4.0 + 0.0^a	4.0 + 0.0^a	4.0 + 0.0^a	4.0 + 0.0	4.0 + 0.0
3.	2×(100 µg/kg)	4.0 + 0.0	4.0 + 0.0^a	4.0 + 0.0^a	4.0 + 0.0^a	4.0 + 0.0	4.0 + 0.0
4.	5×(250 µg/kg)	4.0 + 0.0	2.0 + 0.4^b	2.0 + 0.1^b	2.0 + 0.6^b	3.0 + 0.92	4.0 + 0.0
5.	10×(500 µg/kg)	4.0 + 0.0	2.0 + 0.8^b	1.0 + 0.3^b	1.0 + 0.8^b	3.0 + 0.16	3.0 + 0.87

Columns not sharing the same superscript 'a' and 'b' varied significantly (P<0.05).

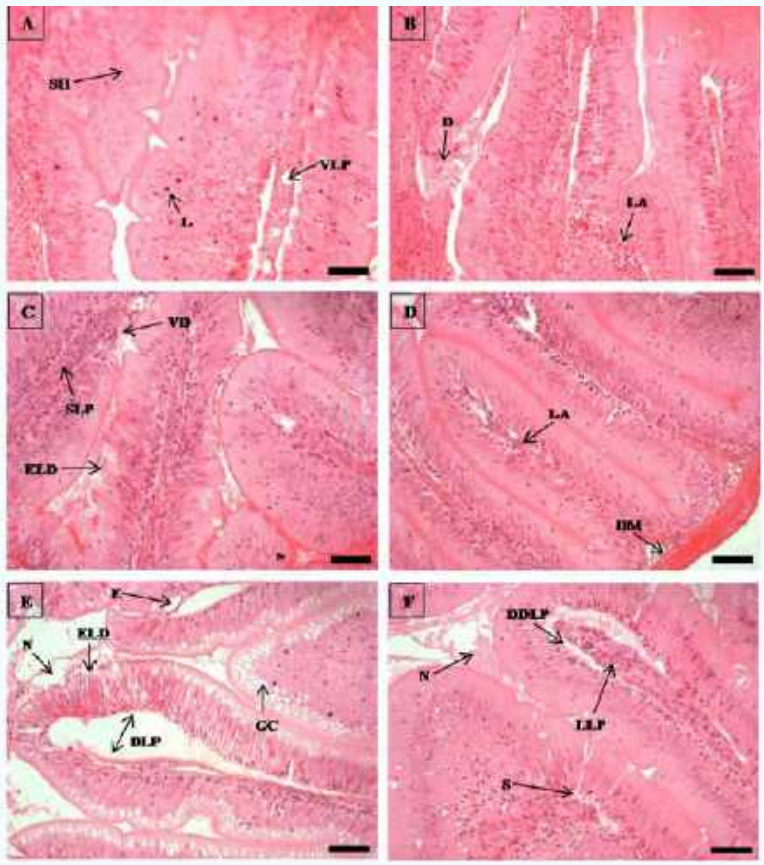


Fig. 1: The histological sections (4 µm) of intestine tissues from EB-administered golden mahseer on the 11th day (A-B) and 21st day (C-F) of EB-medication. The histological changes in intestine tissues of fishes fed with EB doses (A) at 250 µg/kg fish/day showing vacuolated lamina propria (VLP), submucosal hyperplasia (SH), deeply stained lymphocytes (L); (B) at 500 µg/kg fish/day showing degenerative changes in lamina propria and submucosa (D), lymphocytes abundance (LA); (C) at 50 µg/kg fish/day showing swelling of lamina propria (SLP), epithelial layer disintegration (ELD), vili degeneration (VD); (D) at 100 µg/kg fish/day showing disarrangement of muscularis mucosa (DM), abundant lymphocytes in lamina propria (LA); (E) at 250 µg/kg fish/day showing abundant goblet cells (GC), extensively dilated lamina propria (DLP), epithelial layer disintegration (ELD), oedema (E), necrotic debries in lumen (N); (F) at 500 µg/kg fish/day showing dilated and distended lamina propria (DDLP), splitting of submucosal layer (S), lymphocytes aggregation in lamina propria (LLP), necrotic debries in lumen (N). The H&E stained sections are visualized at magnification of 400X under inverted light microscope (Olympus IX53, Canada). The scale bar value in the bottom right corner (A-F) is 20 µm.

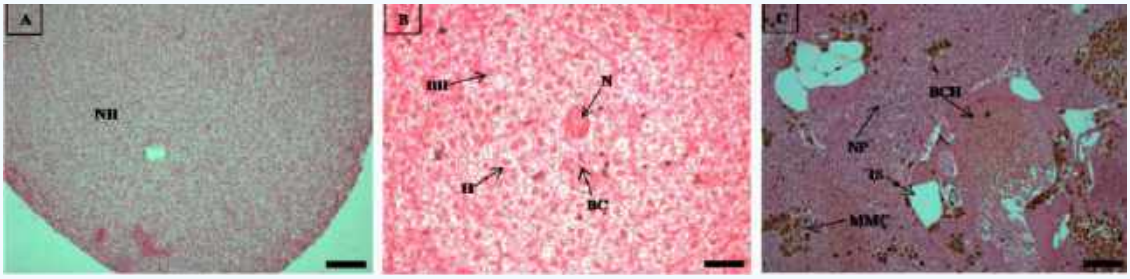


Fig. 2: The histological sections (4 µm) of liver tissues from control fish showing normal hepatocytes (A) and EB-administered golden mahseer on the 11th day (B-C) of EB-medication. The histological changes in liver tissues of fishes fed with EB doses (B) at 250 µg/kg fish/day showing hepatocyte hypertrophy (H), binucleated hepatocytes (BH), blood congestion (BC), necrosis (N); (C) at 500 µg/kg fish/day showing large melanomacrophage centres (MMC), blood congestion in hepatic veins (BCH), increased sinusoids (IS), nuclear pyknosis (NP). The H&E stained sections are visualized at magnification of 200 (A, C) and 400X (B) under an inverted light microscope (Olympus IX53, Canada). The scale bar value depicted in the bottom right corner is 20 µm (B) and 40 µm (A, C).

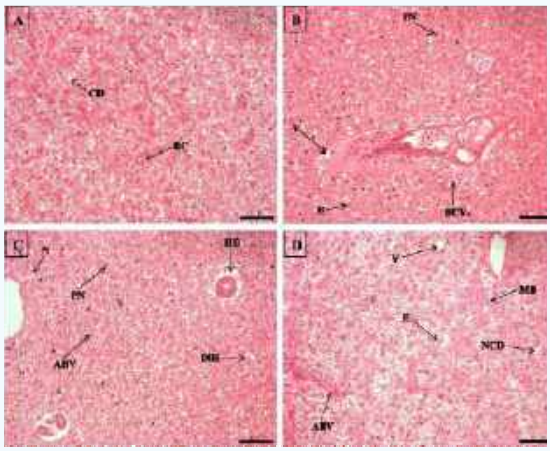


Fig. 3: The histological sections (4 µm) of liver tissues from EB-administered golden mahseer on the 21st day (A-D) of EB-medication. The histological changes in liver tissues of fishes fed with EB doses (A) at 50 µg/kg fish/day showing blood congestion (BC), cytoplsamic degeneration (CD); (B) at 100 µg/kg fish/day showing vacuolization (V), pyknotic nuclei (PN), hypertrophy of hepatocyte (H), blood congestion near vein (BCV); (C) at 250 µg/kg fish/day showing pyknotic nuclei (PN), necrosis (N), irregularly shaped hepatocytes (ISH), accumulation of blood vessels (ABV), hepatocyte degeneration (HD); (D) at 500 µg/kg fish/day showing vacuolization (V), hypertrophy (H), nuclear and cytoplasmic degeneration (NCD), migration of blood cells towards hepatocytes (MB), accumulation of blood vessels (ABV). The H&E stained sections are visualized at magnification of 400X under inverted light microscope (Olympus IX53, Canada). The scale bar value in the bottom right corner (A-D) is 20 µm.

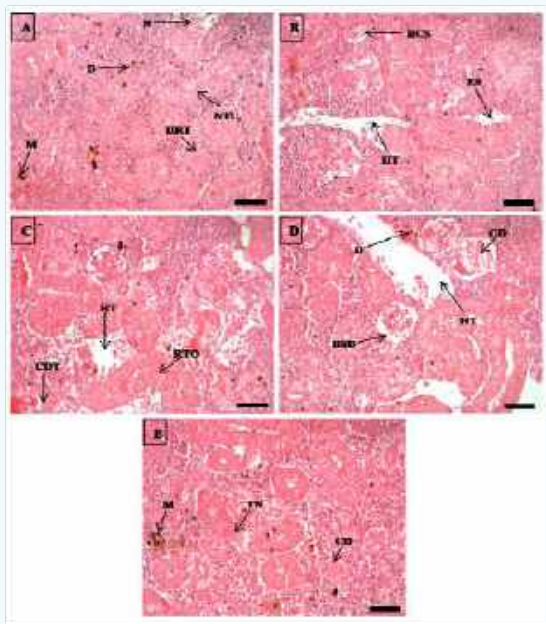


Fig. 4: The histological sections (4 µm) of kidney tissues from EB-administered golden mahseer on the 21st day (A-E) of EB-medication. The histological changes in kidney tissues of fishes fed with EB doses (A) at 50 µg/kg fish/day showing melanomacrophages (M), necrosis (N), narrowing of the tubular lumen (NTL), hypertrophy in renal tubule (HRT), droplet like aggregation (D); (B) at 100 µg/kg fish/day showing renal corpuscle shrinkage (RCS), enlarged sinusoids (ES), decreased hematopoietic tissue (HT); (C) at 250 µg/kg fish/day showing cellular degeneration in renal tubule (CDT), renal tubule occlusion (RTO), decreased hematopoietic tissue (HT); (D-E) at 500 µg/kg fish/day showing Bowman's space dilation (BSD), glomerular degeneration (GD), decreased hematopoietic tissue (HT), droplet like aggregation (D), melanomacrophages (M), tubular necrosis (TN), cloudy degeneration of tubules (CD). The H&E stained sections are visualized at magnification of 400X under an inverted light microscope (Olympus IX53, Canada). The scale bar value in the right bottom right corner (A-E) is 20 µm.

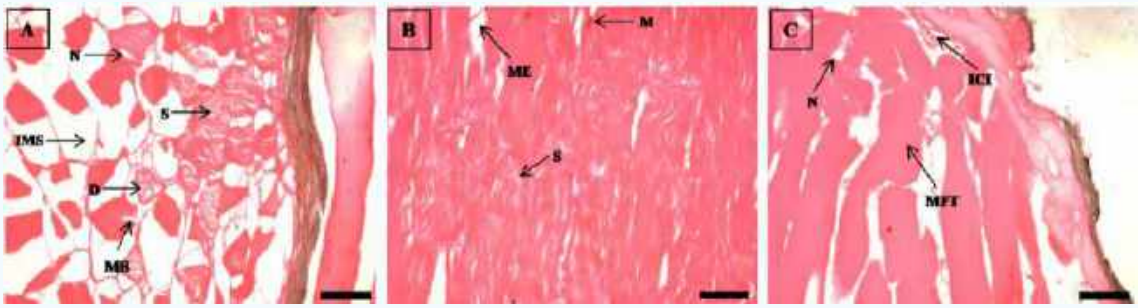


Fig. 5: The histological sections (4 µm) of muscle tissues from EB-administered golden mahseer on the 11th day (A-C) of EB-medication. The histological changes in muscle tissues of fishes fed with EB doses (A) at 100 µg/kg fish/day show degeneration of muscle bundles (D), splitting of myofibrils (S), broken muscle bundles (MB), increased inter muscular space (IMS), necrosis (N); (B) at 250 µg/kg fish/day demonstrate muscular oedema (ME), severe splitting of myofibrils (S), melanomacrophages (M); (C) at 500 µg/kg fish/day showing necrosis (N), muscle fibres thickening (MFT), inflammatory cells infiltration towards broken myofibrils (ICI). The H&E stained sections are visualized at a magnification of 400X under an inverted light microscope (Olympus IX53, Canada). The scale bar value depicted in the right bottom corner (A-C) is 20 µm.

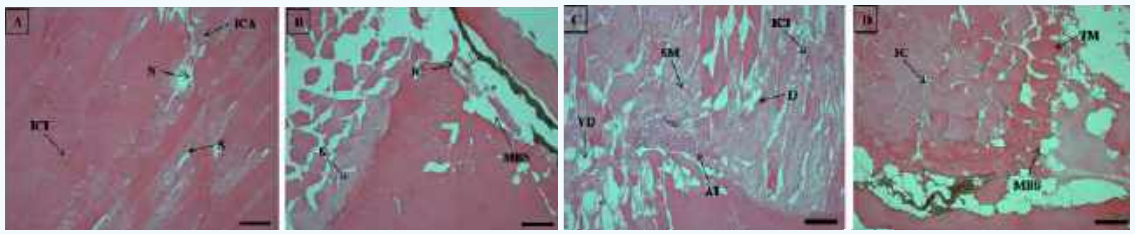


Fig. 6: The histological sections (4 µm) of muscle tissues from EB-administered golden mahseer on the 21st day (A-D) of EB-medication. The histological changes in muscle tissues of fishes fed with EB doses (A) at 50 µg/kg fish/day show focal area of necrosis (N), splitting of myofibrils (S), inflammatory cells aggregation (ICA), infiltration of inflammatory cells between the muscle fibres (ICI); (B) at 100 µg/kg fish/day showing muscular bundles separation (MBS), inflammatory cells (IC), splitting of myofibrils (S); (C) at 250 µg/kg fish/day showing degenerative changes in muscle bundles (D), severe myofibril splitting (SM), inflammatory cells infiltration (ICI), vacuolar degeneration in muscle bundles (VD), acute inflammation (AI); (D) at 500 µg/kg fish/day showing muscular bundles separation (MBS), marked thickening of muscle bundles (TM), inflammatory cells between the muscle fibres (IC). The H&E stained sections are visualized at magnification of 200X under inverted light microscope (Olympus IX53, Canada). The scale bar value depicted in the right bottom corner (A-D) is 40 µm.

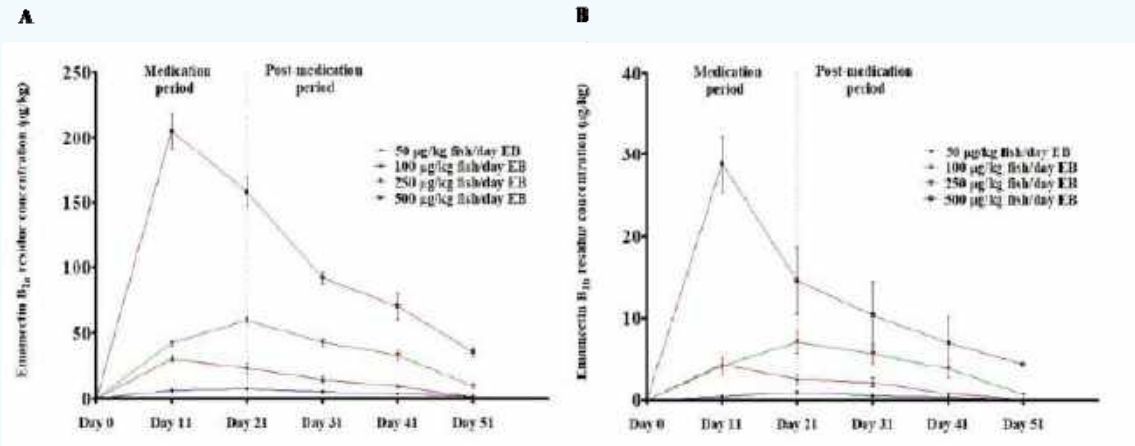


Fig. 7 (A-B): LC-MS/MS based residual analysis of EB metabolites (A) Emamectin B1a and (B) Emamectin B1b from muscle tissues of golden mahseer fed with different doses of EB, viz., 1×: 50 µg/kg fish/day; 2×: 100 µg/kg fish/day; 5×: 250 µg/kg fish/day and 10×: 500 µg/kg fish/day for 21 days (P<0.05). The error bar shows the standard error mean values.

Project: NICRA	**Development of climate resilient rainbow trout and innovative trout farming strategies to mitigate climatic stressors**
Period:	**April 2021-March 2026**
Personnel:	**D. Sarma (PI), B.S. Kamalam, Rajesh, M., P. Sharma, R.S. Patiyal, P. A. Ganie**
Funding Support:	**Nodal Agency-ICAR-CRIDA**

Coldwater RAS for intensive production of rainbow trout

Under the NICRA project, the optimization of rearing conditions and culture practices for higher unit productivity of rainbow trout in RAS is in progress. Based on the current production scenario, water use per kilogram fish production has been reduced by hundred-fold (~700 L per kg fish). Culture duration has been reduced to 5-6 months under optimal rearing conditions, due to faster growth rates and efficient feed conversion. Production cost per kilogram of trout was calculated to be approximately around Rs. 250, which includes cost of feeding (Rs. 150/kg), energy (Rs. 90/kg), seed and chemicals (Rs. 27000/crop cycle). During the reporting period, a revenue of Rs. 3,00,000 was generated through retail sale of market sized rainbow trout from the pilot scale RAS facility.

Fig: Production of market sized rainbow trout in RAS

Functional feeds for augmenting thermal safety margins in rainbow trout

In aquaculture, nutritional solutions and interventions are practically feasible strategies to mitigate the potential adverse impacts of climate change. In this context, we conducted 8-week feeding trial to evaluate the effectiveness of different dietary supplementation levels of antioxidants to enhance the thermal safety margins and acclimation capacity of rainbow trout, at temperatures above the physiological optimum. Growth, feed use, tissue indices, metabolic rates and critical thermal tolerance limits were used as the phenotypic response variables. No difference was observed in zootechnical performance of the fish. But interestingly, the antioxidant supplements were found to augment the upper and lower critical temperature tolerance limits of rainbow trout by 1.5 and 3°C, respectively (the critical thermal scope was enhanced by 4.5°C). Further, plasma and tissue samples were collected for various biochemical and gene expression analyses. The total antioxidant activity was enhanced with reciprocal decrease in TBARS levels in liver and plasma with dietary antioxidant supplementation. Concerning the possible physiological changes that facilitated the improvement in thermal safety margins, we found reduction in the routine metabolic oxygen consumption rate and elevation in the blood hemoglobin levels. Corresponding changes were observed in the transcript abundance of cellular stress response markers and intermediary metabolism enzymes in liver of the experimental rainbow trout.

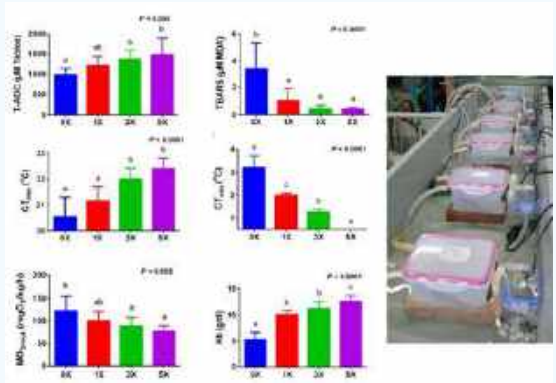


Fig: Antioxidant supplementation and improved thermal acclimation in rainbow trout

Deciphering mechanisms underlying thermal adaptation in rainbow trout

Three potentially novel biomarkers of thermal adaptation in rainbow trout, namely

stress induced phosphoprotein (*stip1*), hypoxia up-regulated protein (*hyou1*) and heat shock protein 40 family member C16 (*dnajc16*) were characterized and their transcriptional regulation in gill during the course of high temperature acclimation was elucidated alongside established biomarkers of cellular stress response in salmonids. The full-length mRNA of *stip1* and *hyou1* were 3096 bp and 3421 bp long, with 1632 and 3063 bp ORF region, encoding a putative protein of 544 and 1020 amino acids, respectively. Whereas, the amplified *dnajc16* fragment was 2528 bp long, with a partial ORF of 2356 bp that encoded 785 amino acids. Phylogenetically, the deduced protein sequences of *stip1*, *hyou1* and *dnajc16* clustered closely with other salmonids. Concerning their expression before (T0) and during the time-course (days) of high temperature (22°C) acclimation (T1, T3, T7, T15 and T30), the gill mRNA levels of *stip1*, *hyou1* and *dnajc16* were uniformly upregulated at T1, after the high-temperature transition. With prolonged exposure, transcripts of *hyou1* and *dnajc16* were elevated again at T15 and T30. A similar acute and chronic upregulation was observed for *hspbp1*, *hsp90b*, *gr1*, *junb*, *hif1a*, *gpx* and *tlr5*. Whereas, the expression of *hsc70*, *hspa5*, *gst* and *tnfa* was similar to that of *stip1* (elevated only at T1). Overall, molecular characterization of the structure and transcriptional regulation of *stip1*, *hyou1* and *dnajc16*, concurrently with their potential regulatory interactions has improved our understanding about thermal adaptation and tolerance in rainbow trout.

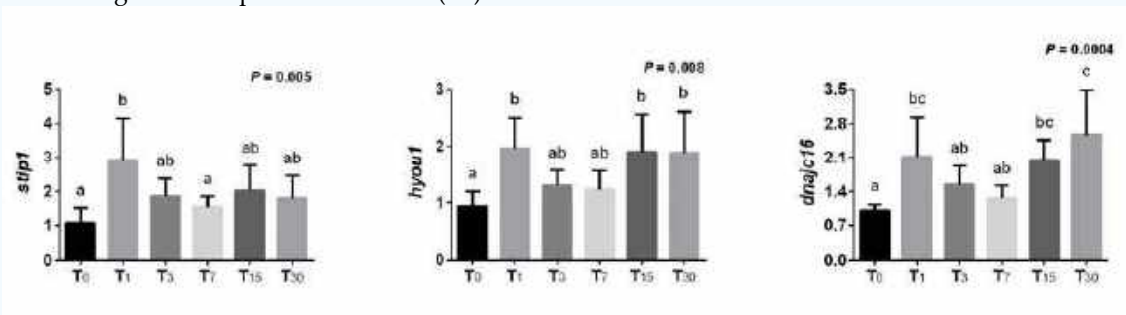


Fig: mRNA expression of the novel thermal stress biomarkers in gill of rainbow trout

Temperature-dependent changes in developmental morphology of rainbow trout

We had previously elucidated the effects of different early-life temperature regimes on hatching, yolk-sac absorption, larval metamorphosis, post-metamorphic growth, developmental morphology and muscle cellularity of rainbow trout, until 52 days post-hatching (dph). From the eyed-ova stage, embryos were exposed to either low (8ºC, LT-8) or high (16ºC, HT-16) temperatures until hatching. Post-hatching, half of the sac-fry from LT-8 group were shifted to higher temperature (16ºC, LHT-16); and half from HT-16 group were shifted to medium temperature (13ºC, HMT-13), for larval rearing. Higher incubation temperature advanced hatching by 6 days, synchronized hatching duration and minimized hatchlings' size-variation. However, it also resulted in faster yolk-sac absorption and yielded smaller and morphologically less developed individuals at hatching (length-wise) and first-feeding (weight-wise), as compared to the LT-8 larvae. With post-hatch shifting of sac-fry to high and medium temperatures, its effect on length was immediate and temporary, but changes in weight were persistent. Red muscle hypertrophy was observed to be high in high-temperature incubated fish; whereas, white muscle hypertrophy was high in high post-hatch rearing temperature groups. The effect of temperature regimes on developmental morphology was found to be strong during earlier life stages (at 22 dph). The post-hatch rearing temperature had a temporary effect on fin development, but incubation temperature affected fin position, in a delayed but persistent manner (subtle at 22 dph, but stronger at 52 dph). We are presently investigating the effect of the above thermal regimes on the regulation of thyroid axis and development of digestive capacities in rainbow trout.

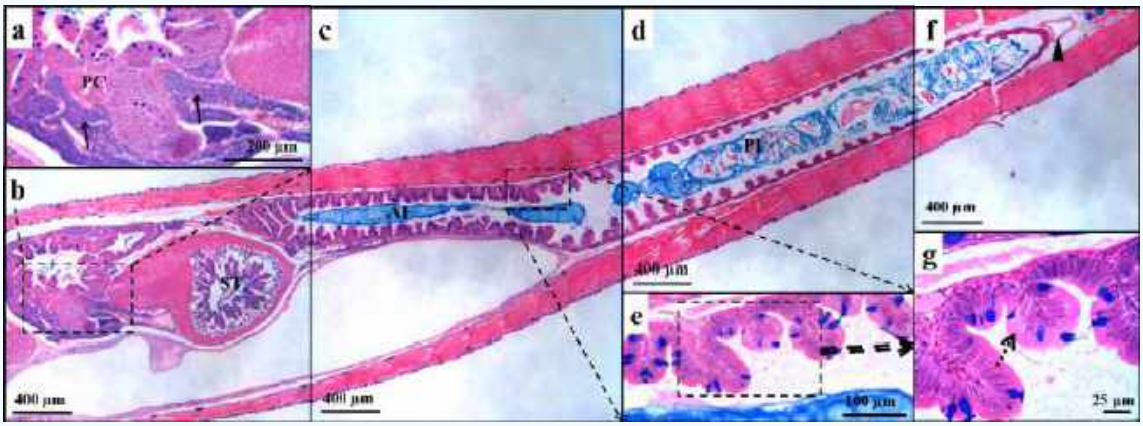


Fig: Photomicrograph of LHT-16 rainbow trout juvenile at 20 dph

Monitoring of abiotic water quality changes in the Urgam trout farming cluster

Abiotic water quality changes in the rainbow trout farming cluster in Urgam village, Chamoli, Uttarakhand, is being regularly monitored to study the potential impact of climate change on farm operation and fish production. The selected farmers were also provided critical inputs such as feed and waders, and simultaneously given scientific advisory regarding water quality monitoring, biomass estimation and feed management. Information on fish growth, feed use and fish production were also collected from the farmers.

Fig: Wader and feed distribution to NICRA farmers of Urgam village

Fig.: Water quality analysis at Urgam village

Project: DBT-10	**Translating the native fish germplasm for socio-economic benefits through aquaculture and fisheries in Himalayan region**
Period:	**May 2022-April 2025**
Personnel:	**N.N. Pandey (PI), R.S. Patiyal, S. Ali**
Funding Support:	**Dept. of Biotechnology, GOI, New Delhi**

Snow trout belongs to the family Cyprinidae and subfamily Schizothoracinae and form an important natural fishery in uplands. In Indian uplands, 17 recognized members of snow-trout are widely distributed in mountain regions above 670 MSL. In winter months, when water in the upper reaches of the streams nearly touches 0°C, snow trout migrates downstream for a considerable distance in the Shiwalik Himalayan streams. It is a preferable fish species in Himalayan region for consumers and has rich nutritive value. However, it is not under aquaculture practice due to slow growth and non-availability of seed. The wild population of this fish is fragmented due to HEPs and anthropogenic activities. Breeding, seed production and conservation is priority for this commercially important indigenous food fish. The breeding protocol has been developed for three species of this fish i. e. *S. richardsonii, S. progastus* and *S. plagiostomus.* During the breeding season, maturity was achieved in 88% brooders keeping at optimal thermal regime i. e. 16-18 °C for 15-18 days having less diurnal fluctuation in water temperature (> 1.5°C). 1.0 % dietary supplementation of the blend of herbs is beneficial for gonadal maturity of females and better spawning in captive coldwater conditions. Voluntary spawning was achieved successfully by inducing with a hormone, environmental manipulation and providing gravel bed covered with muslin cloth. Protocol has also been developed for inducing triploidy in this fish. Breeding is feasible for all three species round the year except the winter months (Dec. to Feb.). Findings would be helpful for the seed production and aquaculture of this fish.

Fig. Brood stock of S. richardsonii

Fig. Voluntary spawning

Fig. Collection of wild fish

Fig. Stripping of female

4. Technology Development

4.1 Technology commercialization: ICAR-DCFR inked MoA with M/s Das and Kumars Pvt. Ltd. for Technology Transfer on "Captive maturation and multiple breeding of golden mahseer"

On 23rd April, 2022, the Tripartite Memorandum of Agreement (MoA) was signed by ICAR-Directorate of coldwater Fisheries Research, Bhimtal, Uttarakhand, with the M/s Das and Kumars Pvt. Ltd, Varanasi and the ICAR-Agrinnovate, New Delhi for the technology transfer of 'Captive Maturation and Multiple Breeding of Golden Mahseer' on the occasion of National Campaign on 'Ann Daata Devo Bhava' program. The MoA was handed over to the licensee, Mr. Harsh Aggarwal by the Chief Guest and Magsaysay Awardees' Dr Rajendra Singh, the 'Waterman of India'. The agreement will be valid for a period of seven years.

Dr Pramod Kumar Pandey, Director, ICAR-Directorate of Coldwater Fisheries Research, Bhimtal stated that this technology encompasses an efficient indoor system and method for year-round seed production of endangered golden mahseer, which will facilitate its conservation and will offer livelihood opportunities through sports fishery, ecotourism and conservation aquaculture.

The technology was developed by Dr M.S. Akhtar and his team- Dr Ciji Alexander, Dr, Rajesh M and Dr Debajit Sarma. The technology has the prospects of reversing the population status of golden mahseer from 'Endangered' to 'Abundance' in the near future.

The MoA is aimed to facilitate close cooperation among three parties and create a small business platform for mahseer conservation and fish based-ecotourism.

Fig. Exchanging MoA for transfer of the technology

5. List of Research Projects

5.1 Institutional Projects

Project Code	Project Title	Investigators	Year of Start	Year of Completion
A. Resource assessment and management				
CF-6	Ecosystem assessment and mapping of aquatic resources in Indian Himalayan regions			
	Sub-project 5: GIS based digital data base on coldwater fishery resources of Arunachal Pradesh in North East Himalaya region	**P.A. Ganie** K. Kunal	2018	2023
	Sub project 6: Ichthyofaunal diversity and health assessment of Central Himalayan River Saryu, Uttarakhand	**K. Kunal** P.A. Ganie Ms. Garima	2020	2023
	Sub project 7: Assessment of health status and influence of hydrobiological variations on fish assemblages pattern in River Ladhiya Central Himalayas, Uttarakhand	**P.A. Ganie** K. Kunal Ms. Garima	2020	2023
CF-7	Angling, ecotourism and conservation			
	Sub project 1: Angling status of mahseer in Kumaun region for Eco-tourism and conservation	**R. S. Patiyal** N.N. Pandey	2020	2023
CF-8	Sub project 1: Network programme on Mahseer species and stock validation of mahseer species of genus *Tor* and *Neolissochielus* from central and eastern Himalayan region of India	**D. Sarma (Coordinator)** **N. Shahi** R.S. Haldar	2020	2023
	Sub project 2: Assessment of IUCN threat status and distribution of freshwater fishes of the eastern and western Himalaya	**S. K. Mallik (PI)** Pramod Kumar Pandey, Co-Project Investigator **Rameshori Yumnam (PI)** Assistant Professor Manipur University.	2022	2024
B. Aquaculture oriented research and development				
AQ-16	Captive management of golden mahseer in perspective to aquaculture and conservation			
	Sub-project 6: Unravelling thermal and size-dependent fertility traits of male golden mahseer brooders in captive conditions	**M.S. Akhtar** Ciji A. S. Ali P. Sharma Siva C.	2022	2025

AQ-19	Domestication, biology and breeding of selected species for species diversification in mid-hill aquaculture			
	Sub-project 6: Upscaling of the seed production protocol of chocolate mahseer, *Neolissochilus hexagonolepis* for technology dissemination	**P. Dash** Ciji A. R.S. Tandel Siva C.	2022	2025
NPOFBC	Network project on Ornamental fish breeding and culture (NPOFBC): ICAR- DCFR component: -Development of breeding protocol and larval rearing technique of the selected indigenous hill stream ornamental loaches, suckers and hill trouts	**P. Dash** D. Sarma A.K. Giri	2018	2023
C. Culture system diversification				
AQ- 22	Sub project 1: Engineering validation of an affordable mini RAS for small scale coldwater fish production	**Rajesh, M.** R.S. Patiyal B.S. Kamalam	2020	2023
	Sub project 2: Development of a sustainable aquaponics model for pilot scale fish vegetable production in mid-hill Kumaon Himalaya	**A.K. Giri** N.N. Pandey S.K. Mallik P. Dash	2020	2023
D. Fish Nutrition and feed development				
AQ-21	Sub project 2: Nutritional intervention for improving reproductive competence and larval quality traits of golden mahseer, *Tor putitora*in captivity	**Ciji, A.** M.S. Akhtar B.S. Kamalam Rajesh M.	2020	2023
	Sub project 3: Formulation, development and validation of efficient brood stock feed for rainbow trout	**P. Sharma** B.S. Kamalam Rajesh M. Ciji, A.	2020	2023
	Sub project 4: Development of a nutrient sensitive and effective package of feeds and feeding strategies for augmenting rainbow trout production	**B.S. Kamalam** Rajesh, M. P. Sharma Ciji, A. N.N. Pandey	2021	2024
E. Molecular genetics and biotechnology				
AQ18	Sub project 6: Fish without water: *In vitro* meat	**Amit Pande** K.V. Chanu	2021	2024
	Sub project 7: Development of complete mitochondrial genome and phylogeny of selected coldwater fish species	**Shahnawaz Ali** Siva C. N.N. Pandey	2021	2024
	Sub project 8: Polymer based approach for *in vitro* transfection in fish cells	**D. Thakuria** Amit Pande K.V. Chanu	2021	2024
	Sub project 9:Evaluation of the effect of different temperatures on the sex differentiation and sex ratio in golden mahseer (*Tor putitora*)	**Shahnawaz Ali** Siva C. Prakash Sharma M.S. Akhtar	2022	2025
	Sub project 10:Design and production of GnRH analog as an inducing agent for spawning in fish	**K. V. Chanu** N.N. Pandey D. Thakuria P. Dash A.K. Giri	2022	2024

F. Disease surveillance and health management				
AQ-20	Development of diagnostic & therapeutic measures for rainbow trout pathogens			
	Sub-project 4: Integration of *in-silico* drug designing methods for development of potential antimicrobial agents against fish pathogens	**R.A.H. Bhat** R.S. Tandel K. Kunal P.A. Ganie	2020	2023
	Sub-project 5: Investigation on health disorder associated with trout loss during seed production in hatcheries and suitable remedial measures for their mitigation	**S. Chandra** S.K. Mallik	2020	2023
	Sub-project 6: Immunomodulatory potential of nano composition and effect of immunization towards *Saprolegnia* infections in rainbow trout	**R.S. Tandel** P.Dash Siva, C. R.A.H. Bhat K. Kunal	2021	2024
AMR	Network programme on antimicrobial resistance (AMR) in fishes under INFAAR	**S.K. Mallik** N. Shahi	2021	2024
5.2 Externally funded projects				
NSPAAD	National surveillance programme for aquatic animal disease-Surveillance of coldwater fish diseases in Himachal Pradesh and Uttarakhand (NFDB funded multi-institutional project)	**Amit Pande** R.S. Tandel	2022	2024
AINP-Fish Health	All India Network Project on Fish Health-AINP-FH	**S.K. Mallik** N. Shahi R.S. Tandel	2021	2026
NICRA	Development of climate resilient rainbow trout and innovative trout farming strategies to mitigate climatic stressors	**D. Sarma** B.S. Kamalam Rajesh, M. P. Sharma R.S. Patiyal P. A. Ganie	2021	2026
DBT-9	Bio-engineered synthetic antimicrobial peptides as alternative to antibiotics for use in aquaculture	**D. Thakuria** A. Pande K.V. Chanu	2019	2022
DBT-10	Translating the native fish germplasm for socio-economic benefits through aquaculture and fisheries in Himalayan region	**N.N. Pandey** R.S. Patiyal S. Ali	2022	2025
5.3 Consultancy project				
UJVN	Study on habitat ecology and biodiversity of mahseer and other indigenous species for developing conservation strategies in the Vyasi Hydroelectric project on river Yamuna, Uttarakhand	**D. Sarma** R.S. Patiyal M.S. Akhtar	2020	2023
Dept. of Fisheries, Arunachal Pradesh	Hatchery management and seed production of golden mahseer as a part of the fisheries management plan for Subansiri Lower HE project, Gerukamukh, Distt. Dhemaji (Assam)	**Pramod Kumar Pandey** M.S. Akhtar D. Darma N.N. Pandey	2022	2025

6. Institute Technology Management Unit (ITMU)

The Institute Technology Management Unit (ITMU) is actively involved in the management, protection, transfer, and commercialization of the Directorate's intellectual assets and technologies. The various activities of ITMU are carried out under the ICAR National Agriculture Innovation Fund scheme, as per the guidelines of the ICAR Intellectual Property and Technology Management (IP & TM) unit. The Institute Technology Management Committee makes decisions on inventions and technologies, which are then approved by the competent authority. The ITMU specifically performed the following activities during the reporting period

- It assisted scientists in preparing documents related to the transfer or commercialization of prospective DCFR technologies, through ICAR Agrinnovate.
- It assisted scientists in patent prior art searches and drafting of IPR registration applications.
- It documented and processed all intellectual property protection applications through the Institute Technology Management Committee.
- Submitted monthly progress reports to ICAR Zonal Technology and Management Centre.

6.1 Patent applications filed

- Application No. 202211067562, titled "An artificially designed antimicrobial peptide" is a joint application from the Indian Council of Agricultural Research (ICAR) – Directorate of Coldwater Fisheries Research, Bhimtal and Department of Biotechnology (DBT), Ministry of Science and Technology, New Delhi. It was developed by Dr Dimpal Thakuria, Dr Khangembam Victoria Chanu, Dr Raja Aadil Hussain Bhat, Dr Amit Pande and Dr Pramod Kumar Pandey and filed on 24.11.2022. The filed patent was published on 10.02.2023. It currently waits for First examination report (FER).
- Application No. 202011057122, entitled "Composition, protocol and diagnostic kit for identification of bacterial pathogen *Lactococcus garvieae*"; developed by Dr Neetu Shahi, Mr. S.K. Mallik, Mr. Krishna Kala and Dr Debajit Sarma. The filed patent was published on 01.07.2022. The first examination report (FER) was issued on 22.11.2022.
- Application No. 202111004283, entitled "System for year-round repeated breeding and higher robust fry production of Golden Mahseer"; developed by Dr M.S. Akhtar, Dr Rajesh, M., Dr Ciji Alexander and Dr Debajit Sarma. The filed patent was published on 12.02.2021. The first examination report (FER) was issued on 24.11.2022.

6.2 Trademark registered™

- Application No. 4820881, "ICAR-Directorate of Coldwater Fisheries Research (DCFR)" logo under Class 44. Certificate No: 2772668 (valid till 18 June 2031)
- Application No. 4868952, "DCFR *Lg* (*Lactococcus garvieae*) kit" logo under Class 5. Certificate No: 2792774 (valid till 17th July 2031)
- Application No. 4868953, "DCFR Aqua FSD fish anaesthetic" logo under Class 5. Certificate No: 2795130 (valid till 19 July 2031)

6.3 Copyright registered

- The book "Biology of indigenous freshwater ornamental fishes of India" in the Class: Literary/Dramatic, authored by Dr Sagar Chandra Mandal and Dr Pramod Kumar Pandey, was filed on 24.06.2022. The Copyright was registered on 22.12.2022 with the registration No: L-119928/2022

6.4 Technologies commercialized through Agrinnovate India Limited

- ICAR-DCFR Captive maturation and multiple breeding of Golden Mahseer technology, was developed by Dr M.S. Akhtar, Dr Rajesh, M., Dr Ciji Alexander and Dr Debajit Sarma. The Terms of Trade (TOT) was signed on 10.03.2022 and was commercialized Das & Kumars, Varanasi on 23.04.2022 for a Non- exclusive license of Rs 5 lakhs for seven years.

6.5 Technologies to be advertised through Agrinnovate India Limited

- Recirculating Aquaculture technology for intensive farming of Rainbow trout, developed by Dr Rajesh and team (Dr Biju Sam Kamalam, Dr Debajit Sarma, Dr R. S. Patiyal and Dr Pramod Kumar Pandey).
- High performance Rainbow trout grower feed developed by Dr Biju Sam Kamalam and team (Dr Rajesh, Dr Prakash Sharma, Dr Nityanand Pandey, Dr Debajit Sarma, Dr Kishore Kunal, Dr Ciji, A., Dr M.S. Akhtar, Dr R.S. Patiyal and Dr Pramod Kumar Pandey).
- High performance Rainbow trout starter feed developed by Dr Biju Sam Kamalam and team (Dr Rajesh, Dr Prakash Sharma, Dr Debajit Sarma, Mr. Parvaiz Ahmad Ganie, Mr. Abhay Kumar Giri, Dr M.S. Akhtar, Dr Ciji, A., Dr Nityanand Pandey, Dr R.S. Patiyal and Dr Pramod Kumar Pandey).

6.6 Technologies already advertised through Agrinnovate India Limited

- DCFR Aqua FSD, a novel anaesthetic formulation for fishes, developed by Dr Neetu Shahi, Mr. S.K. Mallik, Mr. Abhay Kumar Giri and Dr Debajit Sarma.
- DCFR *Lg*Kit, a diagnostic kit for the detection of *Lactococcus garvieae*, developed by Dr Neetu Shahi, Mr. S.K. Mallik, Mr. Krishna Kala and Dr Debajit Sarma.

6.7 Memorandum of Understanding (MoU) signed

- The Tripartite Memorandum of Agreement (MoA) was signed by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, Uttarakhand, with the M/s Das and Kumars Pvt. Ltd, Varanasi and the ICAR-Agrinnovate, New Delhi for the technology transfer of 'Captive Maturation and Multiple Breeding of Golden Mahseer' on 23rd April 2022. The MoA was handed over to the licensee, Mr. Harsh Aggarwal by the Chief Guest and Magsaysay Awardee Dr Rajendra Singh, the Waterman of India. The agreement is Non-exclusive for a license fee of Rs 5 lakhs and will be valid for a period of seven years.
- MoU with Growel Feeds Private Limited, Andhra Pradesh for collaborative research programme on the "Development and validation of complete range of rainbow trout feeds" was signed on July 2020 and is on-going. It includes a commitment of 15 tonnes of R&D feeds. This three-year research collaboration is supervised by Dr Biju Sam Kamalam (Principal Investigator), Dr Rajesh, M., Dr Prakash Sharma, Dr Ciji Alexander, Dr M.S. Akhtar, Dr N.N. Pandey and Dr Debajit Sarma.
- MoU with Uttarakhand Jal Vidyut Nigam Limited, Dehradun for consultancy project "Study on habitat ecology and biodiversity of mahseer and other indigenous fish species for developing conservation strategies in Vyasi hydro-electric project site on River Yamuna, Uttarakhand" was signed on July 2020 and is on-going. The total cost of the three-year project is Rs. 61.9 lakh. The share of ICAR is 30 per cent, which has an intellectual fee of Rs 6 lakhs. This project is supervised by Dr Debajit Sarma (Principal Investigator), Dr R.S. Patiyal and Dr M.S. Akhtar.
- MoU with Department of Animal, Sheep Husbandry (ASH) and Fisheries, Ladakh on the "Sustainable development of fisheries and aquaculture in Ladakh" for technical consultancy and R&D was signed in 2022 and is on-going.

6.8 Meetings organized

- The Institute Technology Management Committee meeting was held on 28thFebruary 2022 at ICAR-DCFR, Bhimtal. It was presided by Dr Pramod Kumar Pandey, Director, ICAR-DCFR; attended by Dr R.S. Patiyal, member secretary, ITMC; and other ITMC member scientists. Several

agenda items related to the approval of Terms of trade (TOT) for licensing of "Captive maturation and multiple breeding of Golden Mahseer technology", evaluation and approval for Patent protection of "An artificially designed anti-microbial peptide", evaluation and approval for patent protection of "Rapid visual identification of *Saprolegnia parasitica* DNA using peptide nucleic acid probe", evaluation and approval for Copyright protection of the book titled "Biology of indigenous freshwater ornamental fishes of India" authored by Dr Sagar Chandra Mandal and Dr Pramod Kumar Pandey were discussed and recommended for further action.

Institute Technology Management Committee meeting on 28th February 2022

- The second Institute Technology Management Committee meeting was held on 20th September 2022 at ICAR-DCFR, Bhimtal. It was presided by Dr Pramod Kumar Pandey, Director, ICAR-DCFR; attended by Dr Veena Pande, Head, Department of Biotechnology, Kumaon University; Dr R.S. Patiyal, member secretary, ITMC; and other ITMC member scientists. Several agenda items related to evaluation and approval of proposal for initiating technology commercialization of "Recirculating Aquaculture technology for intensive farming of Rainbow trout", "High performance Rainbow trout grower feed", "High performance Rainbow trout starter feed" were discussed and recommended for further action.

Institute Technology Management Committee meeting on 20 September 2022

- A Techno-Commercial Assessment and Expert Committee Meeting for ICAR DCFR technologies was held on 6th December 2022 at ICAR-DCFR, Bhimtal to assess the technical and commercial feasibility, handholding requirement, preferred modes of commercialization and licensing terms of three technologies. The meeting was chaired by the Director, Dr Pramod Kumar Pandey. The meeting was attended by Dr Praveen Malik, CEO, Agrinnovate; ITMU team, inventor scientists, external experts (joined online) and representatives from both organizations. The technology details and licensing terms for the commercialization of "Recirculating Aquaculture technology for intensive farming of Rainbow trout" developed by Dr Rajesh and team, "High performance Rainbow trout grower feed, Rainbow trout starter feed" developed by Dr Biju Sam Kamalam and team were specifically discussed.

Techno-Commercial Assessment and Expert Committee Meeting on 6December 2022

6.9 Webinar / Training attended

- The ITMU team, Dr R.S. Patiyal, Dr Biju Sam Kamalam and Dr Ann Pauline attended IPR Awareness Webinar Series organized by National Intellectual Property Awareness Mission (NIPAM) from 01-05 August 2022 and IPR Awareness Program (On-line) organized by National Intellectual Property Awareness Mission (NIPAM) and ICAR-NIVEDI, Bengaluru on 12th July 2022.

7. Extension Activities, Consultancy and Services

7.1 Extension Activities

7.1.1 Programmes organized under *Mera Gaon Mera Gaurav* (MGMG)

Name of Nodal Officer	Designation of Nodal Officer	Contact details (Phone No., email Id etc.)
Dr Suresh Chandra	Principal Scientist (Fish Pathology)	7579054501; suresh.chandra@icar.gov.in

(i) Directorate's summary under MGMG

No. of Teams formed	No. of Scientists	No. of Villages adopted	No. of Blocks covered	No. of Districts covered	Bench Mark Survey conducted (No. of villages)
06	24	23	08	05	

(ii) Summary of activities organized under MGMG by ICAR-DCFR

S.No.	Name of activity	No.	No. of farmers participated/ benefitted
1.	Visit to village by teams	70	435
2.	Interface meeting/ *Goshties*	15	1550
3.	Trainings conducted	8	270
4.	Mobile based advisories	15	550
5.	Literature support provided	9	700
6.	Awareness created	24	1800
7.	Linkages developed with other agencies	08	250

(iii) Summary of other activities organized under MGMG by ICAR-DCFR

S. No.	Name of activity	Quantity (q)/No.	Area (ha)	No. of farmers benefitted
1.	No. of demonstrations laid out	25	1.8	169
2.	Input support provided like seed, planting material, fertilizers, etc.			
	i. Seeds (q)	Rainbow eyed ova- 5 lakh	2.7	25
	ii. Planting material (No.)	Ornamental seed -500 Carp seed - 15,000.	1.5 1.5	38 80
	iii. Fertilizers (q)	-		
	iv. Any other (pl specify)			
	Pelleted trout and carp feed	2400kg	3.0	40
	Water analysis kits	12 types of kits	3.0	35
	Medicines	460packets		460

(iv) Details of MGMG Team and status of benchmark survey of selected villages

Team	Name of team coordinator	Name of scientists with discipline	Name villages adopted	No. of villages
Team 1	Dr D.Sarma Principal Scientist	1. Dr S. Ali, Sr. Scientist 2. Dr Ritesh S. Tandel, Scientist 3. Mr Parviz A.Ganie, Scientist 4. Mr R.K. Araya, Tech. Officer	Khairola Pandey Gaon, Malla Ramgarh (Nainital), Nail (Almora)	3
Team 2	Dr Amit Pande Principal Scientist	1. Dr Biju Sam Kamalam, Sci. 2. Dr Pragyan Dash, Scientist 3. Dr Siva C., Scientist 4. Dr R.S. Haldar,CTO	Padampuri, Chaphi, Talla Dhungil, Chonauti (Nainital)	4
Team 3	Dr N.N.Pandey Principal Scientist	1. Dr Renu Jethi, Sr. Scientist 2. Dr D.Takhuria, Scientist 3. Dr Rajesh M., Scientist 4. Dr Raja A.H. Bhat, Scientist (Till) 5. Mr Santosh Kumar, Sr. Tech. Officer	Jyurkafun (Almora), Vinayak, Maldhan Chaur, Amritpur (Nainital)	4
Team 4	Dr Suresh Chandra Principal Scientist	1. Dr Neetu Shahi, Sr. Scientist (Till) 2. Dr Ciji Alexender, Scientist 3. Mr Abhay K. Giri, Scientist 4. Mr T.M. Sharma, Tech. Officer	Harinagar, Berijala, Saladi, Boharakun, Chack Baheri (Nainital)	5
Team 5	Dr R. S. Patiyal Principal Scientist	1. Dr M.S. Akhtar, Sr. Scientist 2. Sh. S.K. Mallik, Scientist(SG) 3. Dr Victoria Chanu, Scientist 4. Dr Prakash Sharma, Scientist 5. Dr Partha Das, Tec. Asst.	Sangudi Nainital), Pangu, (Pithoragarh) Amrukhurad(Khatima, U.S.Nagar)	3
Team 6	Mr Kishore Kunal Scientist	1. Mrs Garima, Scientist (FRM) 2. Mr Hansa Datt, Tech. Officer	Mudyani, Banlakh, Dudhpokhara, Saktipur bunga (Champawat)	4

(v) List of villages adopted under MGMG by ICAR-DCFR

State	Name of district	Name of block	Name of villages	No. of villages
Uttarakhand	Nainital	Ramgarh Block	Malla Ramgarh	1
	Nainital	Bhimtal Block	Khairola, Pandey gaon, Chaphi, Talla Dhungil, Chonauti, Sangudi, Vinayak, Amritpur, Harinagar, Berijala, Saladi, Boharakun, Chack Baheri	13
Uttarakhand	Nainital	Dhari Block	Padampuri	1
Uttarakhand	Nainital	Ramnagar	Maldhan Chaur	1
Uttarakhand	U. S. Nagar	Khatima	Amrukhurad	1
Uttarakhand	Pithoragarh	Dharchula	Pangu	1
Uttarakhand	Champawat	Champawat	(Mudyani, Banlakh, Dudhpokhara, Saktipur bunga	4
Uttarakhand	Almora	Bhikasaiyan	Nail	1

(vi) Details of demonstration conducted under MGMG in hills by ICAR-DCFR

S. No.	Title of demonstrations	No. of demonstration	Area covered under demonstration (ha)/ number of units, etc.)	No. of farmers benefitted
1.	Rainbow trout breeding and culture	10	0.10 ha (20 raceways)	18
2.	Integrated fish farming	6	1.5 ha (38 fish tanks)	56
3.	Rearing, breeding and marketing of ornamental fishes	5	0.15 ha (27 fish tanks)	30
4.	Trout production in RAS	2	2 fish tanks	35
5.	Increasing income through value addition of rainbow trout products	2	0.05ha (5nos)	30

(vii) Details of Input support provided under MGMG by ICAR-DCFR

Sl. No.	Type of Input Support Provided (Seed, planting material, technology, fertilizers, etc.)	Quantity (Kg/No.)	Area (ha)	No. of farmers benefitted
1.	Rainbow eyed ova	5.0 lakh	1.0	15
2.	Ornamental seed ii. Planting material	100 nos.	0.5	30
3.	Carp seed fingerling size (under SCSP)	15,000 nos.	0.8	60
4.	Pelleted trout and carp feed(Under SCSP)	2800kg	0.5	25
5.	Water analysis kits	08 types of kits	0.8	40
6.	Medicines (disinfectants)	500 packets	2.0	450

(viii) Details of trainings conducted under MGMG by ICAR-DCFR

Sl. No.	Topic of training	Duration of training (No. of days)	No. of farmers participated in training
1.	RAS for rainbow trout farming	3 days	40
2.	Rainbow trout farming in raceways	01	50
3.	Production trials with common carp and Grass carp species in mid hill tanks.	01	15
4.	Feed management in carp farming	01	20
5.	Improved management by stocking fish fingerlings for enhancing fishers income	01	40
6.	Natural fish farming techniques	01	60
7.	Water and Soil management in fisheries	01	18
8.	Disease prevention in trout and carp farms	01	25
9.	Breeding techniques of ornamental fishes	01	12
10.	Culture and breeding of common carp	01	46
11.	Hands on training on value addition of fishery products	01	50
12.	Carp culture with rainbow trout, a new initiatives for better utilization of running water facilities	02	08

(ix) Details of literature support provided under MGMG by ICAR-DCFR

Sl. No.	Title of literature (Scientific cultivation of broccoli/Improved varieties of wheat, etc.)	Type of literature (Folder/pamphlet/leaflet/ package of practice, etc.)	No. of famers benefitted
1.	Rainbow trout ke fry aum anguliyao ki safed daag ki bimari (In Hindi). DCFR Pamphlet No -34	leaflet	110
2.	Rainbow trout ki aakh aur muh kei Beemari, Hand out in Hindi	leaflet	50
3.	Improved Breeding and Seed Production Techniques of Important Coldwater fish species in Hindi (Parvatiye chhetron kei pramukh palan yaog matsya prajatiyon kei prajanan avam beej utpadan takneekiyia Bulletin No -28)	leaflet	150
4.	Argulosis in coldwater fish, DCFR Pamphlet No- 31	leaflet	200
5.	White spot disease in coldwater fish, DCFR Pamphlet No 32.	leaflet	300
6.	Good Management Practices (GMP) for trout and carp farming in mid hills, DCFR Pamphlet No 33.	leaflet	280

(x) Details of linkages created under MGMG by ICAR-DCFR

Sl. No.	Name of department/ organization/agency etc.	Type of linkage/purpose of creating linkage (for training/ for selection of villages/ for credit, etc.)
1.	Uttarakhand Sate Fisheries Department	For providing technical guidance on fish farming and for identifying the suitable need-based beneficiary.
2.	NCDC, Dehradun	For providing technical knowhow on trout farming, pricing, marketing and branding
3.	State Agriculture Department	Imparting trainings and technical guidance.
4.	HESCO(NGO)	Providing technical assistance in hill fish farming
5.	Bhimtal Nagar Panchyat	Providing technical assistance in ranching of mahseer in local lakes.
6.	SC Fish farmers Cooperative, Harinagar	For conducting collaborative dissemination activities for the benefit of SC fish farmers of the area.
7.	ICAR-VIPAKAS, Almora	For conducting trainings on integrated fish farming activities.
8.	ICAR-NBPGR,Bhowali	For conducting collaborative disseminating activities to fish farmers
9.	KVK, Jyolikot, Nainital	Conducting collaborative trainings and demonstrations

(xi) Details of awareness created under MGMG by ICAR-DCFR

Sl. No.	Subject matter of awareness (*Swachhata*/ Crop insurance/ climate change, etc.)	No. of farmers benefitted
1.	Sanitation and SWM. Cleanliness and sanitation drive in the villages adopted under the Mera Gaon Mera Gaurav	310
2.	Sanitation drive in MGMG adopted village	170
4.	Natural fish farming techniques	100
5.	Climate resilient agriculture	147
6.	RAS in aquaculture	45
7.	Improved management practices for doubling of fish farmers income	110
8.	Mass awareness on fish health management	350
9.	Breeding and seed production of trout and carps	250

(xii) Details of problem diagnosed under MGMG by ICAR-DCFR

Sl. No.	Name of village	General problem	Agricultural problem
1.	Malla Ramgarh	Input supply	Non availability of tout feed and feed shortages
2.	Harinagar,	Stock growth	Impaired growth of few species
3.	Malla Ramgarh	Site suitability	Frequent fish tanks and raceways loss by flooding
3.	Malla Ramgarh	Value addition	Table size trout sale is a problem
4.	Berijala	Lower production	Slow growth of carps species
5.	Saladi	Critical input shortage	Impaired water during summer months when actual growth of carps takes place
6.	Alchauna	Water sacristy	Drying of water source in summer months

(xiii) Details of any other activity organised under MGMG by ICAR-DCFR

Sl. No.	Name of activity	No. of farmers benefitted
1.	Kisan Mela	200
2.	Anna data Devo Bhava	150
3.	Natural Fish Farming	186

7.1.2 ICAR-DCFR Organized National Campaign on Annadata Devo Bhava

The ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised a National Campaign on Annadata Devo Bhava in April 23-24, 2022 to commemorate 75 years of India's independence being observed as Azadi Ka Amrut Mahotsav. Dr P. K. Pandey, Director, ICAR-DCFR, Bhimtal, Dr Rajendra Singh, an Indian water conservationist and environmentalist known as the "Waterman of India," underlined the importance of natural farming and indigenous technical knowledge for sustainable development. He expressed concern over groundwater depletion and remarked that water is the elixir of life and necessary efforts should be made to conserve rivers and natural water bodies. Prof. Rajive Mohan Pant, Vice-Chancellor, Assam University, Silchar, urged the farmers to take up the integrated fish farming and value addition technology to double their income. He emphasised on developing the market linkages and distribution channels of cultured and ornamental fish in Uttarakhand. Dr Anil Prakash Joshi, Padma Bhushan Awardee urged the farmers to utilize local resources that may bring sustained economic development in rural India. He further stated that development of local resources and local markets is vital for the socio-economic upliftment of rural people. Dr Gopal Krishna, former Director ICAR-CIFE, Mumbai, highlighted the technological advancements made in the field of coldwater aquaculture. Dr Suresh Chandra, Pr. Scientist, ICAR-DCFR, Bhimtal & Nodal Officer MGMG, delivered a lecture on fish farming in Indian Himalayan Region. The occasion held a stall exhibition displaying the various activities and showcasing the technologies of the DCFR, KVKs, and ICAR institutes. Critical farm inputs such as fish feed and fingerlings of various species were distributed at the event to fish farmers of MGMG adopted villages. 150 fish farmers participated in the event.

Fig. Participants in the program

7.1.3 Ornamental fishes and quality fish seed distribution program organized under Mera Gaon Mera Gaurav in Nai Bhumka of Okhalkanda block

ICAR-DCFR, Bhimtal organized a one-day seminar under Mera Gaon Mera Gaurav at remote village Bhumka of Okhalkanda. This event was organized with the aim of improving the economy of the villagers through advanced fish farming in Bhumka village, which is rich in abundant aquatic resources. On this occasion, in the changing environment, the farmers were made aware on how their livelihood can be run by judicious use of local resources at the village level through small agricultural activities. DCFR is making various efforts to establish fisheries in remote areas of hilly areas. These include providing essential items to the beneficiaries from time to time under the ongoing schemes of the institute, providing advanced carp seed for stocking in the ponds, providing ornamental fishes, and balanced pelleted fish diet to further increase the income. It is introducing activities like value addition of fish, regular inspection of ponds and processing of produced fish.

As a group of 22 fish farmers in Bhumka village, are getting the benefit of various facilities. They were urged to increase income using various schemes being run by the government. In rural areas, fish farming can be adopted as employment by combining it with other businesslike farming, poultry farming, horticulture, mushroom and flower cultivation and using local resources. 55 people from Nai Bhumka participated in this programme. On this occasion, ornamental and grass carp seed, hand nets, nets, breeding hapa, fish feed and medicines for disease treatment were distributed free of cost to fish farmers.

Fig. Distribution of inputs to farmers in the village Bhumka of Okhalkanda

7.1.4 Field day under MGMG at village Chafni (Alchauna), Uttarakhand

A field Day at village Chanfi (Alchauna) was organized on 16th September 2022. Demonstration on fish farm management was conducted. Fish farmers of the area participated in the demonstration cum sanghosti. The area is famous for growing vegetables and use of cauliflowers and other vegetables leaves for manuring and feeding of grass carp in fish pond was also demonstrated to farmers.

Fig. Farmers meet at Village Chanfi, Uttarakhand

7.1.5 A Field Day at Champawat under MGMG was organized and inputs were distributed to participating fish farmers

A field day was organized at Champawat and inputs were distributed to farmers.

Fig. Input distribution to villagers adopted under MGMG at Champawat

A fish farmer of Ghatigarh adopted under MGMG has developed an integrated Natural fish farm using discharged water from the Bhimtal Lake for fish farming. He was technical support and inputs by ICAR-DCFR.

7.1.6 Demonstration of ICAR-DCFR trout grower feed and workshop at Anantnag, Kashmir

To demonstrate the performance efficiency of ICAR-DCFR grower feed and related production economics, we conducted a nine-month on-farm trial in the farm of Dr Md. Iqbal Mir at Ammadzoo village, Anantnag, Jammu and Kashmir from October 2021 to July 2022. At the end of the trial, substantial benefits of using ICAR-DCFR grower feed were observed in terms of higher growth rate and biomass gain (+40%), feed efficiency (+31%), economic valuation (+48% net profit) and water footprint. To highlight and share the very significant and promising findings with the farmers and other important stakeholders, a front-line demonstration programme cum rainbow trout nutrition and feed workshop was organised at the farm site in Anantnag, on 6thAugust 2022.Dr J.K. Jena, Deputy Director General, ICAR Fisheries Division; Prof. N.A. Ganai, Vice-Chancellor, SKUAST; Dr P.K. Pandey, Director, ICAR-DCFR; Shri I.A. Shah, Director, Department of Fisheries, Jammu &Kashmir; and Shri Syed Naseer Ahmad, Sub Divisional Magistrate, Anantnag graced the occasion and witnessed the results in the demonstration raceways. The programme was attended by 120 participants including farmers, Jammu and Kashmir fisheries officials, professors from SKUAST, industry representatives and interested public. During this event, the research and development initiatives of ICAR-DCFR and the beneficial impact of using this nutritionally

balanced and high-performance trout feed was explained to the gathering by the chief guest Dr J.K. Jena (DDG, Fisheries), Dr P.K. Pandey (Director, ICAR-DCFR) and Dr B.S. Kamalam (Principal Investigator, ICAR-DCFR). Prof. Ganai appreciated the efforts of ICAR-DCFR in conducting this field demonstration at Anantnag, and made the farmers aware about the complex interactions of feed performance with environmental conditions and fish health. As part of the workshop, Dr J.K. Jena and ICAR scientists interacted with the farmers and answered their questions about the cost of feed and flesh quality considerations. This activity was coordinated by Dr B.S. Kamalam, Dr Rajesh, M. and Mr. P.A. Ganie.

Fig. Front-line demonstration of ICAR-DCFR grower feed at Anantnag, Kashmir

7.1.7 Extension Activities at Experimental Field Centre, Champawat

Fish seed distribution

Fig. Fish seed distribution to farmers

The farm's distribution of fish seeds is a significant outreach endeavour. The Directorate's various farmer-focused awareness and training programmes included the distribution of fish seed as part of this operation. During the reporting period, about 3325 of rainbow trout fingerlings and 500 common carp fingerlings were distributed to the fish farmers from EFF Champawat.

Fish sale

Farm-raised rainbow trout (table size weight: 1285.62 kg) were sold for generation of revenue of Rs. 7,71,375.00 (Rupees Seven lakh Seventy-one thousand three hundred seventy-five only). About 112500 advanced fingerlings of rainbow trout were sold and a revenue of Rs 554800/- (Rupees Five lakh fifty four thousand eight hundred only) was generated. Farm raised koi carp and Gold fish were also sold and generated revenue around Rs- 9500/582 (Rs Nine thousand five hundred only) and 1,50,000/3000 n (Rs One lakh fifty thousand only) respectively. Farm raised common carp were also sold generating revenue around Rs768 (quantity 4.12 kg).

Fig. Selling of farm raised rainbow trout at EFF, Champawat

Fish feed Distribution

Trout feed and common carp feed were distributed to different fish farmers present in Champawat. Under SCSP fish feed distribution programme on 06.02.2022, 280 kg common carp feed was distributed to fish farmers.

Fig. Fish feed distribution programme at EFF, Chapawat

Experimental Fish Farm-ICAR-DCFR participated in Kisan Mela and Farmers meeting

The Experimental Fish Farm of ICAR-DCFR put an exhibition stall to display all available products and fish farming technologies at one-day Kishan Mela and Farmers' meeting organized by Krishi Vigyan Kendra, Lohaghat on April 26, 2022. Experimental Fish Farm, Champawat gave information about contemporary techniques of aquaculture and value-added fish mince products. Farmers enthusiastically and inquisitively interacted and learned various aspects of coldwater fisheries. Mr. Kishor Kunal, scientist, Mr. Hansa Datt, Technical Officer and Mr. Bhola Dutt, SSS participated in this event.

7.2 Exploratory survey, field visit, farm advisories, awareness campaign & other extension activities

- A.K. Giri shipped rainbow trout eyed ova consignments to Leh (30,000 eyed ova) and Arunachal Pradesh (1lakh eyed ova) on 24.01.2022 for research and development purposes.
- A.K. Giri displayed the 'Coldwater Aquaponics Facility' and explained the research activities of the unit to Dr Suvarna C., Chief Executive along with other NFDB staffs; Sh. S.K. Shukla, Deputy Director (Fisheries), Uttarakhand; Dr R.S. Langer and Mr. S.N. Ogale during their visit to the directorate on 21.05.2022.
- A.K. Giri displayed the exhibition stall of the directorate to the participants during the celebration of National Fish Farmers' Day & National Campaign on Improved Fish Culture Techniques on 11.07.2022.
- A.K. Giri displayed the 'Coldwater Aquaponics Facility' and explained the research activities of the unit to Dr Ravishankar C.N., Director and Dr N.P. Sahu, Joint Director of ICAR-CIFE, Mumbai during their visit to the directorate on 18.05.2022.
- A.K. Giri, on the eve of 17th Parthenium Awareness Week during 16-22 August 2022, organized a field day on parthenium uprooting activity near the institute campus on 18.08.2022.
- A.K. Giri, on the eve of ICAR-DCFR Foundation Day, displayed the first time constructed novel Coldwater aquaponics unit and explained elaborately about the potentiality of the system to Prof. (Dr.) A.K. Misra, Former Chairman, ASRB; Dr Dilip Kumar, Former VC, CIFE and Dr Lakshmi Kant, Director, ICAR-VPKAS, Almora.
- A.K. Giri as a committee member, celebrated *Har Ghar Tiranga* campaign (pin the flag, selfie and upload at the site), organized cleanliness drive in-and-around the directorate campus and flag unfurling session during 13th, 14th and 15th August 2022 respectively.
- A.K. Giri displayed the indigenously developed novel coldwater aquaponic facility and elaborately explained the on-going research activities along with the potentiality of the self-sustained system to Dr R.S. Paroda, Former DG, ICAR during his visit to ICAR-DCFR, Bhimtal on 17.11.2022.
- A.K. Giri displayed the indigenously developed novel coldwater aquaponic facility to Mr. Dilip Ghosh, Vice-President, BJP, West Bengal along with his team of 7 members and explained the on-going research activities during their visit to ICAR-DCFR, Bhimtal on 03.10.2022.

- Ganie P.A., conducted three (03) fish germplasm exploratory survey/ field Visits at Sunnegoan, Sunnkot, Reetha sahib, Baelkheth, Chalthi and Chukka stations of river Ladhiya, Champawat during Jan, June and Oct 2022 for the exploration of its Ichthyodiversity.
- Ganie P.A., conducted an exploratory survey of district Champawat in different seasons, for assessing its suitability for aquaculture activities.
- Ganie P.A. as a Co-coordinator conducted a front-line demonstration cum workshop on, "Showcasing the evaluation performance of Rainbow trout grower feed" at village Amadzoo, Pahalgam, Anantnag Kashmir valley on 06.08.2022.
- Ganie, P.A. served as a member of stall exhibition committee in National Symposium on "Fisheries and Aquaculture for Livelihood and Nutritional Security" organised by ICAR-DCFR, Bhimtal in Collaboration with CFSI, Bhimtal on 18-19 Nov, 2022.
- Ganie P.A. served as a member of transportation and accommodation committee in national fish farmers day and national campaign on, "Azadi ka amrutmahotsav" organised by ICAR-DCFR, Bhimtal on 11.07.22.
- Ganie, P.A. as a committee member conducted an "Awareness programme on Recycling of wastewater" at ICAR-DCFR, Bhimtal campus on 21.12.2022.
- Ganie, P.A., served as a Micro Observer in the Vidhaan Sabha Elections, Uttarakhand, 2022.

Fig. Seminar on Natural farming and Kisan Mela at ICAR-DCFR, Bhimtal

- Kishor Kunal co-coordinated and organised "Fish Seed and Feed Distribution Programme" under Scheduled Caste Sub Plan (SCSP) at Experimental Fish Farm, Champawat on 06.02.2022. Seven farmers from Mudiyani, Bajarikot, Narsinghdanda participated in the training programme. Carp seeds and feed were also distributed to the farmers under the programme.
- Kishor Kunal and Ms. Garima conducted Farmer training and Farm Demonstration programme under Scheduled Caste Sub Plan (SCSP) for 30 farmers at Bajarikot Village of Champawat Dist. on 21.12.2022.
- Ganie P.A., carried out three (03) fish germplasm exploratory survey/ field Visits at Sunnegoan, Sunnkot, Reetha sahib, Baelkheth, Chalthi and Chukka stations of river Ladhiya, Champawat during Jan, June and Oct 2022 for the exploration of its Ichthyodiversity.
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- Ganie, P.A. as a committee member conducted an "Awareness programme on Recycling of wastewater" at ICAR-DCFR, Bhimtal campus on 21.12.2022.
- Ganie, P.A., served as a Micro Observer in the Vidhaan Sabha Elections, Uttarakhand, 2022.

- N.N. Pandey coordinated National Campaign on "Annadata Devo Bhava" at ICAR-DCFR, Bhimtal during 23-24th April, 2022 with participation of 178 fish farmers from different districts of Uttarakhand and 94 students, scientists and research scholars. Three special lectures were delivered during the event coupled with exhibition and Kisan Mela.

Fig. ICAR-DCFR Stall in Kisan mela during "Annadata Devo Bhava"programme at ICAR-DCFR, Bhimtal

- N.N. Pandey coordinated "World Environment Day" at DCFR-ICAR, Campus with participation of 95 staff members and plantation has been done in campus premises during 5th June, 2022.
- N.N. Pandey coordinated Har Ghar Tiranga Campaign on "Azadi ka Amrut Mahotsav" from 13-15th August, 2022.
- N.N. Pandey conducted 17th Parthenium Awareness Week from 17-18 August 2022 at ICAR-DCFR, Bhimtal.

Fig. Parthenium Awareness Week celebrated at ICAR-DCFR

- N.N. Pandey organised the programme of Agri-startup Conclave and PM-Kisan Samman Sammelan 2022 conducted by the Ministry of Agriculture & Farmers Welfare.
- N.N. Pandey Organized the Mission LIFE event by the Hon'ble Prime Minister of India organized by IARI New Delhi in virtual mode on 20th October, 2022.
- N.N. Pandey organized the vigilance week during 31st October to 6th November including different activities for awareness.
- N.N. Pandey organized world soil day on 5th December 2022 at ICAR-DCFR & Experimental Fish Centre, Champawat.
- Prakash Sharma Coordinated the ICAR-DCFR Technology Demonstration in "112th all India Farmer's fair and Agro-industrial Exhibition, organized by G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand; from 17-20th October, 2022. He provided farm and input advisories for coldwater trout farmers and tropical carp farmers.
- Prakash Sharma conducted a rainbow trout brooder feed trial from October, 2021 to February 2022.
- Prakash Sharma conducted on-farm demonstrations in public or private farms in all the major trout producing states of the country, namely Jammu & Kashmir, Himachal Pradesh, Sikkim, Uttarakhand and Kerala based on the encouraging results which were obtained in terms of brooder maturation, spawning response, gamete quality, other reproductive traits and offspring quality.
- Biju Sam Kamalam and Rajesh M. co-coordinated a front-line demonstration programme cum workshop at the farm site in Anantnag, on 6th August 2022 to demonstrate the performance efficiency and production economics of the grower feedin an on-farm production trial conducted during October-2021 to July 2022.
- R. S. Patiyal, Biju Sam Kamalam and Rajesh M coordinated field trial of RAS based hatchery and nursery at progressive farmer Mr. Zabir Ahmad's farm at Chuchot village, Leh, under the tribal sub-plan scheme during 25th January -May, 2022. To demonstrate the benefits and success of controlled RAS based hatchery and nursery for high altitude a front- line demonstration was conducted on 22nd May 2022 to local

farmers and state officials. The program was attended by top officials of State and Central Government including DDG Fisheries. The system successfully produced 30,000 fingerlings which were distributed farmers.

- R. S. Patiyal organized Demonstration workshop on " Recirculatory Rainbow trout hatchery management in high altitudes" at Chichod Chhamaa Leh, UT of Ladakh organised by ICAR-DCFR on dated 3-5th March 2022.
- R.S. Patiyal organized mahseer seed ranching program at Nainital on 23rd July 2022.
- R. S. Patiyal organized the Awareness programme on recycling of waste water, water harvesting for agriculture and allied sector in MGME villages with the involvement of local/village communities under the Special National Campaign- 26th October, 2022 at Saungaon Village, Bhimtal.
- Rajesh M. provided farm advisories to control mortalities in RAS based hatchery at Leh, Ladakh and to control mortalities due to Ich disease in Mr. Pratviraj Singh, trout farm at Ramgarh, Uttarakhand.
- Rajesh M. provided advisories to Mr. Basit Malik, Kashmir, Dr S.S. Koranga, Bageshwar, Mr. Sourav Agarwal, Kolkata, Mr. Praveen Sajwan, Delhi and Mr. Kunal, Shimla, Mr. Renjith Singh, Ramnagar, Capt. Sandeep Kanwar, Dharmshala, Himachal Pradesh and Mr. Deepak Sawhney Director, Associated Management Consultants Private Limited, New Delhi, Mr. Ashish Saini, Chandigarh and Mr. Jitendra Kumar, Chandigarh for starting RAS based fish farming.
- Rajesh M. provided RAS-technical advisories to Mr. Kailash Bhatt, Haldwani and Mr. Nitesh Mohan Singh regarding modification of RAS filtration system specifically biofilter maturation and start-up to control ammonia and nitrite spike.
- Renu Jethi participated and demonstrated ICAR-DCFR technologies in Farmer's fair at ICAR-VPKAS, Almora on 28th Oct 2022.
- Renu Jethi organised online telecast of Agri-Startup conclave and kisan Sammelan on 17th October, 2022.
- Renu Jethi organized National Campaign on Har Ghar Tiranga as a part of Aazadi Ka Amrut Mahotsav during 13th to 15th August, 2022.
- S Chandra and Ganie P.A., conducted an awareness drive on "Sensitizing the officers and mobilizing the ground functionaries" during 14.09.202 to 20.09.22 at ICAR-DCFR, Bhimtal under special campaign 2.0 for disposal of pending matters.
- S. Chandra and Ganie P.A. conducted the survey on Selection of Swachhta campaign sites during 20.09.22 to 26.09.22 at ICAR-DCFR, Bhimtal under special campaign 2.0 for disposal of pending matters.
- S. Chandra participated in the Kisan Mela at VPKAS, Almora on March, 25, 2022
- S. Chandra organized exposure visit for the 15 students of Department of Zoology, University of Burdwan, West Bengal, on 07-06-2022.
- S. Chandra coordinated exposure visit for the faculty and students of Department of Zoology, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehradun on 26 May, 2022.

Farm advisories and field days organized at EFF, Champawat

- Farm advisory on "Health management of carps in mid hills" was conducted on 20th April, 2022 at Village Mudiyani, Champawat. Dr Kishor Kunal, Mr. Hansa Datt, Mr. Bhola Datt and Mr. Vijaydeep Dhapola conducted and coordinated the program.
- Farm advisory on "Water quality management of carp ponds" was conducted on 23rd May, 2022 at Village Dudhpokhara, Champawat. Dr Kishor Kunal, Mr. Hansa Datt, Mr. Omraj and Mr. VijaydeepDhapola conducted and coordinated the program.
- Farm advisory on "Health management of carps in mid hills" was conducted on 28th June, 2022 at Village Chaikuni bora, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr. Hansa Datt, Mr. Omraj and Mr. Vijaydeep Dhapola conducted and coordinated the program.

- Field Day on "Pond preparation and seed stocking for carp culture" was conducted on 18th July, 2022 at Village Mudiyani, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr. Hansa Datt and Mr. Bhola Datt conducted and coordinated the program.
- Farm advisory on "Health management of fishes" was conducted on 10th August, 2022 at Village Shaktipur-bunga, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr. Omraj and Mr. Vijaydeep Dhapola conducted and coordinated the program.
- Farm advisory on "Brood stock management of Common carp" was conducted on 12th August, 2022 at Village Chaikunai, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr. Hansa Datt, Mr. Bhola Datt and Mr. Vijaydeep Dhapola conducted and coordinated the program.
- Farm advisory on "Water quality management of carp ponds" was conducted on 05th September, 2022 at village Chaikuni, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr. Omraj and Mr. Vijaydeep Dhapola conducted and coordinated the program.
- Farm advisory on "Water quality management of carp ponds" was conducted on 6th October, 2022 at village-Shaktipur Bunga, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr. Hansa Datt, Mr. Omraj and Mr. Vijaydeep Dhapola conducted and coordinated the program.
- Farm advisory on "Health management of carps in mid hills" was conducted on 25th October, 2022 at village Dudhpokhara, Champawat. Dr Kishor Kunal, Mr. Parviaz Ahmad Ganie, Mrs. Garima, Mr. Hansa Datt and Mr. Bhola Datt conducted and coordinated the program.
- Farm advisory on "Health management of fishes" was conducted on 4th November, 2022 at village Chaikuni, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr.HansaDatt, Mr. Omraj and Mr. Vijaydeep Dhapola conducted and coordinated the program.
- Field Day on "Pond preparation and seed stocking" was conducted on 5th December, 2022 at Shaktipur Bunga, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr. Hansa Datt, Mr. Bhola Datt and Mr. Vijaydeep Dhapola conducted and coordinated the program.
- Farm advisory on "Brood stock management of common carp" was conducted on 7th December, 2022 at village-Mudiyani, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr.Hansa Datt, Mr. Omraj and Mr. Vijaydeep Dhapola conducted and coordinated the program.

Fig. Field Day organized at Champawat

Awareness programme organized at EFF Champawat

- One day awareness programme cum field day on "Pond preparation and seed stocking" was conducted on 7th Jan, 2022 at Village Mudiyani, Champawat, Mr. Kishor Kunal and Bhola Datt conducted and coordinated the program.
- One day awareness programme cum field day on "Soil and water quality analysis of fish ponds" was conducted on 5th Feb, 2022 at Village Chaikuni bora, Champawat, Mr. Kishor Kunal and Omraj conducted and coordinated the program.

- One day awareness programme cum field day on "Feed Management of carps in mid hills" was conducted on 7th March, 2022 at Village Shaktipur Bunga, Champawat, Mr. Kishor Kunal, Omraj and Bhola Datt conducted and coordinated the program.
- One day awareness programme cum field day on "Poly-culture of carps in mid hills" was conducted on 22nd April, 2022 at Village Chaikuni Bora, Champawat, Mr. Kishor Kunal, Mr. Hansa Datt and Mrs. Basanti Devi conducted and coordinated the program.
- One day awareness cum demonstration programme on "Preparation of carp feed using locally available ingredients" was conducted on 20th May, 2022 at Village Shaktipur Bunga, Champawat, Mr. Kishor Kunal, Mr. Hansa Datt and Mr. Bhola Datt conducted and coordinated the program.
- One day awareness cum Field Day on "Food and feeding habits of carps " was conducted on 24th June, 2022 at Village Mudiyani, Champawat, Mr. Kishor Kunal, Mrs. Garima, Mr. Hansa Datt and Mr. Bhola Datt conducted and coordinated the program.
- One Day awareness programme cum Field Day on "Poly-culture of carps in mid hills" was conducted on 6th September, 2022 at Village- Mudiyani, Champawat. Dr Kishor Kunal, Mrs. Garima and Mrs. Basanti Devi conducted and coordinated the program.
- One day awareness cum demonstration programme on "Preparation of carp feed using locally available ingredients" was conducted on 26th October, 2022 at village-Mudiyani, Champawat. Dr Kishor Kunal, Mr. Parviaz Ahmad Ganie, Mrs. Garima, Mr. Hansa Datt and Mr. Bhola Datt conducted and coordinated the program.
- One Day awareness programme cum Field Day on "Food and feeding habits of carps" was conducted on 3rd November, 2022 at Village-Dudhpokhara, Champawat. Dr Kishor Kunal, Mrs. Garima, Mr. Hansa Datt and Mr. Bhola Datt conducted and coordinated the program.

Fig. Awareness programme cum field day at Champawat

7.3 Participation in exhibition

The research and development activities of the Directorate were exhibited and disseminated to scientists, farmers, students, faculty members of different universities and other stakeholders at several seminar, symposia, workshop, conference and Kisan Mela etc. organized across the country. This Directorate has participated in some exhibitions which are listed below:

Name of the programme	Organizer	Duration	Place/venue
Kisan Mela	ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, (ICAR-VPKAS) Almora (Uttarakhand)	25 March 2022	ICAR-VPKAS Experimental Farm, Hawalbagh. Uttarakhand
Kisan Mela	Krishi Vigyan Kendra, Lohaghat, Champawat	26 April 2022	KVK, Lohaghat, Champawat

25th National Agriculture Exhibition		24- 27 August 2022	Central Park Maidan, Salt Lake City, Kolkata
Kisan Mela	ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, (ICAR-VPKAS) Almora (Uttarakhand)	28 September 2022	ICAR-VPKAS, Almora
12th All India Farmer's fair and Agro-industrial Exhibition	G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand	14-17 October, 2022	GBPUA&T, Pantnagar, Uttarakhand
Kisan Mela	Krishi Vigyan Kendra, Lohaghat, Champawat	15 November, 2022	KVK, Lohaghat, Champawat

Fig. ICAR-DCFR Stall at GBPUA&T, Pantnagar and National Agriculture Exhibition, Kolkata

Fig: Stall of ICAR-DCFR, EFF, Champawat in the Kisan Mela at KVK, Lohaghat, Champawat

- One- day Kisan Mela and exhibition was organized by Krishi Vigyan Kendra, Lohaghat in which Experimental fish farm, Champawat exhibited a stall and shared information regarding modern technologies associated with fish culture. Dr Kishor Kunal, Scientist and Mr. Bhola Dutt, SSS participated in this event.
- On 15Th November 2022 represented EFF, ICAR-DCFR, Champawat at KVK, Lohaghat by displaying a stall at the location. Interacted with different farmers from the locality and provided basic knowledge of aquaculture practices and its benefits. Fish pickle and fish cutlets were displayed in the stall and shared the recipes of preparing them with the farmers. Mr. Saurabh Pandey, YP-II and Mr. Vijaydeep Dhapola, YP-I participated in this event.

7.4 Visitors

7.4.1 Dignitaries/ Students / Farmers' visit

- Dr Bhupendra Nath Tripathi, Deputy Director General (Animal Science), Division of Animal Science, New Delhi visited to ICAR-DCFR, Bhimtal on 26th February 2022.

Fig. DDG (Animal Science) visit to ICAR-DCFR, Bhimtal

- Shri. G.P. Sharma, Director (Finance), ICAR, New Delhi visited ICAR-DCFR, Bhimtal and interacted with all scientists and staffs of the directorate on 2nd May, 2022.

Fig. Director (Finance) visit to ICAR-DCFR, Bhimtal

- Dr C.N. Ravishankar, Director, ICAR-CIFE and Dr N.P. Sahu, Joint Director, ICAR-CIFE, Mumbai visited ICAR-DCFR, Bhimatl on 18th May 2022.

Fig. The Director, ICAR-CIFE and Dr N.P. Sahu, Joint Director, ICAR-CIFE, Mumbai visited ICAR-DCFR, Bhimtal

- Dr (Smt.) Suvarna Chandrappagari, IFS, Chief Executive, National Fisheries Development Board (NFDB), Hyderabad and Dr S.N. Ogle, Consultant, NFDB visited ICAR-DCFR, Bhimtal on 21st May 2022.

Fig. Dr (Smt.) Suvarna Chandrappagari, IFS, Chief Executive, National Fisheries Development Board (NFDB), Hyderabad visited ICAR-DCFR, Bhimtal

- A group of 60 students of Woodbridge School, Sattal, Bhimtal, visited ICAR-DCFR and interacted with the Scientists of the ICAR-DCFR, Bhimtal on 31st May and 1st June 2022.

Fig. Students of Woodbridge School, Sattal, Bhimtal, visited ICAR-DCFR, Bhimtal

- Students and faculties of University of Burdwan, West Bangal, visited ICAR-DCFR and interacted with the Scientists of the ICAR-DCFR, Bhimtal on 7th June 2022.

Fig. Students of University of Burdwan, West Bangal, visited ICAR-DCFR, Bhimtal

- A group of 24 students of Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab visited ICAR-DCFR, Bhimtal on 9th June 2022 to get acquainted with research activities in the field of coldwater fisheries.
- Sh. Narender Bhandari (IAS), District Magistrate, Champawat visited at Experimental Fish Farm, Champawat on 30th August 2022.

Fig. District Magistrate, Champawat visited at Experimental Fish Farm, Champawat

- Thirty Five B.Sc. agriculture students of Graphic Era Hill University, Bhimtal visited ICAR-DCFR on 28th September 2022 to get awareness on coldwater fisheries related research activities.
- Sh. Dilip Ghosh, Vice President, BJP, West Bengal, visited ICAR-DCFR and interacted with the Scientists of the ICAR-DCFR, Bhimtal on 3rd October 2022.

Fig. Sh. Dilip Ghosh, Vice President, BJP, West Bengal, visited ICAR-DCFR, Bhimtal

- A group of 20 students of B.Sc. Life Sciences, Department of Zoology, Ramjas College, University of Delhi along with 6 faculty members visited ICAR-DCFR, Bhimtal on 7th November 2022.
- Dr R.S. Paroda, Former Secretary, DARE & DG, ICAR and Dr K.M.L. Pathak, Former DDG (Animal Sciences), visited ICAR-DCFR and interacted with scientists on 17th November 2022.

Fig. Dr R.S. Paroda, Former Secretary, DARE & DG, ICAR and Dr K.M.L. Pathak, Former DDG (Animal Sciences), visited ICAR-DCFR, Bhimtal

- Dr Basava Purushottam (IAS) Secretary, Animal Husbandry, Cooperatives, Dairy Development, Agriculture, Horticulture · Government of Uttarakhand visited at Experimental Fish Farm, Champawat on 26th December 2022.

Fig. Dr Basava Purushottam (IAS) Secretary, Animal Husbandry, Cooperatives, Dairy Development, Agriculture, Horticulture · Government of Uttarakhand visited EFF, Champawat

7.5 Consultancy & Other Services

7.5.1 Conservation of endangered golden mahseer

Mighty mahseer, *Tor putitora* has been the icon of recreational and sports fisheries in India and Indian-subcontinent. It is one of the sought-after game fishes that attracts anglers worldwide and has immense potential for fish-based eco-tourism generating sufficient employment opportunities for local inhabitants. Once applauded as the 'tiger of the rivers', *T. putitora* is in perils due to anthropogenic activities and its population has been declining in natural water bodies. Therefore, rehabilitation and conservation of golden mahseer is imperative for its sustainability.

In this context, ICAR-DFCR has consistently been carrying out rehabilitation and conservation efforts for several years through ranching of hatchery-bred fry and fingerlings into rivers, lakes and reservoirs of Himalayan region. In continuation of the bonafide conservation efforts, the Directorate in collaboration with the Nainital district administration successfully organized a seed ranching programme of golden mahseer in Nainital lake, Nainital on 23 July, 2022. During this event, ten thousand fingerlings were stocked.

Shri Dhiraj Singh Garbiyal, District Magistrate and Shri Sandeep Tiwari, Chief Development Officer graced the occasion and emphasized upon the need of conservation of mahseer in the lakes of Kumaon. Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal interacted with media and expressed his concerns to save golden mahseer in the natural water bodies of Kumaon region. More than 50 participants including scientists, district administration officials, media persons and local people participated in the event. The programmes were coordinated by Dr R. S. Patiyal, Principal Scientist and Dr M. S. Akhtar, Senior Scientist.

Fig. Ranching programme in Nainital Lake, Nainital

7.5.2 UJVN – Consultancy project: Study on habitat ecology and biodiversity of mahseer and other indigenous species for developing conservation strategies in the Vyasi Hydroelectric project on river Yamuna, Uttarakhand

[PI: Dr Debajit Sarma, Pr. Scientist Co-PI: Dr M S Akhtar, Sr. Scientist and R.S. Patiyal, Pr. Sci.]

From January 2022 to December 2022, seasonal sampling was conducted at the Vyasi hydroelectric project site in Dakpatthar, Dehradun to study the biotic and abiotic parameters along the VHEP site on the Yamuna river. Ichthyofaunal diversity was evaluated at the upstream and downstream sites, with fish samples collected using cast nets and from the local market to assess abundance and diversity. The collected specimens underwent further analysis in the laboratory, including morphometric and meristic parameters, gut content analysis, and length weight relationship analysis. DNA barcoding technique was used for species identification and confirmation. Fish species collected during this period at the site included *Tor putitora, Barilius bendelisis, Barilius vagra, Garra gotyla, Glyptothorax pectinopterus, Puntius ticto, Amblyceps foratum, Nemacheilus species, Schizothorax richardsonii, Schizothorax labiatus* and *Naziritor chelynoides*.

In addition to fish sampling, various water quality parameters such as water temperature, dissolved oxygen, pH, total dissolved solids, water flow, water transparency, conductivity, and alkalinity were analyzed. Plankton, periphyton, and benthos samples were collected and preserved for qualitative and quantitative analysis. DCFR officials conducted a scientific visit to review ongoing activities in hatchery development and provided necessary technical suggestions. The hatchery complex comprises an indoor mahseer hatchery and two rearing and a nursery tank. The installation work of the mahseer hatchery unit is underway, and the cemented rearing and nursery tanks have been completed.

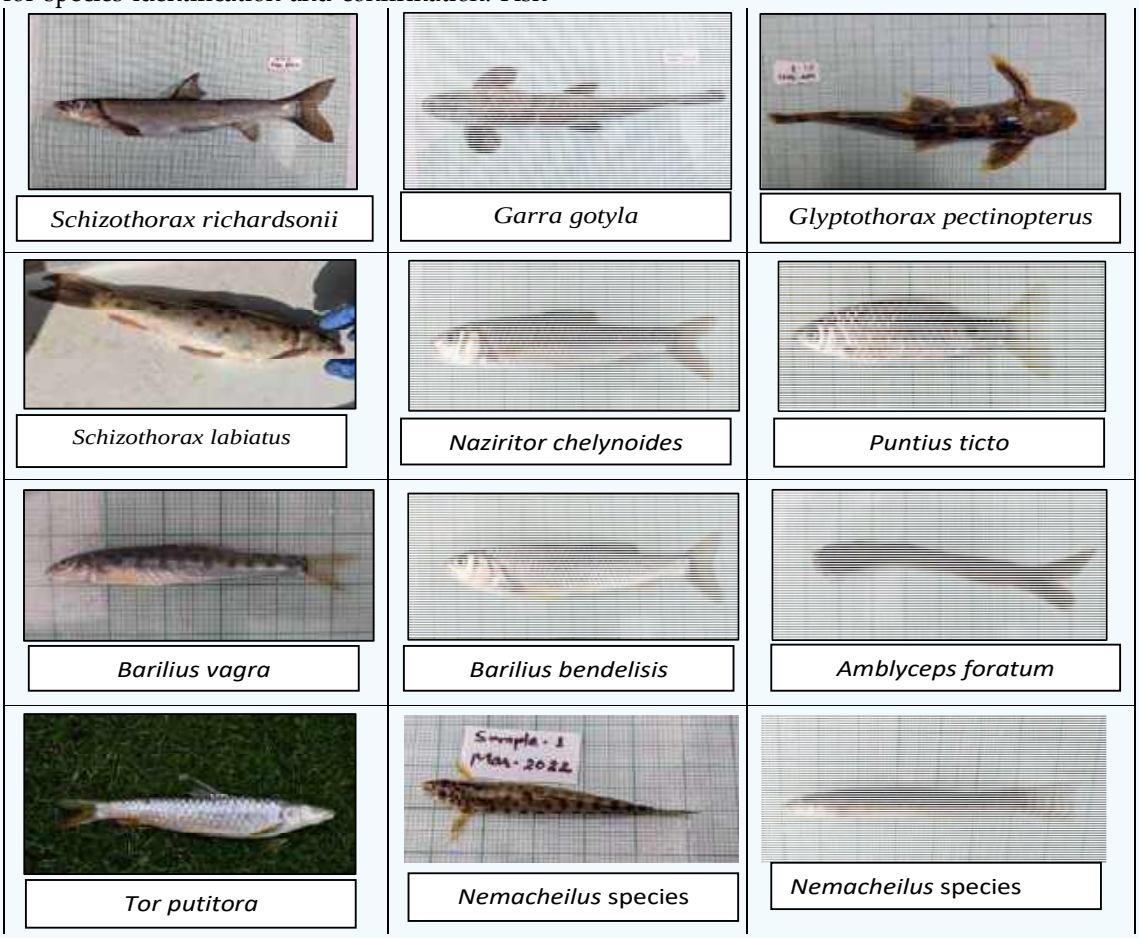

Fig. Fish Species diversity of Yamuna River near the project site

Fig. Hatchery site visit by DCFR scientists

Fig. Hatchery site, rearing tanks

7.5.3 Advisory on rainbow trout nutrition and feed management

ICAR-DCFR is continuously providing scientific guidance and advisory on feed management to the rainbow trout farmers and fisheries department officials of Ladakh, Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Sikkim. This includes support in deciding feeding schedules, calculating feed requirement and facilitating the procurement of DCFR-Growel feeds. For interested feed mill operators, advisory was given on ingredient sources, quality specifications and feed composition. Through the on-going research and development collaboration with M/s Growel Feeds, the commercial supply and use of ICAR-DCFR formulated and validated rainbow trout feeds has progressively increased in all the major trout producing states, reached more than 500 farmers and contributes to 450 metric tonnes trout production. Besides, intellectual support was given for fish feed ingredient start-ups such as Greengrahi Solutions for pilot and scale-up projects on black soldier fly larvae production and evaluation. The trout feed advisory activity was carried out by Dr Biju Sam Kamalam, Dr Rajesh, M. and Dr Prakash Sharma.

7.5.4 Inspection visit to Kumaon Regimental Farm, Kamola, Uttarakhand

The Kumaon regimental farm is an army agricultural farm established in the 1950s to carry out agriculture, agroforestry and aquaculture activities, and thereby provide charitable and welfare assistance to ex-servicemen, war widows and their wards. DCFR's guidance was sought to improve fish culture and production in a 4000 m^2pond, within the farm site. During a visit on 18 February 2022, the pond location was geotagged (29°15.754 N 79°17.032 E; 314 msl). For the on-going culture, 15,000 fingerlings of Indian Major Carps (rohu and mrigal) were procured from a local supplier and stocked during July - August 2020, and fed commercial carp feed (28% protein and 4% fat) supplemented with de-oiled rice bran. The pond was also fertilized with cow dung and water exchange was done when the water level goes down in the pond. However, the production of market-size fish (above 500 g) till January 2022 was only 96 kg. No records were available on water quality, fish growth and standing biomass. Based on the information given and analysed water quality parameters, it was observed that the fish stocking density was higher than optimum and slow growth of IMCs could be due to low water temperature (23°C). Scientific guidance was provided to the farm staff with respect to choosing different fish species (Chinese carps), appropriate stocking density, feed management, regular water exchange and record keeping. This activity was carried out by Dr Pramod Kumar Pandey and Dr Biju Sam Kamalam.

Fig. ICAR-DCFR team at Kumaon Regimental Farm, Kamola

7.5.5 Advisory for rainbow trout hatchery operation at Munnar, Kerala

ICAR-Directorate of Coldwater Fisheries Research continues to provide guidance and consultation to sustain rainbow trout seed production in the heritage rainbow trout hatchery at Rajamallay tea estate of Kanan Devan Hills Plantations Company Pvt. Ltd., Munnar, Kerala. Baseline information of changes in water quality is being recorded at monthly intervals from October 2019 onwards. The nutritional intervention recommended by the Directorate's scientists has resulted in substantial improvement in the size of brooders and growth performance of juveniles. Fresh batch of brooders have been inducted and 5000 fingerlings were produced in the last breeding season. This activity was carried out by the nodal officer Dr Biju Sam Kamalam and Dr Rajesh, M.

7.5.6 Hatchery management and seed production of golden mahseer as a part of the fisheries management plan for Subansiri Lower HE project, Gerukamukh, Distt. Dhemaji (Assam)

[PI: Dr Pramod Kumar Pandey, Director; Co-PIs: M. S. Akhtar, D. Darma and N. N. Pandey]

Under the consultancy project "Hatchery management and seed production of golden mahseer as a part of the fisheries management plan for Subansiri Lower HE project, Gerukamukh, Distt. Dhemaji (Assam)' ICAR-DCFR is entrusted to provide technical consultancy for the establishment of mahseer and snow trout hatcheries at the Subansiri Lower HE project site, Gerukamukh. So far, ICAR-DCFR and the Department of Fisheries, Govt of Arunachal Pradesh, have signed an MoU in the presence of NHPC officials for providing consultancy for the Fisheries Management Plan of Subansiri Lower HEP. A joint site survey has also been done with officials of the Fisheries Department and NHPC. Water samples from the Subansiri river were collected, and water quality parameters, such as total alkalinity, pH, hardness, etc., were assessed.

Fig. Signing of MoU between ICAR-DCFR

Fig. Joint site survey at Gerukamukh, Subansiri and the Department of Fisheries, GoAP Lower HEP

7.5.7 Visit Report to a startup Fermentech Labs Pvt. Ltd., IIT, Roorkee

In response to the letter "Idea/Technical Visit/2022" dated October 11, 2022, Dr Suresh Chandra, Pr. Scientist and Nodal Officer, visited Fermentech Labs Pvt. Ltd., IIT, Roorkee, as a technical expert nominated by the CEO, a-Idea ICAR-NAARM, Hyderabad, and observed work progress on November 6–7, 2022. Along with the CEO, Dr Sidharath Arora visited the facilities developed at the IIT lab and had a detailed discussion with Dr Arora, CEO, Fermentech Labs Pvt. Ltd. The progress report was prepared based on the shared progress report, physical observations, interactions, and experimental findings.

Fig. Fermented end residue fuel powder

Fig. Lab visit with Dr Arora

Fig. CEO Dr Arora in his lab with developed products

7.6. Revenue generated

- Experimental Field Centre, Champawat generated a revenue of Rs. 27,28,374.00 (Rupees Twenty-seven lakh twenty-eight thousand three hundred seventy-four only) through the sale of fishes and fish seeds (eyed ova, fingerlings and grow-out) raised at the farm to different fish farmers, government and private agencies. (Sale of Rainbow trout eyed ova – Rs 16.5 lakh, sale of Rainbow trout grow-out- Rs 7,67,746.00, sale of Rainbow trout fingerlings – Rs 1,42,800.00, sale of common carp seeds – Rs 2,543.00, sale of ornamental fishes – Rs 165285.00).

7.7 Success Stories

Success story of Shri Dilbar Lal

Shri Dilbar Lal lives in the village of Koteshwar, block Gopeshwar, and district Chamoli, Uttarakhand. He is a young, progressive Scheduled Caste fish farmer engaged in agriculture and livestock activities at his remote native village, Koteshwar. mainly in fish cultivation and cow-keeping. Under the SCSP program, he came in contact with ICAR-DCFR Bhimtal and started trout farming with scientific methods. Previously, carp farming produced only 120 kg of fish per 320 m^3 polytank (2019–2020). The available pond facilities were repaired and expanded with the assistance of ICAR-DCFR, Bhimtal. Regular input support in the form of stocking larger-size seed, extruded trout feed, and nets for fish feed now from the ponds produced about 550 kg of rainbow trout during the period, and he also used the fish pond water for the vegetable plots and got the vegetables to double in production with nutrient-rich irrigation water.

Status before intervention

Component Description		**Benchmark (Baseline period 2019-2020)**			
Components	Names	Area (acre/ m^2) /Number	Production (kg/ Liter/ No.)	Gross Income (Rs.)	Net Income (Rs.)
Field Crop 1	Paddy	700 m^2	250 kg	5000	Domestic use
Field Crop 2	Wheat	300 m^2	300 kg	5400	Domestic use
Field Crop 3	Maduwa	250 m^2	250 kg	4000	Domestic use
Livestock 1	Cow	2 No.	1470L	44100	40000
Fish Farming	Carp Fish	320 m^2	120kg	30,000	25,000
Total			Total	88,500	**65,000.00**

Present status

Component Description		Period 2021-22			
Components	Names	Area (acre/ m^2) / No	Production (kg/ Liter/ No.)	Gross Income (Rs.)	**Net Income (Rs.)**
Field Crop 1	Paddy	700 m^2	700 kg	11000	**Domestic use**
Field Crop 2	Wheat	300 m^2	250 kg	6250	**Domestic use**
Field Crop 2	Maduwa	250 m^2	500 kg	8000	**self use**
Livestock 1	Cow	2 no.	1500 L	45000	**40,000.00**
Fish farming	Rainbow trout Fish	520 m^2	550 kg	3,25,000	**3,00000.00**
Total			**Total**	**3,95,250**	**3,40,000**

The farmer used to earn Rs. 65,000 per year from crops, milk, and carp species. He faced problems with low production and productivity in his crops and fish farming. With ICAR-DCFR scientific interventions in rainbow trout breeding and seed production, he has developed skills in trout farming and gets an annual gross income of **Rs. 3,95,000/-**. In addition, a net earnings of **Rs. 3,40,000/-.** was achieved by the production of rainbow trout with agricultural crops.

Fig. Trout farming in raceways at village Koteshwar, Chamoli
[Dr Suresh Chandra, Principal Scientist, ICAR-DCFR]

Success story of Sh. Hem Chandra

Name of farmer : Shri Hem Chandra
Address : Village- Ghatigarh
PO : Bhimtal Block-Bhimtal, District Nainital, Uttarakhand
Mobile Number : 09917615442
Age : 50
Education : High School
Size of land holding (in ha.) : 0.5 (irrigated-0.4 ha, rainfed-0.1 ha.)

Sh. Hem Chandra, a fish farmer adopted under MGMG, lives in the villages of Ghatigarh, Harinagar, Bhimtal in Nainital district of Uttarakhand. He is a middle-aged progressive Scheduled Caste fish farmer mainly engaged in horticultural activities. Under the SCSP program, he came in contact with ICAR-DCFR Bhimtal and started carp, trout, and ornamental fish farming scientifically. Previously, carp farming produced only 100 kg of fish per 200 m^3 polytank (2019–2020). The available pond facilities were repaired and expanded with the assistance of ICAR-DCFR, Bhimtal. From the ponds, he produced about 80 kg of rainbow trout, 15,000 goldfish, and 280 kg of carp during the period, and he also used the fish pond water for the vegetable plots and could double the production of vegetables with nutrient-rich irrigation water.

Status before intervention 2019-20

Component Description		Benchmark (Baseline period 2016-17)			
Components	**Names**	**Area (acre/m^2)/Number**	**Production (kg/Liter/No.)**	**Gross Income (Rs.)**	**Net Income (Rs.)**
Field Crop 1	Paddy	400 sq m	100 kg	1500	Domestic use
Field Crop 2	Wheat	800sqm	200 kg	2400	Domestic use
Hort. Crop 1	Vegetables	800 sq m	3000 kg	40,000	30,000
Fish Farming 1	Carps	(200 sqm) 3nos	100 kg	25,000	18000
Total				68900	**48,000**

Present status 2021-22

Component Description		Period 2020-21				
Components	**Names**	**Area (acre/m^2)/ No**	**Production (Kg/Liter/No.)**	**Gross Income (Rs.)**	**Net Income (Rs.)**	**production**
Field Crop 1	Paddy	300 Sq m	90 kg	2500	self-use	-
Field Crop 2	Wheat	1000 sq m	300 kg	6000	self-use	-
Hort. Crop 1	Vegetables	1200 sq m	8000 kg	120000	100000	266.6
Fish farming 1	Carps	(400 sq m) 4 Nos.	280 kg	98,000	80,000	280.0
Fish farming 2	Ornamental fish	(100 sq m) 3 Nos	15000 nos.	45,000	40,000	New initiative
Fish farming 3	Rainbow trout	(150 sqm) 2 Nos	80 kg	48,000	30,000	New initiative
Total				**319500**	**2,50,000**	

Fig. Integrated fish pond

Fig. Ornamental fish pond and newly constructed polyhouse

Brief: The farmer used to get an annual income of Rs. 48,000/- from crops, horticulture, and carp farming, etc. The main water source is Bhimtal Lake's outgoing water. However, excess rain frequently damaged the ponds. With DCFR interventions, an integrated farming approach with species diversification was adopted. He has presently an annual net income of Rs.2, 50,000/- In addition, there is a cost savings of fertilizers in the production of vegetables with fish fish ponds.

[Dr Suresh Chandra, Principal Scientist, ICAR-DCFR]

8. Coldwater Fish breeding and Seed Production

8.1 Seed production of golden mahseer (*Tor putitora*)

A key focus of the Directorate's work is the breeding and seed production of golden mahseer for the sake of conserving and rehabilitating the species. In the year 2022, numbers of breeding and seed production activities of golden mahseer were carried out throughout the year. The golden mahseer were brought up to maturity in captivity by the use of photo-thermal manipulations. In all, we could strip 225300 eggs. We observed the fertilisation rate in the range of 72 to and 82%, the hatching rate was between 75 and 85%, and the survival rate was between 75 and 90 % till 60 dph. Following a period of nursery rearing (3 months), the fry were placed in the nursery pond at the Mahseer Hatchery Complex of the Directorate so that they could be raised into fingerlings. Ten thousand advanced fry were ranched into Nainital lake. In all, about 30000 eggs and fry were used for various experiments and student research work. During the year, 8000 advanced fry were sold to Fisheries Department, Pauri Garhwal, Uttarakhand and generated a revenue of Rs. 80,000.00 (Rupees eighty thousand only). Dr M. S. Akhtar, Senior Scientist and In-charge, Mahseer Hatchery coordinated all the hatchery activities.

[Report by: Dr M.S. Akhter, Sr. Scientist, ICAR-DCFR]

Stripping of eggs from a golden mahseer brooder matured in captivity

Eggs under incubation

Brooders under maturation unit

Newly hatched golden mahseer fry

8.2 Breeding and seed production of improved common carp at Experimental Fish Farm, Champawat

Fish farmers in the mid hills possess small to medium size ponds where fish growth can be expected only for about 6-8 months a year. Temperature plays an important role in the growth of fishes in mid hill; a temperature tolerant fish variety is need of the hour for fish farmers in the hills. Common carp (*Cyprinus carpio*) is one successful candidate fish in mid Himalayan region. To obtain higher fish productivity in uplands, two improved Hungarian strains of common carp 'Ropsha scaly' and 'Felsosomogy mirror carp' were introduced at Champawat experimental farm in 2007. These species were suitable than other carp varieties for mid-hill farming due to their faster growth, wide temperature tolerance (5-32° C) and minimal maintenance during the grow out period. Breeding and seed production of improved common carp by using conventional "Hapa" breeding method without hormone administration. Brooders were stocked in the ratio of 2:1 (Male: female) in the hapa for breeding. Eggs were collected using plastic twines from unused plastic sacks scattered inside the breeding hapa for the attachment. About 150-200g of twines per kg of female was used to collect eggs. Fertilized eggs of carps are adhesive, pale yellow in colour and diameter ranges from 1.2-2.1 mm. Recorded fecundity was about 0.5-1.0 lakh eggs/kg body weight. At 15-21° C, fertilized egg took 80-120hrs to hatch out and after 70-90 hrs yolk was completely absorbed. The survival percentage of egg to spawn and spawn to fry was found 40-45% and 30-35%, respectively. 0.9-1.0 lakh fry (30 dph) were produced from the improved Hungarian common carp strains during June-July 2022. 112 female brooders of size range 212 g to 487g were used for the breeding purpose. The breeding program was jointly coordinated by Dr K. Kunal and Ms. Garima.

[Report by: Dr K. Kunal and Mrs. Garima, Scientists, Experimental Field Centre, ICAR-DCFR, Champawat]

Common carp brooder

Common carp fingerling

8.3 Breeding and seed production of rainbow trout (*Oncorhynchus mykiss*)

Breeding, seed production and culture of rainbow trout is an important activity at the Experimental Fish Farm, ICAR-DCFR, Champawat. Currently, 3000 adult (1.2-4.8 kg), and 5000 yearlings (15-200 g) are being maintained at the farm. The farm raised rainbow trout brooders were used for the breeding and seed production during Jan, 2022-Feb, 2022. Nine lakh eyed ova, including 50 thousand advanced rainbow trout fry, were produced at EFF, Champawat using 1600 kg female brooders and 1400 kg male brooders. Recorded fertilization rate was about 70-75%. With the use of a RAS system for incubation of rainbow trout eggs the survival rate of 60-65 % (green egg to eyed ova) could be achieved. The seed production and rearing of rainbow trout were coordinated by Dr Kishor Kunal and Ms. Garima at EFF, Champawat.

[Report by: Dr K. Kunal and Mrs. Garima, Scientists, at Experimental Field Centre, ICAR-DCFR, Champawat]

Stripping of brooders Mixing of ova and milt for fertilization

Incubation of fertilized eggs Packaging of eyed ova for Rainbow trout swim-up fry transportation

8.4 Breeding and seed production of ornamental fishes at Experimental Fish Farm, Champawat

Ornamental fishes were bred at EFF during the month of June-August. For the breeding purpose 62 female brooders of Koi carp and 72 female brooders of gold fish were used in separate hapa with their respective male brooders (Male: female, 2:1). The weight of koi carp female brooders varied between 75-320g and that of gold fish from 61-126g. About 4000-5000 nos. of fingerlings (5-8 cm) of koi carp and 3000-4000 of fingerlings of gold fishes were produced during the breeding and seed production cycle. The activities of breeding, seed production and rearing were coordinated by Dr Kishor Kunal and Ms. Garima with the help of technical staff of the farm.

[Report by: Dr K. Kunal and Mrs. Garima, Scientists, at Experimental Field Centre, ICAR-DCFR, Champawat]

Ornamental fish brooders *Ornamental fish fingerling*

Koi carp *Gold fish*

8.4 Breeding and seed production of *Labeo dyocheilus*

Breeding and seed production of *Labeo dyocheilus* had been carried out at ICAR-DCFR, Bhimtal in five phases on 12.07.2022, 18.07.2022, 05.08.2022, 18.08.2022, and 30.08.2022. During 1st phase 4 females of size range 250-550g and 4 males of size range 300-650g were selected and intramuscularly injected with inducing agent, Ovatide @ 0.6ml/kg body weight to female and @ 0.3ml/kg body weight to male and released to spawning pool with continuous water flow @ 8 lpm with shower arrangement. About 1.75 lakh eggs and 1.25 lakh spawns were produced with fertilization and hatching rate of about 60% and 80% respectively. During 2nd phase, 8 females (320-670g) and 8 males (270-820g) were intramuscularly injected with inducing agent, Ovatide @ 0.6ml/kg body weight to female and @ 0.3ml/kg body weight to male and released to spawning pool with continuous water flow @8 lpm with shower arrangement. About 5 lakh eggs and 3.5 lakh spawns were produced with fertilization and hatching rate of about 70% and 85% respectively. During 3rd phase, 4 females (300-680g) and 4 males (270-620g) were selected and intramuscularly injected with same inducing agent with similar dosages and kept in spawning pool with similar arrangements. About 2.0 lakh eggs and and 1.5 lakh spawn were produced with fertilization and hatching rate of about 60% and 80% respectively. The entire stock of *Dero dyocheilus* died on 18.08.2022 due to shortage of electricity and water supply in the hatchery. During the 4th phase, 5 females (250-400g) and 5 males (200-750g) were selected and intramuscularly injected with inducing agent, Ovatide @ 0.6ml/kg body weight to female and @ 0.3ml/kg body weight to male and released to spawning pool with similar arrangements but there was no spawning so dry stripping method was applied but no success in ferritization was achieved. During the 5th phase, three females (350-600g) were intramuscularly injected with inducing agent, Ovatide, three females (270-620) with inducing agent, S (ICAR-DCFR produced synthetic hormone) and five males (340-550g) with inducing agent, Ovatide and kept in spawning pool with similar arrangements. About 30 thousand eggs and 25 thousand spawns were produced with the fertilization and hatching rate of about 70% and 90% respectively. The program was conducted by Dr N.N. Pandey, Dr S. Ali and Dr Sumit Kumar (RA).

Fig. Brooder of Labeo dyocheilus

Fig. Ovatide administration to a brooder

Fig. Eggs in hatching tanks

Fig. Hatchlings in polytanks

9. Tribal Sub Plan (TSP) Activities

During the reporting period 2022, the tribal sub-plan activities of the ICAR-Directorate of Coldwater Fisheries Research were mainly focused on the welfare of tribal farmers of Ladakh and Uttarakhand. The research and developmental activities were coordinated by Dr R.S. Patiyal (Nodal Officer), Dr Biju Sam Kamalam and Dr Rajesh, M. (Co-Nodal Officers).

LADAKH

9.1. Road map for sustainable development of fisheries and aquaculture in Ladakh

A high-level brainstorming meeting was organised to deliberate on the ICAR-DCFR draft road map for sustainable development of fisheries and aquaculture in UT Ladakh, on 21st May 2022, at DRDO-DIHAR, Leh. This meeting was chaired by the Hon'ble Lieutenant Governor of UT Ladakh, Shri Radha Krishna Mathur, and was attended by Dr J. K. Jena (DDG, Fisheries Science); Shri Ravinder Kumar (Secretary, Department of ASH & Fisheries, Ladakh); Dr Pramod Kumar Pandey (Director, ICAR-DCFR); Dr Md. Raza (Director, Department of ASH & Fisheries, Ladakh); Director of Fisheries Departments from Himachal Pradesh, Sikkim and Meghalaya; representatives from Jammu & Kashmir, Manipur and Arunachal Pradesh; scientists from ICAR-DCFR and fisheries officials of UT Ladakh.During this meeting, Shri R.K. Mathur appreciated the sincere efforts of ICAR-DCFR and emphasized on strong linkage of the UT administration with ICAR-DCFR for conducting a baseline survey of the aquatic resources / biodiversity and research on best aquaculture practices. He also mentioned the need to develop entrepreneurship models and offer flexible central schemes according to local needs. In his address, Dr J.K. Jena pointed out the necessity to strike a balance between enhancing aquaculture production and conservation of aquatic biodiversity, engage all stakeholders and undertake long-term continuous efforts. Prior to that, Dr Pramod Kumar Pandey set the context and outlined the present status, target domains and scope for fisheries and aquaculture development in Ladakh. This was followed by a detailed presentation of the ICAR-DCFR road map, challenges and action plan by Dr Biju Sam Kamalam. The officials of UT Ladakh and various hill states actively participated in the ensuing deliberations and shared their valuable experiences and remarks on sustainable efforts for fisheries and aquaculture development. On this occasion, ICAR-DCFR signed a memorandum of understanding with the Department of ASH & Fisheries for technology transfer, scientific hand-holding and human resource development. This brainstorming meeting was coordinated by Dr R.S. Patiyal, Dr Nityanand Pandey, Dr Biju Sam Kamalam and Dr Rajesh, M.

Fig. High-level brainstorming meeting chaired by Hon'ble Lieutenant Governor, Ladakh

Fig. Signing of MoU between ICAR-DCFR and Department of ASH & Fisheries, Ladakh

9.2 Establishment and demonstration of first RAS based rainbow trout hatchery-nursery

ICAR-Directorate of Coldwater Fisheries Research is intensifying efforts to develop advanced aquaculture systems and diverse aquaculture practices for the high altitudinal regions of Ladakh. For the first time, a scientifically designed and validated rainbow trout hatchery-nursery system was established at Chuchot Shamma village, Leh, at Mr. Zabir Ahmad's farm, under the Tribal Sub-Plan scheme. Approximately 75,000 rainbow trout eyed ova were supplied from ICAR-DCFR experimental farm during January-March 2022. Under continuous monitoring and guidance from ICAR-DCFR scientists, hatching and larval rearing were successfully achieved in this RAS-based rainbow trout seed facility, with the final production of more than 30,000 rainbow trout fingerlings. On 21st May 2022, Dr J.K. Jena (DDG, Fisheries Science) inaugurated the ICAR-DCFR established rainbow trout seed production facility, in the presence of Shri Ravinder Kumar (Secretary, Department of ASH & Fisheries, Ladakh), Dr Pramod Kumar Pandey (Director, DCFR),Dr Md. Raza (Director, Department of ASH & Fisheries, UT Ladakh), other senior fisheries officials from Himachal Pradesh, Sikkim, Meghalaya, Jammu & Kashmir, Manipur, Arunachal Pradesh and Ladakh, DCFR scientists, farmers and other stakeholders. The design and operation of this RAS-based seed production facility were demonstrated to the gathering by Dr Rajesh, M.

Fig. Demonstration of the RAS trout seed production facility to the dignitaries and farmers

Furthermore, the rainbow trout fingerlings produced in the facility were distributed and stocked in the raceways of tribal farmers from Leh and Nubra Valley. This RAS model was found to effectively help in overcoming the inherent climatic challenges in Ladakh, enable timely production and availability of rainbow trout seed, and promote self-reliance in rainbow trout culture in Ladakh. Further at the request of the Department of ASH & Fisheries, Ladakh, complete scientific and technical support was provided to convert an existing flow-through system-based trout hatchery facility in the Chuchot Government farm to controlled environment RAS hatchery unit. Dr Rajesh, M., Dr Biju Sam Kamalam and Dr R.S. Patiyal carried out the design, establishment and demonstration of this RAS rainbow trout hatchery-nursery.

Fig. Distribution of rainbow trout seed produced in the RAS facility to farmers and stocking of rainbow trout seed in beneficiary's raceway at Nubra Valley

9.3 Ornamental fish rearing in aqua-garden initiated at Leh, Ladakh

ICAR-DCFR has introduced another new aquaculture practice, namely aqua-gardening with ornamental fishes for integration with eco-tourism in Ladakh. A small aqua-garden with gold fish and koi carp was set-up in Chuchot village, Leh, in March 2022. This aqua-gardening proof-of-concept unit was inaugurated on 21st May 2022 and demonstrated to the local tribal farmers in the presence of Dr J.K. Jena (DDG, Fisheries Science), Shri Ravinder Kumar (Secretary, Department of ASH & Fisheries, Ladakh), Dr Pramod Kumar Pandey (Director, DCFR) and top fisheries officials from various hill states. Dr R.S. Patiyal briefed on the potential of ornamental fish rearing and aqua-gardening to generate alternate livelihood in Ladakh. ICAR-DCFR was encouraged to establish more ornamental fish aqua-gardening units in different parts of Ladakh to promote the aquaculture-ecotourism combination in the high altitude cold arid regions of Ladakh. This activity was carried out by Dr R.S. Patiyal, Dr Biju Sam Kamalam and Dr Rajesh, M.

Fig. Stocking of ornamental fish in aqua-garden unit at Leh

9.4 Feed and other input distribution and demonstration activities

In a major effort to cater to the input requirements of the tribal fish farmers in Ladakh, the ICAR-Directorate of Coldwater Fisheries Research provided and distributed 8040 and 6500 kg of high-energy rainbow trout feed developed by ICAR-DCFR (in collaboration with Growel Feeds), during 2021-22 and 2022-23, respectively. With active cooperation from the Department of Fisheries, Ladakh, this rainbow

trout feed was supplied to 50 farmers spread across Leh, Nubra, Kargil and Drass, to support the entire production cycle in one raceway. On-farm demonstration of the performance of this feed is also being carried out in selected trout farms of the tribal beneficiaries in the Leh and Kargil districts. The ultimate aim of this activity was to promote the use of high-performance feed and inputs to maximise fish production in a relatively shorter culture period. Besides feed, water quality testing kits, record-keeping notebooks and medications were also distributed to tribal farmers in Leh and Kargil. Nearly 60,000 eyed ova produced in ICAR-DCFR experimental farm at Champawat, Uttarakhand, were also supplied to the Government hatchery at Leh, in 2022. Dr Biju Sam Kamalam, Dr R.S. Patiyal and Dr Rajesh, M. coordinated the activity.

Fig. Distribution of feed and record-keeping notebooks to the farmers in Kargil & supply of rainbow trout eyed ova to the Government hatchery at Chuchot, Leh

9.5 Farm visits and scientific advisories

To help the tribal farmers of Ladakh to understand the importance of active farm monitoring and management, the TSP team visited private and government rainbow trout farms in Leh and Kargil districts, analysed important water quality parameters in the trout raceways and shared reports with the farmers and provided scientific advisory to the farmers on best aquaculture practices concerning water quality / flow monitoring, fish stocking density and health observations, feed management and profitable farm operation. This activity was coordinated by Dr R.S. Patiyal, Dr Biju Sam Kamalam and Dr Rajesh, M.

Fig. Farm visit and water quality monitoring in Ladakh

9.6 TSP farmers' training programmes organised at Leh and Kargil

On 5th March 2022, training cum demonstration programme on 'Recirculating Aquaculture System (RAS) based rainbow trout hatchery and nursery management in high altitude' was organised by ICAR-DCFR at Mr. Zabir Ahmad's farm, in collaboration with the Department of Fisheries, Leh. During the training, ICAR-DCFR scientists demonstrated the RAS hatchery-nursery facility and explained critical aspects of hatchery/farm operation, feed management, water quality monitoring, record-keeping and health management to the 25 participants. The Secretary, ASH & Fisheries, Mr. Ravinder Kumar (IAS) graced the occasion as the Chief Guest, distributed DCFR's water quality testing kits and record-keeping notebooks to farmers and appreciated the continuous efforts of DCFR. The Secretary, Dr Stanzin Thakchos (OSD to Secy., ASH & Fisheries), Mr. Md. Amin Lone (ADF, Leh), fisheries department officials and fish farmers also participated in the training.

Fig. Training on RAS rainbow trout hatchery and nursery management

On 6th March 2022, another training on 'Best management practices for rainbow trout farming in high altitude' and feed distribution programme was organised by ICAR-DCFR at Kachan Government Trout Farm, Kargil, in collaboration with the Department of Fisheries, Kargil. The training was attended by 22 farmers, Mr. Murtaza Ali (ADF, Kargil) and ten fisheries department officials from Kargil and Drass. DCFR scientists explained various important aspects of rainbow trout farm management to the gathering and practically demonstrated water flow rate measurement, biomass estimation, feeding and water quality monitoring. For regular monitoring of the on-farm feed performance and farm management, record keeping note books were provided to all the feed recipient farmers and fisheries officials of Government farms in Leh and Kargil. The training programmes were coordinated by Dr R. S. Patiyal, Dr Biju Sam Kamalam and Dr Rajesh M.

Fig. Training on BAPs for rainbow trout farming in high altitude

9.7 Optimization of rainbow trout eyed ova shipment conditions

In India, there are specialized rainbow trout brood fish farms and breeding units, from where eyed ova are shipped to geographically distant farms and hatchery facilities across the country. But, often, there is an occurrence of huge losses due to poor shipment conditions. Therefore, under our tribal sub-plan programme, we carried out a field study to test few pre-shipment and shipment conditions for minimizing eyed ova losses. Critical factors such as eyed ova loading density (0.6, 0.8, 1 and 1.2 ml per cm^3), post-fertilization time of shipment (240 *vs.* 250-degree days) and acclimation to ice-cold temperature before packing (tempered *vs.* not tempered) were evaluated based on eyed ova losses at the time of receipt and cumulative losses up to 96 hours post-receipt (until the onset of hatching). Eyed ova for this study were obtained from an age group of more than four years female and male rainbow trout, bred and incubated at ICAR-DCFR experimental fish farm, Champawat, Uttarakhand. The eyed ova were measured by volumetric displacement, packed in trays, kept in an insulated box between layers of crushed ice and shipped in iced condition (< 2°C) to Leh, Ladakh (a high-

altitude cold arid region) by road and air. The total distance covered and the duration taken was 1500 km and 24 h, respectively. Out of the 86,000 eyed ova shipped, shipment loss at the time of receipt was 5.1% and cumulative 96 hours post-shipment loss was 4.1%. Concerning shipment conditions, five eyed ova per cm^3 loading density had minimum loss on-receipt and 96 hours post-receipt. Whereas the post-fertilization time of 250-degree days and tempering improved the cumulative post-receipt survival. This field experiment was carried out by Dr Biju Sam Kamalam, Dr Kishor Kunal, Dr Rajesh, M. and Dr R.S. Patiyal.

Fig. Rainbow trout eyed ova shipment receipt and checking at the destination, Leh

UTTARAKHAND

9.8 Input distribution, capacity building programmes and pond renovation

Besides Ladakh, ICAR-DCFR also carried out various developmental activities among the tribal farmers in the Pithoragarh and Udham Singh Nagar districts of Uttarakhand. Five trainings were conducted on best aquaculture practices, aqua gardening, aquaponics, feed management and rainbow trout breeding. Likewise, seven awareness programmes and exposure visits were organised for the tribal farmers regarding fish-based livelihood security avenues. For input distribution, 4000 kg of carp and trout feed, 7000 fish seed, and water quality analysis kits were distributed to 55 tribal beneficiaries in the two districts. Also, one community fish pond was renovated in Pithoragarh district. Dr R.S. Patiyal coordinated all the aquaculture development activities in Uttarakhand.

10. North East Hill Activities (NEH) Activities

10.1 Establishment of trout hatchery at Mechuka, Arunachal Pradesh

A survey was carried out in November 2021 at Mechuka, Shi Yomi District of Arunachal Pradesh by Dr R. S. Haldar and Dr Amit Pande, along with the Director and other senior officials of the Department of Fisheries, Government of Arunachal Pradesh. During the survey, an urgency of establishing a trout hatchery was realised to promote trout farming in and around Mechuka. After the survey by the team from ICAR-DCFR along with the team from the Department of Fisheries, the village Dechenthang was selected. Realising the need for a trout hatchery for the popularisation of trout farming, a hatchery was finally established at Dechenthang, Mechuka, in collaboration with the Department of Fisheries, Govt. of Arunachal Pradesh, for which equipment like modern vertical egg incubators and FRP start feeder and rearing tanks were procured by ICAR-DCFR and delivered at Mechuka.

Initially, 2.5 lakh rainbow trout-eyed ova were shipped to Mechuka from ICAR-DCFR Champawat Centre for incubation and further rearing of the seedlings. Thus, establishing a functional hatchery was a pioneering attempt to introduce rainbow trout in this remote region of Arunachal Pradesh. A consignment of 12 kg of rainbow trout starter feed was also provided to DFDO, Shi Yomi District, to rear the newly hatched fry for better growth and survival. More than 22 farmers are rearing yearlings in their raceways to produce brooders. Dr R. S. Haldar and Dr Amit Pande coordinated the establishment of a trout hatchery at Dechenthang, Mechuka.

Fig. Rainbow trout hatchery established at Dechenthang, Mechuka.

Another consignment of one lakh rainbow trout-eyed ova were provided to the District Fisheries Development Officer (DFDO), West Kameng and Tawang Districts of Arunachal Pradesh for incubation and rearing in Shergaon trout hatchery.

Fig. Eyed Ova provided to Mechuka, Shi-Yomi district, Arunachal Pradesh.

Rainbow trout-eyed ova provided by ICAR-DCFR were hatched at Government Trout Farm, Shergaon. After attaining a fingerling size, the seed were distributed among the farmers of the districts West Kameng and Tawang. The most important output of the work in the NEH is the enhanced rainbow trout production in West Kameng District. The production jumped from one ton to nine tons in the past two years, for which the necessary support provided by ICAR-DCFR has been duly acknowledged. The programme was coordinated by Dr R. S. Haldar, CTO.

10.2 Ornamental Fish Culture- a Source of Income Generation

A training programme on "Ornamental Fish Culture - a Source of Income Generation" was organised under North East Hill activity by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, in collaboration with the Department of Fisheries, Government of Sikkim at village Mabong (West Sikkim) during 4-5th March 2022. The training programme emphasised the importance of ornamental fish, its culture and role in livelihood security. Maintaining an aquarium, preventing common fish diseases and ways to transport ornamental fish were also discussed. Further, hands-on training on making aquariums and bio-filters was provided to 25 participants. The trainees were provided all required inputs for preparing an aquarium, such as glass, silicone gel, plants, thermostats, filters, power head etc. A certificate was distributed to all the trainees for completing the training. The programme was coordinated by Dr Amit Pande, Dr Ritesh Tandel, Dr Pragyan Das and Dr R. S. Haldar.

Fig.: Training on Ornamental Fish Culture - at Mabong, West Sikkim

10.3 An awareness-cum-training programme

An awareness-cum-training programme on "High-value trout farming for Livelihood Security" was organised under North East Hill activity by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, in collaboration with the Department of Fisheries, Government of Sikkim at Karjee-Mangnam Gram Panchyat Bahwan (West Sikkim) on 7th March 2022. Sri Tendup Lepcha, Hon'ble Gram Panchayat Vice-President, Karjee village (West Sikkim), inaugurated the programme as the Chief Guest. An overview of trout farming and its benefits in improving the income of fish farmers was delivered. The farmers were provided piece of detailed information on trout farming, including site selection, construction of ponds, requirements of fresh flowing water, trout feed, seed, temperature requirements and water quality. Later, the Assistant Director of Fisheries presented detailed information on government schemes available under PMMSY for the benefit of the farmers. Dr Amit Pande and Dr R. S. Haldar coordinated the programme.

Fig. Training on "High-value trout farming for Livelihood Security" at Karji, West Sikkim

For DoNER aspirational villages of Lotsu and Renthan in district Wohka, Nagaland, two training programmes on "*Integrated Fish Farming as a Source of Income*" were organized on 4th June 2022 at Lotsu and 5th June 2022 at Renthan in district Wohka, Nagaland. 25 quintal of carp feed, 25 hand nets and 25 cast nets were distributed as input among the 25 farmers of each village namely Lotsu and Renthan adopted under this programme. The Department of Fisheries, Nagaland was also assisted in procuring five tons of trout feed to sustain their rainbow trout brood stock at Dzuleke, Kohima district. Dr R.S. Haldar and Dr Amit Pande coordinated the programme.

Fig.: Training on "Integrated fish farming as a source of income" and inputs provided to the adopted fish farmers at village Lotsu, Sanis Block, Wokha District, Nagaland

Fig. Integrated fish farming as a source of income was organised and inputs provided to the adopted fish farmers at village Renthan, Bhandari Block, Wokha District, Nagaland

Further, Dr Kishor Kunal, Scientist, ICAR-DCFR, and Dr R. S. Haldar, CTO visited Tongou village of Lungchong Meiphai (LM) Tehsil, District Ukhrul, in August 2022 to explore the feasibility of rainbow trout farming and establishment of rainbow trout hatchery/ raceways. The headwater source site (Altitude-1485 masl, Latitude-25.04376, Longitude-94.23317) had an atmospheric temperature of 25.1°C, and the source water was turbid. The headwater quality parameters were recorded as 18.4°C; pH-7.3; DO - 7.56 mgL^{-1}, CO_2 - 2.0 mgL^{-1}, total alkalinity-40 mgL^{-1} with a clear oil slick

floating over the surface. The residents informed them that the site was being used for the washing and cleaning of motor vehicles. The second site was about 300-400 m downstream of the headwater site (Altitude-1444 masl, Latitude-25.0455, Longitude-94.23508). The water quality parameters were: water temperature 19.1°C, pH-6.7, DO - 7.56mgL^{-1}, CO_2 - 2.0 mgL^{-1}, total alkalinity- 50.0mgL^{-1}, TDS- 76.0 mgL^{-1}, conductivity- 102.2 µs/cm, chloride-12.0 mgL^{-1}, total hardness – 36.0 mgL^{-1}, Nitrite (NO_2) -15.0 µgL^{-1}, ammonia- <0.02 mgL^{-1}, water flow- 600 LPM with the width of the stream about 3.5 ft that flows alongside the paddy fields where agrochemicals were being used. Moreover, as per the information collected from the residents, the rainy season stretches from March to May/June. July-August receives scanty rains in the region which was evident from the turbidity in the source water. The water flow rate can be considered maximum from April to July-August in the headwater. It can be expected to reduce further in the summer and winter months.

Fig. The headwater source, team analysing water quality and use of Agro-chemicals

10.4 Collaborative Network Project

A collaborative Network Project on "Species and stock validation of mahseer species of genus *Tor* and *Neolissochilus* from western and eastern Himalayan region of India for its propagation and conservation" was carried out with the Department of Aquatic Environment Management, College of Fisheries, Assam Agricultural University, Raha; Department of Fisheries & Biotechnology, St. Anthony's College, Shillong; Department of Zoology, Manipur University, Imphal (Manipur) and Department of Zoology, D.M. College of Science, Imphal (Manipur) under the financial assistance of ICAR-DCFR, Bhimtal. College of Fisheries, AAU Raha, completed bar coding employing PCR amplification and sequencing of the mitochondrial genes cytochrome oxidase (COI) from 10 samples of *Neolissocheilus* and three *Tor* species from Jiabharali River while three samples of *Neolissocheilus* and six *Tor* species from Tissa River. In Meghalaya, sampling was conducted from four rivers Umngi, Umran, Umngot and Myntang and morphometric and meristic data were recorded. PCR amplification and sequencing of (CO-I), cytochrome b (cyto b), ATPase 6 and ATPase 8 was carried out for mahseer samples from Umngi river and sequences submitted to NCBI GenBank. The Department of Zoology, DM College Manipur collected samples from the Brahmaputra and Chindwin Basin and recorded the morphological data. Nucleotide sequences of 16 ATPase6 and eight ATPase8 were deduced and submitted to GenBank. The Department of Zoology, Manipur University, collected samples from ten rivers of the Chindwin basin. 126 samples of different mahseer species were collected, PCRs of 88 samples were carried out, and accession numbers from 14 samples were obtained. The collaborating centers also participated in trainings on "Taxonomic identification of *Neolissocheilus* and *Tor* species" and DNA barcoding of mahseer and bioinformatics data analysis.

A National Consultation cum Review Meeting on Mahseer Network Project was held on 16th March 2022, presided by the Director ICAR-DCFR. During the consultation, a MOU was also signed between Manipur University and ICAR-DCFR.

Fig. National Consultation cum Review Meeting on Mahseer Network Project

Five days training program on Classical Freshwater Fish Taxonomy was organized at Manipur University, Imphal, during 16-20 August 2022, 24 participants attended the programme from different ICAR institutes, Universities, and colleges of the country.

Fig. Training program on 'Classical Fresh Water Fish Taxonomy'at Manipur University, Imphal

Media coverage of the activities

মাশীর নেতৃত্বাধীন প্রোজেক্টকী মতাঙদা নেসনেল কন্সলতেতিব কম রিভিউ মীতিং পাঙথোকখ্রে

TRAINING AND INPUT DISTRIBUTION CONDUCTED AT LOTHU AND HEATH ASVILLAGES

EASTERN MIRROR

Training for fish farmers held in Nalbari

THE MORUNG EXPRESS

Appreciation:

STATUS REPORT ON TROUT CULTURE AT WEST KAMENG AND TAWANG DISTRICT, ARUNACHAL PRADESH

11. Scheduled Caste Sub Plan (SCSP)

The scheduled Caste Sub Plan (SCSP) programme was implemented to create rural livelihood and socio-economic improvement among scheduled caste populations in different hill states. A cluster approach was applied for the implementation of need-felt scientific interventions. The programme was conducted in 11 different clusters covering the activities for benchmark survey, renovation of fish ponds, inputs distribution, proper water supply, hands-on training and literature distribution. The major scientific intervention has been done for stocking suitable sized quality seed, appropriate feeding, health care, value addition and water quality monitoring to achieve the optimum fish production. As per the three-pronged aquaculture system in hill states, polyculture of exotic carp in mid-hill regions and rainbow trout farming at higher altitudes have been adopted for different clusters according to the resource availability and location. However, ornamental fishery and fish-based tourism was also adopted for entrepreneurship development. Technical detail of each cluster is given below:

Cluster-1: Integrated carp farming in polytanks at village Dadim near Nathuakhan, Uttarakhand

A benchmark survey was conducted to collect basic information from 25 farmers, and three awareness-cum-training programmes were conducted for the selected fish farmers. It was the first initiative on fish farming in this cluster. The polytanks constructed by ICAR-VPKAS, Almora, were available with a few farmers for irrigation cum fish farming. Under this programme, farmers were provided with silpauline for pond lining, PVC pipe for water supply in the pond, advanced fingerlings, weighing balance, carp feed, fish harvesting nets and therapeutic medicines. Advanced fingerlings of exotic carp (Grass carp, silver carp and common carp) in species composition of 30SC/40GC/30CC were stocked after proper pond preparation. All demonstrations were integrated with vegetable production. The major technical interventions were stocking with advanced fingerlings in proper species composition, appropriate supplementary feeding and regular health care with a target to achieve optimum production and better income with integrated fish farming. Water quality, additional azolla feeding to grass carp, and data recording for growth and yield were regularly monitored.

Fig.: Training and demonstration at Dadim village

Cluster-2: Integrated carp farming in poly-tanks at the Champawat district of Uttarakhand

A benchmark survey was conducted, and 30 fish farmers from Champawat and Pati blocks were selected for the demonstrations of fish farming. All farmers have polytanks, and they

practice polyculture of exotic carp. However, they are getting 20-30 kg/100m² fish production. Under the programme, two awareness-cum-trainings were conducted for the fish farmers. They were provided information on stocking of advanced fingerlings, proper feeding, pond water management and health care. The major technical intervention was the proper feeding and water quality management. Farmers were given carp feed, fish harvesting nets and therapeutic medicines to the 30 selected farmers. Water quality, additional azolla feeding to grass carp, and data recording for growth and yield were regularly monitored.

Fig: Training and demonstration at Champawat

Cluster-3: Carp farming and value addition at Harinagar and Berijala village, Uttarakhand

Basic information was collected on intercultural activities, fish production and income from fish farming from 32 practising fish farmers. Awareness and initiative of fish farming was carried out by ICAR-DCFR during the previous year. All farmers have polytanks and achieve 15-30 kg/100m² fish production with carp farming. Five awareness-cum-training programmes were conducted for the selected fish farmers. The major technical intervention focused on stocking of advanced fingerlings in proper species composition, appropriate supplementary feeding and value addition with the target of achieving optimum production and better income with carp farming. Farmers were provided with silpauline for pond lining, PVC pipe for sufficient water supply in the polytanks, advanced fingerlings for stocking, weighing balance for proper feeding, balanced carp feed, fish harvesting nets and therapeutic medicines. Advanced fingerlings of exotic carp (Grass carp, silver carp and common carp) in species composition of 30SC/40GC/30CC were stocked after the harvesting of previous fish crops & proper pond preparation. Some of the demonstrations were integrated with vegetable production. Water quality monitoring, additional azolla feeding to grass carp, and data recording for growth and yield was monitored. Some farmers were supported for the rearing of brood stock for breeding and fingerlings production of grass carp and common carp.

Fig: Training & demonstration at Harinagar and Berijala village

Cluster-4: Fish farming at Pauri Garhwal district of Uttarakhand

In Pauri Garhwal district, 21 fish farmers were selected for the proper feeding demonstrations. All farmers have fish ponds and are in the practice of Pungasius culture. Conducted one-awareness-cum training programme for the fish farmers and provided information on proper feeding and pond water management. The major technical intervention was the proper feeding and water quality management. Fish feed and proper feeding procedures, fish harvesting nets and therapeutic medicines were provided to the 21 selected farmers. Data was recorded to monitor growth and yield.

Cluster-5: Carp farming at Rudra Prayag district of Uttarakhand

In the Rudra Prayag district, 20 fish farmers were selected for the proper feeding demonstrations. All farmers have fish ponds, and are practicing polyculture of exotic carp. An awareness-cum-training programme for the fish farmers was conducted that provided information on proper feeding and carp-rearing intercultural activities. Fish feed and proper feeding procedure, fish harvesting nets and therapeutic medicines were provided to the 20 selected farmers. Growth and yield data were regularly monitored.

Cluster-6: Rainbow trout culture at Uttarkashi district of Uttarakhand

Jagdumba Mata Matsya Jivi Utpadan cooperative society Khaladi, Uttarkashi was approached and 11 trout growers were selected for the feeding demonstrations. All farmers have trout raceways, and are practicing rainbow trout farming. An awareness-cum-training programme was conducted for the farmers to provide information on proper feed and feeding of rainbow trout along with intercultural activities. The technical intervention focused on proper feeding and water quality management for optimum production. Trout feed, fishing nets, hand nets and therapeutic medicines were provided to the 11 selected farmers of the society. A vertical trout egg incubator, trough and trays were also provided to the society for trout seed rearing. Data on growth and yield is being recorded regularly.

Cluster-7: Rainbow trout culture at Chamoli district of Uttarakhand

Himalayan trout Machhali Palak cooperative society, Urgam, Chamoli was approached and 11 trout growers were selected for the proper feeding demonstrations. The farmers have their own trout raceways and are farming rainbow trout. Conducted one awareness-cum-training programme for the farmers and provided information on proper feed and feeding to rainbow trout along with pond water quality management. The technical intervention was focused on the proper feeding and water quality management for optimum rainbow trout production. Trout feed, rainbow trout seed, wader, hand nets and therapeutic medicines were provided to the 11 selected farmers of the society. A vertical trout egg incubator, trough and trays were also provided to the society for trout seed rearing. Data on growth and yield were regularly monitored. Farmers are being supported for rearing brood stock to make the cluster efficient for trout breeding and seed rearing.

Fig.:Distribution of trout feed to the trout growers of Urgam village

Cluster-8: Rainbow trout culture at Pithoragarh district of Uttarakhand

Sixteen trout raceways were selected for rainbow trout culture demonstrations as the farmers had district plan-supported trout raceways. An awareness-cum-training programme was conducted for the farmers and information was disseminated on intercultural activities for rainbow trout farming. Rainbow trout seed, trout feed, wader, hand nets and therapeutic medicines were also provided to the farmers. Records of water quality, growth and yield are being regularly maintained. Two farmers are being supported for the rearing brood stock.

Fig.: Rainbow trout seed for the farmers of Pithoragarh

Cluster-9: Entrepreneurship with fish farming in Nainital district of Uttarakhand

The district fisheries department was approached and six trout growers were selected for the rainbow trout culture demonstrations besides four carp farmers. These farmers had district plan-supported trout raceways and ponds. Three awareness-cum-training programmes were conducted for the farmers and information on intensive rainbow trout farming and carp culture was provided. The fish farmers were provided rainbow trout seed, trout feed, weighing balance, wader, hand nets, carp fingerlings, silpauline, PVC pipe and therapeutic medicines. Records of water quality, growth and yield are being regularly maintained. All farmers are being supported for the rearing of brood stock.

Fig.: Trout and carp farmers of Nainital district

Cluster-10: Rainbow trout culture at Kullu Manali district of Himachal Pradesh

With the help of the State Fisheries Department, 15 trout growers were selected for the proper feeding demonstrations. All farmers had trout raceways, were practicing rainbow trout culture. The technical intervention focused on proper feed and feeding and water quality management to obtain an optimum trout production. The selected farmers of the area were provided trout feed and therapeutic medicines. Records of water quality, growth and yield are being regularly maintained.

Cluster-11: Entrepreneurship with ornamental fish farming and aquarium making

Conducted two awareness-cum-training programmes in Uttarakhand for the farmers and provided information on ornamental fish culture. One training programme was conducted in collaboration with Manipur University, Imphal, on entrepreneurship development through ornamental fish culture and aquarium making. Inputs such as ornamental fishes, glass aquaria and therapeutic medicines were provided to the farmers.

Fig.: Training on entrepreneurship development in Manipur

Creation of carp and rainbow trout seed rearing facility

A polyhouse covered carp seed rearing pond of 5x 20 m with the capacity of rearing 1.0 lakh fingerlings rearing was created for the seed supply to SC fish farmers regularly. A flow through-eyed ova incubation unit and vertical egg incubator was established with a capacity to produce 2.0 lakh rainbow trout fry. A portable carp hatchery was established to breed exotic & minor carp for the supply of seed to the SC fish farmers. An ornamental fish breeding and seed rearing unit was established with FRP tanks with a capacity of 1.0 lakh seed rearing.

Fig.: Fish seed rearing facility for SC fish farmers

(a) Awareness and training programmes conducted

Sl. No.	Programme	Location	Number of participants
1.	Awareness cum training programme for one day (11)	Harinagar, Berijala, Dadim, Champawat, Rudra Prayag, Urgam, Pithoragarh, Bhimtal, Ramgarh	162
2.	Skill training programme for two days (2)	Imphal, Bhimtal	45
3.	Skill training programme for three days or more (2)	Bhimtal, Harinagar	46
3.	Farm advisory/ site visits (21)	Harinagar, Berijala, Dadim, Champawat, Ghati gad, Chakbaheri, Surakhal Jhutiya, Vinayak, Ramgarh	64

(b) Distribution of inputs to the SC fish farmers

Sl. No.	Item (s)	Quantity	Number of beneficiaries
1.	**Fish seed**		
	Rainbow trout fingerlings	92000	102
	Rainbow trout eyed ova	1.0 lakh	
	Fingerlings of exotic carp	30000	120
	Ornamental (Koi & gold fish)	6000	120
2.	**Fish feed**		
	Rainbow trout feed	4 tonnes	102
	Carp feed	13 tonnes	120
3.	Water supply pipe	3000 m	24
3.	Netting material	190	190
3.	Wader	20	20
4.	Vertical incubator	4	120
5.	$KMnO_4$ & Chloromin-T	5 kg & 1 kg	120
6.	Silpauline for pond lining (200 GSM)	16	30
8.	Weighing balance(10kg)	40	40
8.	Literature Booklet on fish farming	500	500

Fig. Distribution of water supply pipe, silpauline & weighing balance

Fig. Distribution of fish feed

Fig.: Distribution of fish seed

Activites at village Uragam, Uttarakhand

A cluster of 10 trout growers has been supported through large rainbow trout seed stocking and regular input supply under SCSP.

Fig. A cluster SC village at Urgam, Joshimath, Chamoli adopted under SCSP programe (The trout raceways and trout harvest)

Activities under SCSP at Experimental Field Centre, Champawat

- Fish Seed and Feed Distribution Programme" under Scheduled Caste Sub Plan (SCSP) was organised at Experimental Fish Farm, Champawat. Total number of 07 farmers participated from various villages of Champawat such as Mudiyani, Bajarikot, Narsinghdanda, in the end seeds of carps fishes were distributed to each farmer present in programme. The programme was organised in presence of the Dr N.N. Pandey, PS, Dr Suresh Chandra, PS, Dr Kishor Kunal, Scientist of ICAR-DCFR. (06.02.2022)

- "Farmer training and Farm Demonstration" under Scheduled Caste Sub Plan (SCSP) was organised by ICAR-DCFR, Experimental Fish Farm, Champawat at Bajarikot Village of Champawat District. Total number of 30 farmers participated in the programme. (21.12.2022)

Fig. Farmer training under SCSP conducted at Champawat

12. Training and Capacity Building

12.1 Training on Re-circulating Aquaculture System (RAS) based rainbow trout hatchery and nursery management in high altitude'

On 5th March 2022, a training-cum-demonstration programme on 'Recirculating Aquaculture System (RAS) based rainbow trout hatchery and nursery management in high altitude' was organised by ICAR-DCFR at Mr. Zabir Ahmad's farm, in collaboration with the Department of Fisheries, Leh. During the training, DCFR scientists gave a demonstration of the RAS hatchery-nursery facility and explained critical aspects of hatchery/farm operation, feed management, water quality monitoring, record-keeping and health management to the 25 participants. The Secretary, ASH & Fisheries, Mr. Ravinder Kumar (IAS) graced the occasion as the Chief Guest, distributed DCFR's water quality testing kits and record keeping notebooks to farmers and appreciated the continuous efforts of DCFR. Along with the Secretary, Dr Stanzin Thakchos (OSD to Secy., ASH & Fisheries), Mr. Md. Amin Lone (ADF, Leh), fisheries department officials and fish farmers participated in the training.

Fig. Training-cum-demonstration programme on 'Recirculating Aquaculture System (RAS) based rainbow trout hatchery and nursery management

12.2 Hands-on training on "DNA barcoding of mahseer and bioinformatics analysis of data

Hands-on training on "DNA barcoding of mahseer and bioinformatics analysis of data" was organised during 20–28th May, 2022 under the network project on Mahseer to provide and disseminate knowledge and skill to the faculties and young professions working under the network project. Hands on training on molecular techniques like DNA isolation, estimation and PCR, sequence analysis and submissions of mitochondrial genes of the collected specimens, bioinformatics and biostatistics analysis were provided to the trainees. 20 participants attended the training and successfully learnt different molecular techniques during this training.

Fig. Training attended by the young professionals and delegates

12.3 Three days of "Hands-on training on Re-circulating Aquaculture System for Intensive Farming of Coldwater Fish"

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, conducted three days hands-on training on "Recirculating aquaculture system for intensive farming of coldwater fish" from 1-3rd August 2022. The training was attended by 17 trainee/participants, including farmers, entrepreneurs, aquaculture/fisheries start-ups, and marketing executes. The training program included a lecture and practical demonstration of all the aspects of RAS. Dr Rajesh M. (Scientist) delivered the lecture on "Recirculating Aquaculture System: Concept, Design and Components, Water quality monitoring in Recirculating Aquaculture Systems: theory and estimation, Bio-planning, product quality management and techno-commercial feasibility of RAS" and practical demonstration of different RAS models of the Directorate. Mr. Anupam Pandey and Ms. Nahida Rashid (Research Scholar) conducted the practical demonstration of various water quality assays required for fish farming in RAS. Dr. Ritesh Shantilal Tandel (Scientist) delivered a lecture on "Disease management in RAS", and Dr Biju Sam Kamalam (Scientist) deliberated on the topic "Standard operating procedures and risk management in RAS". A special lecture was also organised on the topic of "Feed management in RAS" by Prof. Sadasivam Kaushik, (Founder Director of Research, Laboratory of Nutrition, INRA, France and European Research Area Chair of ULPGC, Spain). Three days of training ended with the valedictory session, where the participant's feedback was received, and the certificates were distributed to participants by Dr Amit Pande (Principal Scientist), who presided over the session. The training generated revenue of Rs. 50150/-. The training was coordinated by Dr Rajesh M and co-cordinated by Dr Debajit Sarma, Dr R.S. Patiyal and Dr Biju Sam Kamalam.

Fig. Participants of 'Hands-on training on Recirculating Aquaculture System'

12.4 IUCN workshop organized

ICAR-DCFR organized five days workshop on "Assessment of IUCN threat status and distribution of the fishes of Eastern Himalayan Freshwater Biodiversity Hotspot and Western Himalayan of India" from 5th to 9th Sept. 2022, in collaboration with Manipur University at Dept. of Zoology, Manipur University, Manipur.

12.5 Re-circulating Aquaculture System (RAS) training for Jharkhand farmers

The Directorate of Fisheries, Jharkhand, organised a three days training for the farmers and entrepreneurs of the state who are presently doing or planning to start fish farming in RAS, during 13-15th September 2022, at the Fish Farmers Training Centre, Ranchi. The training was attended by 50 keen participants and PMMSY scheme beneficiaries. ICAR-DCFR scientists, Dr Rajesh, M. and Dr. Biju Sam Kamalam were invited to serve as the resource persons for this training. Theoretical and practical aspects of RAS principle, design, components, standard operating procedures, feed and risk management, water quality monitoring, bio-planning, product quality management and techno-commercial feasibility were covered in this training. A field exposure visit was also organised for the participants, where the resource persons showed the functionalities, standard protocol and operational challenges in RAS.

Fig. RAS training and field exposure visit at Ranchi, Jharkhand

12.6 Hands-on-training on hatchery management and seed production of golden mahseer

ICAR-DCFR, Bhimtal organized a three-day training programme on "Hands-on-training on hatchery management and seed production of golden mahseer" during 29th September-01st October, 2022. State Fisheries Department officials, entrepreneurs and students attended the training, which was coordinated by Dr M.S. Akhtar (Course Director), Dr Ciji Alexander, and Dr Renu Jethi (Co-course Directors). There were both theoretical sessions and practical demonstrations about the various aspects of golden mahseer seed production, such as captive maturation and breeding, hatchery management, water quality analysis, fabrication of bio-filters, brood-stock nutrition, larval nutrition and nursery rearing, etc. The training concluded with distribution of certificates to the participants by the Director.

Fig. Demonstration of mahseer seed rearing to participants

12.7 Five days of hands-on training on "Recirculating Aquaculture System for Intensive Farming of Fish"

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, conducted five days hands-on training on "Re-circulating Aquaculture System for Intensive Farming of Fish" from 5-9th December 2022. Twenty trainees attended the training, including state fisheries department officials, farmers, entrepreneurs, aquaculture /fisheries start-ups, and marketing executes. The training program included a lecture and practical demonstration of all the aspects of RAS. Dr Rajesh M. (Scientist) delivered the lecture on "Recirculating Aquaculture System: Concept, Design and Components, Water quality monitoring in Recirculating Aquaculture Systems: theory and estimation, Bio-planning, product quality management and techno-commercial feasibility of RAS, water flow and biofilter design and practical demonstration of different RAS models of the Directorate. Ms Nahida Rashid and Mr Junaid (Research Scholar) conducted the practical demonstration of various water quality assays required for fish farming in RAS. Dr Renu Jethi (Senior Scientist) delivered a lecture on " Support from the state, central government, NABARD, NFDB, NCDB for fisheries and aquaculture development ", and Dr Biju Sam Kamalam (Scientist) deliberated on the topic "Standard operating procedures and risk management in RAS and Rainbow trout: biology, nutrition, breeding seed production and culture". Two guest lectures were also organised on the topic of "Feed for Recirculating Aquaculture System: Feeding the fish or System? and "Importance of RAS in sustainable fish production: a global perspective" by Dr Arjen Roem (Strategic Marketing Director, Skretting) and Dr Antony Jesu Prabhu Philip (Scientist, Institute of Marine Research, Bergen, Norway), respectively. On the fourth day, Dr Suresh Chandra (Principal Scientist) deliberated on the "Disease management aspect of RAS". A

guest lecture on "Biofloc for Commercial Fish and Shellfish Production" was delivered by the subject expert Dr Aksaya Panigrahi (Principal Scientist, ICAR-CIBA, Chennai), for the benefit of participants. Five days of training ended with the valedictory session, where the participant's feedback was received, and the certificates were distributed to participants by the Director, Dr Pramod Kumar Pandey Director, who presided over the session. Further, individual project-specific suggestions were provided for the issues faced by the participants through individual consultation. The training generated revenue of Rs. 70000/-. The training was coordinated by Dr Rajesh M (Course Director) and co-coordinated by Dr Biju Sam Kamlam (Course Co-director), Dr Renu Jethi (Course Co-director), Dr Debajit Sarma (Course Co-director) and Dr R. S. Patiyal (Course Co-director).

Fig. Participants of training programme on 'Recirculating Aquaculture System for Intensive Farming of Fish'

12.8 Other Trainings / Capacity building programme/ Webinars conducted

- An Online training programme on "Understanding the classical taxonomy of mahseer was organized on 1st February, 2022.

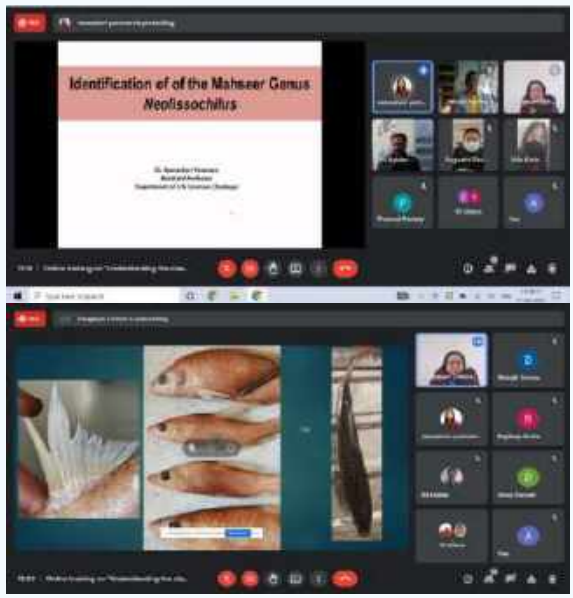

Fig. Virtual training programme on Understanding the classical taxonomy of mahseer

- M.S. Akhtar acted as convener for organizing an online 21-days national refresher course on 'Recent Technologies of Livestock-based Integrated Farming Systems for Doubling Farmer's Income' jointly organized by Birsa Agricultural University, Ranchi, ICAR-NAHEP and NADCL, Baramulla during 1 to 21 February, 2022.
- M.S. Akhtar acted as resource person and delivered an online lecture online on "Captive maturation and multiple breeding of golden mahseer: A journey of technology development and commercialization" on 13th May, 2022 during the 21-days National Refresher Course on 'Fisheries, Aquaculture and Post-harvest Technology' jointly organized by ICAR-CIFT, Kochi, SKUAST-Kashmir and NADCL, Baramulla.
- M.S. Akhtar and R. S. Patiyal organized, in collaboration with Nainital District Administration, a participatory awareness and ranching programme of golden mahseer in Nainital lake, Nainital on 23rd July, 2022.
- N. N. Pandey coordinated meeting of Institute Research Committee as member secretary during 24-25th May, 2022.
- P. Dash co-coordinated a training programme on "Culture of ornamental fish for livelihood security" at Mabong, West Sikkim during 4-5 Mar, 2022

- S. Chandra as programme coordinator organized three days Integrated Farming System- Exposure Visit for trout farming and propagation to the official of the Department of horticulture and Fisheries of Nilgiris District, Tamilnadu under the Special Area development Programme (SADP) -During 13th July, 2022- 15th July, 2022
- S. Chandra organized Workshop on Natural Farming cum Kisan Mela on 23 March, 2022 as the Programme Coordinator. 136 fish farmers attended the workshop.(VideNo.4-4(105)/ 2018/DC dated 02.03.3022)
- Renu Jethi co-coordinated training programme on "Hatchery management and seed production of golden mahseer from 29th September to 1st October, 2022 at ICAR-DCFR, Bhimtal.
- Renu Jethi co-coordinated training programme on "Hands-on training on "Recirculating Aquaculture System for Intensive Farming of Fish" from 5-9th December 2022.

12.9 Lectures/Talks delivered

- Amit Pande delivered a lead lecture on "Status of Viral diseases in Coldwater Fisheries Sector" at in XXX Annual convention cum International Conference on "Emerging and Re-emerging Viral Infections Impacting Humans, Animals, Plants, Fish and Environment" VIROCON-2022 on 05th November, 2022 held at Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-K), Srinagar.
- Amit Pande delivered an expert lecture on "Coldwater Fish Viral Diseases and their Management" during a virtual regional Capacity Building Program on "Application of Biotechnological Tools for Management of Aquatic Genetic Resource Management and Ex situ Conservation" organized by ICAR-NBFGR in collaboration with the Asia-Pacific Association of Agricultural Research Institutions (APAARI) on 19th Jan 2022.
- Amit Pande, presented a paper on "Development of a cell line from rainbow trout heart" during the National Symposium on Fisheries and Aquaculture for Livelihood and Nutritional Security, Held on 18-19th Nov 2022.
- B.S. Kamalam delivered a lecture and demonstration on 'Standard operating procedures and risk management in RAS' to the participants of the ICAR-DCFR training programme on Recirculating Aquaculture System for intensive farming of coldwater fish, at Bhimtal, during 1-3 August 2022.
- B.S. Kamalam delivered a lecture on 'Impacts of climate change on rainbow trout farming in India' and conducted the 'Farmer-scientist initiative practical session on basic water quality monitoring' during the NICRA workshop on Climate resilient rainbow trout farming, organized by ICAR-DCFR at Bhimtal, during 10-11 October 2022.
- B.S. Kamalam delivered a lecture on 'Mahseer broodstock management and nutrition' to the participants of the ICAR-DCFR training programme on Seed production and hatchery management of golden mahseer, at Bhimtal, on 30 September 2022.
- B.S. Kamalam delivered a talk on 'A glimpse of fisheries science and research in India' for the students of Woodbridge School, during 31 May and 1 June 2022.
- B.S. Kamalam delivered a talk on 'Best feed management practices and record keeping in rainbow trout farms and hatcheries' for tribal farmers during the ICAR-DCFR TSP training program organised in Leh and Kargil, Ladakh, during 5-6 March 2022.
- B.S. Kamalam delivered a talk on 'Feed management in rainbow trout farming' to the horticulture and fisheries department officials of Nilgiris district, Tamil Nadu, during exposure visit to ICAR-DCFR Bhimtal under the SADP programme, 13-15 July 2022.
- B.S. Kamalam delivered an invited lecture on 'Role of brooder and larval nutrition in improving rainbow trout production', during the NFDB sponsored webinar on 'Larval rearing and broodstock management of rainbow trout' organized

by Faculty of Fisheries, SKUAST, Jammu & Kashmir, on 31 March 2022.

- B.S. Kamalam delivered an invited lecture on 'Standard operating procedures and feed management in RAS' for Jharkhand fish farmers, during the RAS training programme organized by Directorate of Fisheries, at Ranchi, 13-15 September 2022.
- B.S. Kamalam delivered an invited lecture on 'Understanding the standard operating protocols of RAS and trouble-shooting', during the 6-days national webinar on "Aquapreneurship through recirculating aquaculture system" organized by College of Fisheries, CAU, Tripura (under IDP-NAHEP), on 20 January 2022.
- B.S. Kamalam delivered an invited talk on 'Fish feed production technology and economics' during the training programme on Fish feed business by FFPO, organized by National Cooperative Development Corporation, at Bhimtal, on 28 September 2022.
- B.S. Kamalam delivered the lead presentation on 'ICAR-DCFR's rainbow trout feed research and development', during the field demonstration cum feed workshop organized by ICAR-DCFR at Anantnag, Jammu & Kashmir, on 6 August 2022.
- B.S. Kamalam delivered two lectures on 'Standard operating procedures and feed management in RAS' and 'Rainbow trout farming - an overview' to the participants of the ICAR-DCFR training programme on Recirculating Aquaculture System for intensive farming of coldwater fish, at Bhimtal, during 5-9 December 2022.
- Dr Suresh Chandra gave a talk on prevention and control of coldwater fish diseases to M. Sc. students of D. S. College, Dept of Zoology, Aligarh, UP on 12.04.2022.
- Dr Suresh Chandra delivered a Talk on Fish farming in Himalayan Region on 24th April 2022 in the programme National Campaign on Annadata Devo Bhav under the Amrut Mahoutsav Celebration.
- Dr Suresh Chandra delivered an invited lecture on pricing branding and marketing of fish feed on 28.09.2022 in the NSDC organized training for the fish farmers of Uttarakhand.
- Dr Suresh Chandra gave a talk on coldwater fisheries to the B.Sc students of Khalasa College, Unveristy of Delhi on 15th July, 2022.
- Dr Kishor Kunal delivered a lecture on "Avenues and Opportunities in Rainbow Trout Farming" to the farmers and entrepreneurs in the training programme organized by Office of the District Fisheries Incharge, Champawat, on 13.09.2022 at Vikas Bhawan, Champawat.
- Dr Kishor Kunal delivered lecture on "Advances in breeding and seed production of rainbow trout" during one day national workshop on 'larval rearing and broodstock management by College of Fisheries Science, SKUAST-K, Shalimar, Jammu & Kashmir on 31st March 2022.
- Ganie P.A., delivered lecture on "Application of GIS in Fisheries" to the training participants of Department of Horticulture and Fisheries of Nilgiris, Tamil Nadu under the Special Area Development Programme-Integrated Farming system exposure visit for Trout farming and Propagation on 13th July 2022.
- M.S. Akhtar delivered a lecture on "Captive breeding technology of golden mahseer and hatchery management" to the trainees undergoing *Hands-on Training on Seed Production and Hatchery Management of Golden Mahseer* during 29 September to 01 October, 2022.
- M.S. Akhtar held practical demonstrations on golden mahseer breeding and seed production techniques, including larval feeding management and nursery rearing for the trainees undergoing *Hands-on Training on Seed Production and Hatchery Management of Golden Mahseer* during 29 September to 1st October, 2022.
- Ms. Garima delivered a lecture on "Conservation of aquatic ecosystem" to the farmers, entrepreneurs and other stakeholders in the training programme organized by Office of the District Fisheries Incharge, Champawat, on 29th November 2022 at Narsingh Danda, Champawat.
- Ms. Garima Delivered a lecture on

"Livelihood generation through value added fish and fishery products" to the farmers and entrepreneurs in the training programme organized by Office of the District Fisheries Incharge, Champawat, on 13.09.2022 at Vikas Bhawan, Champawat.

- Ms. Garima Delivered a lecture on "Significance of biodiversity" to the farmers, entrepreneurs and other stakeholders in the training programme organized by Office of the District Fisheries Incharge, Champawat, on 30.11.2022 at Reetha Sahib, Champawat.
- Ms. Garima, Delivered a lecture and participated as resource person in the third phase of Vigyan Jyoti (DST, GOI) orientation programme at JNV, Champawat on 29.08.2022.
- NN. Pandey organized a lecture on Food and Nutritional security by Waterman of India & Magsaysay awardees, Dr Rajendra Singh, a national environmentalist during celebration of National Campaign on "Annadata Devo Bhava" at ICAR-DCFR, Bhimtal on 23rd April, 2022.
- P. Dash Delivered three lectures and one practical demonstration on Breeding and seed production of important ornamental fish, Feed preparation and aquarium management, and Aquarium and under-gravel filter fabrication in training programme of Culture of ornamental fish for livelihood security from 04-05 February, 2022 at Mabong, Sikkim.

12.10 Student Guided

- Anupam Pandey, a PhD student from Kumaon University under the supervision of Dr D. Sarma, Dr B. S. Kamalam and Dr M. S. Akhtar submitted his thesis entitled 'Molecular and phenotypic investigation of thermal adaptation in a coldwater fish, rainbow trout (*Oncorhynchus mykiss*)'.
- M. Junaid Sidique is pursuing his PhD from ICAR-Central Institute of Fisheries Education, Mumbai under the supervision of Dr M. S. Akhtar, Dr Ciji Alexander, and Dr P. K. Pandey on the topic 'Studies on the phenotypic, physiological and molecular signatures in the Himalayan golden mahseer, *Tor putitora* under UV light exposure.
- Mr. Sivaramakrishnan, T., completed his PhD research at ICAR-Central Institute of Brackishwater Aquaculture under the co-supervision of Dr B.S. Kamalam, on the topic 'Elucidation of critical larval nutritional elements for the production of robust milkfish fry'; registered at Tamil Nadu Dr J. Jayalalitha Fisheries University, Chennai.
- Ms. Amarjeet Kaur, from Dept. of Zoology & Environmental Science, Punjabi University, Patiala, Punjab is pursuing her PhD thesis work under the co-supervision of Dr S. Ali, on the topic "A study on transcriptome profiling and evaluation of differentially expressed genes related to thermal stress in golden mahseer (*Tor putitora*)".
- Ms. Arzoo Khan, from College of Fisheries, GBPUA&T, Pantnagar pursuing her M. F. Sc. dissertation under the co-supervision of Dr S. Ali, on the topic "A study on molecular responses of hypoxia exposure in golden mahseer, *Tor putitora* (Hamilton, 1822)".
- Ms. Bhawna Gehlot is pursuing her PhD research at ICAR-DCFR under the supervision of Dr S. Chandra, Dr B.S. Kamalam and Dr Rajesh, M., on the topic 'Investigation on the comparative physiology and behaviour of coldwater Himalayan cyprinid fishes'; registered at Delhi University, New Delhi.
- Ms. Deepika Kotlia from Department of Biotechnology, Kumaun University completed her dissertation for M.Sc. in Biotechnology under the guidance of Dr Kh. Victoria Chanu on topic "Development of an easy protocol for isolation of genomic

DNA from *Saprolegnia*".

- Ms. Diksha Arya, student from GBPUAT, Pantnagar PhD under the guidance of Dr N. N. Pandey.
- Ms. Kanika Pathak from Department of Biotechnology, Kumaun University completed her dissertation for M.Sc. in Microbiology under the guidance of Dr Kh. Victoria Chanu on topic "Isolation, identification and anti-Saprolegnia activity of *Pseudomonas fluorescens*".
- Ms. Mayuri Nag completed a graduate exposure project at ICAR-DCFR under the supervision of Dr B.S. Kamalam, on the topic 'Taxonomic identification of *Triplophysa* and *Gammarus* specimens from high altitude saline lake Pangong Tso in Ladakh'.
- Ms. Nahida Rasheed is pursuing her PhD research at ICAR-DCFR under the supervision of Dr B.S. Kamalam and Dr N. N. Pandey, on the topic 'Study on the interactional effects of low fish meal diet and rearing environment in rainbow trout, *Oncorhynchus mykiss*'; registered at ICAR-Central Institute of Fisheries Education, Mumbai.
- Ms. Pratiksha Karki from Department of Biotechnology, Kumaon University completed her dissertation (M.Sc.-Biotechnology) under the supervision of Dr D. Thakuria on topic "Characterization of aerolysin gene of *Aeromonas hydrophila* isolated from rainbow trout".
- Ms. Toshiba, student from Kumaon University, Nainital pursuing PhD under the guidance of Dr N. N. Pandey.
- Priyanka H. Tripathi a PhD student from Kumaon University under the supervision of Dr M. S. Akhtar and Dr Ciji Alexander has submitted her PhD thesis entitled 'Molecular investigation of selected immune and reproductive genes in golden mahseer, *Tor putitora* during ontogeny and in response to dietary β-glucan.

13. Events and Meetings

13.1 Republic Day celebration

The 73rd Republic Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate. Dr Parmod Kumar Pandey, Director, ICAR-DCFR unfurled the National Flag and saluted the patriots who fought for our freedom besides the importance of 26th January. In his address to the staff of DCFR, he laid stress upon working in harmony and putting up the best for the progress of the organization and the country. Likewise, the Republic Day was celebrated at Experimental Fish Farm, Champawat with great fervour. Mr Kishor Kunal, Scientist and Officer Incharge, EFF, hoisted the National Flag. Scientists and staff of the centre also expressed their pride for being the part of such a glorious occasion.

Fig. Republic Day celebration at ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat

13.2 Research Advisory Committee (RAC) meeting

The institues RAC was held on 21-22nd March, 2022 under the Chairmanship of Dr W.S. Lakra, Former Director and Vice-Chancellor ICAR-CIFE, Mumbai. The meeting was attended by other RAC members Dr B.P. Mohanty, ADG (I.Fy), ICAR; Dr.V.R. Chitranshi, Former ADG (I.Fy) ICAR; Dr K.M. Shankar, Former Dean, College of Fisheries, Mangalore; Dr Y. Bassavaraju, Professor & Head, Fisheries Research & Information Centre, Bhutanal, Bijapur, Karnataka, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, and Dr S. Chandra, member secretary, ICAR-DCFR. The Chairman, RAC appreciated the work and progress made by the Directorate and urged the scientist to work towards making the DCFR an 'International Knowledge Center' for coldwater fisheries. The progress of on-going and externally funded projects presented by respective scientist was reviewed by the RAC and suggestions were made for any improvement or course correction.

Fig. Research Advisory Committee meeting at ICAR-DCFR

13.3 Workshop on Natural farming cum Kisan Mela

The ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised an orientation workshop on Natural farming cum Kisan Mela on 23rd March 2022. Dr Pramod Kumar Pandey, Director, ICAR-DCFR, highlighted the importance of natural fish farming. The Chief Guest of the programme, Dr W.S. Lakra, former Director & Vice-Chancellor, ICAR-CIFE, Mumbai, underlined the importance of integrated fish farming and value addition technology for doubling the farmer's income. Dr Lakshmikant, Director ICAR-VPKAS expressed concern over groundwater depletion and suggested use of Polyethylene lined ponds for storage of water and fish culture in hilly regions. The eminent aquaculture scientists and former Deans of the College of Fisheries, Mangalore, Prof. K.M. Shankar and Prof. Y. Bassavaraju gave their remarks on natural fish farming and highlighted the importance of endemic fish species for diversification of hill aquaculture. Several fish farmers of the Kumaon region shared their success stories and highlighted the profitability of the venture. On the occasion, critical farms input such as fish feed and fingerlings of different species were distributed among the farmers. The event witnessed a gathering of 186 participants, including 136 fish farmers, officials, scientists, entrepreneurs, and stake holders. The event ended with formal vote of thanks.

13.4 National Campaign on Annadata Devo Bhava and Kisan Mela

The ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised a National Campaign on Annadata Devo Bhava on 23-24th April, 2022 to commemorate 75 years of India's independence being observed as Azadi Ka Amrut Mahotsav. Dr Rajendra Singh, an Indian water conservationist and environmentalist known as the "Waterman of India," graced the occasion as chief guest underlined the importance of natural farming and indigenous technical knowledge for sustainable development. He expressed concern over groundwater depletion and remarked that water is the elixir of life and necessary efforts should be made to conserve rivers and natural water bodies. Prof. Rajive Mohan Pant, Vice-Chancellor, Assam University, Silchar, urged the farmers to take up the integrated fish farming and value addition technology to double their income. Dr Pramod Kumar Pandey, Director,

ICAR-DCFR, highlighted the role of farmers in the economy of India. Several Kumaon fish farmers recounted their success stories and emphasised the profitability of the venture. Critical farm inputs such as fish feed and fingerlings of various species were distributed during the event.

Fig. Glimpse of National Campaign on Annadata Devo Bhava and Kisan Mela organized at ICAR-DCFR, Bhimtal

13.5 Institute Research Committee (IRC) meeting

The 15th IRC meeting was held on 24th to 25th May 2022 at ICAR-DCFR, Bhimtal under the Chairmanship of Dr Pramod Kumar Pandey, Director, ICAR-DCFR. Scientists of the institute presented the progress of the ongoing research programmes along with concept notes on new project proposals. Discussion was also made on NEH, TSP and farm activities at Experimental Fish Farm, Champawat. All the scientists of ICAR-DCFR participated in the meeting.

Fig. IRC meeting held at ICAR-DCFR

13.6 World Environment Day celebration

World Environment Day celebration was celebrated on 6th June, 2022 at ICAR-DCFR Bhimtal. On this ocassion a lecture was delivered by Dr Anjuli Agrawal, Professor and Incharge, KVK, GBPU&T. She expressed her concern about the environmental pollution in hill areas and also suggested some measures for the cleanliness and safety from natural hazards. Dr Pramod Kumar Pandey, Director, ICAR-DCFR also addressed the gathering and highlighted the importance of nature and its conservation. On this occasion, tree plantation was done in the campus. The scientists and staff participated in the programme.

Fig. Celebration of world environment Day at ICAR-DCFR, Bhimtal

13.7 International Yoga Day Celebration

The 8th International Yoga Day was celebrated by all the staff and research scholars of the Directorate and its Experimental Field Centre, Champawat on 21st June 2022. Yoga has been beneficial in keeping the body and mind in sound health. The United Nations theme for International Day of Yoga 2022 is "**Yoga for humanity**". Yoga is universal — it can be practised anywhere, at any time, and by anyone irrespective of age, gender, culture or nationality.

Fig. International Yoga Day celebration at ICAR-DCFR, Bhimtal

13.8 National Fish Farmers Day and National Campaign on Emerging Aquaculture Systems and Practices

The ICAR-DCFR celebrated national campaign on "Emerging Aquaculture Systems and Practices" and farmers' meet on National Fish farmers' day on 11th July, 2022, under Azadi ka Amrut Mahotsava-75th year of celebration of Independence. Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal welcomed the chief guest and all the participants, officials, scientists, farmers, professionals, entrepreneurs, and stakeholders and underlined the importance of induced breeding in fishes that paved the way for continuous seed supply and sustainable aquaculture development in the country. The Chief Guest of the programme, Padma Bhushan Dr Anil Prakash Joshi an environmentalist, green activist and founder of HESCO underlined the importance of natural farming and indigenous technical knowledge for sustainable development. He urged the farmers to utilise local resources that may bring sustained economic growth in rural India. On this occasion Dr Maibam Birla Singh, DST faculty of NIT, Manipur and young entrepreneur, delivered an invited lecture on the "design and fabrication of the aquaponic system".

The four selected progressive fish farmers from

Meghalaya, Manipur, Sikkim and Uttarakhand were felicitated and honoured on this occasion. The farmers shared their success stories and emphasised the profitability of the venture. The event witnessed a gathering of 194 participants, including 95 fish farmers, officials, scientists, entrepreneurs, and stakeholders. Several KVKs and scientists also participated through virtual mode.

Fig. Visit to farm facilities at ICAR-DCFR Bhimtal and Inauguration of National Campaign

Fig. Address by Padma Bhushan Dr Anil Prakash Joshi

13.9 ICAR Foundation Day celebration at Experimental Fish Farm, Champawat

On the Occasion ICAR Foundation day a tree plantation programme was organised on 16th July 2022 at Experimental Fish Farm, Champawat. On this occasion 25 Lemon, 25 Walnut, 25 Angu, 50 Deodar, 50 Tejpatta and 25 Morpankhi saplings were planted in the premises of Experimental Fish Farm, Champawat. The event was attended by staff permanent and contractual of the farm.

Fig. Plantation at Experimental Fish Farm, Champawat

13.10 National campaign on Non-Conventional Aquaculture System

ICAR-DCFR, Bhimtal, organized a virtual lecture on "Integrated Multi-trophic Aquaculture Systems (IMTA)" as a part of "National campaign on Non-Conventional Aquaculture System" under Azadi Ka Amrut Mahotsav celebration on 27th July 2022. This talk assumes greater significance in the imitative of Natural farming. The talk was delivered by Prof. Arun Patel, Head, Department of Aquaculture, College of Fisheries, CAU, Lembucherra, Agartala, Tripura. Around 60 participants from ICAR-DCFR and different ICAR Institutes, KVKs, SAUs attended the programme through virtual mode. In addition, The ICAR-DCFR also participated in online webinar on "Non-Conventional Aquaculture System" organized by ICAR-CMFRI, Cochin on 27th July 2022. Dr S. Ali and Dr Ritesh S. Tandel coordinated the programme. All scientists, technical staff, and research scholars participated in the programme.

Fig. Lectures delivered during National campaign on Non-Conventional Aquaculture System

13.11 National campaign on 'Fish for Health and Prosperity'

As a part of the Azadi Ka Amrit Mahotsav celebration and ICAR Fisheries Division's national campaign on 'Fish for Health and Prosperity', ICAR-DCFR organised a special event on 1st August 2022 at Bhimtal. Globally renowned aquaculture and nutrition scientist, Prof. Sadasivam Kaushik (Former Director of Research, INRA, France and European Research Area Chair of ULPGC, Spain) graced the occasion as the chief guest. 100 participants from ICAR-DCFR attended this event physically and 35 participants from other ICAR Institutes joined through virtual mode. At the outset, Dr Pramod Kumar Pandey, Director, briefed the gathering about the major research achievements of the Directorate that can contribute towards health and prosperity. Following that, in his theme talk on 'Aquatic foods for health and prosperity', Prof. Kaushik highlighted several important and evolving aspects of fish production such as the growing importance of aquaculture across the globe; expansion of fed aquaculture; predominance of few farmed species; feeding strategies for improving nutritional quality of the fish; sustainability of fish production systems; environmental considerations; and various ways in which fish contributes to human health and prosperity. This was followed by a very fruitful exchange of ideas and deliberation on coldwater aquaculture with Prof. Kaushik. This programme was coordinated by Dr Biju Sam Kamalam and Dr Shahnawaz Ali.

Fig. Fish for health and prosperity campaign with Prof. Sadasivam Kaushik, France

13.12 Independence Day Celebration

The 76th Independence Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate. Dr D. Sarma, Principal Scientist, ICAR-DCFR unfurled the national flag and saluted the patriots who fought for our freedom besides the importance of 15th August. In his address to the staff of DCFR, he laid stress upon working in harmony and putting up the best for the progress of the organization and the country. Likewise, the Independence Day was celebrated at Experimental Fish Farm, Champawat with great fervour. Mr Kishor Kunal, Scientist hoisted the national flag. Scientists and staff of the centre also expressed their pride for being the part of such a glorious nation. Scientist in-charge Mr. Kishor Kunal along with other staff of the farm remembered the freedom struggle and paid homage to the freedom fighters on this occasion.

Fig. 76th Independence Day celebration at ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat

13.13 Hindi Pakhwara

Hindi Pakhwara was organized ICAR-DCFR, Bhimtal from 1st to 15th September 2022. On this occasion different programmes such as debate, quiz, eassy competition, Hindi typing, and Hindi translation were organized. The programme was coordinated by Mr. Amit Joshi, Hindi Officer, ICAR-DCFR. All the staff and students participated in the programme. Likewise, the Hindi Saptah was celebrated at Experimental Field Centre, Champawat. Events like essay writing, Hindi translation, Hindi noting and format writing, debate competition, speech competition and Hindi poetry recitation events were organised for the staff of the farm. The programme was coordinated and conducted by Mr. Kishor Kunal, Scientist, and Ms. Garima, Scientist ICAR-DCFR, Champawat. Prizes were distributed to the winners of different competitions under different categories.

13.14 Celebration of 35th Foundation Day of ICAR-DCFR

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal celebrated its 35th foundation day on 24th September 2022. ICAR-DCFR is the only premier research institute in the country working towards sustainable development of coldwater aquaculture, management, and conservation of the hill stream fishes. The Directorate was established in 1987 under the administrative control of the Indian Council of Agricultural Research (ICAR), New Delhi. In his welcome address, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, congratulated all the scientists, progressive fish farmers, and stakeholders who were part of the momentous 35 years journey of the ICAR-DCFR success story. The Chief Guest, Professor Aditya Kumar Misra, Former Chairman, ASRB, New Delhi, applauded the Director and scientific staff of ICAR-DCFR on the historic occasion. He appreciated the commendable work done by the scientists of the directorate in Himalayan states for the overall growth of coldwater fisheries and aquaculture. He emphasised the role of fisheries in uplifting the socio-economic status of fish farmers and providing nutrition and food security to the country.

The guest of honour, Dr Dilip Kumar, Former Director & Vice Chancellor, ICAR-CIFE, Mumbai, congratulated the Director, DCFR, for excellent leadership and conveyed his best wishes on this occasion. He underlined the importance of linkages between scientific institutes and stakeholders for better

dissemination of the technologies among end-users. He said that India being the second largest agrarian economy in the world needs transformation to ensure nutritional security through agricultural production. He laid emphasis on making farming commercially viable by strengthening inter-linkages with other sectors of the economy. He also underlined the importance of 'smart agriculture' farming practices for combating climate change, bringing innovative thinking and multi-disciplinary expertise for doubling the farmer's income. Dr Lakshmi Kant, Director ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (ICAR-VPKAS), Almora, while appreciating the Directorate, expressed concern over groundwater depletion and spoke about the simultaneous use of polyethylene lined ponds for storage of water and fish culture in hilly regions. The programme was attended by all scientist and staff of the directorate. Apart from this, farmers, state department officials and other stakeholders also participated in the programme.

Fig. Plantation by Chief Guest Dr A.K. Misra and vist to RAS Unit at ICAR-DCFR Bhimtal

Fig. Address by Chief Gust and distribution of fish seed to farmers on the ocassion of 35th Foundation Day at ICAR-DCFR, Bhimtal

13.15. Workshop on climate resilient rainbow trout farming

Under NICRA project, the Directorate organised a two-day workshop on 'Climate resilient rainbow trout farming' during 10-11th October 2022. The workshop was attended by NICRA adopted farmers from Chamoli district in Uttarakhand, and Kullu and Mandi districts in Himachal Pradesh. During the workshop, various practical aspects in farm operation, feed management, health management and water quality monitoring, with respect to climate change were elaborated to the farmers.

Fig: Workshop on climate resilient rainbow trout farming

The participants were also provided practical exposure to RAS and they were given hands-on training on standard operating methods like water flow and water quality analysis, and fish biomass monitoring. As a part of participatory farm surveillance initiative, each of the farmers were also provided water quality analysis kit for regular monitoring of water quality at their farms. This workshop was coordinated by Dr Debajit Sarma, Dr Biju Sam Kamalam, Dr Rajesh and Dr Prakash Sharma.

13.16 Celebration of Agri Start up conclave and Famers meet

ICAR-DCFR, Bhimtal organized live telecast of Agri Startup Conclave and Exhibition. Honorable Prime Minister inaugurated the Agri Startup Conclave and Exhibition at a two-day event titled "PM Kisan Samman Sammelan 2022" on 17th October 2022 at the mela ground of ICAR-Indian Agricultural Research Institute (IARI), New Delhi. Hon'ble MLA Bhimtal, Mr. Ram Singh Kaira attended the programme as the chief guest. He stressed on the importance of fisheries in increasing farmer's income in hills of Uttarakhand. He appreciated the role of farmers in sustaining Indian economy during corona pandemic. Dr Debajit Sarma, Pr. Scientist, informed all the fish farmers and farm women about various technologies developed by the institute for the benefit of fish farming community. Mr. Anil Chunautia, President Nagar Panchayat in his speech praised the contribution of the institute in upliftment of fish farmers. The gathering of farmers, farmwomen, and staff listened to the lectures of Shri Narendra Singh Tomar, Minister of Agriculture & Farmers Welfare, and Prime minister Shri Narendra Modi during the live telecast. The Prime Minister released the 12th instalment amount of Rs. 16,000 crores under the Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) through Direct Benefit Transfer. In this programme Prime minister also inaugurated 600 "Pradhan Mantri Kisan Samruddhi Kendras (PMKSK)", launched Pradhan Mantri Bhartiya Jan Urvarak Pariyojana – One Nation One Fertiliser and an e-magazine 'Indian Edge'.

Fig. Hon'ble MLA Bhimtal, Mr. Ram Singh Kaira inaugurated the programme at ICAR-DCFR, Bhimtal

Fig. Hon'ble Prime Minister inaugurated the Agri Startup Conclave

13.17 Communal Harmony Day

In compliance to National Foundation for Communal Harmony on 25th October 2022 pledge was taken at the premises of EEF, ICAR-DCFR, Champawat for maintaining communal harmony of all the people of India regardless of caste, creed, region, religion and language. All the staff members (Permanent and Contractual) were present at the premises of EEF, ICAR-DCFR, Champawat while taking the pledge.

Fig. Pledge taken on occasion of communal Harmony Day

13.18 National Symposium on Fisheries and Aquaculture for livlihood and Nutritional security

The ICAR-DCFR in collaboration with Coldwater Fisheries Society of India (CFSI) has organized two days "National Symposium on Fisheries and Aquaculture for Livlihood and Nutritional security"during 18-19 November, 2022 at Bhimtal. Padam Bhushan Dr R.S. Paroda, Former Secretary DARE & Director General ICAR, New Delhi graced the ocassion as Chief Guest. The Programme was inauagrated with lighting the lamp by all dignitaries including Dr Pramod Kumar Pandey, Director, ICAR-DCFR. In his welcome address, Director honoured the Chief Guest and other dignitaries. In his welcome address, He highlighted in detail about the research work being done by the directorate including in the states located in the north-eastern region of the country. On this occasion Dr Paroda, appreciated the work done by the directorate in the field of coldwater fisheries research. He highlighted the importance of rainbow trout, tilapia and other species and elaborated on doubling the livelihood of the fish farmers of the country, along with the vision of Hon'ble Prime Minister Shri Naremdra Modi's Jai Jawan, Jai Kisan, Jai Vigyan and Jai Anusandhan slogan. He explained and shared his views on the topics of Global Hunger, Global Nutritional Security, Covid-19 Environment Security etc. He told that India is the second largest producer of fish in the world after China. Therefore, fish farmers in this area will have to be informed about new techniques so that India can become a leading country in fish production. If the farmer of India is happy then the country will be happy. He said that we have to pay attention to fisheries as well as other sectors to maintain our nutritional security. Earlier, Dr Paroda also visited the recirculatory aquaculture system (RAS) which is described as a milestone for the directorate progress. He also emphasized on the need of setting up a gene bank. In the end, he wished for the better future of the institute. The first session of the symposium ended with the vote of thanks by Dr Debajit Sarma, Principal Scientist.

On this occasion, Dr B.P. Mohanty, Assistant Director General, ICAR New Delhi, Dr G. Sugumar, Vice-Chancellor, TNJFU, Tamilnadu, Dr Dilip Kumar, Former Director, ICAR-CIFE, Mumbai, Dr K.M.L. Pathak, Former DDG (Animal Science), ICAR, Dr Wazir Singh Lakra, Former Director, ICAR-CIFE, Mumbai also presented his views.

During the symposium, four publications of the institute were also released by Padma Bhushan Dr R.S. Paroda and other dignitaries. Selected fish farmers were also honoured by CFSI. Further a number of awards and honours were presented to different scientists and academicians among them Dr S. Ali, Senior Scientist, Dr Dipesh Debnath, Dr Janmejay Parhi, Dr M.S. Akhtar, Dr Biju Sam Kamalam, Dr Rajesh M., Dr Ciji Alexander, Dr Pushpa Chowdhary were awarded for their contribution in the field of research. On this occasion, the exhibition stall by different ICAR institutes and organization were installed where different products and technology related information were displayed. More than 250 participants from different institutes, universities and colleges participated in the national symposium.

Fig. Dignitaries attened the National Symposium at ICAR-DCFR

Fig. Padam Bhushan Dr R.S. Paroda ji visiting different exhibition stall at ICAR-DCFR, Bhimtal

Fig. Iaugaration of National Symposium

Fig. Release of Souvenier & other publications and address by Chief guest Padam Bhushan Dr R.S. Paroda ji during the National Symposium

Fig. Address by Dr G. Sugumar, Fig. Felicitation of Dr.B.K. Das, Director, ICAR- Vice Chancellor, TNJFU, Tamilnadu CIFRI, Barrackpore

13.19 World Fisheries Day

The directorate celebrated World Fisheries Day on 21st November, 2022. On this ocassion fish farmers of the different villages of Kumaun region participated in the programme. The programme was Chaired by Dr Pramod Kumar Pandey, Director, ICAR-DCFR. The director highlighted the role and potential of fisheries in the livlihood and socio-economic development. On this ocassion, Dr D. Sarma and Dr.N.N. Pandey and Principal Scientist, ICAR-DCFR also interacted with farmers and answred their queries. The programme was also attended by all scientist and staff of ICAR-DCFR as well as state fisheries officials and other stakeholders.

Fig. Celebration of world Fisheries Day at ICAR-DCFR, Bhimtal

13.20 Swachhta Abhiyan

Special Cleanliness Drive -2nd to 31st October, 2022 (Special Campaign 2.0 - Disposal of pending matters)

Staff members of the directorate at the Bhimtal campus and its field station, Champawat, observed the Special Campaign-2 implementation phase with joy and vigour. On 153rd birth anniversary of Mahatma Gandhi, the Director and staff members paid floral tributes in the beginning. Dr Pramod Kumar Pandey, the Director, requested the employees to actively take part in this noble endeavour and devote their energy in raising awareness among the locals and villagers and keep the workplace tidy. Informing the date-wise designated cleaning and pending issue disposal activities, Dr S. Chandra, Nodal Officer appealed the participants to take the activity earnestly for making the month long program successful. On this occasion, a cleaning pledge was taken by staff members.

Fig. Staff membres in the inaugraution of Excution Phase with Swatchhatcha pledge on 2nd October, 2022

Special Campaign 2.0 - Disposal of pending matters

S. No.	Special Campaign 2.0	Dated	Team/Personnel	Photographs
1.	Special Campaign 2.0 was cleanliness drive in administration section; a comprehensive survey was carried out to identify the old files of the establishment section.	03.10.2022	Smt. Khilawati Rawat, AO Sh. A.K. Sinha, AAO Sh. J.C. Bhandari, Asst.	
2.	Weeding out of old records in different sections; Audit & Accounts, Stores, DDO section was carried out systematically	04.10.2022	Smt. Khilawati rawat, AO Sh. D.C. Sati, F&AO Sh. R.K. Arya, TO	
3.	A cleanliness and sanitation drive was conducted at Hariya village, Vinayak, Bhimtal	05.10.2022	Dr D. Thakuria Sr. Scientist	

4.	Cleanliness drive in establishment section of the Institute was carried out	06.10.2022	Sh. A.K. Sinha, AAO; Sh J. C. Bhandari, Assistant	
5.	Cleanliness drive in stores and purchase section & weeding out of old records	07.10.2022	Mrs. Khilawati Rawat, AO & I/C Stores Mrs. Munni Bhakt, UDC, Sh. R.K. Arya, Sh. Partha Das, Sr.Technician	
6.	Sanitation and Cleaning in RAS complex	08.10.2022	Dr Rajesh, M., Scientist Dr.M.S. Akhtar, Sr. Scientist Dr Ciji, A. Scientist & Research Scholars	
7.	Scrap disposal and cleaning activities in the Feed Mill and Fish Nutritional Physiology Lab	09.10.2022	Dr C. Alexandar, Scientist, Dr M. Rajesh, Scientist Dr M.S. Akhtar, Sr. Scientist & Research Scholars	
8.	Sanitation and Cleaning of Diagnostic bacteriology laboratory and Wet laboratory at ICAR-DCFR complex	10.10.2022	Shri S.K. Mallik Scientist & Research Scholars	
9.	Sanitation and cleaning of aquaculture lab at ICAR-DCFR complex was carried out by	11.10.2022	Dr N. N. Pandey, Pr. Scientist Dr R.S. Patiyal, Pr. Scientist Dr S. Ali, Sr. Scientist Mr. Santosh Kumar, Sr.TO Dr Sumit Kumar, RA	
10.	Awareness programme on utilization of organic wastes/generation of wealth from waste in nearby villages. The team from DCFR organized a programme in Govt. Junior High School and Govt. Primary School, Dhungshil. 74 persons	12.10.2022	Dr Amit Pande Pr. Scientist Dr R.S. Haldar, CTO	

	attended the campaign.			
11.	Cleaning of GIS Lab, Museum and Backside of office	13.10.2022	Sh. P.A. Ganie, Scientist Sh. R. Posti, YP-II	
12.	Organizing workshops/ awareness camp on technology demonstration of agricultural technologies for conversion of waste to wealth	14.10.2022	Dr D. Sarma, Pr. Scientist Sh. Partha Das TA	
13.	Awareness cum cleaning programme" was organized at Govt. Primary School, Chanfi, Bhimtal, District Nainital, Uttarakhand	15.10.2022	Dr S. Ali, Sr. Scientist. Sh. Santosh Kumar, Sr.TO Sh. Manoj Kumar (SSS)	
14.	Awareness cum cleaning programme" was organized at Village Nissola, Bhimtal, District Nainital, Uttarakhand	16.10.2022	Dr S. Chandra, Pr. Sceintist,	
15.	An awareness programme on swachhata was organized by the team from DCFR in the nearby village Dhungshil, Bhimtal with the involvement of villagers.	17.10.2022	Dr R.S. Haldar, CTO	
16.	Special Drive on Public Sensitization and Observance of Cleanliness in Common Places	18.10.2022	Dr S. Chandra, PS, Dr M.S. Akhtar, Sr. Scientist, Sh. A.K. Giri, Scientist Sh. Parth Das, TA	
17	Special cleanliness drive near model fish hatchery and backyard ornamental fish facilities	19.10.2022	Dr S. Chandra, pr. Scientist Smt. Susheela Tiwari, P.S Dr D. Thakuria Sh. Sundar Lal, Technician	

18.	Special cleanliness drive in rainbow trout hatchery at EFF, Champawat	20.10.2022	Dr Kishor Kunal, Scientist Smt. Garima, Scientist Sh. Bhola Dutt Maouni, SSS	
19.	Cleanliness drive in pocket-B at EFF, Champawat	21.10.2022	Sh. Hansa Dutt, TO Sh. Omraj SSS	
20.	Cleanliness drive in scientist rest house at EFF, Champawat	22.10.2022	Dr Kishor Kunal, Scientist Smt. Garima, Scientist Sh. Dharam Singh, LDC	
21.	Cleanliness drive in office and laboratory	23.10.2022	Smt. Garima, Scientist Smt. Basanti Devi, SSS	
22.	Cleanliness drive near Jimdaar baba mandir and nearby places at Chamapawat	24.10.2022	Smt. Garima, Scientist Dr K.Kunal Smt. Basanti Devi, SSS Sh.	
23.	Cleanliness campaign, thorough cleaning of the ornamental unit was carried out.	25.10.2022	Dr Pragyan Dash, Scientist Dr Ritesh tandel, Scientist	
24.	Awareness on recycling of waste water, water harvesting for agriculture and allied sector in MGMG villages with the involvement of local/village communities- Village Soangaon	26.10.2022	Dr R.S. Patiyal, Pr. Scientist Dr N. N. Pandey, Pr. Scientist	

25.	Essay and drawing competitions amongst the research scholars, young professionals and contractual staff were organized with the aim to increase cleanliness propensity among all the working staff of the directorate.	27.10.2022	Dr S. Chandra Pr. Scientist	
26.	Awareness on Waste Management in Nearby Village (Nishola, Naldamyantital and a village enroute to Sattal	28.10.2022	Dr R.S. Tandel, Scientist Dr Siva C., Scientist Sh. Manoj Kumar, SSS	
27.	Sensitization and Cleanliness drive in Jangaliagaon, Bhimtal	29.10.2022	Dr Suresh Chandra, Pr. Scientist	
28.	Cleaning in main office building	30.10.2022	Smt. K. Rawat, AO Dr S. Chandra, Pr. Scientist	
29.	Cleanliness drive and highlighting the activities of Swatch Bharat Abhiyan 2.0 in print and electronic media	31.10.2022	Dr S. Chandra, Pr. Scientist	  गांवों में लोगों को स्वच्छता के प्रति जागरूक किया

2. Swachhta Pakhwara 16-31 December, 2022

Swachhta Pakhwada for the period 16.12.2022 to 31.12.2022 initiated at Institute with a pledge on swachhata taken by all the members of staffs & farmers on 16.12.2022 followed by message on swachhata by the Director, Dr Pramod Kumar Pandey. Various activities to be carried out during the *Swachhta Pakhwada* were briefed along with guidelines.

Activities on 16.12.2022

Display of banner at the prominent places, taking Swachhata pledge, Stock taking and briefing of the activities to be organized during

the *Pakhwada*. Banners depicting *Swachhta Pakhwada* were displayed at the prominent places at ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat followed by cleaning of the institute, farm campus and community places.

Fig. Swachhta Pledge taken by staff of ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat

Fig. Cleanliness activity at institute and community places

Activity	Date	Photograph
Basic Maintenance: Stock taking on digitization of office records/e-office implementation. Cleanliness drive was undertaken by Smt. Khilawati Rawat, AO & Sh. A.K Sinha, AAO in the office premises. A review of e-office implementation was undertaken. Some old files were disposed off as a part of cleanliness drive.	17.12.2022	
Sanitation and SWM, Encourage cost effective and appropriate technologies for ecologically safe and sustainable sanitation. Cleanliness and sanitation drive in the villages adopted under MGMG or other schemes by ICAR institutes involving village community. As a part of Swachhta Pakhwada, a sanitation campaign was initiated in the SCSP village, Darima of Nainital district.	18.12.2022	

Cleanliness and sanitation drive within campus and surrounding including residential colonies, common market place. Stock taking on biodegradable and non-biodegradable waste disposal status and providing on the spot solution.	19.12.2022	
Stock taking of waste management & other activities including utilization of organic wastes/generation of wealth from waste, polythene free status, composting of kitchen and home waste materials, promoting clean & green technologies and organic farming practices in kitchen gardens of residential colonies/one nearby village and providing on the sport technology solution.	20.12.2022	
The significance of reduced water usage (>50 fold) of the directorate's already running recirculating aquaculture system was briefed to all the participants. The awareness session included how one can create a small-scale backyard RAS to culture fish and grow vegetables in a backyard garden. Information was disseminated through a poster display also on how one can utilize vegetable and farm waste to produce BSF larvae, reducing feeding costs in poultry and aquaculture while achieving a circular economy.	21.12.2022	
As part of the Swachhta Campaign, a rally on the swachhata was organized from the ICAR-Directorate of Coldwater Fisheries Research Bhimtal campus to nearby public places such as streets and parks. Nearly 50 office employees took part in the rally to raise awareness among local residents. A cleanliness drive was also held in the park adjacent to Lake International School. Children from the surrounding areas also participated in the cleaning programme.	22.12.2022	
Celebration of special Day-Kisan Diwas (Farmer's Day) A Kisan Diwas was organised at Harinagar Village near Bhimtal. In this programme farmers were made aware about the importance of usage of waste water for fish production and horticulture. Dr N N Pandey discussed recycling of waste water for fisheries. Dr Vishal Dutta of State Fisheries department informed farmers about various government schemes available for fisheries and aquaculture in coldwater. BDC member Mr. Gopal Krishna Bhatt of Harinagar village also shared his experience of fish production and encouraged farmers to take advantage of government schemes. Dr Amit Pandey gave a small lecture on important fish diseases. More than 40 farmers and farm women of Harinagar and Berijhala village participated in the Kisan Diwas programme.	23.12.2022	

Swachhta awareness at local level: A Swachhta campaign was organized by In-charge, Experimental Fish Farm, Champawat, Dr Kishore Kunal at village Banlekh, Champawat with the help of farmers, farm women and village youth. Cleaning of surrounding area was also done with active participation of all. Dr Kunal discussed on importance of cleanliness in surrounding areas and public places especially when there are Covid cases increasing now a days again.	24.12.2022	
Cleaning of public places, community market places and/or nearby tourist/selected spots. A cleaning drive under the "SwachhtaPakhwada (16-31 December 2022)" was organized at the Bhimtal bypass highway on 25th December 2022 by ICAR-DCFR. Many scientists, technical and other staff participated in the cleaning programme. Around 0.5 km of the road was cleaned and enhanced the aesthetic appeal of the road to the tourists.	25.12.2022	
An essay competition was organized at Govt. Primary School, Tirchakhet, Bhowali for students of class 4 and 5. Best essay were judged and awarded. School children also recited poems on importance of swachhta. They were made aware about the importance of swachhta in our daily life by Drs R S Patiyal, Renu Jethi and Victoria Chanu. This activity was performed with the help of Mrs. Mira Singh, School teacher of the school along with her staff.	26.12.2022	 
An awareness campaign on waste management was organized at the coldwater recirculating aquaponics unit of ICAR-Directorate of Coldwater Fisheries Research, Bhimtal. Participants were made aware about the significance of organic farming practices including the use of various techniques for the utilization of organic wastes, released as effluents from the fish farming units. They were also sensitized on the promotion of clean & green technologies like recirculating aquaponics, with the production of both fish and plants (vegetables).	7.12.2022	
Mass Awareness on waste management was organised at village Chachai, Bageshwar, Uttarakhand under the supervision of Dr Suresh Chandra, Pr. Scientist, ICAR-DCFR, Bhimtal. Gram Pradhan of the Chachai village, SHG group representative and fish farmers and other villagers actively participated in the activity. Villagers stressed on establishment common waste disposal containers in the village. A cleanliness activity in the village was undertaken with the help of the villagers.	28.12.2022	

An awareness campaign on 'Treatment and safe disposal of bio-degradable/non-bio-degradable waste' under the "*Swachhta Pakhwada*", was organised at Dhungsil, Bhimtal. Significance of treatment and safe disposal of bio-degradable/non-bio-degradable wastes and methodology of vermicomposting was explained to villagers. Approximately 30 villagers were sensitized about the need to keep their surroundings neat and clean to lead a healthy life.	29.12.2022	
"*Swachhta Sangosthi evam patrakaar Varta*" was organized at ICAR-DCFR, Bhimtal. Mr Devendra Chanautia, City Panchayat Chairman was chief guest on the occasion. They were briefed about the various activities carried out by the Institute during the *Swachhata Pakhwada*. The activities were published in institute website as well as social media platforms; facebook, twitter, Instagram.	30.12.2022	
Swachhta Pakhwada activities organized during the period of 16-31 December 2022 were briefed with press and media. All the highlights of Swachhta Pakhwada activities that involved cleanliness drive, campaign, rallies, essay competitions for students, kisan diwas etc were well covered by press and media. These activities were uploaded in institute website and social media pages.	31.12.2022	 स्वच्छता के लिए लोगों की सहभागिता बेहद जरूरी : चनौतिया

13.21 Other programmes organized

▪ **National consultation cum review meeting on mahseer**	**16th March 2022**
▪ **Kisan Bhagidari, Prathmikta Hamari campaign**	28th April 2022
▪ **Parthenium Awareness Week**	16th to 22nd August 2022
▪ **Gandhi Jyanti**	2nd October 2022
▪ **Live telecast global launch of Mission Life**	20th October 2022
▪ **Communal Harmony Day**	25th October 2022
▪ **Rashtriye Ekta Diwas**	31st October 2022
▪ **Vigilance Awareness Week**	31st Oct. to 6th Nov. 2022
▪ **World Soil Day**	5th December 2022
▪ **22nd Institute Management Committee (IMC) meeting**	28th December 2022

Fig. 22nd Institute Management Committee meeting

Fig. Vigilance Awarness Week celebration held at ICAR-DCFR, Bhimtal at ICAR-DCFR, Bhimtal

14. Awards, Honours and Recognitions

- ICAR-DCFR Received Ganesh Shankar Vidyarthi Patrika Puraskaar 2021 for Himjyoti on 16th July, 2022, at New Delhi. Dr Pramod Kumar Pandey, Director, ICAR-DCFR and Sh. Amit Joshi, Hindi Officer received the prize from Hon'ble Union Minister for Agriculture & Farmer's Welfare, Sh. Narendra Singh Tomar in the presence of Hon'ble Minister of State for Agriculture & Farmer's Welfare Sh. Kailash Choudhary and Hon'ble Minister of Fisheries, Animal Husbandry and Dairying, Shri Parshottam Rupala.

Fig. Dr Pramod Kumar Pandey, Director, ICAR-DCFR and Sh. Amit Joshi, Hindi Officer received the prize

- Dr Biju Sam Kamalam, Scientist, ICAR-DCFR was awarded the "CFSI Gold Medal" by the Coldwater Fisheries Society of India for his significant contribution in the area of coldwater fisheries research and development, during the National symposium on Fisheries and Aquaculture for Livelihood and Nutritional Security, 18-19 November 2022, at Bhimtal.
- Dr Biju Sam Kamalam, Scientist, ICAR-DCFR was nominated for 'ICAR Think Tank' as a young scientist from Fisheries Science Division, by the Deputy Director General (Fisheries).

Fig. Dr Biju Sam Kamalam receiving CFSI Gold Medal and Certificate from Padma Bhushan Dr R.S. Paroda, Former Secretary, DARE and DG, ICAR

- Dr Biju Sam Kamalam, Scientist, ICAR-DCFR was nominated to act as a member of the review committee for 'Dr E.G. Silas Centre of Excellence and Innovations in Marine Fish Microbiome and Nutrigenomics' at ICAR-CMFRI, Kochi.
- Dr Ciji Alexander, Scientist, ICAR-DCFR was conferred "Dr S.S Gupta Memorial Award for the Young Scientist-2022" by the Coldwater Fisheries Society of India, Bhimtal, during the National Symposium on 'Fisheries and Aquaculture for Livelihood and Nutritional Security' held at ICAR-DCFR, Bhimtal.

Fig. Dr Ciji Alexander receiving Dr S.S. Gupta Memorial Award for the Young Scientist-2022 from Padma Bhushan Dr R.S. Paroda, Former Secretary, DARE and DG, ICAR

- Kishor Kunal, Garima, P.A. Ganie and P.K. Pandey received Best Paper Presentation Award in the National Conference (Hindi)-Atmnirbhar Bharat ke Liye Tikau Jalkrishi organised by ICAR-CIFA, Bhubneshwar on 23-24 Sep., 2022.
- Dr M.S. Akhtar, Senior Scientist, ICAR-DCFR was conferred "CFSI Gold Medal" for his contributions in the area of coldwater fisheries research and development, by the Coldwater Fisheries Society of India, Bhimtal, at the National Symposium on 'Fisheries and Aquaculture for Livelihood and Nutritional Security' held during 18-19th November, 2022 at ICAR-DCFR, Bhimtal.

Fig. Dr M.S. Akhtar receiving CFSI Gold Medal and Certificate from Padma Bhushan Dr R.S. Paroda, Former Secretary, DARE and DG, ICAR

- Dr Rajesh, M. and Dr Biju Sam Kamalam, Scientists, ICAR-DCFR received a 'Certificate of Appreciation' from the Directorate of Fisheries, Jharkhand for training their farmers on Recirculating Aquaculture System (RAS) at Ranchi, during 13-15 September 2022.
- Dr Shahnawaz Ali, Senior Scientist, ICAR-DCFR conferred CFSI Fellowship for his outstanding contribution in the area of coldwater fisheries research and development by Coldwater Fisheries Society of India, Bhimtal during National Symposium on "Fisheries and Aquaculture for livelihood and nutritional security" held on 18-19 November, 2022.

Fig. Dr Shahnawaz Ali receiving "CFSI Fellowship" from Padma Bhushan Dr R.S. Paroda, Former Secretary, DARE and DG, ICAR

- Smt. Garima and Dr Kishor Kunal, Scientists, ICAR-DCFR were awarded First prize for presenting a research paper on the topic "Jalashaymein microplastic pradushan" in Hindi Scientific Seminar on "Vigyan Evam Kisan: Bharat @ 75" held on 19 Sept. 2022 at ICAT-NINFET, Kolkata.
- Dr N.N. Pandey, Principal Scientist, ICAR-DCFR nominated as member of Institute Management Committee, ICAR-VPKAS, Almora.
- Dr N.N. Pandey, Principal Scientist, ICAR-DCFR nominated as member of Board of Studies (BoS) of Kumaon University, Nainital, Uttarakhand.
- Dr N.N. Pandey Principal Scientist, ICAR-DCFR nominated as member of monitoring committee for import of fish germplasm, Kashmir.
- Dr P. Dash, Scientist, ICAR-DCFR has been conferred with Young Scientist award 2022 by ICAR-DCFR and CFSI for Best oral presentation in National symposium on Fisheries and Aquaculture for livelihood and nutritional security

- Dr R.S. Tandel, Scientist, ICAR-DCFR received young scientist award (poster) during National Symposium on "Fisheries and Aquaculture for Livelihood and Nutritional security" during 18-19 Nov. 2022 (2 days) at DCFR Bhimtal
- Dr Raja Adil Bhatt, Scientist, ICAR-DCFR joined as an editorial board member in BMC Veterinary Research published under Springer Nature.
- Dr Raja Adil Bhatt, Scientist, ICAR-DCFR received prestigious Marie Skiodowska-Curie fellowship under the European Commission Horizon 2020
- Dr Raja Adil Bhatt, Scientist, ICAR-DCFR received Prof. Ravindranath Krothapalli Best PhD. Thesis Gold medal from ICAR-CIFE, Mumbai, for the year 2021-22.
- Dr Raja Adil Bhatt, Scientist, ICAR-DCFR received Young Scientist Award-2022 from Asian Fisheries Society.
- Dr Rajesh M., Scientist, ICAR-DCFR awarded with S.S. Gupta Memorial Award for the Young Scientist (2022) for his outstanding contribution in the area of coldwater fisheries research and development by Coldwater Fisheries Society of India, Bhimtal during National Symposium on "Fisheries and Aquaculture for livelihood and nutritional security" held on 18-19 November, 2022.

Fig. Dr Rajesh M. receiving Dr S.S Gupta Memorial Award for the Young Scientist-2022 from Padma Bhushan Dr R. S. Paroda, Former Secretary, DARE and DG, ICAR

- Singh, B., Shahi, N., Sarma, D., Malik, S.K, Haldar, R.S., Posti, R., Ganie, P.A. and Pandey P.K. received the best poster presentation award on the poster titled as, "Species validation of vulnerable dark mahseer, *Naziritor chelynoides* (Mcclelland, 1839) by conventional and molecular methods" in the National Symposium on "Fisheries and Aquaculture for Livelihood and Nutritional Security" organised by ICAR-DCFR, Bhimtal in Collaboration with CFSI, Bhimtal on 18-19 Nov, 2022
- Dr S. Chandra, Principal Scientist, ICAR-DCFR nominated an examiner for evaluation of the Ph.D. Thesis of a student of Dept of Zoology, University of Delhi.

15. Linkages

ICAR-Directorate of Coldwater Fisheries Research has developed functional linkages with different National level organizations, Agricultural Universities, State department of fisheries, Financial agencies, Private companies, and Registered societies for promotion of R&D in collaborative programmes.

15.1 ICAR Institutes

- ICAR-National Bureau of Fish Genetic Resources, (ICAR-NBFGR), Lucknow, U.P
- ICAR-Central Institute of Fisheries Technology, (ICAR-CIFT), Kochi, Kerala
- ICAR-Central Institute of Fisheries Education, (ICAR-CIFE), Mumbai, Maharashtra
- ICAR-Central Institute of Freshwater Aquaculture,(ICAR-CIFA), Bhubaneshwar, Odisha
- ICAR-Central Institute of Brackishwater Aquaculture, (ICAR-CIBA), Chennai, Tamil Nadu
- ICAR-Central Inland Fisheries Research Institute, (ICAR-CIFRI), Braarackpore, West Bengal
- ICAR-Research Complex for NEH Region, Barapani, Meghalaya
- ICAR-Indian Institute of Soil and Water Conservation, (ICAR-IISWC), Dehradun, Uttarakhand
- ICAR-Vivekanand Pravatiya Krishi Anusandhan Sansthan, (ICAR-VPKAS), Almora, Uttarakhand
- ICAR-Indian Veterinary Research Institute, (ICAR-IVRI), Izatnagar, U.P
- ICAR-Directorate of Foot and Mouth Disease, (ICAR-PDFMD), Mukteswar, Uttarakhand
- ICAR-Indian Agricultural Statistics Research Institute, (ICAR-IASRI), New Delhi
- ICAR-Indian Agricultural Research Institute, (ICAR-IARI), New Delhi
- ICAR-National Institute of Animal Nutrition and Physiology, (ICAR-NIANP), Bengaluru, Karnataka

15.2 Central Agencies/Departments

- National Fisheries Development Board (NFDB), Hyderabad, Telangana
- Department of Biotechnology (DBT), New Delhi
- Science and Engineering Research Board (SERB), New Delhi
- Indian Space Research Organization (ISRO), Bengaluru
- North Eastern Space Application Centre, Shillong, Meghalaya
- Uttarakhand State Council for Science and Technology, Dehradun
- Survey of India, Dehradun, Uttarakhand
- State Agricultural Management & Extension Training Institute (SAMETI), Jammu
- Ministry of Environment, Forest & Climate Change, New Delhi
- Indian Council of Forest Research and Education (ICFRE), Dehradun
- Tehri Hydro Development Corporation Ltd.
- Sashastra Seema Bal (SSB), Ministry of Home Affairs, Govt. Of India, Champawat
- Indian Institute of Engineering (IIT), Roorkie

15.3 State Agencies/Departments

- Department of Fisheries, Uttarakhand
- Department of Fisheries, Himachal Pradesh
- Department of Fisheries, Jammu & Kahsmir
- Department of Fisheries, Sikkim
- Department of Fisheries, Arunachal Pradesh
- Department of Fisheries, Meghalaya
- Department of Fisheries, Mizoram
- Department of Fisheries, Meghalaya
- Department of Fisheries, Nagaland

- Department of Fisheries, Tamil Nadu
- Uttarakhand Council for Biotechnology
- Directorate of Animal/Sheep Husbandry, UT of Ladakh.

15.4 Universities & Colleges

- GB Pant University of Agricultural Science & Technology, Pantnagar
- GB Pant Institute of Himalayan Environment and Development, Almora
- College of Fisheries, SKUAS&T, Srinagar, J&K
- College of Fisheries, Assam Agricultural University, Raha
- College of Fisheries, Central Agricultural University, Lembucherra
- Tamil Nadu Dr J. Jayalalithaa Fisheries University, Naggapattinam
- Kerala University of Fisheries & Oceanography
- CSKHP Agricultural University, Himachal Pradesh
- Kumaun University, Nainital, Uttarakhand
- HNB Garhwal University, Srinagar, Uttarakhand
- Guwahati University, Assam
- Assam Don Bosco University, Guwahati
- West Bengal University of Animal & Fisheries Sciences, Kolkatta
- Nagaland University, Kohima
- Rajiv Gandhi University, Arunachal Pradesh
- Bhimrao Ambedekar Central University, Lucknow, U.P
- Deen Dayal Upadhaya Gorakhpur University, Gorakhpur, U.P
- Central Agricultural University, Imphal, Manipur
- Acharaya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya, UP
- Manipur University, Imphal
- Central Agricultural University, Jhansi, U.P
- Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan
- Soban Singh Jeena University, Almora, Uttarakhand.
- ICFAI University, Agaratala, Tripura

15.5 Krishi Vigyan Kendras (KVK)

- KVK Lohaghat, Champawat, Uttarakhand
- KVK, Almora, Uttarakhand
- KVK, Jyolikot, Uttarakhand
- KVK, West Kameng, Arunachal Pradesh
- KVK, Tawang, Arunachal Pradesh
- KVK, Lower Subansiri, Arunachal Pradesh
- KVK, Upper Subansiri, Arunachal Pradesh
- KVK, Lower Dibang Valley, Arunachal Pradesh
- KVK East Siang, Arunachal Pradesh
- KVK, Bajaura, Himachal Pradesh

15.6 Registered Societies/ NGOs/ Private Companies

- Devan Hills Plantations Company (P) Ltd., Munnar, Kerala
- Gaumco Multipurpose Cooperative Society (P) Ltd. Ziro, Arunachal Pradesh
- ABACA, Nameri, Tezpur, Assam
- Jasingfaa Aqua Tourism Centre at Nagaon, Assam
- ICICI Pvt. Limited, Mumbai
- SPY Agro Pvt. Ltd. Nadyal, Kurnool, Andhra Pradesh
- String Bio Pvt. Ltd. Bengaluru, Karnataka.

ICAR-DCFR in News & Media

नये अनुसंधान कार्यों को मत्स्य कृषकों तक पहुंचाने पर जोर

भीमताल डीसीएफआर में किसान मेला आयोजित

उत्तर उजाला संवाददाता

भीमताल। शीत जल मत्स्य अनुसंधान निदेशालय (डीसीएफआर) में बुधवार को प्राकृतिक मत्स्य पालन सह किसान मेला का आयोजन किया गया। किसान मेले का शुभारंभ मुख्य अतिथि केंद्रीय मत्स्यकी शिक्षा संस्थान मुंबई के पूर्व उप कुलपति डॉक्टर वजीर सिंह लाकड़ा व डीसीएफआर के निदेशक डॉ प्रमोद कुमार पंडे ने संयुक्त रूप से दीप प्रज्जवलित कर किया। डॉ सिंह ने वैज्ञानिकों से नये-नये अनुसंधान कार्यों को मत्स्य कृषकों तक पहुंचाने पर जोर दिया। ताकि नयी वैज्ञानिक तकनीकी का लाभ कृषकों को मिल सके। उन्होंने संस्थान के वैज्ञानिकों से कृषकों के द्वार तक जाकर उनकी समस्याओं को सुलझाने का आह्वान किया। उन्होंने मेले में पहुंचे कृषकों से ट्राउट पालन व जैविक मत्स्य पालन को अपनाने पर बल दिया। विशिष्ट अतिथि विवेकानंद पर्वतीय कृषि अनुसंधान संस्थान अल्मोड़ा के निदेशक डॉक्टर लक्ष्मीकांत थे। मेले में कृषकों से मत्स्य पालन को प्राकृतिक कृषि को अपनाने पर जोर दिया गया। कार्यक्रम को मत्स्यकी कॉलेज कर्नाटक के पूर्व अधिष्ठाता प्रोफेसर केएम शंकर ने कृषकों से नवीनतम तकनीकी अपनाने को कहा। फिशरीज कॉलेज मंगलोर के पूर्व अधिष्ठाता डॉक्टर वाई बासव राजू ने प्राकृतिक मत्स्य पालन की उपयोगिता के बारे में बताया। मेले में चंपावत, चमोली, जोशीमठ, सितारगंज, रामगढ़, अल्मोड़ा व रामगंगा आदि क्षेत्रों से आए मत्स्य पालक उनको ट्राउट मत्स्य बीज एवं मत्स्य चारा भी वितरित किया गया। इससे पहले डीसीएफआर निदेशक डॉ प्रमोद कुमार पांडे ने सभी अतिथियों व किसानों का स्वागत किया। कार्यक्रम का संचालन संस्थान के प्रधान वैज्ञानिक डॉ एनएन पांडे ने किया। इस अवसर पर डॉ एस अली, प्रधान वैज्ञानिक डॉ देवाजीत शर्मा, अमित कुमार जोशी, पीसी तिवारी समेत 186 किसानों ने भाग लिया।

किसानों की आजीविका को मजबूत करेगा मत्स्य पालन

भीमताल। शीतजल मात्स्यिकी अनुसंधान निदेशालय में बुधवार को प्राकृतिक मत्स्य पालन सह किसान मेला आयोजित किया गया। संस्थान के निदेशक डॉ. प्रमोद कुमार पांडे ने बताया कि पर्वतीय क्षेत्रों में मत्स्य पालन किसानों की आजीविका का मजबूत कर रहा है। उन्होंने बताया कि अनुसंधान की ओर से किसानों को मत्स्य पालन के लिए हर संभव मदद की जा रही है। ग्रामीण क्षेत्रों के किसानों से मत्स्य पालन के क्षेत्र में आगे आने का आह्वान किया।

विवेकानंद पर्वतीय कृषि अनुसंधान संस्थान अल्मोड़ा के डॉ. लक्ष्मीकांत ने किसानों से मत्स्य पालन के साथ-साथ बतख पालन और कृषि के क्षेत्र में भी काम करने को कहा। डॉ. केएम शंकर ने आधुनिक तकनीक का उपयोग कर अधिक से अधिक आय अर्जित करने को कहा। इस दौरान डॉ. एनएन पांडे, डॉ. एसअली, डॉ. देबाजीत शर्मा, डॉ. आरएस पतियाल, अमित कुमार जोशी, पीसी तिवारी आदि थे। (संवाद)

स्वच्छता के लिए लोगों की सहभागिता बेहद जरुरी : चनौतिया

भीमताल। शीतजल मात्स्यिकी अनुसंधान निदेशालय भीमताल में शुक्रवार को कार्यक्रम आयोजित कर कृषकों व नगर क्षेत्र के लोगों को स्वच्छता के प्रति जागरूक किया गया। कार्यक्रम के मुख्य अतिथि नगर पंचायत अध्यक्ष देवेंद्र चनौतिया रहे। उन्होंने उपस्थित लोगों से नगर को स्वच्छ व ग्रीन बनाने के लिए एकजुट होकर सहभागिता निभाने के लिए प्रेरित किया। घरों में अनुपयोगी कार्बनिक सामानों के सही निस्तारण एवं अकार्बोनिक अनुपयुक्त पदार्थों से कम्पोस्ट बनाने तथा प्लास्टिक के सही निस्तारण पर जोर दिया। संस्थान निदेशक डा. प्रमोद कुमार पांडेय ने बताया कि 16 दिसंबर से स्वच्छता अभियान चलाया गया था, जिसके अन्तर्गत गांवों में स्वच्छता जागरूकता रैली, कृषक गोष्ठी, स्कूलों में स्वच्छता आधारित निबंध लेखन, मेरा गांव मेरा गौरव के अन्तर्गत अंगीकृत गांवों में ग्रामीणों को स्वच्छता के प्रति जागरूक समेत अन्य आयोजन किये गये। बताया इस दौरान कृषकों को मत्स्य पालन के प्रति जागरूक भी किया गया। यहां प्रधान वैज्ञानिक डा. देवाजीत शर्मा, ड. अमित पांडे, डा. एन पांडे, डा. आरएस पतियाल, डा. राजेश, डा. सीजीएएके मल्लिक, डा. सुरेश चंद्रा, डा. रितेश टंडेल, डा. डी ठाकुरिया, परवेज अहमद, डा. आरएस हालदार, प्रशासनिक अधिकारी सुशीला तिवारी, पार्थ दास, अमित जोशी, अमित सक्सेना, अजय बहादुर, गिरीश बनाल आदि स्टाफ मौजूद रहा।

गांवों में लोगों को स्वच्छता के प्रति जागरुक किया

सरकारी पब्लिक स्कूल के बच्चों के साथ जागरूकता रैली निकालते वैज्ञानिक

डीसीएफआर की ओर से चलाया जा रहा है अभियान

भीमताल। शीतजल मात्स्यिकी अनुसंधान निदेशालय भीमताल ने विशेष स्वच्छता अभियान के तहत मेरा गांव मेरा गौरव के पब्लिक स्कूल आदि स्थानों पर कार्यक्रम आयोजित कर बच्चों व लोगों को स्वच्छता के प्रति जागरूक किया। लोगों को घरों में अनुपयोगी कार्बनिक सामान का सही निस्तारण एवं अकार्बनिक अनुपयुक्त पदार्थों से कम्पोस्ट बनाने तथा प्लास्टिक के सही निस्तारण एवं इसका उपयोग न करने के लिए प्रेरित किया गया। निदेशक डॉ. प्रमोद कुमार पाण्डे ने लोगों में स्वच्छता के प्रति जागरूकता लाने पर जोर दिया। वरिष्ठ वैज्ञानिक डॉ. सुरेश चंद्रा ने कहा कि मत्स्य पालकों, व्यापारियों, सरकारी संस्थानों व स्कूलों की सक्रिय भागीदारी से स्वच्छता के लक्ष्य को प्राप्त किया जा सकता है। इस दौरान वैज्ञानिक डॉ. डी शर्मा, डॉ. अमित पांडे, डॉ. एन पांडे, डॉ. आरएस पतियाल, डॉ. एजेस, डॉ. सीजीएएके मल्लिक, डॉ. रितेश टंडेल, डॉ. डी ठाकुरिया, परवेज अहमद, डॉ. आरएस हालदार, प्रधानाचार्य गीता रौतेला, प्रशासनिक अधिकारी सुशीला तिवारी, पार्थ दास, अमित जोशी, अमित सक्सेना, अजय बहादुर, गिरीश बनाल व अभिषेक के साथ मेरा गांव मेरा गौरव के पब्लिक स्कूल आदि स्थानों पर कार्यक्रम विक्रम आदि ने सहयोग प्रदान किया।

Summit TIMES

Training on Ornamental Fish Culture at Mabong

TRAINING AND INPUT DISTRIBUTION CONDUCTED AT LOUSE AND RENTHAN VILLAGES

ICAR

The MORUNG EXPRESS

Fish farmers trained in Lotus and Renthan villages

Flash Floods affected Mahseer Hatchery

The flash floods, triggered by very hefty rainfall and downpour in Bhimtal on 14th July, 2022, once again badly affected the Mahseer Hatchery of the Directorate, after the similar incidence happened during 18-20 October, 2021. The deluge washed away and caused damage to the infrastructure, including loss of fish stocks. The boundary wall has been further damaged. There was again heavy siltation in all the ponds as well as the hatchery premises. Around 25 golden mahseer brooders, 15000 advance fry, 30000 incubating eggs and approximately 25000 fingerlings/ yearlings were lost in the flash flood.

Submerged ponds and tanks of the Mahseer Hatchery during the flash floods

16. Publications

16.1 Research papers

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Shahi, N., Mallik, S.K., Singh, B., Sarma, D., Ganie, P., Posti, R. and Haldar, R. Abstract Paper ID 15472 "Taxonomic description, DNA Barcoding and Habitat mapping of Naziritorchelynoides (McClelland, 1839) from Uttarakhand, India." Abstract submitted and presented at 12th IFAF, TNJJFU, Chennai, Pp. 518.

Shahi, N., Sarma, D., Singh, B., Posti, R. and Mallik, S.K. "Tor sattalensis, a new species of genus Tor (Cypriniformes: Cyprinidae) discovered from mid-altitude Sattal lake of Uttarakhand, India." Abstract submitted and presented as LEAD SPEAKER in National symposium on Fisheries and aquaculture for livelihood and nutritional security, p48.

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Sharma, P., Kamalam, B.S., Rajesh, M., Kunal, K., Suresh, A.V., Angel, G., Garima, Dubey, M., Pandey, A., Ciji, A. and Pandey, P.K., 2022. Improvement of rainbow trout breeding and seed production through a specially formulated brooder feed: a study report based on repeated on-farm trials. Book of Abstracts - National symposium on Fisheries and Aquaculture for Livelihood and Nutritional Security, pp. 103.

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Singh, B., Shahi, N., Sarma, D., Mallik, S.K., Haldar, R., Posti, R., Ganie, P. and Pandey, P.K. BPP-10 "Species validation of vulnerable dark mahseer, Naziritor chelynoides (McClelland, 1839) by conventional and molecular methods". Abstract submitted and presented in National symposium on Fisheries and aquaculture for livelihood and nutritional security, p108 (Received Best Poster Award).

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16.6 NCBI submissions

Kotlia, D., Pant, V., Karki, P., Pathak, K., Thakuria, D. and Khangembam, V.C. (2022). *Schizophyllum commune* isolate TP/Bhimtal/2022 small subunit ribosomal RNA gene, partial sequence; internal transcribed spacer 1, 5.8S ribosomal RNA gene, and internal transcribed

spacer 2, complete sequence; and large subunit ribosomal RNA gene, partial sequence(Accession no. OP135505).

Kotlia, D., Pant, V., Karki, P., Pathak, K., Thakuria, D. and Khangembam, V.C. (2022). *Saprolegnia parasitica* isolate OM/Bhimtal/2022 internal transcribed spacer 1, partial sequence; 5.8S ribosomal RNA gene and internal transcribed spacer 2, complete sequence; and large subunit ribosomal RNA gene, partial sequence. (Accession no. OP135506).

Kushwaha, B., Mishra, A.K., Murali, S.K., Singh, V.K., Kumar, R., Pande, A. and Thakuria, D. (2021) Oncorhynchus mykiss isolate RBT-H cytochrome c oxidase subunit I(COX1) gene, partial cds; mitochondrial. GenBank: MW832714.1

Mishra, A.K., Pande, A., Kushwaha, B., Murali, S.K., Singh, V.K. and Kumar, R. (2022) Schizothorax richardsonii isolate SRM-1 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. GenBank: OM992314.1

Pathak, K., Pant,V., Kotlia, D., Karki, P., Thakuria, D. and Khangembam, V.C. (2022). *Pseudomonas fluorescens* strain PF/OM/UK/IND/2021 16S ribosomal RNA gene, partial sequence(Accession number ON908465).

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* anti-Mullerian hormone mRNA, complete cds. GenBank: OP776394.

Siva, C., Betsy,J., Sharma, P. and Ali, S. (2022). *Tor putitora* beta-catenin mRNA, complete cds .GenBank: OP776396.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* bone morphogenetic protein 5 mRNA, complete cds. GenBank: OP776395.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* cytochrome P450 aromatase (cyp19b) mRNA, complete cds. GenBank: OP776398.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* splicing factor 1 (sf1) mRNA, complete cds. GenBank: OP776407.

Siva,C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* SRY-box transcription factor 3 (sox3), mRNA, complete cds. GenBank: OP776408.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* SRY box 9a(sox9a) mRNA, completecds. GenBank: OP776409.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* synaptonemal complex protein 3(sycp3) mRNA, complete cds. GenBank: OP776410.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* zygote arrest 1 (zar1), mRNA, complete cds. GenBank: OP776412.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* doublesex and mab-3-related transcription factor 3 (Dmrt3) mRNA, complete cds. GenBank: OP776403.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* forkhead transcription factor L2 (FoxL2) mRNA, complete cds. GenBank: OP776405.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* hydroxysteroid (17-beta) dehydrogenase 7 (hsd17b7) mRNA, complete cds. GenBank: OP776406.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* synaptonemal complex protein 3 (sycp3) mRNA, complete cds. *Tor putitora* DEAD (Asp-Glu-Ala-Asp) boxpolypeptide 4 (ddx4) (VASA) mRNA, complete cds, GenBank: OP776411.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* cytochrome P450 aromatase (cyp19a) mRNA, complete cds. GenBank: OP776397.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* diploid DNA meiotic recombinase 1 (Dmc1) mRNA, complete cds. GenBank: OP776399.

Siva,C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* DMRT-like family A2 (dmrta2) mRNA, complete cds. GenBank: OP776401.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* factor in the germline alpha (figla) mRNA, complete cds. GenBank: OP776404.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* dsx and mab-3 related transcriptionfactor 1-1 (Dmrt1-1) mRNA, complete cds. GenBank: OP776400.

Siva, C., Betsy, J., Sharma, P. and Ali, S. (2022). *Tor putitora* dsx and mab-3 related transcription factor 2b mRNA, complete cds. GenBank: OP776402.

Thakuria, D. and Khangembam, V.C. (2022). *Aeromonas hydrophila* strain MBL1 16S ribosomal RNA gene, partial sequence. (Accession number OP164566).

Tripathi, P.H., Akhtar, M. S., Pandey, A., Ciji, A., Rajesh, M. and Pande, V. *Tor putitora* cluster of differentiation 36 (CD36) mRNA, complete cds (Genbank Accession No. MW322905).

Tripathi, P.H., Akhtar, M.S., Pandey, A., Ciji, A., Rajesh, M. and Pande, V. *Tor putitora* doublesex and mab-3-related transcription factor (DMRT1) mRNA, complete cds (Genbank Accession No. MW322906).

Tripathi, P.H., Akhtar, M.S., Pandey, A., Ciji, A., Rajesh, M. and Pande, V. *Tor putitora* follicule-stimulating hormone beta subunit (FSHb) mRNA, complete cds (Genbank Accession No. MW322907).

Tripathi, P.H., Akhtar, M.S., Pandey, A., Ciji, A., Rajesh, M. and Pande, V. *Tor putitora* myeloid differentiation primary response protein (Myd88)

mRNA, complete cds (Genbank Accession No. MW322908).

Tripathi, P.H., Akhtar, M.S., Pandey, A., Ciji, A., Rajesh, M. and Pande, V. *Tor putitora* interleukin 8 (IL-8) mRNA, complete cds (Genbank Accession No. MW322909).

Tripathi, P.H., Akhtar, M.S., Pandey, A., Ciji, A., Rajesh, M. and Pande, V. *Tor putitora* CXC chemokine (CXC) mRNA, partial cds (Genbank Accession No. MW322910).

Tripathi, P.H., Akhtar, M.S., Pandey, A., Ciji, A., Rajesh, M. and Pande, V. *Tor putitora* toll-like receptor 2 (TLR2) mRNA, complete cds (Genbank Accession No. MW322911).

Tripathi, P.H., Akhtar, M.S., Pandey, A., Ciji, A., Rajesh, M. and Pande, V. *Tor putitora* luteinizing hormone beta subunit (LHb) mRNA, complete cds (Genbank Accession No. MW322912).

16.7 New species registration

New species registration number for *Tor sattalensis* received from Freshwater Biology Regional Centre, ZSI, Telangana. Regn. No. FBRC/ZSI/VS14 (Sarma *et al.*, 2022; reported by Dr D. Sarma)

17. Participation in Conference / Symposia / Workshop / Meetings / Trainings

17.1 Participation in Conference/Symposia/Workshop

Meetings /seminars/conferences/workshops attended by Dr Pramod Kumar Pandey, Director during 01.01.2022 to 31.12.2022:

S.No	Purpose	Date
1.	Attended Assessment Committee Meeting of ARS Scientist for CAS in the discipline of FRM as Chairman (nominated by ASRB) at ICAR Research Complex for Eastern Region, Patna, Bihar.	14.01.2022
2.	Signing of MoU with the ICFAI University Tripura, Agartala to take up collaborative activities with the university.	07.03.2022
3.	National Consultation cum review meeting of Mahseer Network project to be organized by ICAR-DCFR at the Department of Zoology, Manipur University, Manipur.	16.03.2022
4.	Participated in ICAR Directors' Conference at New Delhi.	13.04.2022
5.	Participated in the Executive Development Programme for Leadership Development to be organized by NAARM, Hyderabad.	09.05.2022 to 14.05.2022
6.	Brainstorming meeting to finalize the action plan and road map for sustainable development of fisheries and aquaculture at Leh-UT of Ladakh.	21.05.2022
7.	Participated in the monthly meeting of SMD with the Directors, followed by an interaction meeting with scientists and students of CIFE under the chairmanship of DDG (FS) at ICAR-CIFE Mumbai.	28.05.2022
8.	Meeting with Hon'ble Chief Minister of Manipur to discuss the issues related to fisheries and aquaculture development in the state.	13.06.2022

Fig. Dr Pramod Kumar Pandey, Director, ICAR-DCFR meeting with Hon'ble Chief Minister, Manipur, Sh. N. Biren Singh

9.	**Attended meeting as a Chairman CAS of ARS Scientist under promotion at ICAR Research Complex for NEH Eastern Region, Patna**	**13.07.2022**
10.	Participated in ICAR Foundation Day & Award Ceremony at NASC Complex New Delhi.	16.07.2022

11.	Attended meeting convened by the Hon'ble Chief Minister of Uttarakhand to develop Champawat as model district.	30.07.2022
12.	• To organize an on-farm demonstration cum workshop at Anantnag, Kashmir. • Meeting with the Hon'ble Lieutenant Governor, Srinagar. • To sign MoU with Shere Kashmir University of Agricultural Sciences & Technology (SKUAS&T), Srinagar-Kashmir.	04.08.2022 to 07.08.2022
13.	• Attended inaugural and valedictory function on "National Hands on Training on Freshwater Classical Fish Taxonomy" at Manipur University, Canchipur, Imphal, Manipur. • To finalize site for establishment of trout hatchery at Ukhrul. • Discussion with Department of Fisheries, Govt. of Manipur, Manipur • Meeting with Vice Chancellor, Central Agricultural University, Imphal, Manipur.	15.08.2022 to 22.08.2022
14.	Signing of MoU between DCFR & Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur, Rajasthan.	23-24.08.2022
15.	As a member of the Peer Review Team (PRT), to visit College of Fisheries, Muthukur and Andhra Pradesh Fisheries University (APFU) separated from Shri Venkateswara Veterinary University, Tirupati, Andhra Pradesh for ICAR accreditation.	30.08.2022 to 03.09.2022
16.	Attended workshop on "Assessment of IUCN Threat Status and Distribution of Fishes of the Eastern Himalaya Freshwater Biodiversity Hotspot and Western Himalaya part of India" in collaboration with the Department of Zoology, Manipur University, Imphal being organized by ICAR-DCFR Bhimtal.	03.09.2022 to 06.09.2022
17.	To participate in the event "Neeli Kranti Ke Saath Arth Kranti: 2nd PMMSY Launch Celebration" to be organized by the Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India at Dr.Ambedkar International Centre, New Delhi.	10.09.2022
18.	To sign MoU with the Department of Fisheries, Arunachal Pradesh and to meet Governer, A.P	14-15.09.2022
19.	To select the site for trout hatchery at Mao, Manipur and to meet Fisheries Minister, Manipur.	17.10.2022
20.	Participated in International Workshop titled 'Current and Traditional Practices for Sustainable Management of Aquatic Ecosystems' being organized under GIZ's NERAQ (Protection and Sustainable Management of Aquatic Resources in the North-Eastern Himalayan Region of India) at the Kohima Science College, Jotsoma, Nagaland.	24-25.11.2022

Fig. Dr Pramod Kumar Pandey, Director, ICAR-DCFR along with other dignitaries during brainstorming meeting at Leh, UT of Ladakh

Online meetings attended by Director from January-December 2022

	January 2022	
1.	Review Meeting of Officers and Staff of ICAR Hqrs., Institutes of ICAR, ASRB and DARE under the Chairmanship of Secy., DARE & DG, ICAR.	04.01.2022
2.	Monthly Meeting of Fisheries SMD & Directors of Institutes under the chairmanship of DDG (FS), ICAR, New Delhi.	05.01.2022
3.	To deliver an online lecture on "Sustainable Management of Water Resources" organized by Human Resource Development Centre, Jamia Millia Islamia, New Delhi on the occasion of 7th Online Faculty Induction Programme as an expertise.	05.01.2022
4.	Monthly Meeting of SDM-FS with Directors of RI.	06.01.2022
5.	विश्व हिन्दी दिवस–2022 organized by ICAR, New Delhi.	
6.	Celebration under Azadi Ka Amrit Mahotsav-Yoga for Health: Scientific Perspectives by Dr W. Selvamurthy, President ASTIF, Amity University and Former Chief Controller R&D(LS), DRDO under the Chairmanship of Dr T. Mohapatra, Sec, DARE and DG, ICAR.	10.01.2022
7.	Dr J.K. Jena, DDG, Fisheries Science, Meeting.	12.01.2022
8.	Ph.D. Viva Voce Examination of Ms. Kaveri Nath (Aquaculture) of ICAR-CIFE Mumbai.	13.01.2022
9.	Dr J.K. Jena, DDG, Fisheries Science Meeting.	20.01.2022
	February 2022	
10.	Online training on "Understanding the classical taxonomy of Mahseer" organized by ICAR-DCFR Bhimtal.	01.02.2022
11.	The EFC meeting for Continuation of the DARE/ICAR Central Sector Scheme "Fisheries and Aquaculture for Sustainable Development" under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR.	02.02.2022
12.	Presentation on ARMS.	08.02.2022
13.	Dr J.K. Jena, DDG, Fisheries Science, Meeting.	09.02.2022
14.	Dr J.K. Jena, DDG, Fisheries Science, Meeting on Vision@2047.	11.02.2022
15.	32nd Meeting of National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the chairmanship of Joint Secretary (Inland Fisheries) through VC	16.02.2022
16.	UK - India Aquaculture Innovation Club Launch event under the chairmanship of DDG (FS), ICAR, New Delhi.	18.02.2022
17.	Webinar on "Smart Agriculture" and "Budget Implementations" addressed by the Hon'ble Prime Minister and Hon'ble Agriculture Minister of India.	24.02.2022
	March 2022	
18.	Meeting with Directors & SMD (FS) under the chairmanship of DDG (FS), ICAR, New Delhi.	02.03.2022
19.	ICAR-SOC meeting for discussion on budget utilization and related issues under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR.	07.03.2022
20.	Webinar on iThenticate User Workflow Training organized by ICAR-DCFR Bhimtal.	11.03.2022
21.	Webinar on 7th National Youth Convention on Food Security to Nutritional Security: Youth Perspective (FSNS2022) to be jointly organized by AIASA, ICAR and TNAU at TNAU Campus, Coimbatore as the lead speaker on theme "Priming Indian aquaculture towards nutritional security".	24.03.2022
22.	Meeting on Budget utilization under the chairmanship of Director (Finance) & AS&FA, ICAR, New Delhi.	25.03.2022
23.	93rd Annual General Meeting (AGM) of ICAR Society, ICAR, New Delhi.	26.03.2022

24.	FS-SMD Review Meeting under the chairmanship of DDG (FS), ICAR, New Delhi.	26.03.2022
25.	Virtual meeting on budget and Expenditure Review for 2021-22 under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR.	29.03.2022
	April 2022	
26.	XXVII Meeting of ICAR Regional Committee No. I comprising the States of Himachal Pradesh, Uttarakhand and Union Territories of Jammu & Kashmir & Ladakh under the chairmanship of Hon'ble Union Minister of Agriculture and Farmers Welfare Shri Narendra Singh Tomar Ji and Hon'ble Union Ministers of Parshottam Rupala, Minister of Fisheries, Animal Husbandry and Dairying & Hon'ble Union Ministers of State Shri Kailash Chaudhary Ji, Ms Shobha Karandlaje Ji would also participate in the meeting as the Guests of Honour convened by ICAR, New Delhi.	22.04.2022
27.	Celebration under Azadi Ka Amrit Mahotsav- 'Kisan Bhagidari, Prathmikta Hamari' campaign on `bio-fortification, nutrient grooms and crop diversification being organized by ICAR-DCFR Bhimtal.	28.04.2022
	May 2022	
28.	Celebration under Azadi Ka Amrit Mahotsav- "Managing Soil for Food and Climate Security and Advance SDGs of the UN" by Prof. Rattan Lal, World Food Prize (2020) Distinguished University Professor of Soil Science, Director, CFAES Rattan Lal Center for Carbon Management and Sequestration, The Ohio State University, USA under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR.	10.05.2022
29.	Celebration under Azadi Ka Amrit Mahotsav- AI and IOT: Enabling Sustainable Digital Agriculture by Prof. Santanu Chaudhury, Director, IIT Jodhpur, under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR.	11.05.2022
30.	Monthly Meeting of Fisheries SMD-May 2022 under the chairmanship of DDG (FS), ICAR, New Delhi.	17.05.2022
31.	33rd Meeting of the National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the chairmanship of Joint Secretary (Inland Fisheries).	31.05.2022
	June 2022	
32.	SFC/EFC Meeting of Fisheries Division under the chairmanship of DDG (FS), ICAR, New Delhi.	16.06.2022
33.	Meeting with the scientists retiring after 2047 to discuss their vision 2047 in their respective fields for preparing a strategic road map under the chairmanship of DDG (FS), ICAR, New Delhi.	21.06.2022
34.	9th meeting of the Project Monitoring and Evaluation Unit (PMEU) of PMMSY under the chairmanship of Joint Secretary (Marine Fisheries) and Joint Secretary (Inland Fisheries), Department of Fisheries Ministry of Fisheries, Animal Husbandry and Dairying, New Delhi.	24.06.2022
35.	UKFFDA Governing Meeting under chairmanship of Hon. Minister Fisheries, Govt. of Uttarakhand, Dehradun.	27.06.2022
36.	Meeting with Research & Development (R&D) Institutes of ICAR, State Fisheries Universities and experts under the chairmanship of Secretary, Department of Fisheries. Animal Husbandry and Dairying, New Delhi.	28.06.2022
	July 2022	
37.	Meeting on updated status of funds utilization of released to ICAR for promotion of Kisan Drone and their Action Plan for 2022-23 under the Chairpersonship of Ms. Shomita Biswas, Joint Secretary (M&T).	05.07.2022

38.	National campaign on "FISH FOR HEALTH AND PROSPERITY" on the occasion of 75th year of Independence as Azadi Ka Amrut Mahotsav organized by ICAR-CIFT Cochin.	16.07.2022
39.	Sucess Stories of Farmer's on the occasion of 94th Foundation Day and Award Ceremony of ICAR hosted by DA&FW.	16.07.2022
40.	Discussion and finalization of Sankalp points for the Division under the chairmanship of DDG (FS), ICAR, New Delhi.	19.07.2022
41.	Consultation reg. Reservoir Fisheries convened by Director of Fisheries, Govt. of Arunachal Pradesh, Itanagar.	21.07.2022
42.	Meeting on IUCN organized by ICAR-DCFR Bhimtal.	22.07.2022
43.	Integrated Multi-Trophic Aquaculture Systems (IMTA) organized by ICAR-DCFR Bhimtal.	26.07.2022
44.	Celebration under 75th Anniversary of Indian Independence -Azadi Ka Amrit Mahotsav- National Campaign on Non-conventional Aquaculture Systems with seven ICAR Fisheries Research Institutes (CIFE, CIFRI, CIFT, CIFA, CIBA, NBFGR & DCFR) organized by ICAR-CMFRI.	27.07.2022
	August 2022	
45.	Meeting for Fisheries Science-EFC discussions with FA under the chairmanship of DDG (FS), ICAR, New Delhi.	10.08.2022
46.	Meeting on "Parthenium Menace & its Management" convened by ICAR-DCFR Bhimtal.	22.08.2022
47.	Interaction Meeting with Directors of ICAR Institutes chaired by Secretary, DARE and DG, ICAR. (Attended by Dr D.Sarma, P.S).	30.08.2022
	September 2022	
48.	Adarsh Champawat- ICAR- Consortium convened by ICAR-IISWC, Dehradun (Attended by Dr N.N.Pandey P.S).	03.09.2022
49.	35th Meeting of the National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the Chairmanship of Joint Secretary (Inland Fisheries) (Attended by Dr N.N.Pandey P.S).	05.09.2022
50.	Institutional Performance-AM Presentation-For Discussion (EFC) under the chairmanship of DDG (FS), ICAR, New Delhi.	07.09.2022
51.	SMD Meeting under the chairmanship of DDG (FS), ICAR, New Delhi.	21.09.2022
52.	Second phase of मूल द्वारका एवं वनकबारा, गुजरात में आयोजित "सागर परिक्रमा कार्यक्रम"– 2022" organized by NFDB Hyderabad. (Attended by Dr D.Sarma, P.S).	23.09.2022
	October 2022	
53.	PM Agri – Startup Conclave & Kisan Samman Sammelan program convened by ICAR- Agricultural Technology Application Research Institute, Zone-I, PAU Campus, Ludhiana.	17.10.2022
	November 2022	
54.	FS SMD Meeting under the chairmanship of DDG (FS), ICAR, New Delhi	01.11.2022
55.	36th meeting of the National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the Chairmanship of Shri Sagar Mehra. Joint Secretary (IF&A), Department of Fisheries, GoI	02.11.2022
56.	"Revitalizing ICAR: Aspirations and Action Plan" convened by The Secretary, DARE & DG, ICAR.	11.11.2022
57.	Presentation by DDG (Animal Science) being organized by DARE/ICAR.	22.11.2022
58.	Lecture by DDG (Education) Agricultural Education.	25.11.2022
59.	Emergency meeting to discuss SFC of Fisheries Institutes under the chairmanship of DDG (FS), ICAR, New Delhi.	25.11.2022

	December 2022	
60.	Lecture by Dr S.K. Chaudhari, Deputy Director General (Natural Resource Management), ICAR.	02.12.2022
61.	Presentation by Dr A.K. Singh, Deputy Director General (Horticulture), ICAR.	05.12.2022
62.	Techno-Commercial Assessment and Expert Committee Meeting convened by ICAR-DCFR Bhimtal in collaboration with Agrinnovate India Ltd..	06.12.2022
63.	Meeting with Dr Joykrushna Jena, Deputy Director General (Fisheries Science).	06.12.2022
64.	Opening ceremony of International Year of Millets-2023 convened by Secretary, DARE & DG, ICAR. The hybrid event will be held at FAO headquarters in Rome, Italy.	06.12.2022
65.	Presentation by Dr J.J. Jena, Deputy Director General (Fisheries), ICAR.	13.12.2022
66.	Presentation by Deputy Director General (Education) to Celebrate International Year of Millets 2023 chaired by Secretary, DARE and DG, ICAR.	15.12.2022
67.	Celebration of KISAN DIWAS, 2022 under the Chairmanship of Shri Narendra Singh Tomar, Hon'ble Minister of Agriculture & Farmers Welfare. Sushri Shobha Karandlaje & Shri Kailash Choudhary, Hon'ble Ministers of State.	23.12.2022

17.2 Participation in meetings / seminars / conferences / workshops

- A.K. Giri attended 12th IFAF and its parallel event, International Symposium on Insulating Marine Fisheries Sector in South Asia from Uncertainties: Global Experiences with Insurance at Image Campus, Chennai during 05-07.05.2022.
- A.K. Giri attended a brainstorming meeting with NABARD officials at the directorate on 20.09.2022. During their visit to aquaponics unit, elaborately described the research outputs of coldwater recirculating aquaponics system for the establishment of a small scale aquaponic demonstration unit on cluster mode.
- A.K. Giri attended an International Conference on "Harnessing Indian Agriculture for Indigenous and Global Prosperity" at A.P. Shinde Hall, NASC, ICAR, New Delhi during 22-23.07.2022.
- A.K. Giri attended an international webinar on 'A Mutation is A Mutation is A Mutation' by Prof. Detlef Weigel, Managing Director, Max Planck Institute for Biology, Tübingen, Germany, organized by ICAR-NRRI, Cuttack on 28.01.2022.
- A.K. Giri attended an international workshop on FCDO UK India Aquaculture Pilots: Outcomes showcase on 05.06.2022.
- A.K. Giri attended and presented an abstract on 'Competency of an indigenous re-circulatory coldwater aquaponics model for pilot scale production of rainbow trout and lettuce' on 23.08.2022, while attending an International conference on "Advances in Agriculture & Food System towards Sustainable Development Goals" (AAFS-2022) during 22-24 August, 2022.
- A.K. Giri attended and presented an abstract on 'Performance of rainbow trout and lettuce in a low cost re-circulatory coldwater aquaponic system' in 12th IFAF, Chennai on 06.05.2022.
- A.K. Giri attended and presented an abstract on 'Proficiency of different hydroponic subsystems in an affordable rainbow trout (Oncorhynchus mykiss) - lettuce (Lactuca sativa) aquaponic system' in National Symposium on Self-Reliant Coastal Agriculture, Goa on 12.05.2022 (online mode).
- A.K. Giri participated in a webinar on 'Smart Agriculture' and 'Budget Implementations' on 24.02.2022, which was addressed by Hon'ble PM and Agriculture Minister of India and attended a lecture on 'Chemical free natural farming and its outreach'.
- A.K. Giri participated in an online brainstorming event with DDG (FS), where several valuable inputs and innovative ideas were discussed for the preparation of ICAR vision document-2047 with a strategic road map on 21.06.2022.
- B.S. Kamalam attended the 12th Indian Fisheries and Aquaculture Forum- Fish for Nutritional Security and Economic

Sustainability organised by Tamil Nadu Dr J. Jayalalithaa Fisheries University and Asian Fisheries Society Indian Branch during 5-7 May, 2022 at Chennai, and presented two papers.

- B.S. Kamalam attended the National symposium on Fisheries and Aquaculture for Livelihood and Nutritional Security organized by Coldwater Fisheries Society of India and ICAR-DCFR during 18-19 November, 2022 at Bhimtal.
- B.S. Kamalam delivered a detailed presentation of the 'Road map for sustainable development of fisheries and aquaculture in the Union Territory of Ladakh' during the high-level brainstorming meeting organised at DRDO-DIHAR, Leh, on 21 May, 2022.
- Ciji Alexander attended '13th Asian Fisheries and Aquaculture Forum' and presented an abstract entitled "Low dietary β-glucan improves immunity and reproductive performance in endangered golden mahseer, Tor putitora (Hamilton, 1822)" during May 31- June 02, 2022, Taiwan.
- Ciji Alexander attended International Conference on 'Advances in Agriculture & Food System Towards Sustainable Development Goals' and presented an abstract entitled "Higher intake of β-glucan impairs reproduction in a female teleost, Tor putitora (Hamilton, 1822)" during 22-24th August, 2022 at University of Agricultural Sciences, Bangalore.
- Ciji Alexander attended National Symposium on 'Fisheries and Aquaculture for Livelihood and Nutritional Security' during 18-19th November, 2022 jointly organized by ICAR-DCFR and Coldwater Fisheries Society of India, Bhimtal.
- Dimpal Thakuria attended National symposium on Fisheries and aquaculture for livelihood and nutritional security held at DCFR, Bhimtal during 18-19th Nov 2022.
- Ganie P.A., Posti, R., Bharti V.S., Sehgal, V.K., Sarma, D. and Pandey, P.K., presented a research paper titled as, "Evaluating the performance of various open source digital elevation models in the mountainous region of north western Himalaya"in the National Symposium on "Fisheries and Aquaculture for Livelihood and Nutritional Security" organised by ICAR-DCFR, Bhimtal in Collaboration with CFSI, Bhimtal on 18-19 Nov, 2022.

Dr R.S. Paroda, Former Secretary, DARE & DG, ICAR visiting different stall during national Symposium at ICAR-DCFR, Bhimtal

- Ganie, P.A. attended one day National webinar on "Technical interventions for sustainable aquaculture" Organized by School of Fisheries, Centurion University of Technology and Management (CUTM), Odisha 29.07.2022.
- Ganie, P.A. attended the Webinar on, "The Value of Elisa (Serology) for Vaccination Monitoring" organised by WVPA on 09.07.2022.
- Ganie, P.A. has participated in the National Workshop cum Stakeholders Meet on "Climate Resilient Natural Farming for Sustainable Agriculture" during 22nd and 23rd July, 2022 at ICAR-IISWC, Research Centre, Udhagamandalam, Tamil Nadu
- Ganie, P.A. participated in National Symposium on "Fisheries and Aquaculture for Livelihood and Nutritional Security" organised by ICAR-DCFR, Bhimtal in Collaboration with CFSI, Bhimtal on 18-19 Nov, 2022.
- Ganie, P.A. participated in one day symposium (hybrid mode) on "Soils: Where food begins" organised jointly by Division of Soil science and Agricultural Chemistry, ICAR-IARI, New Delhi and Indian society of soil science, Delhi chapter on 30th Nov., 2022.
- Garima participated in Hindi scientific seminar on "Vigyan evam Kisan: Bharat

@75 organised by ICAR-NINFET, Kolkata on 19 Sep., 2022

- Garima participated in National Conference (Hindi) on "Atmnirbhar Bharat ke Liye Tikau Jalkrishi" organised by ICAR-CIFA, Bhubneshwar on 23 and 24 Sep. 2022.
- Garima participated in National webinar on "Sea tutule conservation strategies and its implications in India" organised by TNJFU-FCRI, Thoothukudi on 23.05.2022
- Garima participated in two days National symposium on "Fisheries and Aquaculture for livelihood and Nutritional security" at ICAR-DCFR, Bhimtal on Nov. 18 and19, 2022
- Khangembam V.C. International Conference on "Advances in Agriculture and Food System Towards Sustainable Development Goals (AAFS-2022)" held at University of Agricultural Sciences-Bangalore, Karnataka, India from 22- 24th August, 2022.
- Khangembam Victoria Chanu, attended 12th Indian Fisheries & Aquaculture Forum held at Chennai during 5-7th May, 2022.
- Khangembam Victoria Chanu, attended 13th Asian Fisheries and Aquaculture Forum held at Taiwan during 31st May to 2nd June 2022.
- Khangembam Victoria Chanu, attended National symposium on Fisheries and aquaculture for livelihood and nutritional security held at DCFR, Bhimtal during 18-19th Nov 2022.
- Kishore Kunal participated in Hindi scientific seminar on "Vigyan evam Kisan: Bharat @75 organised by ICAR-NINFET, Kolkata on 19 Sep. 2022
- Kishore Kunal participated in National Conference (Hindi) on "Atmnirbhar Bharat ke Liye TikauJalkrishi" organised by ICAR-CIFA, Bhubneshwar on 23 and 24 Sep. 2022.
- Kishore Kunal participated in National webinar on "Sea tutule conservation strategies and its implications in India" organised by TNJFU-FCRI, Thoothukudi on 23.05.2022
- Kishore Kunal participated in One-day Kisan Mela and exhibition organised by Krishi Vigyan Kendra, Lohaghatand exhibited a stall and shared information regarding modern technologies associated with fish culture on 26th April 2022.
- Kishore Kunal participated in two days National symposium on "Fisheries and Aquaculture for livelihood and Nutritional security" at ICAR-DCFR, Bhimtal on Nov. 18 and 19, 2022
- M.S. Akhtar attended '13th Asian Fisheries and Aquaculture Forum (virtual)' and delivered an oral presentation on "Effects of β-glucan on non-specific immune parameters and expression of anti-oxidative genes in *Tor putitora* brooders" during May 31- June 02, 2022, Taiwan.
- M.S. Akhtar attended 12th Indian Fisheries and Aquaculture Forum organized by Tamil Nadu Dr J. Jayalalithaa Fisheries University (TNJFU) & Asian Fisheries Society Indian Branch (AFSIB) during 5-7 May 2022 and delivered two oral presentations on (1) Captive maturation and multiple breeding of golden mahseer: A journey of technology development and commercialization, and (2) β-D-glucan influences male gamete quality indices and the expression of anti-oxidative genes in endangered golden mahseer, *Tor putitora*.
- M.S. Akhtar attended International Conference on 'Advances in Agriculture & Food System towards Sustainable Development Goals' and presented a paper entitled "Captive maturation and multiple breeding technology of endangered golden mahseer (*Tor putitora*) for its sustainable conservation and rehabilitation' during 22-24th August, 2022 at the University of Agricultural Sciences, Bangalore.

Fig. Students of Woodbridge school interacting with scientists at ICAR-DCFR Bhimtal

- M.S. Akhtar attended National Symposium on 'Fisheries and Aquaculture for Livelihood and Nutritional Security' during 18-19th November, 2022 jointly organized by ICAR-DCFR and Coldwater Fisheries Society of India, Bhimtal, and delivered an oral presentation on ' Influence of light spectra on reproductive performance and expression of immune and anti-oxidative genes in *Tor putitora* female brooders'.
- N.N. Pandey performed essential duty as micro observer in general Vidhan Sabha Election, Uttarakhand, 2022.
- N.N. Pandey attended the meeting as member of the board of study on 15th July, 2022 at Department of Zoology Kumaon University, Nainital.
- N.N. Pandey attended the all meetings of the National committee on Introduction of exotic aquatic species conducted by DoF, Ministry of Fisheries, animal Husbandry and dairying.
- N.N. Pandey attended the 27th RCM of Zone-I conducted by ICAR on 22th April, 2022.
- N.N. Pandey conducted the practical examination of MSc Fisheries student on 6th September, 2022 at Department of Zoology Kumaon University, Nainital.
- N.N. Pandey attended the meeting on Adarsh Champawat at Dehradun conducted by Chief Minister of Uttarakhand and UCOST, Dehradun.
- N.N. Pandey coordinated the technical meeting with NABARD on 20th September at ICAR-DCFR Bhimtal.
- N.N. Pandey coordinated the technical meeting on Fish Feed Business by EFPO organized by NCDC, Dehradun at ICAR-DCFR on 28th September, 2022.
- N.N. Pandey coordinated the organization of national programme "Mission LIFE event" at ICAR-DCFR on 20th October 2022.
- N.N. Pandey coordinated the organization of Kisan Diwas at ICAR-DCFR on 23rd December, 2022.
- N.N. Pandey coordinated the national campaign on "Annadata Devo Bhava" at ICAR-DCFR on 23-24th April, 2022.
- N.N. Pandey coordinated the programme on "Kisan Bhagidari Prathmicta Hamari" at ICAR-DCFR on 28th April, 2022.
- N.N. Pandey co-coordinated the programme on brainstorming for finalization of roadmap for sustainable development of fisheries & aquaculture in UT Ladakh during 21-22nd May, 2022.
- N.N. Pandey coordinated meeting of Institute Research Committee as member secretary during 24-25th May, 2022.
- P. Dash attended and delivered an oral presentation in the Virtual 13th Asian Fisheries and Aquaculture Forum held at Taiwan (13th AFAF), 31st May- 2nd June 2022.
- P. Dash attended and delivered an oral presentation in the National symposium on Fisheries and Aquaculture for livelihood and nutritional security, organized at ICAR-DCFR, Bhimtal during 18th -19th Nov. 2022
- Posti, R., Ganie, P.A., Baruah, D., Kunal, K., Kunal, G., Sarma, D. and Pandey, P.K. presented a poster on "land suitability assessment for rainbow trout faming in eastern Himalayan region, India; A case study of Anjaw valley" in the National Symposium on "Fisheries and Aquaculture for Livelihood and Nutritional Security" organised by ICAR-DCFR, Bhimtal in Collaboration with CFSI, Bhimtal on 18-19 Nov, 2022
- Prakash Sharma attended and presented a paper on "Incubation and rearing temperature differentially affect hatching, developmental morphology, larval growth and muscle cellularity in rainbow trout, *Oncorhynchus mykiss*" in National symposium on "Fisheries and Aquaculture for livelihood and nutritional security" organized jointly by ICAR-DCFR and CFSI during 18-19 November 2022.
- Prakash Sharma attended and presented a paper on "Nutritional status and muscle fatty acid of golden mahseer (Tor putitora) changes with gonadal status, but dynamic is stronger in females than males: A case study from Bhimtal lake" in National symposium on "Fisheries and Aquaculture for livelihood and nutritional security" organized jointly by ICAR-DCFR and CFSI

during 18-19 November 2022.

- R.S. Patiyal participated in online ICAR Meeting of DG, ICAR on Aazadi ka Amrit Mahotsav on 4th February 2022.
- R.S. Patiyal attended the Lecture on the title Managing Soil for Food and Climate Security and Advance SDGs of the UN given by Prof. Rattan Lal, World Food Prize (2020), Distinguished University Professor of Soil Science, Director, CFAES Rattan Lal Center for Carbon Management and Sequestration, the Ohio State University, USA under Azadi Ka Amrit Mahotsav on 10th May 2022.
- R.S. Patiyal participated in Kisan Bhagidari, Prathmikta Hamari Campaign on 28th April, 2022.
- R.S. Patiyal attended A online Lecture on Enabling Sustainable Digital Agriculture", delivered by Prof. Santanu Chaudhury on the occasion of Azadi Ka Amrit Mahotsav.
- R.S. Patiyal attended an online webinar on the topic "Increasing the Visibility and Impact of Research" As a part of Azadi ka Amrut Mahotsav 12th May, 2022, Organised by ICAR New Delhi.
- R.S. Patiyal attended an online webinar on the topic: Designer technologies for productivity increase among livestock on 20th July 2022 Organised by ICAR New Delhi.
- R.S. Patiyal attended a webinar on Fish for Health and Prosperity" under the Azadi Ka Amrit Mahotsav National Campaign of ICAR Fisheries Division organised by DCFR, Bhimtal on 1st August 2022.
- R.S. Patiyal attended A online webinar' on "Funding Opportunities for Entrepreneurs through BIRAC under BIG Scheme on 25th July 2022 organized by Agri-Business Incubation Centre ICAR-Central Institute for Subtropical Horticulture.
- R.S. Patiyal attended webinar on "Intellectual Property Rights Awareness Webinar under National Intellectual Property Awareness Mission (NIPAM)"during 1st to 5th August, 2022 organized by, IP&TM, ICAR &, NAHEP, ICAR Under National Intellectual Property Awareness Mission (NIPAM).
- R.S. Patiyal attended The webinar on "Post Budget Webinar 2023-24: SAMARTH" on 24th February, 2023. organized by Ministry of Fisheries, Animal Husbandry and Dairying along with Ministry of Agriculture & Farmers Welfare, and Ministries of Cooperation.
- R.S. Patiyal attended webinar on "National Campaign on Participatory Management for Sustainable Fisheries and Biodiversity Conservation" on 4th August, 2022 under Aazadi ka Amrit Mahotsav organized by ICAER-NBFGR, Lucknow.
- R.S. Patiyal attended webinar on Designer technologies for productivity increase among livestock on 20th July, 2022 organized by Agricultural Education, Indian Council of Agricultural Research New Delhi.
- R.S. Patiyal attended online training program "Intellectual property rights awareness webinar series" Under National Intellectual property awareness mission (NIAPM) from 1-5 August 2022 organized by NIAPM Delhi.
- R.S. Patiyal attended online webinar on "Entrepreneurship Development in processing fodder and allied crops" organized by ABI-ICAR-Indian Grassland and Fodder Research Institute, Jhansi on 20th August 2022.
- R.S. Patiyal attended Launch of Mission LiFE event by the Hon'ble Prime Minister of India on 20th October, 2022.
- R.S. Patiyal, attended online webinar Grammarly Training-orgonised by ICAR-DCFR, Bhimtal.
- R.S. Tandel attended and delivered oral presentation on "Emergence of Argulus siamensis in endangered golden mahseer, Tor putitora brooders" in 12th IFAF, 5-7 May, 2022, Chennai. Abstract ID: 15797
- R.S. Tandel attended and presented a paper entitled "Antioomycete and immunostimulatory potential of the artificially designed peptide against saprolegnia spp." in 12th IFAF, 5-7 May, 2022, Chennai. Abstract ID: 16152.
- Renu Jethi delivered and oral presentation on "Nutri-Smart villages as platform to address nutritional security in Himalayan region of Uttarakhand" in National

Symposium on Fisheries and Aquaculture for Livelihood and Nutritional Security 18-19 November, 2022.

- Renu Jethi attended M.Sc. Viva of two students of Pantnagar University as an external expert.
- S. Chandra as an external expert attended the thesis viva of an M.F.Sc. student of Aquatic Environment Management, COF, GADVASU, Ludhiana, on October 21, 2022.
- S. Chandra attended Launch of Agri Udaan-5 on 6th August, 2022 organized online by ICAR-NAARM, NFDB and a-Idea.
- S. Chandra attended the meeting at ICAR-DCFR, Bhimtal with Dr Suvarna C., CEO, NFDB, Hyderabad on May 21, 2022.
- S. Chandra under the Azadi ka Amrit Mahotasv, attended NBFGR online Participatory Management for Sustainable Fisheries and Biodiversity Conservation on 4th August, 2022.
- S. Chandra as Member Secretary, Research Advisory Committee of the Institute under the Chairmanship of Dr W.S. Lakra convened RAC meeting during 21-22 March, 2022
- S. K. Mallik attended 5th review meeting on Network Programme on Antimicrobial Resistance in Fisheries on 5-6, December, 2022, organized at ITC Hotel, Kolkata.
- S. K. Mallik attended National symposium on Fisheries and aquaculture for livelihood and nutritional security held at DCFR, Bhimtal during 18-19th November, 2022.
- S. K. Mallik attended workshop on "Assessment of IUCN threat status and distribution of the fishes of Eastern Himalayan Freshwater Biodiversity Hotspot and Western Himalayan of India" during 5th to 9th September 2022, organized at Department of Zoology, Manipur University, Manipur.
- S. Ali attended 13th Asian Fisheries and Aquaculture Forum (13th AFAF), held at Taiwan during 31st May to 2nd June 2022.
- S. Ali attended National symposium on Fisheries and aquaculture for livelihood and nutritional security held at DCFR, Bhimtal during 18-19th November, 2022.
- S. Ali, Attended as nominated member of Scientific Advisory Committee meeting of KVK, Jeolikot on 11.01.2022 and 12.01.2022.
- S. Ali attended virtual seminar on "Smart Agriculture" and "Budget Implementations -Natural Farming on 24-02-2022. The programme was addressed by by Hon'ble Prime Minister.
- S. Ali attended webinar on 'FASTQ to final report: An ultra-fast workflow for comprehensive genomic profiling' on 14th July, 2022 organized by labroots.
- S. Ali attended webinar on 'How and Why to Enter the Digital Laboratory' on 30th June, 2022 organized by labroots.
- S. Ali attended Launch of Mission LiFE event by the Hon'ble Prime Minister of India on 20th October, 2022.
- Siva, C. attended and presented a paper on "Gonadal transcriptome analysis provides insights into differentially expressed genes involved in sex-related differences in Golden Mahseer" in 12th IFAF, 5-7 May, 2022, Chennai. Abstract ID: 15719
- Siva, C. attended National symposium on Fisheries and aquaculture for livelihood and nutritional security held at DCFR, Bhimtal during 18-19th Nov 2022.

17.3 Participation in training

- Ganie, P.A. attended 5 days online training programme, on "Advances in Monitoring and Modelling of Hydro-Meteorological Hazards using Geospatial Technology and Process based Models" during 05.12.2022 to 09.12.2022 organised by Indian Institute of Remote Sensing, Department of Space, Dehradun.
- Ganie, P.A. attended 5 days online training programme on "Satellite Remote Sensing of Atmosphere" during 11.07.2022 to 15.07.2022 organised by Indian Institute of Remote Sensing, Department of Space, Dehradun.
- Ganie, P.A. attended 5 days online collaborative training program, "Integrated watershed management for strengthening PMKSY" during 11-14 July, 2022 organised jointly by MANAGE-ICAR-IIWSC, RC, Udhagamandalam.
- Kishor Kunal attended five days training on "Freshwater Classical Fish Taxonomy"

at Manipur University, Imphal from 16 to 20 Aug. 2022.

- Rajesh, M., Scientist, ICAR-DCFR, Bhimtal has participated and successfully completed training entitled "Protein Structure Modelling and Dynamics" during 27th to 29th October, 2021 under the project ICAR Consortium Research Platform on Genomics at ICAR-Indian Agricultural Statistics Research Institute, Library Avenue, PUSA, New Delhi.
- Chandra, S. attended three days Online Training programmme on 'Competency Enhancement programme for Effective Implementation of Training Functions' by HRD Nodal Officer of ICAR 21-23 February, 2022.Organoised by NAARM, Hyderabad
- Shahnawaz Ali attended online training programme on "Life science meets programming" during 13-15th Sept., 2022 organized by ICAR-Indian Institute of Spice Research, Kozhikode, Kerala.

18. Library and Information Services

18.1 Library Procurement and Holdings

The ICAR-DCFR library and documentation unit acts as a repository of literature and provides the latest information in fisheries and allied subjects.

During the year (January-December) 2022, the library finalized the procurement process of scientific books amounting to approx. Rs. Three lakhs. The current holdings of the library include~ 7430 books, ~1700 volumes of foreign journals, ~550 volumes of Indian journals and more than 9000 other publications. The library provides services to the institute's scientists and other staff members apart from scholars, researchers, students and other stakeholders from local organizations interested in the scientific literature on coldwater fisheries and allied subjects. The Directorate's library is provides access to the ICAR CeRA journals through the J-gate platform.

18.2 Library automation

Various activities of the library have been computerized using TLS software. The records of books, Journals, bulletins etc., were entered into the database. The bar-coding of books and periodicals is actively being done. The digitalization work of the institute's in-house publications has been completed and hosted on the Directorates website.

18.3 Information services

The library also provides a platform to access free online downloads of publications and articles of many international and national journals through www.cera.jece.in. The library continues by its efforts in collecting processing and disseminating scientific/technical information to the potential users. The library, during 2021, has provided many scanned reprints of offline/back volume research articles to various distant users/researchers of NARS through DDR (document delivery request), an online document delivery service of J-gate plus under CeRA of ICAR.

18.4 Exchanges services

The library maintained exchange relationships with various research organizations and institutes of national and international reputation. The annual reports, newsletters, special publications and technical bulletins published from time to time have been mailed to more than 100 organizations / institutions, Directors of the Department of Fisheries, Deans College of Fisheries, and other stakeholders.

18.5 Documentation section

The documentation section of the library is entrusted with the responsibility of publishing in-house publications such as scientific bulletins, brochures, pamphlets, annual reports, newsletters, monographs etc., through the GeM portal. During the year, this section published one annual report for2021, one Training Calendar for 2022-23, Two manuals, one English-Hindi Dictionary, and one Hindi magazine (Himjyoti).

ICAR-DCFR's in-house publications during the year 2022

19. Important Committees

19.1 Members of Research Advisory Committee

Dr W.S. Lakra, Former VC & Director, ICAR-CIFE, NABARD Professor & Chair, 7 Bunglows, Research Centre of ICAR-CMFRI (CIFE Campus), Mumbai-400061	Chairman
Dr V.R. Chitranshi, Former ADG (I.Fy.) Fisheries Science Division, ICAR, Flat No. 57 A, Pocket U&V, Shalimar Bagh, New Delhi-110088	Member
Dr S. Dham Roy, Former Director, CIARI, ICAR-CIARI, Bathubasti, Garacharma P.O. Port Blair-744105	Member
Dr K.M. Shankar, Former Dean, College of Fisheries, Mangalore "Greeshma" Neela Meghum layout Opp: Chaithanya Social Institute, Gopalagowda extension, Shivamogga-577205, Karnataka	Member
Dr Y. Basavaraju, Former Dean, Fisheries 17-18, 1st Cross Snehanagar, Amrutahally Main Road, Bangalore-560092	Member
Dr B.P. Mohanty, Asst. Director General (Inland Fisheries), ICAR, Krishi Anusandhan Bhawan-II, New Delhi-110012.	Member
Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal.	Member
Dr Suresh Chandra, Principal Scientist, ICAR-DCFR, Bhimtal.	Member Secretary

19.2 Members of Institute Management Committee

Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal	Chairman
Dr B.P. Mohanty, Assistant Director General (Inland Fisheries), ICAR, Krishi Anusandhan Bhawan -II, Pusa, New Delhi-110012.	Member
Director of Fisheries, Government of Uttarakhand, Badasi Grand Dhanyari, Raipur Road, Dehradun-248008 (UK)	Member
Director of Fisheries, Government of Arunachal Pradesh, P.O. Itanagar, PIN – 791111, Arunachal Pradesh	Member
The Vice Chacellor, G.B. Pant University of Agriculture & Technology, Pantnagar – 263145, US Nagar(UK)	Member
Dr K.V. Rajendran, Pr. Scientist, ICAR-CIFE, Panch Marg, Off Yari Road, Versova, Andheri (W), Mumbai – 400061	Member
Dr P.C. Das, Pr. Scientist, Aquaculture Production Division, ICAR-CIFA, P.O. Kausalyaganga, Bhubaneshwar – 751002, Odisha	Member
Dr M.A. Hassan, Pr. Scientist, ICAR-CIFRI, Barrackpore – 700120, West Bengal	Member
Dr Ravindra Kumar, Head of Division, ICAR-NBFGR, Canal Ring Road, P.O. Dilkusha, Telibagh, Lucknow – 226002, U.P.	Member
Sh. Rahul Kumar, Sr. Finance & Accounts Officer, ICAR-NIPB, LBS Centre, Pusa Campus, New Delhi – 110012	Member
Smt. Khilawati Rawat, Administrative Officer, ICAR-DCFR, Bhimtal	Member Secretary

19.3 Members of Prioritization Monitoring & Evaluation Cell

Dr N.N. Pandey, Principal Scientist	In-charge
Dr Shahnawaz Ali, Sr. Scientist	Member
Dr Kh. Victoria Chanu, Sr. Scientist	Member
Sh. Amit Kumar Saxena, Sr. Technical Officer	Technical support
Smt. Susheela Tewari, Private Secretary	Secretarial assistance

19.4 Members of Prioritization Monitoring & Evaluation Committee

Dr Pramod Kumar Pandey, Director	Chairman
Dr S. Chandra, Principal Scientist	Member
Dr R.S. Patiyal, Principal Scientist	Member
Dr N.N. Pandey, Principal Scientist	Member Secretary

19.5 Members of Institute Technology Management Committee

Dr Pramod Kumar Pandey, Director	Chairman
Dr Veena Pande, Head, Dept. of Biotechnology, Kumaon, University, Bhimtal Campus	External Member
Dr N.N. Pandey, Principal Scientist	Member
Dr Shahnawaz Ali, Sr. Scientist	Member
Dr Neetu Shahi, Sr. Scientist	Member
Dr M.S. Akhtar, Sr. Scientist	Member
Dr Biju Sam Kamalam, Scientist (SS)	Member
Dr R. S. Tandel, Scientist (SS)	Member
Dr R.S. Patiyal, Principal Scientist	Member Secretary

19.6 Members of Institute Technology Management Unit

Dr R.S. Patiyal, Principal Scientist	In-charge
Dr Biju Sam Kamalam, Scientist (SS)	Member

19.7 Members of Agricultural Knowledge Management Unit

Dr R.S. Tandel, Scientist (SS)	In-charge
Sh. Parvaiz Ahmad Ganie, Scientist	Member
Sh. Amit Kr. Saxena, Sr. Technical Officer	Technical Support

19.8 ARMS

Dr N.N. Pandey, Principal Scientist	In-charge
Sh. Amit Kr. Saxena, Sr. Technical Officer	Technical support

19.9 Library Advisory Committee

Dr Pramod Kumar Pandey, Director	Chairman
Dr N.N. Pandey, Principal Scientist	Member
Dr Shahnawaz Ali, Sr. Scientist	Member
Dr M.S. Akhtar, Sr. Scientist	Member
Sh. Siva C., Scientist	Incharge Library
Smt. Khilawati Rawat, Administrative Officer	Member
Sh. Sayed Mohsin Ali, Asst. Fin. & Acc. Officer (Upto 11.04.2022)	Member
Sh. Baldev Singh, Senior Technical Officer	Member Secretary

19.10 Institute Joint Staff Council

Official side	
Dr Pramod Kumar Pandey, Director	Chairman
Dr N.N. Pandey, Principal Scientist	Member
Dr R.S. Patiyal, Principal Scientist	Member
Smt. Khilawati Rawat, Administrative Officer	Member
Sh. D.C. Sati, Finance & Accounts Officer	Member
Sh. Ankesh Sinha, Assistant Admin. Officer	Member Secretary
Staff side	
Sh. Pratap Singh Bisht, Assistant	Member, CJSC
Sh. Prakash Chandra Tewari, Assistant Admin. Officer	Member
Sh. T.M. Sharma, Technical Officer	Member Secretary
Sh. R.K. Arya, Technical Officer	Member
Sh. Manoj Kumar, Skilled Supporting Staff	Member
Sh. Bhola Dutt Mouni, Skilled Supporting Staff	Member

19.11 Institute Biosafety Committee

Dr Amit Pande, Pr. Scientist, ICAR-DCFR, Bhimtal	**Chairman**
Dr M.A. Ramakrishnan, Acting Head & Pr. Sci., Div. of Virology, IVRI, Mukteshwar	DBT Nominee
Dr A. B. Pandey, Professor, School of Biological sciences, Faculty of Rural Management Sustainability, Dev Sanskriti Vishwavidyalaya, Haridwar	Outside Expert
Dr Sujoy Kumar Dhara, Pr. Sci., Div. of Veterinary Biotechnology, IVRI, Izatnagar	Outside Expert
Col. (Dr.) C. S. Rawat, MBBS, DPH, FRIPHH	Biosafety Officer
Dr Shahnawaz Ali, Sr. Scientist, ICAR-DCFR, Bhimtal	Internal Expert
Dr Kh. Victoria Chanu, Sr. Scientist, ICAR-DCFR, Bhimtal	Internal Expert
Dr Biju Sam Kamalam, Scientist, ICAR-DCFR, Bhimtal	Internal Expert

19.12 Institutional Animal Care & Use Committee

Dr Pramod Kumar Pandey, Director	**Chairman**
Sh. Sumant Kumar Mallik, Scientist (Selection Scale)	Member
Dr Shahnawaz Ali, Sr. Scientist	Member
Dr Dimpal Thakuria, Sr. Scientist	Member
Dr Neetu Shahi, Sr. Scientist	Member Secretary

19.13 Store Purchase Advisory Committee

Dr Shahnawaz Ali, Sr. Scientist	**Chairman**
Sh. S.K. Mallik, Scientist (Selection Scale)	Member
Dr Neetu Shahi, Sr. Scientist	Member
Dr M. S. Akhtar, Sr. Scientist	Member
Dr Dimpal Thakuria, Sr. Scientist	Member
Sh. D.C. Sati, Finance & Accounts Officer	Member
Smt. Khilawati Rawat, Administrative Officer	Member Secretary

19.14 Aadhar Enabled Biometric Attendance System Committee

Sh. Amit Kr. Saxena, Sr. Technical Officer	**Nodal Officer**

19.15 Women Cell Committee

Dr Pragyan Dash, Scientist (SS)	**Incharge**
Dr Neetu Shahi, Sr. Scientist	Member
Dr Kh. Victoria Chanu, Sr. Scientist	Member
Dr Ciji A., Scientist (SS)	Member
Smt. Susheela Tewari, Private Secretary	Member
Sh. Amit Kumar Saxena, Sr. Technical Officer	Member

20. Staff News

20.1 Joining

- Dr Renu Jethi joined as Sr. Scientist, ICAR-DCFR, Bhimtal on 01st June 2022.

20.2 Transfer

- Sh. Syed Mohsin Ali, AF&AO transferred to ICAR-IVRI, Bareilly on 11th April 2022.

Fig. Farewell programme of Sh. Mohsin Ali

20.3 Promotions

- Dr Shahnawaz Ali promoted from Level 12 to Level 13A with effect from 26th February, 2020.
- Dr Neetu Shahi promoted from Level 12 to Level 13A with effect from 21st April, 2021.
- Sh. S.K. Mallik promoted from Level 12 to Level 13A with effect from 07th January, 2021.
- Dr M.S. Akhtar promoted from Level 12 to Level 13A with effect from 15th December, 2021.
- Dr Dimpal Thakuria promoted from Level 11 to Level 12 with effect from 29th August, 2019.
- Dr Kh. Victoria Chanu promoted from Level 11 to Level 12 with effect from 23rd January, 2021.
- Sh. Siva C. promoted from Level 10 to Level 11 with effect from 01st July, 2020.
- Sh. Parvaiz Ah. Ganie promoted from Level 10 to Level 11 with effect from 01st January, 2021.
- Sh. Raja Aadil H. Bhatt promoted from Level 10 to Level 11 with effect from 01st January, 2021.
- Dr Kishor Kunal promoted from Level 10 to Level 11 with effect from 01st January, 2021.
- Sh. Baldev Singh promoted from Sr. Technical Officer to Assistant Chief Technical Officer with effect from 01st January, 2020.
- Sh. Santosh Kumar promoted from Sr. Technical Officer to Assistant Chief Technical Officer with effect from 26th December, 2020.
- Sh. Amit Kumar Saxena promoted from Technical Officer to Sr. Technical Officer with effect from 28th July, 2021.
- Sh. Manoj Kumar Yadav promoted from Technical Assistant to Sr. Technical Assistant with effect from 26th July, 2021.

OBITUARY

The Director and all the staff of DCFR express their condolence and deepest sympathies on the sad demise of Sh. Ravinder Kumar, Technical Officer who has left for heavenly abode on 3rd May, 2022. May his soul rest in peace and Almighty God give strength to his bereaved family.

21. Personnel

Staff list as on 31.12.2022

21.1 Research Management		
Dr Pramod Kumar Pandey		Director
21.2 Scientific Staff		
1.	Dr Debajit Sarma	Principal Scientist (Fisheries Resource Management)
2.	Dr Amit Pande	Principal Scientist (Biotechnology-Animal Science)
3.	Dr Nityanand Pandey	Principal Scientist (Aquaculture)
4.	Dr Suresh Chandra	Principal Scientist (Fish Pathology)
5.	Dr R.S. Patiyal	Principal Scientist (Fish Genetics & Breeding)
6.	Dr Shahnawaz Ali	Senior Scientist (Aquaculture)
7.	Sh. Sumanta Kumar Mallik	Scientist (Selection Scale)(Aquaculture)
8.	Dr Neetu Shahi	Senior Scientist (Biotechnology-Animal Science)
9.	Dr Md. Shahbaz Akhtar	Senior Scientist (Fish & Fishery Science)
10.	Dr Renu Jethi	Senior Scientist (Agriculture Extension)
11.	Dr Dimpal Thakuria	Senior Scientist (Biochemistry-Animal science)
12.	Dr Kh. Victoria Chanu	Senior Scientist (Biochemistry-Animal science)
13.	Dr Ciji Alexander	Scientist (SS) (Fish Nutrition)
14.	Dr Biju Sam Kamalam J.	Scientist (SS) (Fish Nutrition)
15	Dr Rajesh M	Scientist (SS) (Fish Nutrition)
16.	Dr Tandel Ritesh Kumar Shantilal	Scientist (SS) (Fish Health)
17.	Sh. Abhay Kumar Giri	Scientist (SS) (Aquaculture)
18.	Dr Pragyan Dash	Scientist (SS) (Aquaculture)
19.	Dr Prakash Sharma	Scientist (SS) (Fish Nutrition)
20.	Sh. Siva, C.	Scientist (SS) (Fish Genetics & Breeding)
21.	Dr Kishor Kunal	Scientist (SS) (Fisheries Resource Management)
22.	Sh. Parvaiz Ahmad Ganie	Scientist (SS) (Fisheries Resource Management)
23.	Dr Raja Aadil Hussain Bhat	Scientist (SS) (Fish Health)
24.	Smt. Garima	Scientist (Fisheries Resource Management)
21.3 Technical Staff		
1.	Dr R.S. Haldar	Chief Technical Officer
2.	Sh. Amit Kumar Joshi	Assistant Chief Technical Officer
3.	Sh. Baldev Singh	Assistant Chief Technical Officer
4.	Sh. Santosh Kumar	Assistant Chief Technical Officer
5.	Sh. Amit Kumar Saxena	Sr. Technical Officer
6.	Sh. Hansa Dutt	Technical Officer
7.	Sh. T.M. Sharma	Technical Officer
8.	Sh. R.K. Arya	Technical Officer
9.	Sh. Partha Das	Sr. Technical Assistant
10.	Sh. Manoj Kumar Yadav	Driver (Sr. Technical Assistant)
11.	Sh. Sunder Lal	Technician

21.4 Administrative Staff		
1.	Smt. Khilawati Rawat	Administrative Officer
2.	Sh. D.C. Sati	Finance & Accounts Officer
3.	Sh. Ankesh Kumar Sinha	Asstt. Admn. Officer
4.	Sh. P.C. Tewari	Asstt. Admn. Officer
5.	Smt. Susheela Tewari	Private Secretary
6.	Sh. J.C. Bhandari	Assistant
7.	Sh. Pratap Singh Bisht	Assistant
8.	Smt. Munni Bhakt	UDC
9.	Sh. Hansa Singh Bhandari	UDC
10.	Sh. Mangla Prasad	LDC
11.	Sh. Dharam Singh	LDC
21.5 Skilled Supporting Staff		
1.	Sh. Ravinder Kumar	Skilled Supporting Staff
2.	Sh. Om Raj	Skilled Supporting Staff
3.	Sh. Pooran Chandra	Skilled Supporting Staff
4.	Sh. Manoj Kumar	Skilled Supporting Staff
5.	Sh. Kuldeep Kumar	Skilled Supporting Staff
6.	Sh. Bhola Dutt Mouni	Skilled Supporting Staff
7.	Smt. Basanti Devi	Skilled Supporting Staff

भा.कृ.अनु.प.-शीतजल मात्स्यिकी अनुसंधान निदेशालय

भीमताल-263 136, नैनीताल, उत्तराखंड, भारत

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