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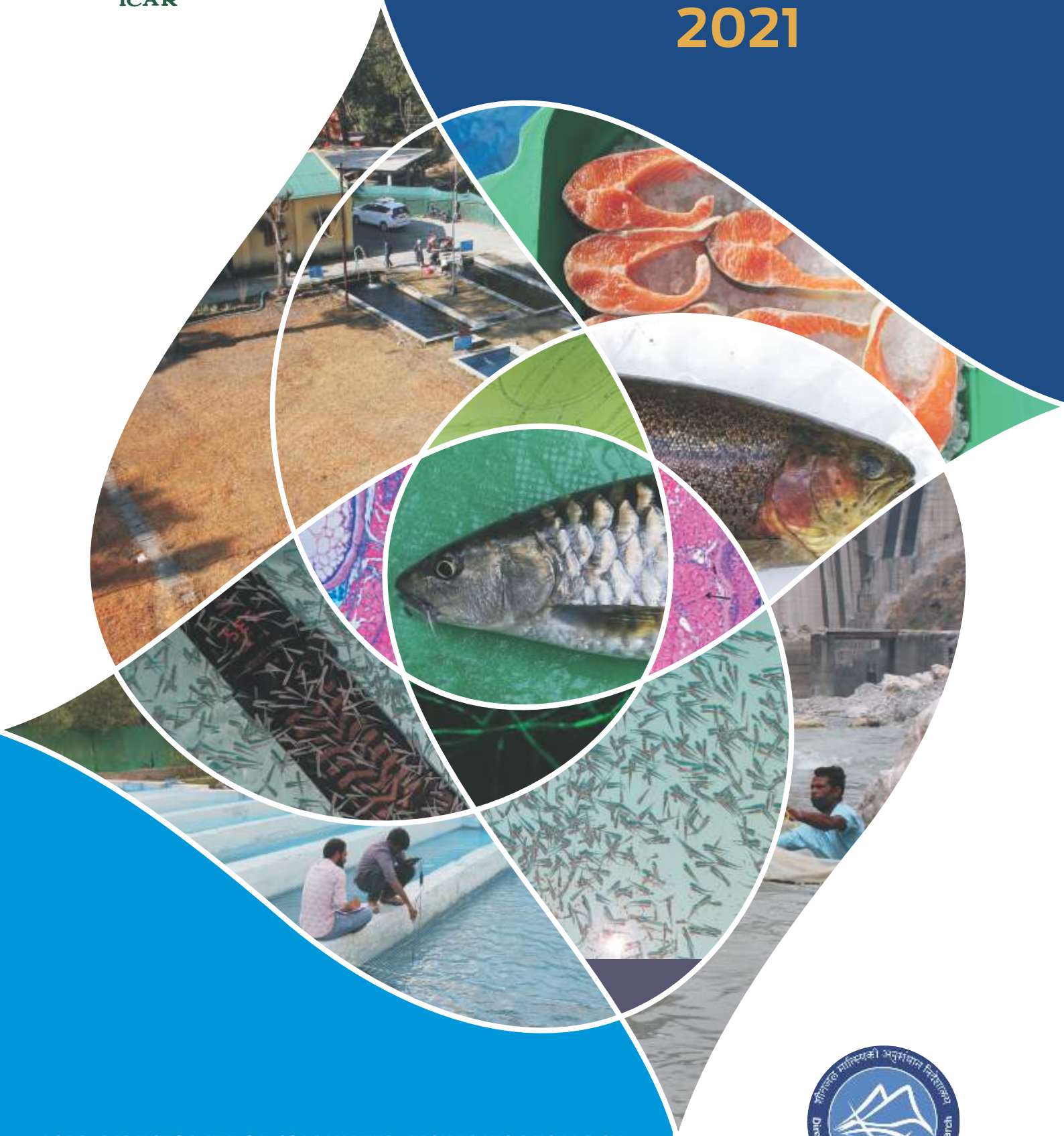

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Bhimtal - 263 136, Nainital, Uttarakhand, India

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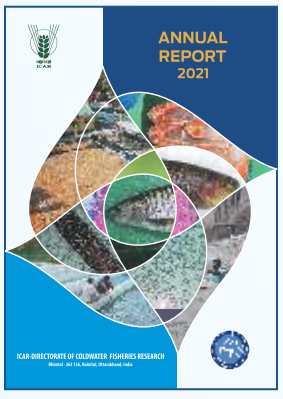

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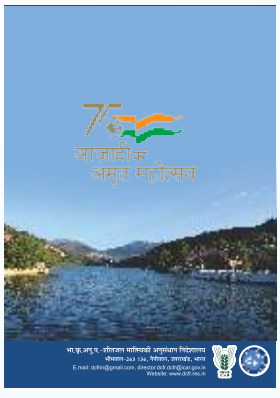
Research, development & extension activities of ICAR-DCFR



Back cover page theme:
View of Bhimtal lake

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प्रस्तावना

तीन दशकों की उपलब्धियों के दौरान, आईसीएआर–डीसीएफआर ने देश के शीतजल मात्स्यिकी विकास के लिए अथक प्रयास किया है। शीतजल मात्स्यिकी ने पहाड़ी किसानों के सामाजिक–आर्थिक विकास और आजीविका सुरक्षा में महत्वपूर्ण भूमिका निभाई है। वर्तमान में, भारत में शीतजल मात्स्यिकी को अधिक महत्व दिया जा रहा है और इसे एक महत्वपूर्ण क्षेत्र के रूप में भी विकसित किया जा रहा है जो देश के हिमालयी राज्यों के पर्वतीय क्षेत्रों की पोषण सुरक्षा में महत्वपूर्ण योगदान कर सकेगा। प्रगति के शिखर को प्राप्त करने और आत्म निर्भर भारत के सपनों को साकार करने के लिए आईसीएआर–डीसीएफआर ने अपने अनुसंधान और विकासात्मक प्रयासों को त्वरित किया है। प्रस्तुत प्रगति आख्या में वर्ष के दौरान निदेशालय ने देश के शीतजल के क्षेत्र की आवश्यकताओं को प्राथमिकता देते हुए आवश्यकतानुरुप विभिन्न अनुसंधान कार्यक्रमों की पहल की है। वर्ष 2021 भी COVID–19 महामारी की चुनौती के साथ सवेदनशील वर्ष रहा है। लॉकडाउन के दौरान, निदेशालय संचार के उपलब्ध साधनों के माध्यम से सभी काम करता रहा और अपरिहार्य चुनौतियों का सामना करने का साहस दिखाया।

निदेशालय ने सुनहरी महासीर की कैप्टिव जनन परिपक्वता और बहु प्रजनन तकनीक को सफलतापूर्वक हासिल किया है. यह तकनीक बड़े पैमाने पर बीज उत्पादन में उपयोगी होगी, जोकि हिमालयी क्षेत्र के प्राकृतिक जल निकायों में लुप्तप्राय महासीर के संरक्षण और पुनर्वास को प्रोत्साहित करेगी। ठंडे पानी की जलीय कृषि के लिए प्रजाति विविधीकरण पिछले कई वर्षों से एक चुनौतीपूर्ण कार्य बना हुआ है। निदेशालय ने स्वदेशी स्नो ट्राउट, साइजोथोरैक्स प्रोगैस्टस और साइजोथोरैक्स प्लेजियोस्टोमस के कृत्रिम प्रजनन और वृद्वि मूल्यांकन के लिए कार्य किया गया है। इसके अलावा, कुछ देशी सजावटी मछली प्रजातियों को तालाब में सफलतापूर्वक पैदा किया गया, जिनकी बाजार में अच्छी मांग है। रेनबो ट्राउट पर्वतीय क्षेत्रों के ठंडे पानी में पालन हेतु उपयुक्त मत्स्य प्रजाति है, अतः देश के पर्वतीय प्रान्तों में ट्राउट पालन के विस्तार की अपार संभावना हैं। रेनबो ट्राउट का गुणवत्तापूर्ण बीज उत्पादन सुनिश्चित करने के लिए, आईसीएआर–डीसीएफआर ने पोषक तत्वों से भरपूर और उत्तम प्रजनक आहार विकसित किया है। विभिन्न स्थानों पर प्रारंभिक क्षेत्र परीक्षणों ने उत्साहजनक और आशाजनक परिणाम दिए हैं। इसके अतिरिक्त, देश में रेनबो ट्राउट उत्पादन को बढाने के लिये उपयुक्त आहार व्यवस्था पर भी कार्य किया है। ट्राउट के आहार की लागत को कम करने के लिए, रेनबो ट्राउट ग्रो आउट आहार में मछली के भोजन के विकल्प के रूप में मेथनोट्रोफिक जीवाणु भोजन का मूल्यांकन किया गया। पर्वतीय क्षेत्र के छोटे एवं मझोले मत्स्य पालकों की आवश्यकता के मद्देनजर छोटे पैमाने पर रेनबो ट्राउट पालन के लिए एक अत्यन्त उपयोगी बैकयार्ड आरएएस (री–सर्कुलेटिंग एक्वाकल्चर सिस्टम) का विकास किया गया है, जो कि कम लागत की यान्त्रिक व्यवस्था के साथ पानी की आवश्यकता को पारंपरिक पालन प्रणाली की तुलना में 50 से 100 प्रतिशत तक कम करने में उपयोगी है।

पहली बार, पहाड़ों के ऊपरी इलाकों में पायलट पैमाने पर मछली–सब्जी उत्पादन के लिए 'एकीकृत कृषि–जलकृषि खेती' (आईएएएफ) मॉडल विकसित किया गया है। हिमालयी क्षेत्रों में नियोजन, प्रभावी प्रबंधन के साथ–साथ उपयुक्त जलीय कृषि विकास के लिए संसाधन मूल्यांकन और मानचित्रण अनिवार्य रूप से आवश्यक है। आईसीएआर–डीसीएफआर ने अरुणाचल प्रदेश के आठ जिलों के लिए आरएस–जीआईएस आधारित संसाधन मानचित्रण का काम पूरा कर लिया है और पूर्वोत्तर क्षेत्र में मत्स्य पालन विकास के लिए जलीय कृषि साइट उपयुक्तता मानचित्र भी विकसित किए हैं। इसके अलावा, पारिस्थितिक मॉडल विकसित करने के लिए मध्यम हिमालयी नदियों की मात्स्यिकी जैव विविधता और विविधता और स्वास्थ्य मूल्यांकन भी किया गया है। इकोटूरिज्म हिमालयी क्षेत्र में मुख्य आधारों में से एक है और इसलिए, उत्तराखंड के कुमाऊं क्षेत्र में महासीर की मछली पकड़ने की स्थिति के लिए डेटा संकलित किया गया है।

ट्राउट और विदेशी कार्प पर आधारित ठंडे पानी की जलीय कृषि प्रथाओं में विस्तार के साथ खेती योग्य प्रजातियों के रोग निगरानी और स्वास्थ्य प्रबंधन के लिये कार्य किया है। आईसीएआर–डीसीएफआर ने फंफूदी जनित रोग सैप्रोलेग्निया पैरासिटिका की पहचान के लिए प्रोटीन–न्यूक्लिक एसिड (पीएनए) आधारित जांच विकसित की है। इसके अलावा, इस संक्रमण के खिलाफ एक बहुलक आधारित सूत्रीकरण प्रभावी पाया गया। इसके अलावा, पांच प्राकृतिक पौधों के अर्क यौगिकों को

सैप्रोलेग्निया पैरासिटिका और सैप्रोलेग्निया ओस्ट्रेलिस के खिलाफ प्रभावी पाया गया। आईसीएआर–डीसीएफआर ने मछली रोगजनकों के खिलाफ संभावित रोगाणुरोधी एजेंटों के विकास के लिए सिलिको ड्रग डिजाइनिंग पर भी काम शुरू किया है। शीतजल मछली पालन में मछलियों की मौजूदा रोगाणुरोधी प्रतिरोधक क्षमता जानने के लिए गहन सर्वेक्षण तथा विश्लेशण किया जा रहा है, जिसमें पाया गया है कि एरोमोनास तथा ई. कोलाई प्रजातियों के कुछ परजीवी शाकाणु प्रयोग की जा रही एंटीवायोटिक दवाओं के प्रति प्रतिरोधी हैं। इसके अलावा, राष्ट्रीय रोग निगरानी कार्यक्रम के तहत परजीवी और वायरल रोगों की जांच की जा रही है। आईसीएआर–डीसीएफआर ने डेनमार्क से आयातित रेनबो ट्राउट आइड ओवा के परिवहन, अनुकूलन और संगरोध में राज्य मत्स्य विभाग, उत्तराखंड को सभी आवश्यक तकनीकी सहायता प्रदान की गई है। ग्लोबल वार्मिंग और जलवायु परिवर्तन हिमालयी क्षेत्र के लिए आगामी खतरे और चुनौतियों का विशय हैं और एक अनुमान के अनुसार हिमालय में संभावित वार्मिंग दर वैश्विक औसत से तीन गुना अधिक है। ठंडे पानी के क्षेत्र और यहां की मत्स्य प्रजातियां जलवायु परिवर्तन के लिये अत्यन्त संवेदनशील हैं। आईसीएआर–डीसीएफआर ग्लोबल वार्मिंग के प्रभाव को समझने और शमन उपायों के लिये प्रयासरत है सुनहरी महासीर की नर एवं मादा मछलियों पर बढ़ते तापक्रम के प्रभाव को समझने के लिए ट्रांसक्रिप्टोम आधारित अध्ययन किया गया है, जिसमें नर मछली पर तापक्रम प्रभाव विश्लेशण हेतु कई जीन्स की पहचान की गई है। इसके अलावा, आणविक तंत्र को बेहतर ढंग से समझने हुये तापक्रम सुरक्षा तंत्र, जोकि शारीरिक इष्टतम से ऊपर के तापमान पर इंद्रधनुष ट्राउट की अनुकूलन प्रतिक्रियाओं को नियंत्रित करते हैं, तथा बढते तापक्रम के प्रति ऊतक विशिष्ट ट्रांसक्रिप्शनल प्रतिक्रिया को इंगीत करने के लिए अध्ययन किया गया है। इसके अलावा सुनहरी महासीर और रेनबो ट्राउट के लिए थर्मल मॉलिक्यूलर बायोमार्कर की भी पहचान की गई है। रेनबो ट्राउट पालन प्रक्षेत्रों में अजैविक जल गुणवत्ता सूचकांकों में मौसमी परिवर्तनों पर प्रक्षेत्र अवलोकन भी किया गया है। एक विशेश मत्स्य आहार भी विकसित करने का भी प्रयास किया जाता है जो रेनबो ट्राउट की तापक्रम अनुकूलन क्षमता को बढ़ाने में मदद कर सकेगा, जबकि इस मछली को शारीरिक इष्टतम से ऊपर के तापमान पर पाला जायेगा। पूर्वोत्तर क्षेत्रों, जनजाति समुदायों तथा अनुसूचित जाति समुदायों के लिये विशेश परियोजनाओं के तहत आईसीएआर–डीसीएफआर ने विभिन्न कार्यक्रमों के आयोजन के लिए ठोस प्रयास किया गया है और लक्षित समुदायों को उनके सामाजिक–आर्थिक उत्थान और आजीविका सुरक्षा के लिए आवश्यक सहायता भी प्रदान की है। इन कार्यक्रमों के तहत, विभिन्न पहाड़ी राज्यों में मछली किसानों के कई समूह विकसित किए गए हैं जो उनकी आजीविका में एक ठोस बदलाव मे सहायक है। इसके लिये आईसीएआर–डीसीएफआर ने वर्ष के दौरान कई कार्यक्रम, वेबिनार, प्रशिक्षण और अन्य कार्यक्रम आयोजित किए हैं। मत्स्य जीव विज्ञान, जलीय कृषि और पोषण से संबंधित विभिन्न विषयों पर वेबिनार का आयोजन किया गया है जिससे काफी संख्या में शोधकर्ताओं, शिक्षाविदों, विभिन्न संस्थानों और विश्वविद्यालयों के छात्र लाभान्वित हुए हैं। कई किसान–वैज्ञानिक संवाद एवं संगोश्ठी भी आयोजित की हैं जिसमें विभिन्न पहाड़ी राज्यों के किसानों ने भाग लिया है। भारत की आजादी के 75 साल पूरे होने के उपलक्ष्य में 'आजादी का अमृत महोत्सव' के एक भाग के रूप में, प्रासंगिक विषयों पर प्रख्यात वक्ताओं द्वारा ऑनलाईन व्याख्यानों की एक श्रृंखला भी आयोजित की गई है। इसके अलावा उत्तराखंड के विभिन्न गांवों में मत्स्य पालन हेतु कई जागरूकता कार्यक्रम भी आयोजित किये गये हैं। जिसमें आईसीएआर–डीसीएफआर ने स्वच्छता–पकवाड़ा में सक्रिय रूप से भागीदारी करते हुये स्वच्छता और स्वास्थ्य पर विभिन्न कार्यक्रमों का आयोजन किया है।

अततः यह स्पश्ट है कि आगामी वर्शो के संभावित चुनौतियों के मद्देनजर उत्पादन और उत्पादकता बढ़ाने के लिए ठोस प्रयासों की आवश्यकता है। मुझे पूरी उम्मीद है कि देश के हिमालयी क्षेत्र की वंचित आबादी की पोषण सुरक्षा के लिए शीतजल मात्स्यिकी का महत्वपूर्ण योगदान रहेगा। मैं डॉ. त्रिलोचन महापात्रा, सचिव, डेयर और महानिदेशक, भाकृअनुप और डॉ. जे.के. जेना, उप महानिदेशक (मत्स्य विज्ञान) को उनके निरंतर मार्गदर्शन एवं समर्थन के लिए हृदय से धन्यवाद देता हूं। निदेशालय के शोध कार्यक्रमों में महत्वपूर्ण मार्गदर्शन करने के लिए मैं शोध सलाहकार समिति के अध्यक्ष और सदस्यों का आभारी हूं। मैं भाकृअनुप–डीसीएफआर के सभी वैज्ञानिकों और कर्मचारियों को वर्ष के दौरान उनके उत्कृश्ट कार्य के लिए बधाई देता हूं और वार्षिक रिपोर्ट टीम की संपादकीय समिति को वार्षिक रूप से आईसीएआर–डीसीएफआर की वैज्ञानिक उपलब्धियों और गतिविधियों को संकलित करने और प्रस्तुत करने के लिए सराहना करता हूं।

(प्रमोद कुमार पाण्डेय)
निदेशक

दिनांकः 24 मार्च, 2022

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Preface

During the journey of three decades, ICAR-DCFR has tirelessly worked for the development of coldwater fisheries sector of the country. It has played pivotal role in the socio-economic development and livelihood security of the hill farmers. In recent years, coldwater fisheries in India has been gaining further significance and has also been identified as one of the important sector which can contribute nutritional security of mountainous regions of the Himalayan states of the country. For achieving greater heights and to realize the dreams of Atam Nirbhar Bharat the ICAR-DCFR has intensified its research and developmental efforts. During the year in report the directorate prioritized the coldwater sector's requirements of the country and accordingly has taken up different research programmes to address the need of the sector. The year 2021 remained another year of COVID-19 pandemic which brought new challenges to the world. During the lockdown, the directorate kept working through all available means of communication and showed courage to face the inescapable challenges.

The directorate has successfully achieved captive maturation and multiple breeding of golden mahseer (*Tor putitora*). This technology would be useful in large scale seed production which would facilitate conservation and rehabilitation of endangered mahseer in natural water bodies of Himalayan region. Species diversification for coldwater aquaculture remained a challenging task for last many years. The directorate has put sincere efforts for artificial spawning and growth evaluation of indigenous snow trout, *Schizothorax progastus* and *S. plagiostomus*. Apart from this, a couple of indigenous ornamental fish species were successfully bred in captivity that has good market potential. Rainbow trout being a commercial coldwater cultivable species has immense scope of expansion in potential areas of the country. For ensuring quality seed production of rainbow trout, ICAR-DCFR has developed nutritionally rich and efficient brood stock feed. The initial field trials at different locations have given encouraging and promising results. Additionally, work has also been initiated for the development of a nutrient sensitive and effective package of feeds and feeding strategies for augmenting rainbow trout production in the country. In order to reduce the cost of trout feed, evaluation of methanotrophic bacterial meal as substitute of fish meal in rainbow trout grow out feed was made. To cater the need of small and medium farmers, two backyard re-circulating aquaculture system (RAS) models were designed, fabricated and validated for small scale rainbow trout production with minimal mechanical equipments. The new RAS models have the advantage of reducing water usage 50-100 times compared to conventional flow through system. For the first time, an 'Integrated Agri-Aquaculture Farming' (IAAF) model has been developed for pilot scale fish-vegetable production in Indian uplands. Resource assessment and mapping is essentially required for planning, effective management as well as suitable aquaculture development in the Himalayan regions. ICAR-DCFR has completed RS-GIS based resource mapping for eight districts of Arunachal Pradesh and also developed aquaculture site suitability maps for fisheries development in North-eastern region. Further, ichthyofaunal diversity and health assessment of central Himalayan Rivers were also done to develop ecological models. Ecotourism is one of the mainstays in the Himalayan region and therefore, data has been compiled for the angling status of mahseer in Kumaun region of Uttarakhand.

Disease surveillance and health management of cultivable species has gained attention with expansion in coldwater aquaculture practices based on trout and exotic carps. ICAR-DCFR has developed protein-nucleic acid (PNA) based probes for the identification of Saprolegnia parasitica, causing an oomycetes infection common in coldwater cultured fish. Further, a polymer based formulation was found effective against this

infection. Moreover, five natural plant extract compounds were found effective against S. parasitica and S. australis. ICAR-DCFR has also initiated work on in silico drug designing for development of potential antimicrobial agents against fish pathogens. An active survey and screening of antimicrobial resistance (AMR) in fish was carried out in coldwater aquaculture which indicates that Aeromonas spp, and E. coli were resistant to certain antibiotics. Further, screening of parasitic and viral diseases under national disease surveillance programme was taken up. ICAR-DCFR has also provided all necessary technical support to the State Fisheries Department, Uttarakhand in transportation, acclimatization and quarantine of rainbow trout eyed ova imported from Denmark. Global warming and climate change is posing new threats and challenges for the Himalayan region and according to one estimate progressive warming rate in Himalayas is three times greater than the global average. The coldwater region and species would be the first to receive the brunt of climate change. ICAR-DCFR has rightly initiated the efforts for understanding the effect of warming and devising the mitigation measures. Transcriptome based studies were carried out to understand the effect of thermal stress on different sexes of the golden mahseer where a number of differentially expressed genes (DEGs) were identified in thermally stressed male. Further, to better understand the molecular mechanisms which regulate thermal safety margins and adaptive responses of rainbow trout at temperatures above physiological optimum, studies were taken up to profile tissue specific transcriptional response after high temperature exposure. Apart from this, thermal molecular biomarkers for golden mahseer and rainbow trout also were identified. Field observations on seasonal changes in abiotic water quality indices in rainbow trout farms were also made. Efforts are also made to develop a functional feed which can help in enhancing the thermal acclimation capacity of rainbow trout, when reared at temperatures above the physiological optimum.

Under the NEH, TSP and SCSP programme the ICAR-DCFR has put concerted efforts to organize various programmes and also provided necessary inputs to the targeted communities for their socio-economic upliftment and livelihood security. Under these programmes, a number of clusters of fish farmers have been developed in different hill states which indicate a tangible change in their livelihood. ICAR-DCFR has conducted a range of events, webinars, training and other programmes during the year. Webinars on various topics related to fish biology, aquaculture and nutrition has been organized and attended by a considerable numbers of researchers, academicians, students from different institutions and universities. A number of Farmers-Scientist interface meet was also organized where farmers from different hill states participated. As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the 75 years of India's Independence, a series of lectures by eminent speakers on pertinent topics were also organized through virtual mode. Apart from this, many awareness programmes were also organized at different villages of the Uttarakhand. ICAR-DCFR has also actively participated in the Swachhata-Pakwara and organized various programmes on cleanliness and health.

At the end, I would like to emphasize that the coming years are more challenging and therefore, need concerted efforts to increase the production and productivity. I sincerely hope that the coldwater fisheries will also be a contributing sector for the nutritional security of the underprivileged population of the Indian Himalayan region. I sincerely thank Dr. T. Mohapatra, Secretary, DARE 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) and Dr. P. Pravin, ADG (Marine 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 splendid work during the year and my appreciation to the editorial committee of the annual report team for their meticulous efforts in compiling and presenting the scientific achievements and activities of the ICAR-DCFR in Annual Report 2021.

(Pramod Kumar Pandey)
DIRECTOR

Dated: 24 March, 2022

CONTENTS

1. कार्यकारी सारांश

शीतजल मात्स्यिकी काफी हद तक भारतीय हिमालयी क्षेत्रों तक ही सीमित है, जिसका पारिस्थितिकी तंत्र अपने आप में अनूठा है तथा इसमें विशिष्ट प्रकार की कई महत्वपूर्ण स्थानिक मत्स्य प्रजातियों का वाास है। हाल के वर्षों में शीतजल मात्स्यिकी के महत्व को भारतीय उच्च हिमालयी क्षेत्रों की वंचित आबादी को आजीविका और पोषण सुरक्षा प्रदान करने के रूप में महसूस किया गया है। भारतीय कृषि अनुसंधान परिषद (आईसीएआर) के तत्वावधान में शीतजल मात्स्यिकी अनुसंधान और विकास के लिए एक नोडल संस्थान के रूप में आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल ने पहाड़ी क्षेत्रों में बुनियादी, रणनीतिक और अनुप्रयुक्त अनुसंधान, विस्तार गतिविधियों, जलीय कृषि और संसाधन मूल्यांकन में अत्यधिक योगदान दिया है। यह जलीय संसाधनों के बेहतर और सतत उपयोग के साथ–साथ प्रजातियों के विविधीकरण, अनुसंधान और विकास के लिए केंद्रित क्षेत्र रहा है। प्रशिक्षण और क्षमता निर्माण ने पहाड़ी क्षेत्रों में मछली पालन के अवसर भी प्रदान किए हैं। पिछले वर्ष के दौरान निदेशालय ने भू–सूचना विज्ञान का उपयोग करके जलीय संसाधन मानचित्रण को सफलतापूर्वक पूरा किया है और हिमालयी राज्यों में जलीय कृषिके विकास हेतु स्थलों के उपयुक्त मानचित्र तैयार किए हैं।

निदेशालय द्वारा शीतजल मत्स्य प्रजनन पर किए जा रहे अनुसंधान कार्यों में लुप्तप्राय सुनहरी महासीर (टोर पुटिटोरा) के बहु प्रजनन और बीज उत्पादन में तकनीकी की प्रगति एक मील का पत्थर है। इसने भारतीय हिमालय की इस मूल्यवान प्रमुख प्रजाति के संरक्षण और प्रसार का मार्ग प्रशस्त किया है। मत्स्य स्वास्थ्य प्रबंधन और निदान के क्षेत्र में महत्वपूर्ण उपलब्धियां हासिल की गई हैं और साथ ही जलीय दवाओं को बनाने और रोगाणुरोधी प्रतिरोध के खिलाफ समाधान विकसित करने के प्रयास किए गए हैं। जैव प्रौद्योगिकी और आणविक अनुप्रयोगों ने लिंग भेदभाव और अजैविक प्रतिक्रिया में जीन विनियमन के तंत्र को समझने के अवसर प्रदान किए हैं। CRISPER-Cas प्रणाली का उपयोग करते हुए जीनोम संपादन पर कार्य चल रहा है तथा यह कार्य वांछित लक्षणों की प्रजातियों के विकास की आशा प्रदान करते हैं। वर्ष 2021 में COVID–19 महामारी का एक और वर्ष रहा जिसने दुनिया के लिए नई चुनौतियां पेश कीं। लॉकडाउन के दौरान, निदेशालय सभी उपलब्ध संचार साधनों के माध्यम से काम करता रहा और अपरिहार्य चुनौतियों का सामना करने का साहस दिखाया। इसने COVID-19 परीक्षण में भाग लिया और किसानों के लिए सलाह तैयार की और सभी हिमालयी राज्यों के मछली किसानों तक पहुंचने की कोशिश की। निदेशालय ने मास्टर और पीएचडी में छात्रों के अकादमिक और अनुसंधान के लिए सहयोगी विश्वविद्यालयों, राज्य मत्स्य विभागों और अन्य संस्थानों के साथ एम.ओ.यू. के माध्यम से संबंध बनाए हैं। वर्ष 2021 में संस्थान की अनुसंधान उपलब्धियों को संक्षेप में प्रस्तुत किया गया है:–

संसाधन मूल्यांकन एवं प्रबंधन

- अरुणाचल प्रदेश के आठ जिलों अर्थात दिबांग घाटी, निचली दिबांग घाटी, पूर्वी सियांग, सियांग, निचला सियांग, पश्चिम सियांग, ऊपरी सियांग और ऊपरी सुबनसिरी का सर्वेक्षण कर जांच की गई। जलीय संसाधन, जल निकासी नेटवर्क, भूमि उपयोग भूमि कवर, डिजिटल ऐलिवेशन मॉडल, ढलान नक्शा और जलीय कृषि के लिए उपयुक्तत स्थलों के लिए मानचित्र निकाले गए और आर्क जी.आई.एस. v 10.8 के स्थानिक विश्लेषण उपकरण का प्रयोग करके उनका सैटेलाइट डेटा, जियो रेक्टिफाइड SOI टोपोशीट, स्थानिक और गैर स्थानिक डेटा विकसित किया गया।
- मध्य हिमालयी नदी सरयू और लढिया, उत्तराखंड की मत्स्य विविधता और स्वास्थ्य मूल्यांकन का ऑकलन करने के लिए अध्ययन किए गए हैं। मात्स्यिकी और अन्य महत्वपूर्ण जल की गुणवत्ता के मानकों को दर्ज किया गया और लदिया नदी का WQI विकसित किया गया।
- कुमाऊं क्षेत्र में ईको–टूरिज्म एवं संरक्षण के लिए महाशीर की एंगलिंग स्थिति का ऑकलन करने का कार्य किया गया। महाशीर के संरक्षण पर एंगलिंग के प्रभाव का विश्लेषण करने के लिए अतीत और वर्तमान की एंगलिंग स्थिति पर ऑकड़े एकत्रित किए गए।
- भारत के मध्य और पूर्वी हिमालयी क्षेत्र से महाशीर की प्रजातियों (टोर और नियोलिसोचिलस) के स्टॉक सत्यापन पर नेटवर्क कार्यक्रम के अर्न्तगत विभिन्न नदियों, झीलों के नमूने लिए गए, साथ ही साथ महाशीर के नमूने भी एकत्र किए गए। नजीरिटर चेलिनोइड्स के लिए कालसी धारा में

एक आवास मानचित्र भी विकसित किया गया। विभिन्न जल स्रोतों और झीलों से एकत्रित प्रजातियों की बारकोडिंग के लिए एकत्रित किए गए मॉर्फोमेट्रिक और मेरिस्टिक पैरामीटर एवं डीएनए का अध्ययन भी किया गया।

जलीय कृषि उन्मुख अनुसंधान और विकास

- महासीर के तालाब प्रबंधन के तहत, तालाबों में एन. हेक्सागोनोलेपिस की स्पॉनिंग को बढ़ाने के लिए महत्वपूर्ण कारकों का निर्धारण किया गया और सोलोमन कोडर के माध्यम से उनके व्यवहार को समझने के साथ साथ उसको कूटबद्ध किया गया।
- फोटो–थर्मल हस्तकौशल के साथ तालाबो के तल में फैलायी गयी बजरी में सुनहरी महाशीर का प्रजनन और पालन पोषण कर उनके प्रदर्शन में अनुकूल वृद्धि देखी गयी तथा अधिकतम निषेचन दर को अनुकूलित किया गया।
- एस. प्रोगैस्टस और एस. प्लेजियोस्टोमस में बेहतर जननांगी परिपक्वता के लिए विभिन्न जड़ी–बूटियों को फीड सप्लीमेंट के रूप में उपयोग करके प्रायोगिक परीक्षण किए गए। यह पता चला कि अश्वगंधा (विथानिया सोम्निफेरा) की जड़ के पाउडर, लहसुन के सूखे पाउडर (एलियम सैटिवम) और हींग (फेरुला हींग) के मिश्रण से युक्त पूरक आहार मादाओं की जननांगी परिपक्वता और तालाबों में बेहतर स्पॉनिंग के लिए फायदेमंद है।
- सकर हैड, गारा गोटिला को तालाब में सफलतापूर्वक पैदा किया गया और 25 ग्राम आकार तक की अंगुलिकाओं से जीवित रहने की दर 98% दर्ज की गई। लगभग 200–300 मछली/घनमीटर/वर्ष छोटे पॉली– टैंकों में 1000–1500/एम^3/वर्ष की दर से रु. 10/– प्रति पीस का शुद्ध लाभ के साथ उत्पादन किया जा सकता है। अध्ययन के लिए, गारा गोटिला के बीज को विभिन्न तापमानों पर पाला गया जिसके प्रारंभिक परिणाम आशाजनक दिखाई दिए।
- सजावटी मछली प्रजनन कार्यक्रम के तहत हिमालयी क्षेत्र में पाई जाने वाली एक स्वदेशी सजावटी मत्स्य प्रजाति, बेरिलियस वेग्रा के बीज उत्पादन के लिए प्रयास किए गए।
- दो बैकयार्ड रीसर्क्युलेटिंग एक्वाकल्चर सिस्टम मॉडल को छोटे पैमाने पर रेनबो ट्राउट उत्पादन के लिए डिजाइन किया गया ताकि छोटे किसानों की उपकरण विफलता की संभावनाओं को कम करने और प्रारंभिक निवेश को कम करने में मदद मिल सके। दोनों प्रणालियों से से 386 किलो मछली का उत्पादन किया गया और स्थानीय बाजार में बेचा गया। तकनीकी –आर्थिक संभावना के आधार पर अध्ययन से पता चला है कि दोनों प्रणालियों में 2–3 फसलों (1–2 वर्ष) की पे–बैक अवधि थी और इस प्रणाली के पानी के उपयोग की गणना 908–1082 लीटर प्रति किलोग्राम मछली के उत्पादन में की गई जो कि 50–100 गुना कम है।
- भारतीय पर्वतीय क्षेत्र में व्यापक पैमाने में एक 'एकीकृत कृषि–जलकृषि खेती' (आईएएएफ) का एक मॉडल मछली–सब्जी उत्पादन के लिए विकसित किया गया । कम लागत और कम तकनीक वाले ठंडे पानी के रीसर्क्युलेटरी एक्वापोनिक्स मॉडल को इस तरह से डिजाइन किया गया है कि कुछ घटकों जैसे हाइड्रोपोनिक कम बायोफिल्टरेशन यूनिट, सम्प कम बेस एडिशन टैंक इत्यादि का उपयोग एक से अधिक कार्यों के लिए किया जा सकता है ताकि जगह और लागत को कम किया जा सके।

मछली पोषण और चारा विकास

- रेनबो ट्राउट के वृद्धि आहार में मछली के भोजन के विकल्प के रूप में मेथनोट्रोफिक बैक्टीरिया भोजन का मूल्यांकन किया गया। इस अध्ययन में, रेनबो ट्राउट में इस नवीन मेथनोट्रोफिक बैक्टीरियल प्रोटीन मील (स्ट्रिंग प्रो बीएम) की आहार फिशमील (एफएम) प्रतिस्थापन क्षमता, विकास, फीड उपयोग, पाचनशक्ति, पोषक संतुलन और ऊतकीय टिप्पणियों के आधार पर मूल्यांकन किया गया।
- गोल्डन महासीर की प्रजनन क्षमता और लार्वा गुणवत्ता लक्षणों में सुधार के लिए पोषण संबंधी व्यवधान के रूप में, तालाब में टोर पुतिटोरा के प्रजनन प्रदर्शन और लार्वा गुणवत्ता का मूल्यांकन करने के लिए मौजूदा प्रजनक भण्डार के आहार में कुछ पोषक तत्वों/योजकों को शामिल करके एक बेहतर प्रजनक भण्डार का आहार तैयार किया गया। परीक्षण आहार खिलाने से निषेचन और अंडे सेने की दर, अंडे और शुक्राणु की गुणवत्ता के साथ–साथ लार्वा के जीवित रहने में उल्लेखनीय रूप से सुधार हुआ।
- रेनबो ट्राउट के ब्रूडर फीड की आवश्यकता हेतु राष्ट्रीय स्तर पर गुणवत्ता वाले बीज के पर्याप्त उत्पादन के लक्ष्य को प्राप्त करने हेतु रेनबो ट्राउट के लिए कुशल ब्रूडर फीड का विकास और सत्यापन किया गया। फील्ड सेंटर और अन्य स्थानों पर फील्ड ट्रायल के दौरान आशाजनक परिणाम प्राप्त हुए।

- रेनबो ट्राउट उत्पादन को बढ़ाने के लिए पोषक तत्वों के प्रति संवेदनशील और फीड के प्रभावी पैकेज और फीडिंग रणनीतियों के विकास के लिए कार्य शुरू कर दिया गया है। प्रारंभ में आनुवंशिक पृष्ठभूमि के संबंध में ग्रो–आउट फीड प्रदर्शन का मूल्यांकन किया गया। वैकल्पिक प्रोटीन अवयवों के मिश्रण के साथ मछली के भोजन प्रतिस्थापन के प्रभावों का पता लगाने के लिए आगे के अध्ययन और फीड प्रदर्शन पर भंडारण घनत्व और आकार की विविधता के प्रभाव का पता लगाने के लिए अध्ययन किए जा रहे हैं।

आणविक आनुवंशिकी और जैव प्रौद्योगिकी

- लिंग विशिष्ट जीन अभिव्यक्ति को समझने के लिए नर और मादा मछलियों के जननांगों के ट्रांसक्रिप्टोम प्रोफाइल के लिए अध्ययन किए गए। डे नोवो असेंबली ने 316,548 गैर–अनावश्यक टेपों और 1327 बीपी के एक N50 के साथ एक अत्यधिक पूर्ण संदर्भ प्रतिलेख का उत्पादन किया।
- विभेदक अभिव्यक्ति विश्लेषण ने लिंगों के बीच यौन–पक्षपाती टेप (17,355) के एक बड़े सेट की पहचान की। यह अध्ययन टी. पुटिटोरा के पहले गोनाडल ट्रांसक्रिप्टामिक विश्लेषण का प्रतिनिधित्व करता है और महाशीर में लिंग निर्धारण के आणविक तंत्र की आगे की जांच के लिए एक आधार प्रदान करता है।
- स्वर्ण महाशीर के विभिन्न लिंगों पर थर्मल तनाव के प्रभाव को समझने के लिए अध्ययन किए गए। नर और मादा के जननांग और मस्तिष्क का ट्रांसक्रिप्टोम प्रोफाइल किया गया तथा एक डे नोवो ट्रांस्क्रिप्टोम तैयार किया गया। जननांग में स्क्रीन डिफरेंशियल रूप से व्यक्त जीन (डीईजी) की स्क्रीनिंग से पता चला कि दोनों लिंगों में 24 DEG पाए गए, यह सुझाव है कि उच्च तापमान के संपर्क में आने के लिए एक सामान्य आनुवंशिक तंत्र होने की संभावना है। ये DEG यौन भेदभाव, नाइट्रोजन चयापचय, ग्लूकागन सिग्नलिंग मार्ग, प्रोटीन पाचन और अवशोषण, फोटो ट्रांसडक्शन और एडिपोसाइटोकाइन सिग्नलिंग मार्ग से संबंधित KEGG मार्गों में समृद्ध थे।
- जेब्राफिश, डैनियो रेरियो और कॉमन कार्प, साइप्रिनस कार्पियो के एकल कोशिका चरण में RNPs को सूक्ष्म इंजेक्शन लगाने के लिए एक प्रोटोकॉल विकसित किया गया तथा MSTN और DND जीन के नॉकआउट के लिए मानकीकृत किया गया।
- रेनबो ट्राउट के हृदय की कोशिकाओं से एक कोशिका रेखा विकसित की गई और इसे RBT&H नाम दिया गया। कोशिकाओं को आईसीएआर–डीसीएफआर की सेल कल्चर प्रयोगशाला में बनाए रखा गया और क्रायोप्रिजर्व किया गया। कोशिकाओं को नेशनल रिपोजिटरी फॉर फिश सेल–लाइन्स (NRFC) ICAR&NBFGR लखनऊ में जमा किया गया।
- आण्विक व्यवस्थित, प्रजातियों की पहचान और संरक्षण के लिए अधिक विश्वसनीय और उपयोगी ऑकड़ो के लिए NGS पद्धति का उपयोग करते हुए स्वदेशी ठंडे पानी की प्रजातियों और इसके फाईलोजेनी का पूर्ण माइटोकॉन्ड्रियल जीनोम लक्षण का वर्णन शुरू किया गया।
- पॉलीमर आधारित दृष्टिकोण का उपयोग करते हुए मछली की कोशिकाओं में इन विट्रो ट्रांसफेक्शन विकसित करने के लिए कार्य शुरू किया गया। इसके तहत मछली की कोशिकाओं के अंदर जीन वहन करने की क्षमता के लिए पॉलीहेक्सामेथिलीनबिगु आनाइड एक बहुलक का मूल्यांकन किया गया।

रोग निगरानी और स्वास्थ्य प्रबंधन

- एक PNA जांच एस. पैराएटिका की पहचान के लिए विकसित की गई है, जो कि शीतजल मत्स्य प्रजातियों में काफी आम है। यह जांच एस. पैराएटिका के लिए विशिष्ट थी और स्वस्थानी संकरण में फ्लोरोसेंट (फिश) का उपयोग एस. पैरासिटिका की पहचान के लिए इस्तेमाल किया जा सकता है।
- सैप्रोलेग्निया पैरासिटिका के प्रति इसकी एंटी–ओमाइसीट गतिविधि के लिए बहुलक–आधारित फॉर्मूलेशन का परीक्षण किया गया। परिणामों ने संकेत दिया कि बहुलक में सैप्रोलेग्निसिस को नियंत्रित करने की क्षमता है। इसके अलावा, न्यूनतम प्रतिकूल प्रभाव के साथ सैप्रोलेग्निओसिस के लिए एक प्रभावी वैकल्पिक उपचार के रूप में एंटिफंगल/ एंटीसेप्टिक एजेंट क्लोरहेक्सिडिन (सीएचएक्स) की एंटी–ओमाइसीट गतिविधि को जानने के लिए एक अध्ययन किया गया।
- ओमाइसीट्स संक्रमण के खिलाफ उनकी प्रभावकारिता के लिए एंटी–फंगल एजेंटों और जड़ी–बूटियों के मूल्यांकन के तहत, रेन्बो ट्राउट के विभिन्न जीवन चरणों से चार अलग–अलग प्रजातियों के विरूद्व लगभग नौ उपलब्ध एंटिफंगल/रासायनिक दवाओं और पांच हर्बल बायोएक्टिव अणुओं का परीक्षण किया गया। पांच प्राकृतिक पौधों के अर्क से यौगिकों की प्रभावशीलता, करक्यूमिन (CUR); Saprolegnia की दो प्रजातियों पर Eugenol (EUG), Cinnamaldehyde (CIN), Stigmasterol (ST) और

Morin (MOR), Saprolegnia parasitica और *S. australis* की जांच की गई।

- मछली रोगजनकों के प्रति संभावित रोगाणुरोधी एजेंटों के विकास के लिए इन सिलिको ड्रग डिजाइनिंग के तहत, संभावित लक्ष्य प्रोटीन और उनके अवरोधकों की पहचान करने और इन विट्रो दृष्टिकोण द्वारा चयनित यौगिकों के बाद के प्रयोगात्मक सत्यापन के लिए एक आम सहमति पर कम्प्यूटेशनल ढांचा विकसित किया गया।
- बीज उत्पादन के दौरान ट्राउट फार्मों में मृत्यु से जुड़े सामान्य स्वास्थ्य विकारों से संबंधित जांच को लक्षित किया गया। ट्राउट फार्म और हैचरी के भौतिक–रासायनिक मापदंडों के साथ–साथ उत्तराखंड के विभिन्न फार्मों से महामारी विज्ञान संबंधी जानकारी एकत्र की गई। इसके अलावा, बैरांगना ट्राउट फार्म, चमोली में डेनमार्क से आयातित रेनबो ट्राउट के आइड ओवा के परिवहन और अनुकूलन पर अवलोकन कार्य किए गए।
- रेनबो ट्राउट में ओमाइसीट्स संक्रमण के खिलाफ टीकाकरण के प्रभाव के मूल्यांकन पर एक परियोजना, ओन्कोरहिन्कस मायकिस शुरू की गयी, जिसके तहत हिमालयी पौधों से लगभग तीन प्राकृतिक यौगिकों की जांच की गई है जिनमें एंटी–ओमाइसीट्स और इम्यूनोस्टिम्युलेटरी गतिविधि शामिल है।

राष्ट्रीय नेटवर्क कार्यक्रम

- मछलियों में रोग–रोधक प्रतिरोध (एएमआर) पर नेटवर्क कार्यक्रम के तहत, विभिन्न एंटीबायोटिक दवाओं के विरूद्ध एरोमोनस एसपीपी और ई. कोलाई के रोगाणुरोधी प्रतिरोध का प्रदर्शन किया गया था। परिणामों ने प्रदर्शित किया कि एरोमोनाज समूह के लिए एम्पीसिलीन के प्रति 78-6% की अधिकतम एंटीबायोटिक प्रतिरोधक क्षमता देखी गयी, इसके बाद सेफॉक्सिटिन (35-7%) का स्थान रहा। ई कोलाई के मामले में, सेफलोथिन (83-3%) के प्रति अधिकतम प्रतिरोध दिखायी दी, इसके बाद सेफॉक्सिटिन (66-7%) थी।
- जलीय जंतु रोग के लिए राष्ट्रीय निगरानी कार्यक्रम के तहत शीतजल मत्स्य रोगों की निगरानी (NSPAAD) उत्तराखंड के चमोली, अल्मोड़ा और नैनीताल जिलों में 32 कार्प और ट्राउट फार्म हैचरी, 6 ट्राउट ग्रो आउट रेसवे में सक्रिय और निष्क्रिय रोग निगरानी की गई। उत्तराखंड के चमोली और नैनीताल जिलों में मछली के विभिन्न नमूनों में परजीवी और वायरल रोगों की जांच भी की गई।
- मछली के स्वास्थ्य पर अखिल भारतीय नेटवर्क परियोजना के तहत रेनबो ट्राउट जुवेनाइल में फ्लोरफेनिकॉल वाले फीड के बाद किडनी में फ्लोरफेनिकॉल के जमाव का मूल्यांकन किया गया।
- निक्रा (NICRA) परियोजना के तहत, निदेशालय ने रेनबो ट्राउट की खेती के लिए जलवायु के अनुकूल ठंडे पानी के पुनः परिसंचारी जलीय कृषि प्रणालियों को विकसित करने, मान्य करने और बढ़ावा देने का प्रयास किया गया।
- इसके अलावा, रेनबो ट्राउट के आणविक तंत्र एवं थर्मल सुरक्षा को बेहतर ढंग से समझने के लिए शरीर की ईष्टतम से उपर के तापमान पर रेन्बो ट्राउट की अनुकूली प्रतिक्रियाओं की जांच की गयी।
- रेनबो ट्राउट में थर्मल टॉलरेंस से संबंधित बायोमार्कर के लक्षण का वर्णन किया गया और रेनबो ट्राउट में थर्मल टॉलरेंस के तीन संभावित बायोमार्कर के MRNA अनुक्रम, अर्थात् तनाव प्रेरित फॉस्फोप्रोटीन (ओमस्टिप 1–*Omstip1* 539749, पूर्ण), हाइपोक्सिया अपग्रेडेड प्रोटीन (*Omstip1*– *OL* 539750, पूर्ण) और A हीट शॉक प्रोटीन 40 परिवार के सदस्य (*Omdnajc*16 & OL539748] आंशिक) पूरा हो गया।
- हिमाचल प्रदेश के कुल्लू और मंडी जिलों के दो अलग–अलग सूक्ष्म जलवायु वाले क्षेत्रों में बारह निजी रेन्बो ट्राउट फार्मों में महत्वपूर्ण अजैविक जल की गुणवत्ता के सूचकांकों में मौसमी परिवर्तनों का क्षेत्रवार अवलोकन किया गया।
- रेन्बो ट्राउट के शरीर के ईष्टतम से उपर के तापमान पर पालने के लिए उसके शरीर की तापीय क्षमता को बढ़ाने हेतु आठ सप्ताह तक आहार परीक्षण किया गया तथा एंटीऑक्सीडेंट विटामिन के सप्लीमेंट के विभिन्न आहार स्तरों की प्रभावशीलता का मूल्यांकन किया गया।

बाह्य वित्त पोषित परियोजनाएं

- डीबीटी प्रायोजित परियोजना के अर्न्तगत, तालाबों में सुनहरी महासीर (टोर पुटिटोरा) के प्रजनक भण्डार में इम्यूनो मॉड्यूलेशन β–ग्लूकेन की प्रतिरक्षा–मॉड्यूलेटरी क्षमता को स्पष्ट करने के लिए प्रायोगिक परीक्षण किए गए तथा यह पाया गया कि β–ग्लूकेन (1.0þ) का आहार समावेशन नर्सरी पालन के दौरान प्रतिरक्षा, तापीय सहनशीलता और सुनहरी महासीर के फ्राई के रोग प्रतिरोध में सुधार करने में कुशल है।
- डीबीटी प्रायोजित परियोजना के तहत, प्रयोगशाला में डिजाइन और संश्लेषित सात

पेप्टाइड्स में से चार पेप्टाइड्स (KK12YW, KK12FW, KY12WY और RH12) का मूल्यांकन एंटीबायोटिक प्रतिरोधी बैक्टीरिया सहित विभिन्न जीवाणु रोगजनकों के प्रति इसकी एंटी माइक्रोबियल गतिविधियों के लिए किया गया।

बौद्धिक संपदा अधिकार एवं प्रौद्योगिकी विकास

- 2021 की अवधी में आईसीएआर–डीसीएफआर में तीन ट्रेडमार्क पंजीकृत किए गए और आईसीएआर–डीसीएफआर एवं विभिन्न विश्वविद्यालयों के बीच चार समझौता ज्ञापनों (एम. ओ.यू.) पर हस्ताक्षर किए गए।
- आईसीएआर–डीसीएफआर ने क्रिश्चियन मेडिकल कॉलेज (सीएमसी) एवं अस्पताल, वेल्लोर द्वारा संचालित बाह्य गुणवत्ता आश्वासन योजना (ईक्यूएएस) (ईक्यूएएस 1 और ईक्यूएएस 2) में भाग लिया।
- सुनहरी महासीर के पुनर्वासन एवं संरक्षण के लिए सतत् बीज उत्पादन को सुनिश्चित करने के लिए आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल द्वारा तालाबों में लुप्तप्राय स्वर्ण महासीर (टोर पुतिटोरा) के बहुप्रजनन की तकनीक विकसित की गयी है।
- आईसीएआर–डीसीएफआर, भीमताल में मुख्य रूप से अंडे और लार्वा की उत्तरजीवितता में सुधार के लिए ट्राउट अंडे के पालन के लिए एक पुनः परिसंचारी अंडा ऊष्मायन और लार्वा पालन प्रणाली डिजाइन और निर्मित की गई है। प्रारंभिक अध्ययन से पता चला कि कम तापमान संबंधी असामान्यताओं के साथ ताप नियंत्रित करने वाले पुर्नजल संचरण प्रणाली का उपयोग करके अंडों में 90% से अधिक उत्तरजीवितता को प्राप्त किया जा सकता है।

महत्वपूर्ण घटनाएँ, विस्तार गतिविधियाँ, प्रशिक्षण और अन्य विकास

- दिनांक 26 जनवरी, 2021 को देश का गणतंत्र दिवस समारोह हर्षोल्लास के साथ मनाया गया इस अवसर पर संस्थान के निदेशक ने ध्वजारोहण किया और इसमें निदेशालय के सभी वैज्ञानिकों और कर्मचारियों एवं दैनिक वेतनभोगी कर्मचारियों ने भाग लिया।
- आईसीएआर–डीसीएफआर ने 24 फरवरी, 2021 को ''ठंडे पानी की मछली पालन प्रौद्योगिकियों में हालिया प्रगति'' विषय पर एक वेबिनार का आयोजन किया।
- दिनांक 26 मार्च, 2021 को डॉ. डब्ल्यू. एस. लकड़ा, पूर्व निदेशक और कुलपति, आईसीएआर–सी.आई एफ. ई, मुंबई की अध्यक्षता में संस्थान की आरएसी बैठक का ऑनलाइन रूप से आयोजन किया गया।
- दिनांक 18 जून, 2021 को भीमताल में आयोजित 'एक्वाकल्चर में उर्वरकों के संतुलित उपयोग' पर जागरूकता सह किसान गोष्ठी का आयोजन किया गया।
- निदेशालय और उसके प्रायोगिक क्षेत्र केंद्र, चंपावत पर सभी वैज्ञानिकों/कर्मचारियों और शोधार्थियों द्वारा 21 जून 2021 को अंतर्राष्ट्रीय योग दिवस मनाया गया।
- दिनांक 23 से 25 जून 2021 को संस्थान की आई.आर.सी. की बैठक डॉ. प्रमोद कुमार पांडे, निदेशक, आईसीएआर–डीसीएफआर भीमताल की अध्यक्षता में आयोजित की गई।
- दिनांक 29 जून, 2021 को आईसीएआर–डीसीएफआर, चंपावत के प्रयोगिम मत्स्य प्रक्षेत्र में एक किसान–वैज्ञानिक संवाद बैठक और मछली बीज–चारा वितरण कार्यक्रम आयोजित किया गया।
- दिनांक 3 जुलाई, 2021 को प्रख्यात वक्ता प्रो. एम. प्रेमजीत सिंह, पूर्व कुलपति केंद्रीय कृषि विश्वविद्यालय, इंफाल द्वारा भारत की आजादी के 75 साल पूरे होने के उपलक्ष्य में 'आजादी का अमृत महोत्सव' के एक भाग के रूप में, "पहाड़ी क्षेत्र में किसानों की आय दोगुनी करने के लिए रणनीतियाँः तकनीकी विकल्प" पर एक व्याख्यान दिया गया।
- दिनांक 10 जुलाई, 2021 को आईसीएआर–डीसीएफआर ने राष्ट्रीय मत्स्य किसान दिवस मनाया। यह आयोजन भारत के आगामी 75वें स्वतंत्रता दिवस 'आजादी का अमृत महोत्सव' के लिए चल रहे समारोहों का भी एक हिस्सा है।

- दिनांक 16 जुलाई, 2021 को आईसीएआर–डीसीएफआर के चम्पावत स्थित प्रयोगिक मत्स्य प्रक्षेत्र में भाकृअनुप स्थापना दिवस के अवसर पर वृक्षारोपण कार्यक्रम का आयोजन किया गया।
- दिनांक 7 अगस्त, 2021 को भारत की आजादी के 75 साल पूरे होने के उपलक्ष्य में 'आजादी का अमृत महोत्सव' के एक भाग के रूप में, "पोषण सुरक्षा के लिए कृषि परिवर्तन" पर एक प्रख्यात वक्ता पद्म भूषण डॉ. राम बदाम सिंह, पूर्व कुलाधिपति, केंद्रीय कृषि

विश्वविद्यालय, इंफाल, द्वारा व्याख्यान दिया गया था।

- दिनांक 15 अगस्त, 2021 को 75वां स्वतंत्रता दिवस के अवसर पर संस्थान के निदेशक द्वारा ध्वजारोहण किया गया तथा इस अवसर पर एक समारोह का भी आयोजन किया गया जिसमें संस्थान के सभी सदस्यों ने भाग लिया।
- दिनांक 26 अगस्त, 2021 को भारत की आजादी के 75 साल पूरे होने के उपलक्ष्य में आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय (आईसीएआर–डीसीएफआर) ने 'आजादी का अमृत महोत्सव' के एक भाग के रूप में और "किसानों के लिए खाद्य और पोषण" पर एक राष्ट्रीय अभियान, पर एक वेबिनार का आयोजन किया। प्रो. आर.एस. चौहान, डीन, कॉलेज ऑफ फिशरीज, जीबीपीयूए एंड टी, पंतनगर द्वारा ''किसानों के लिए भोजन और पोषण'' विषय पर पर एक व्याख्यान दिया गया।
- दिनांक 17 सितंबर, 2021 भारत की स्वतंत्रता के 75 वर्ष (भारत का अमृत महोत्सव) और "एक्वाकल्चर में सिस्टम विविधीकरण" पर एक राष्ट्रीय अभियान की स्मृति में आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल द्वारा पहली बार "एक्वाकल्चर में विविधीकरण" पर एक वार्ता आयोजित की गई। उपरोक्त विषय पर एक वार्ता डॉ ए.पी. शर्मा, पूर्व निदेशक, आईसीएआर–सीआईएफआरआई, बैरकपुर द्वारा दी गई।
- दिनांक सितंबर, 2021 को आईसीएआर–डीसीएफआर ने "न्यूट्री गार्डन और वृक्षारोपण पर बाजरा 2023 अभियान का अंतर्राष्ट्रीय वर्ष" मनाया। इस अवसर पर प्रो. अर्चना कुशवाहा, जीबीपीयूए एंड टी, पंतनगर द्वारा मानव पोषण में मोटे अनाज के महत्व पर एक व्याख्यान प्रस्तुत किया।
- दिनांक 24 सितंबर, 2021 को आईसीएआर–शीत जल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने अपना 34वां स्थापना दिवस मनाया। डॉ प्रमोद कुमार पांडे, निदेशक, आईसीएआर–डीसीएफआर, भीमताल ने उन सभी वैज्ञानिकों, प्रगतिशील मत्स्य कृषकों और हितधारकों को बधाई दी, जो आईसीएआर– डीसीएफआर की सफलता की कहानी की 33 साल की महत्वपूर्ण यात्रा का हिस्सा थे।
- दिनांक 14 से 19 सितंबर, 2021 तक भाकृअनुप–डीसीएफआर, भीमताल में हिन्दी सप्ताह का आयोजन किया गया। इस अवसर पर हिन्दी अनुभाग द्वारा निदेशालय के सभी अधिकारियों एवं कर्मचारियों के लिए विभिन्न हिन्दी प्रतियोगिताओं का आयोजन किया गया।
- दिनांक 2 अक्टूबर, 2021 को भाकृअनुप–डीसीएफआर भीमताल और प्रायोगिक क्षेत्र केंद्र, चंपावत में गांधी जयंती बड़े उल्लास के साथ मनाई गई।
- दिनांक 12 अक्टूबर, 2021 को मत्स्य विभाग, भीमताल और राष्ट्रीय सेवा योजना (एनएसएस), रामगढ़ के सहयोग से गवर्नमेंट इंटर कॉलेज, तल्ला रामगढ़, नैनीताल में आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल द्वारा भारत सरकार के "विशेष राष्ट्रीय स्वच्छता अभियान" के तहत 'अपशिष्ट से धन' पर एक कार्यक्रम का आयोजन किया गया।
- दिनांक 15 अक्टूबर 2021 को भाकृअनुप–शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल ने भारत की स्वतंत्रता के 75 वर्ष पूरे होने के उपलक्ष्य में "आजादी का अमृत महोत्सव" के एक भाग के रूप में "महिला किसान दिवस" का आयोजन किया।

- दिनांक 16 अक्टूबर, 2021 को आईसीएआर–डीसीएफआर, भीमताल ने स्वतंत्रता के 75 वर्षों के चल रहे समारोह के एक भाग के रूप में "आजादी का अमृत महोत्सव" के रूप में भारत सरकार के "राष्ट्रीय स्तर के अभियान" के तहत ग्रीन माउंट ग्लोबल स्कूल, क्वेराली, भीमताल के सहयोग से 'विश्व खाद्य दिवस' मनाया।
- दिनांक 29–30 अक्टूबर, 2021 को आईसीएआर–शीत जल मत्स्य अनुसंधान निदेशालय ने नेशनल इनोवेशन इन क्लाइमेट रेजिलिएंट एग्रीकल्चर (एनआईसीआरए) परियोजना के तहत, उर्गम गांव, जोशीमठ, चमोली जिले में गोद लिए गए दस अनुसूचित जाति के किसानों के एक समूह के लिए 'लचीली जलवायु परिवर्तन और रेन्बो ट्राउट की कुशल खेती' पर एक कार्यशाला का आयोजन किया।
- दिनांक 02–31 अक्टूबर, 2021 की अवधी में, आईसीएआर–डीसीएफआर ने 'लंबित मामलों के निपटान और स्वच्छता अभियान के लिए विशेष अभियान' के तहत विभिन्न कार्यक्रम आयोजित किए।

- दिनांक 31 अक्टूबर, 2021 को आईसीएआर–डीसीएफआर ने सरदार वल्लभ भाई पटेल की जयंती के अवसर पर राष्ट्रीय एकता दिवस मनाया।
- दिनांक 21 नवंबर 2021 को आईसीएआर–डीसीएफआर में विश्व मत्स्य दिवस मनाया गया।
- दिनांक 26 नवंबर 2021 को आईसीएआर– शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल ने स्कूली बच्चों के साथ बातचीत करके "आजादी का अमृत महोत्सव" मनाने के लिए "कृषि और पर्यावरणः नागरिक चेहरा" विषय पर कार्यक्रम का आयोजन किया।
- दिनांक 22 दिसम्बर, 2021 को नैनीताल जिले के खिरोला पाण्डेय ग्राम में स्वच्छता अभियान का कार्यक्रम आयोजित किया गया।
- दिनांक 16–31 दिसंबर, 2021 की अवधि में आईसीएआर–डीसीएफआर में स्वच्छता पखवाड़ा आयोजित किया गया इस अवसर पर आस–पास के क्षेत्रों में जाकर निदेशालय परिवार के सदस्यों ने साफ सफाई का कार्य किया।
- दिनांक 22 जनवरी, 2021 को भाकृअनुप– शीत जल मत्स्य अनुसंधान निदेशालय, भीमताल, भारत द्वारा "मछली प्रजनन" पर एक आभासी अंतर्राष्ट्रीय वेबिनार आयोजित किया गया।
- दिनांक 4 दिसंबर, 2021 को आईसीएआर–डीसीएफआर ने डॉ. अंजुली अग्रवाल, प्रोफेसर, जीबीपीयू एंड टी, पंतनगर द्वारा विशेष वार्ता के साथ आईसीएआर–डीसीएफआर, भीमताल में विश्व मृदा दिवस मनाया।
- भाकृअनुप–डीसीएफआर भीमताल ने 'मेरा गॉव मेरा गौरव' (एमजीएमजी) कार्यक्रम के तहत, अल्मोड़ा के ज्यूर काफुन, ग्राम में मत्स्य कृषकों के लिए एक जागरूकता सह प्रशिक्षण कार्यक्रम आयोजित किया।
- दिनांक 28 सितंबर 2021 को आईसीएआर–डीसीएफआर भीमताल ने "साइंटिस्ट–फार्मर इंटरफ़ेज ऑन क्लाइमेट–रेजिलिएंट वैरायटीज, टैक्नोलॉजीज़ एण्ड प्रैक्टिसेज" पर एक कार्यक्रम का आयोजन किया। इस समारोह के सत्र का आरम्भ आईसीएआर– राष्ट्रीय जैविक तनाव प्रबंधन संस्थान (एनआईबीएसएम), रायपुर के आभासी उद्घाटन के साथ शुरू हुआ और भारत के माननीय प्रधान मंत्रीजी द्वारा अद्वितीय लक्षणों वाली 35 फसल किस्मों का विमोचन किया गया।
- दिनांक 18–24 नवंबर, 2021 को आईसीएआर–डीसीएफआर, भीमताल ने के 'विश्व एंटीबायोटिक जागरूकता सप्ताह (डब्ल्यूएडब्ल्यू)' और "मछली में रोगाणुरोधी प्रतिरोध पर राष्ट्रीय अभियान" के अवसर नैनीताल जिले के विभिन्न स्थानों पर छह कार्यक्रमों का आयोजन किया।
- दिनांक 23 नवंबर, 2021 को मत्स्य पालन विभाग उत्तराखंड के सहयोग से मोना गांव, रामगढ़, नैनीताल में पर्वतीय जलीय कृषि में रसायनों और दवाओं के विवेकपूर्ण उपयोग पर जागरूकता कार्यक्रम आयोजित किया गया।
- दिनांक 17 और 23 फरवरी, 2021 को आईसीएआर–डीसीएफआर ने क्रमशः नौकुचियाताल, नैनीताल झील और सुयाल नदी (विश्वनाथ घाट पर) अल्मोड़ा में सुनहरी महासीर के बीज पालन कार्यक्रम का सफलतापूर्वक आयोजन किया।

- दिनांक, मार्च 2021 में उत्तराखंड के नैनीताल और अल्मोड़ा जिलों के विभिन्न गांवों में पर्वतीय क्षेत्र के ग्रामीण मत्स्य पालकों की आजीविका सुरक्षा के उत्थान हेतु आईसीएआर–डीसीएफआर ने पीपीपी मोड में आई.सी.आई.सी.आई फाउंडेशन के साथ सहयोगात्मक कार्य किया। इस कार्यक्रम के तहत एक दिवसीय प्रशिक्षण का आयोजन भी किया गया।
- आईसीएआर–डीसीएफआर ने कानन देवन हिल्स प्लांटेशन कंपनी प्राइवेट लिमिटेड को परामर्श सेवाएं प्रदान कीं तथा राजमल्लय चाय बागान लिमिटेड, मुन्नार, केरल में रेनबो ट्राउट हैचरी के संचालन में सुधार के लिए वैज्ञानिक और तकनीकी मार्गदर्शन प्रदान किया।
- आईसीएआर–डीसीएफआर, भीमताल हिमाचल प्रदेश, सिक्किम, जम्मू –कश्मीर, उत्तराखंड और नागालैंड के ट्राउट पालकों को और राज्य के मत्स्य पालन विभागों को सक्रिय रूप से फीड सलाहकार और वैज्ञानिक मार्गदर्शन प्रदान कर रहा है।
- दिनांक 24 जनवरी, 2021 को उत्तराखंड सरकार को डेनमार्क से आयातित आइड ओवा के पालन–पोषण के लिए जैव सुरक्षा उपायों का कार्यान्वयन और तकनीकी सहायता प्रदान की गई। इसके अतिरिक्त बैरंगना ट्राउट फार्म, चमोली में छह लाख नारंगी आंखों वाले डिंब लाए गए।

- दिनांक 21 जनवरी, 2021 को इस निदेशालय के आउटरीच सह विस्तार प्रशिक्षण कार्यक्रम के तहत, प्रायोगिक मछली फार्म, आईसीएआर–डीसीएफआर के चम्पावत स्थित प्रयोगिक फार्म द्वारा "इंटीग्रेटेड कोल्डवाटर फिश फार्मिंग" पर एक दिवसीय प्रशिक्षण सह जागरूकता कार्यक्रम आयोजित किया गया।
- दिनांक 29 जनवरी, 2021 को भाकृ अनुप–डीसीएफआर, भीमताल ने ''रेनबो ट्राउट की गहन खेती के लिए रीसर्क्युलेटिंग एक्वाकल्चर सिस्टम'' पर वर्चुअल प्रशिक्षण आयोजित किया।
- दिनांक 1–6 मार्च, 2021 को नेटवर्क कार्यक्रम "स्पेसीज एण्ड स्टॉक वैलिडेसन ऑफ महासीर स्पेसीज ऑफ जीनस टॉर एण्ड निओलिस्सोचिलस फ्रॉम वैस्टर्न एण्ड ईस्टर्न हिमालयन रिज़न ऑफ इण्डिया फॉर इट्स प्रोपागेसन एण्ड कंजरवेसन" के अर्न्तगत 'मॉलिक्यूलर बायोजलॉजी टेक्नीक्स इन डी.एन. ए. बारकोडिंग'पर छः दिवसीय प्रशिक्षण कार्यक्रम आयोजित किया।
- दिनांक 4–7 अप्रैल, 2021 को आईसीएआर–डीसीएफआर, भीमताल ने हिमाचल प्रदेश के मात्स्यिकी आधिकारियों को 'रिसर्कुलेटिंग एक्वाकल्चर सिस्टम' पर प्रशिक्षण कार्यक्रम आयोजित किया।
- आईसीएआर–डीसीएफआर, भीमताल ने टी.एस.पी., एस.सी.एस.पी. एवं एन.इ.एच. कार्यक्रम के अर्न्तगत लाभार्थी किसानों और समुदायों के लिए विविध विस्तार एवं प्रशिक्षण कार्यक्रम आयोजित किए।
- आईसीएआर–डीसीएफआर, भीमताल के वैज्ञानिकों/तकनीकी अधिकारियों द्वारा आई.वी.आर.आई. मुक्तेश्वर में कोविड–19 आर.टी.पी.सी.आर. परीक्षण में अपना योगदान दिया।
- आईसीएआर–डीसीएफआर, भीमताल ने 16 से 31 दिसम्बर, 2021 संस्थान एवं विभिन्न स्थानों पर स्वच्छता पखवाड़ा का आयोजन किया।

2. Executive Summary

Coldwater fisheries are largely confined to Indian Himalayan regions which have unique ecosystem and home to many endemic fish species having special characteristics and importance. In recent years importance of coldwater fisheries has been realized in terms of providing livelihood and nutritional security to underprivileged population of Indian uplands. 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. Better and sustainable utilization of aquatic resources as well as species diversification remained focus for research and development. Training and capacity building has also provided opportunities for fish farming in hilly areas.

Last year the directorate successfully completed aquatic resource mapping using geoinformatics and prepared site suitability maps for aquaculture development in the Himalayan states. The directorate's technological advancement in multiple breeding and seed production of endangered golden mahseer (*Tor putitora*) is a milestone in the coldwater fish breeding research. This has paved the way for the conservation and propagation of this valuable flagship species of Indian Himalayas. Significant achievements were made in the area of fish health management and diagnostics as well as efforts have been made for designing aquadrugs and developing solutions against antimicrobial resistance. The biotechnological and molecular applications have provided opportunities in understanding mechanisms of gene regulation in sex differentiation and abiotic response. The ongoing work on genome editing using CRISPER-Cas system provides hopes for the development of species of desired traits. 2021 remained another year of COVID-19 pandemic which posed new challenges for the world. During the lockdown, the Directorate kept working through all available means of communication and demonstrated courage to face the inescapable challenges. It participated in COVID-19 testing and prepared advisories for the farmers and tried to reach out to the fish farmers of all Himalayan states. Directorate has made linkages through MoUs with Universities, State Fishery Departments and other institutions for academic and collaborative research of students in Master and Ph.D. level. The research accomplishments of the institute in the year 2021 are summarized as follows:

Resource assessment and management

- Eight districts of Arunachal Pradesh viz., Dibang valley, Lower Dibang Valley, East Siang, Siang, Lower Siang, West Siang, Upper Siang and Upper Subansiri were investigated for aquatic resources, drainage network, land use land cover, digital elevation model, slope map and final site suitability maps for aquaculture were extracted and developed by spatial analysis tool of ArcGIS v 10.8 using the Satellite data, geo rectified SOI toposheets, spatial and non-spatial data
- Studies have been undertaken to assess the ichthyofaunal diversity and health assessment of central Himalayan River Saryu and Ladhiya, Uttarakhand. The ichthyofauna and other important water quality parameters were recorded and WQI of River Ladhiya was developed.
- Assessment of the angling status of mahseer in Kumaun region for eco-tourism and conservation was carried out. Data on angling status of past and present were recorded for analyzing the impact of angling on conservation of mahseer.
- 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. A habitat map was also developed for Kalsi stream for *Naziritor chelynoides.* Morphometric and meristic parameters were collected and DNA isolation was done for barcoding of the species collected from different drainages and lakes.

Aquaculture oriented research and development

- Under captive management of mahseer, important factors for enhancing the spawning of *N. hexagonolepis* in captivity were determined and behaviours were configured and coded by means of Solomon Coder.
- Optimizing reproductive and spawning performance of golden mahseer in captivity was achieved by gravel bed breeding substratum with photo-thermal manipulations. The maximum fertilization rate achieved was optimized.
- Experimental trials were made by using different herbs as feed supplements for better

gondal maturities in *S. progastus* and *S. plagiostomus*. It was revealed that dietary supplementation consisting a blend of Ashwagandha (*Withania somnifera*) root powder, dried powder of garlic (*Allium sativum*) and hing (*Ferula asafoetida*) is beneficial for gonadal maturity of females and better spawning under captive condition.

- Sucker Head, *Garra gotyla* was successfully bred in captivity and the survival rate from fingerling up to 25gm size recorded to be 98%. Approximately, 200-300 fish /m^3/year can be produced in small poly-tanks with a net profit of Rs. 1000-1500/m^3/year with a sale price of Rs. 10/-per piece. For the growth performance study, *Garra gotyla* seed was reared at different temperatures and preliminary results appear promising.
- Under ornamental fish breeding programme efforts were made for the seed production of *Barilius vagra*, a promising ornamental indigenous species found in the Himalayan region.
- Two backyard recirculating aquaculture system models were designed, fabricated and validated for small scale rainbow trout production with minimal mechanical equipments for helping small farmers to reduce the risk of equipment failure posssibilities and to reduce the initial investment. 386 kg fish were harvested from both systems and sold in the local market. The techno-economic feasibility study showed that both systems had pay-back period of 2-3 crops (~1-2 year) and water usage of system was calcualted to be 908-1082 L per kg fish produced which is 50-100 times less than the flow-through system.
- An 'Integrated Agri-Aquaculture Farming' (IAAF) model has been developed for pilot scale fish-vegetable production in Indian uplands. The low-cost and low-tech coldwater recirculatory aquaponics model has been designed in such a manner that some of the components viz., hydroponic cum biofiltration unit, sump cum base addition tank etc. can be used for more than one function so as to reduce the space and cost.

Fish nutrition and feed development

- Methanotrophic bacteria meal as substitude of fish meal in rainbow trout grow-out feeds were made. In this study, the dietary fishmeal (FM) replacement potential of this novel methanotrophic bacterial protein meal (String Pro BM), in rainbow trout, based on growth, feed utilisation, digestibility, nutrient balance and histological observations were evaluated in rainbow trout
- As a nutritional intervention for improving reproductive competence and larval quality traits of golden mahseer, *Tor putitora* in captivity an improved broodstock diet has been formulated and prepared by incorporating some nutrients/additives to the existing broodstock diet to evaluate the reproductive performance and larval quality. Feeding of test diet notably improved fertilization and hatching rates, egg and sperm quality as well as larval survival.
- To address rainbow trout brooder feed and to achieve the target of sufficient production of quality seed at the national level, development and validation of efficient brood stock feed for rainbow trout was made. Promising results obtained during the field trial at Field centre and other locations.
- Work has been initiated for development of a nutrient sensitive and effective package of feeds and feeding strategies for augmenting rainbow trout production. Initially grow-out feed performance with respect to genetic background was evaluated. Further studies being conducted to find out the effects of fish meal substitution with a blend of alternate protein ingredients and effect of stocking density and size heterogeniety on feed performance

Molecular genetics and biotechnology

- To understand the sex specific gene expression studies were made for the transcriptome profile of the gonads of male and female fishes. The *de novo* assembly produced a highly complete reference transcriptome with 316,548 non-redundant transcripts and an N50 of 1327 bp. Differential expression analysis identified a large set of sex-biased transcripts (17,355) between the sexes. This study represents the first gonadal transcriptomic analysis of *T. putitora* and provides a basis for further investigation of the molecular mechanisms of sex determination in mahseer.
- Studies were made to understand the effect of thermal stress on different sexes of the golden mahseer. Transcriptome profile of male and female gonads and brain was done and a *de novo* transcriptome was prepared. Screening of screen differentially expressed genes (DEGs) in gonads revealed 24 DEGs in both sexes, suggesting that there is likely a common genetic mechanism to cope with exposure to high temperature. These DEGs were enriched in the KEGG pathways related to sex differentiation, nitrogen metabolism, glucagon signalling pathway, protein digestion and absorption, phototransduction, and adipocytokine signaling pathway.
- A protocol for microinjecting the RNPs into single cell stage of zebrafish, *Danio rerio* and common carp, *Cyprinus carpio* was developed and standardized for knockout of MSTN and dnd genes.
- A cell line was developed from rainbow trout

heart cells (RBT-H). The cells are being maintained and cryopreserved in the cell culture laboratory of ICAR-DCFR and deposited at National Repository for Fish Cell-lines (NRFC) ICAR-NBFGR Lucknow. RBT-H is listed among the authentic cell lines by the repository.

- 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.
- Work has been initiated to develop *in vitro* transfection in fish cells using polymer based approach. A polymer, polyhexame thylenebiguanide was evaluated for its gene carrying capacity inside fish cells.

Disease surveillance and health management

- A PNA probe has been developed for the identification of *S. paraitica*, an oomycetes infection common in coldwater cultured fish. The probe was specific to *S. paraitica* and fluorescent in situ hybridization (FISH) could be used to identify *S. parasitica*.
- A polymer-based formulation was tested for its anti-oomycete activity against *Saprolegnia parasitica*. The results indicated that polymer has potential in controlling saprolegniasis. Further, a study was carried out to know the anti-oomycete activity of antifungal/antiseptic agent chlorhexidine (CHX) as an effective alternative treatment for saprolegniosis with minimum adverse effect.
- Under evaluation of anti-fungal agents and herbs for their efficacy against oomycetes infection, around nine available antifungal drugs/chemical and five herbal bioactive molecules were tested against four isolated species from different life stages of rainbow trout. The effect of five natural plant extract compounds, Curcumin (CUR); Eugenol (EUG), Cinnamaldehyde (CIN), Stigmasterol (ST) and Morin (MOR) was on two species of *Saprolegnia*; *Saprolegnia parasitica* and *S. australis*, were investigated.
- Under *in silico* drug designing for development of potential antimicrobial agents against fish pathogens, a consensus computational framework for identifying potential target proteins and their inhibitors and subsequent experimental validation of selected compounds by *in vitro* approach was developed.
- Investigations related to common health disorders associated with mortality in trout farms during seed production was targeted. Physicochemical parameters of trout farm and hatcheries along with epidemiological information was collected from different farms of Uttarakhand. Further, observations on transport and acclimatization of rainbow trout eyed ova imported from Denmark were made at Bairagna trout farm, Chamoli.
- A project on evaluating the effect of immunization against oomycetes infection in rainbow trout, *Oncorhynchus mykiss* started under which around three natural compounds have been screened from Himalayan plants having anti-oomycetes and immunostimulatory activity.

National Network programmes

- Under the Network programme on antimicrobial resistance (AMR) in fishes, the antimicrobial resistance of *Aeromonas* spp, and *E. coli* was assessed against different antibiotics. The results demonstrated that maximum antibiotic resistance of 78.6% was observed against ampicillin for *Aeromonas* group followed by Cefoxitin (35.7%). In case of *E. coli*, maximum resistance was shown against Cephalothin (83.3%) followed by Cefoxitin (66.7%).
- Under the National Surveillance Programme for Aquatic Animal Ddisease- (NSPAAD), an active and passive disease surveillance of coldwater fish diseases was carried out in 32 carp and trout farms, hatcheries, six trout grow out raceways in Chamoli, Almora and Nainital Districts of Uttarakhand. Further, the samples were also screened for parasitic and viral diseases. Under the All India network project on fish health Florfenicol deposition was evaluated in kidney after florfenicol administered feed in rainbow trout juvenile.
- Under the NICRA, the Directorate has taken a lead to develop, validate and promote climate resilient Coldwater re-circulating aquaculture systems for rainbow trout farming.
- Further, for the better understanding the molecular mechanisms which regulate thermal safety margins and adaptive responses in rainbow trout at temperatures above physiological optimum, simultaneously investigated the time course of changes in critical thermal tolerance thresholds and associated hepatic and renal transcript abundance of molecular markers related to cellular stress response, after high temperature exposure.
- Thermal tolerance related biomarkers in rainbow trout was characterized and mRNA sequences of three potential biomarkers of thermal tolerance in rainbow trout, namely stress induced phosphoprotein (*Omstip1* - OL539749, complete), hypoxia upregulated protein (*Omhyou1*- OL539750, complete) and a heat shock protein 40 family member (*Omdnajc16* - OL539748, partial) was completed.

- Field observation of seasonal changes in important abiotic water quality indices were carried out in twelve private rainbow trout farms in two distinct micro-climatic zones in Kullu and Mandi districts of Himachal Pradesh.
- For the development of functional feed, an eight-week feeding trial was conducted to evaluate the effectiveness of different dietary levels of antioxidant vitamin supplementation to enhance the thermal acclimation capacity of rainbow trout, when reared at temperatures above the physiological optimum.

Externally funded projects

- Under DBT sponsored project, entitled "Immunomodulation in golden mahseer (*Tor putitora*) broodstock under captive conditions" experimental trials were conducted to elucidate the immuno-modulatory potential of β-glucan on golden mahseer broodstock under captivity. It was found that dietary inclusion of β-glucan (1.0%) is efficient in improving immune function, thermal tolerance and disease resistance of golden mahseer fry during nursery rearing.
- Another DBT funded project, four peptides (KK12YW, KK12FW, KY12WY and RH12) out of seven peptides designed and synthesized in the laboratory have been evaluated for their antimicrobial activities against various bacterial pathogens including antibiotic resistant bacteria.

IPR and technology development

- ICAR-DCFR registered three trademarks and four MoU were signed between ICAR-DCFR and different universities.
- ICAR-DCFR participated in the External Quality Assurance Scheme (EQAS) (EQAS 1 and EQAS 2) conducted by Christian Medical College (CMC) & Hospital, Vellore.
- A technology of captive maturation and multiple breeding of endangered golden mahseer (*Tor putitora*) has been developed by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal ensuring sustainable seed production for its rehabilitation and conservation.
- A re-circulating egg incubation and larval rearing system was designed and fabricated for rearing trout eggs at ICAR-DCFR, Bhimtal, mainly to improve egg and larval survival. The preliminary study suggested that above 90% survival of eggs could be achieved using thermal controlled recirculating system.

Important events, extension activities, trainings and other developments

- The Republic Day of our nation was celebrated with flag hoisting ceremony on 26th January, 2021, with the participation of all the scientists and staffs of directorate.
- ICAR-DCFR organized a webinar on the topic "Recent advances in cold water fish farming technologies" on 24th February, 2021.
- The institues RAC was held online on 26th March, 2021 under the chairmanship of Dr. W.S. Lakra, Former Director and Vice-Chancellor ICAR-CIFE, Mumbai.
- Awareness cum farmers goshti on 'Balanced use of fertilizers in aquaculture' organized at Bhimtal on 18th June, 2021.
- International Yoga Day was celebrated by all the staff and research scholars of the Directorate and its Experimental Field Centre, Champawat on 21st June, 2021.
- The Institute IRC meeting was held on 23rd to 25th June, 2021 at ICAR-DCFR, Bhimtal under the Chairmanship of Dr Pramod Kumar Pandey, Director, ICAR-DCFR.
- A farmers-scientist interactive meet and fish seed-feed distribution program was arranged on 29th June, 2021 at EFF, Champawat.
- As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the 75 years of India's Independence, a talk on "Strategies for doubling farmer's income in the hill region: Technological options" was delivered by an eminent speaker Prof. M. Premjit Singh, Former Vice-Chancellor Central Agricultural University Imphal on 3rd July, 2021.
- ICAR-DCFR celebrated National Fish Farmers' Day on 10th July, 2021. This event is also a part of the ongoing celebrations for the upcoming 75th Independence Day of India named 'Azadi ka Amrut Mahotsav'.
- On the Occasion ICAR Foundation day a tree plantation programme was organised on 16th July, 2021 at Experimental Fish Farm, Champawat.
- As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the 75 years of India's Independence, a talk on "Agricultural Transformation for Nutritional Security" was delivered by an eminent speaker Padma Bhushan Dr Ram Badan Singh, Former Chancellor, Central Agricultural University, Imphal, on 7th August, 2021.
- The 75th Independence Day was celebrated with flag hoisting ceremony on 15th August, 2021 and attended by all Scientists and staff of the Directorate. The Director unfurled the national flag and saluted the Flag and freedom fighters.
- As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the 75 years of India's Independence, and a National Campaign on "Food and Nutrition for Farmers", ICAR-Directorate of Coldwater Fisheries Research (ICAR-DCFR) organized a webinar on the topic "Food and Nutrition for Farmers" on 26th August, 2021. A talk on the above topic was

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delivered by Prof. R.S. Chauhan, Dean, College of Fisheries, GBPUA&T, Pantnagar.

- In commemoration of 75 years of India's Independence (Bharat ka Amrit Mahotsav) and a National Campaign on "System Diversification in Aquaculture" a talk on **"**Diversification in Aquaculture" was organized by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, on 1st September 2021. A talk on the above topic was delivered by Dr A.P. Sharma, Former Director, ICAR-CIFRI, Barrackpore.
- ICAR-DCFR celebrated "International year of Millets 2023 campaign on Nutri Garden and tree plantation" on 17th September, 2021. On this occasion a talk on importance of coarse cereals in human nutrition was presented by Prof. Archana Kushwaha, GBPUA&T, Pantnagar.
- ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, celebrated its 34th foundation Day on 24th September, 2021. Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, congratulated all scientists, progressive fish farmers, and stakeholders who were part of the momentous 33 years journey of the ICAR-DCFR success story.
- Hindi Saptah was organized ICAR-DCFR, Bhimtal from 14th to 19th September, 2021. A Quiz competition was organized for the staff of this Directorate.
- A Scientist-Farmers' interface on climiate resilient agriculture was held on 28th September, 2021 in which a talk was delivered on Jalvayu Anukool Krishi and the occasion was graced by Hon'rable Prime Minster.
- Gandhi Jayanti on 2nd October, 2021 was celebrated at ICAR-DCFR Bhimtal and Experimental Field Centre, Champawat.
- ICAR-Directorate of Coldwater Fisheries Research, Bhimtal organised a programme on 'Waste to Wealth' under the "Special National Swachhta Campaign" of Govt. of India in association with Fisheries Department, Bhimtal and National Service Scheme (NSS),Ramgarh, at Government Inter College, Talla Ramgarh, Nainital on 12th October, 2021.
- ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised a "Mahila Kisan Diwas" on 15th October 2021 as a part of the "Azadi Ka Amrut Mahotsav" to commemorate 75 Years of India's Independence
- ICAR-DCFR, Bhimtal celebrated 'World Food Day' under the "National level Campaign" of Govt. of India in association with Green Mount Global School, Kwerali, Bhimtal as a part of the ongoing celebrations of 75 years of independence being celebrated as "Azadi Ka Amrut Mahotsav" on 16th October, 2021.
- Under the National Innovations in Climate Resilient Agriculture (NICRA) project, ICAR - Directorate of Coldwater Fisheries Research organised a workshop on 'Climate resilient and efficient rainbow trout farming' for a group of ten adopted SC farmers in Urgam village, Joshimath, Chamoli district, Uttarakhand during 29-30th October, 2021.
- ICAR-DCFR organized various programme under the 'Special campaign for disposal of pending matters and cleanliness drive' during 02-31st October, 2021.
- ICAR-DCFR celebrated Rashtriye Ekta Diwas on 31st October, 2021 on the occasion of birth anniversary of Sardar Vallabh Bhai Patel.
- World Fisheries Day was celebrated on 21st November 2021.
- ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised campaign on the theme of "Agriculture and Environment: the citizen face" to commemorate "Azadi ka Amrit Mahotsav", by interacting with school children on 26th November, 2021.
- A program of Swachhaata Abhiyan on 22nd December, 2021 was organized at Khirola Pandey Village in Nainital District
- Swachhta Pakhwada for the period 16-31st Dec., 2021 was organized at ICAR-DCFR.
- A virtual international webinar on "Fish Reproduction" on 22nd January, 2021 organized by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, India.
- ICAR-DCFR celebrated World Soil Day at ICAR-DCFR, Bhimtal with special talk by Dr Anjuli Agrawal, Professor, GBPU&T, Pantnagar on 4th December, 2021.
- ICAR-DCFR Bhimtal, conducted Awareness cum training programme to fish farmers at Jyur Kafun, Almora under MGMG programme
- ICAR-DCFR Bhimtal, organized a "Scientists-Farmers interface on climate-resilient varieties, technologies and practices on 28th September 2021. The session started with the virtual inauguration of the ICAR-National Institute of Biotic Stress Management (NIBSM), Raipur and the release of 35 crop varieties with unique traits by Honorable Prime Minister of India.
- ICAR–DCFR, Bhimtal organized six programmes at different locations in Nanital district during 18-24 November, 2021 on the occasion of 'World Antibiotic Awareness Week (WAAW)' and "National campaign on antimicrobial Resistance in fish" under "National campaign on antimicrobial Resistance".
- An awareness programme on prudent use of chemicals and drugs in Hill aquaculture at Mona village, Ramgarh, Nanital was organised on 23rd November, 2021 in collaboration with the Department of fisheries Uttarakhand.
- The ICAR-DCFR successfully organized a seed ranching programme of golden mahseer in Naukuchiatal lake, Nainital and in Suyal river

(at Vishwanath ghat), Almora during 17th and 23rd February, 2021 respectively.

- ICAR-DCFR is undertaken collaborative work in PPP mode with ICICI Foundation for upliftment of rural livelihood security of hill fish farmers in different villages of Nainital and Almora districts of Uttarakhand. Under this programme one day training was organized in the month of March, 2021.
- ICAR-DCFR provided consultancy services to Kanan Devan Hills Plantations Company Pvt. Ltd., Munnar, Kerala, to provide scientific and technical guidance to improve the operation of the heritage rainbow trout hatchery at Rajamallay tea estate.
- ICAR-DCFR is actively providing feed advisory and scientific guidance to the trout farmers and state fisheries departments of Himachal Pradesh, Sikkim, Jammu & Kashmir, Uttarakhand and Nagaland.
- Implementation of biosafety measures and technical assistance was provided for rearing of imported Denmark eyed ova to Government of Uttarakhand. Six lakh orange eyed ova were brought on 24th January, 2021 at Bairangana trout farm, Chamoli
- Under outreach cum extension training programme of this Directorate, one day training cum awareness programme on "Integrated Coldwater Fish farming" was organised by Experimental Fish Farm, ICAR-DCFR, on 21st January, 2021.
- ICAR-DCFR, Bhimtal conducted Virtual Training on "Recirculating Aquaculture System for Intensive Farming of Rainbow Trout" on 29th January, 2021.
- Under network programme "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", ICAR-Directorate of Coldwater Fisheries Research, Bhimtal has organised six days hands on training on "Molecular Biology Techniques in DNA Barcoding" from 1 to 6th March 2021.
- ICAR-DCFR, Bhimtal conducted hands on training programme for officers from department of fisheries Himachal Pradesh, on Re-circulating Aquaculture System during 4-7th April, 2021.
- ICAR-DCFR has conducted various extension and training iprogrammes for the benefits of farmers and communities under TSP, SCSP and NEH programme.
- ICAR-DCFR Scientists contributed in COVID-19 RT-PCR testing at IVRI Regional Station, Mukteshwar.

2. Introduction

2.1. Brief history

Coldwater fisheries in Indian sub-continent was initiated by a British administrator turned naturalist who introduced two main types of trouts *viz.* brown trout (*Salmo trutta fario*) and rainbow trout (*Oncorhynchus mykiss*) around the beginning of the last century primarily for sport fishing or recreational angling. These introductions in India could be considered as the formal beginning of coldwater fisheries development in the country. For many decades, recreational fisheries was promoted to satisfy the needs of anglers for sports. The development of hill fisheries thus started in the selected locations particularly in the Kashmir valley and some parts of the peninsular India.

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 is an important sector have 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 sector, the Indian Council of Agricultural Research established ***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 dedicated to the research investigation on capture and culture aspects of coldwater with a focus on exotic and indigenous fish species. Since its inception, the NRCCWF 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 past 33 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 in the 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. 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 Nainital district of Uttarakhand. 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 is accessible from Delhi via Haldwani by bus. DCFR has an experimental fish farm 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

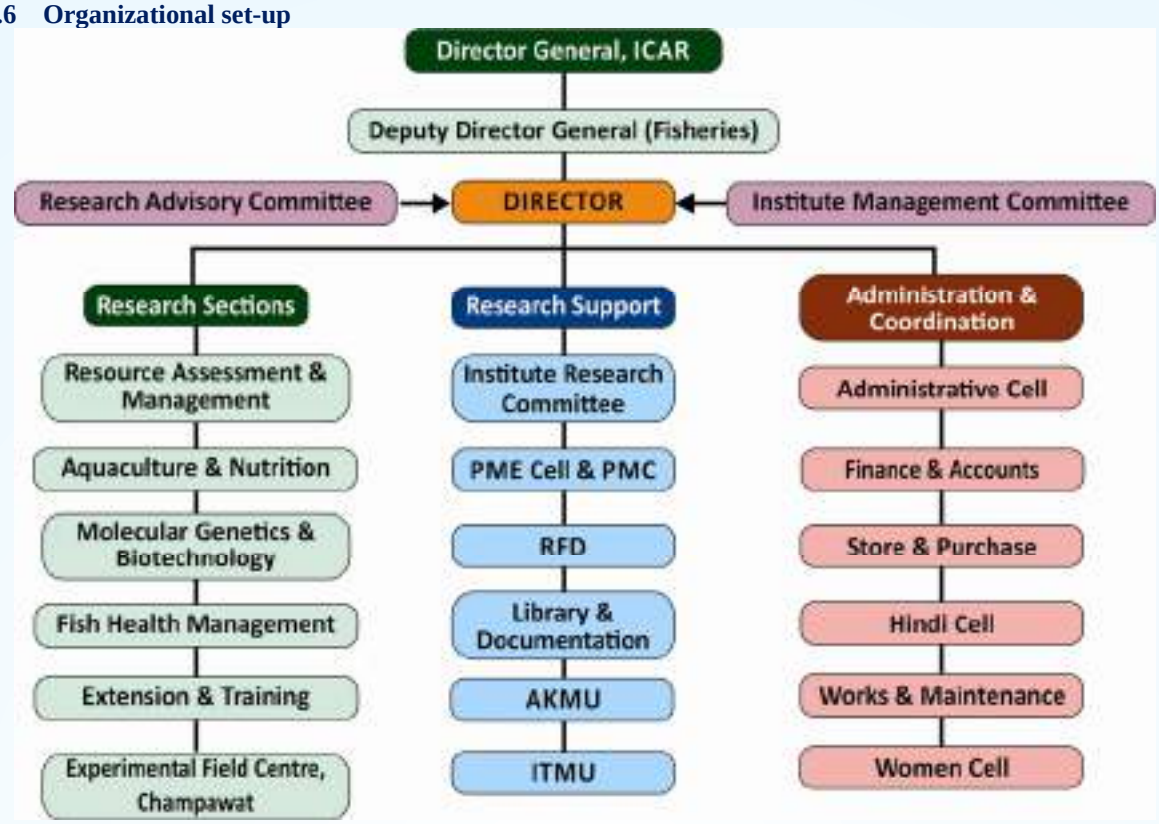
2.4 Mission

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,Research Advisory Committee (RAC) consisting of eminent scientist, experts, Director and one senior level scientist as member secretary review the research achievements of the institute. The committee also suggest research programmes based on national and global context in the thrust areas within the mandate of the institute. The RAC also guide 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 the various administrative and financial aspects of the Directorate, under the chairmanship of the Director. 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 smooth functioning and 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 and well maintained aquarium open for public, guest house, committee rooms and auditorium. A functional mahseer seed production unit is also available at a separate site in Bhimtal. The Directorate has an Experimental Field Centre at Chhirapani, Champawat, Uttarakhand. The field centre has 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.

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Main office building of ICAR-DCFR, Bhimtal

Coldwater Fishery Museum at ICAR-DCFR, Bhimtal

Guest House of ICAR-DCFR, Bhimtal

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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, nutrition, nutritional physiology, molecular genetics, molecular biochemistry, biotechnology, fish cell culture, bacteriology and mycology. There is also a wet laboratory facilities available in the institute for conducting research experiments in coldwater fishes. A small 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 cell of the institutemonitors the implementation and progress of research projects. The PME cell is responsible for maintaining the records of project reports 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. The 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 and 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 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 with internet facility ies is also available for research scholars and students working under various project/programmes. The 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, training programmes, seminars, symposia, recruitments and tender notices are also 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 at 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. The library maintains active reprography services by producing departmental publications and supplying required photocopies to the scientists and research scholars. It has an inventory of e-journals comprising more than 35,000 soft copies of important fisheries research articles. 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 patents and other intellectual property rights developed at 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 concerned scientists with respect to IPR issues. The ITMU cell observes World Intellectual Property day on 26th April every year by organizing a special workshop to create awareness on intellectual property rights.

2.10 Staff strength (as on 31.12.2021)

Category	Sanctioned	Filled	Vacant
Director (RMP)	01	01	-
Scientific	30	23	07
Technical	14	12	02
Administrative	18	11	07
Supporting	12	07	05
Total	**75**	**54**	**21**

2.11 Financial statement for the year 2021-22

(*Rs. in lakh*)

S. No.	Head	Expenditure 2020-21	RE 2021-22	Expenditure up to 31.12.2021
CAPITAL				
1.	Works			
	A. Land	–		
	B. Office Building	6.38	5.00	
	C. Residential Building			

2.	Equipments	20.58	73.00	
3.	Information Technology	2.03	15.00	1.14
4.	Library Books & Journals	0.165	2.00	
5.	Vehicle & Vessels			
6.	Furniture & Fixtures	3.03	5.00	
	Total Capital	**32.18**	**100.00**	**1.14**
Grants in Aid- Salaries (Revenue)				
	Establishment Expenses			
	A. Salaries	699.44	740.22	619.52
	B. Arrear of Scientific staff			
	Total	699.44	740.22	619.52
Grants in Aid- General (Revenue)				
1.	Pension & other Retirement Benefit	0.00	0.00	27.89
2.	**Travelling Allowance**			
	Domestic TA/Transfer TA	4.99	20.00	16.12
3.	**Research & Operation Expenses**			
	A. Research Expenses	210.34	110.00	19.66
	B. Operational Expenses	98.35	100.00	47.86
	Total- Research & Operation Expenses	**308.69**	**210.00**	**67.53**
4.	**Administrative Expenses**			
A.	Infrastructure	88.00	110.00	82.17
B.	Communication	0.79	1.00	0.74
C.	Repair & Maintenance			
i)	Equipments, Vehicle & Others	5.93	7.00	0.40
ii)	Office Building	29.16	20.00	8.90
iii)	Residential Building			
iv)	Minor Works	10.02	7.00	
D.	Other (excluding TA) (instt.)	74.07	120.00	
	Total AdministrativeExpenses	**207.97**	**265.00**	**135.17**
5.	**Miscellaneous Expenses**			
A.	HRD within India	0.73	3.00	0.28
	HRD (Abroad)	-	3.00	
B.	Other Items (Fellowship)	-		
C.	Publicity & Exhibition	0.53	10.00	0.04
D.	Guest House Maint.	0.72	9.00	0.23
E.	Other Miscellaneous	4.53	10.00	3.38
	Total Misc. Expenses	**6.52**	**35.00**	**3.93**
	NEH (Capital)	2.80	15.00	
	NEH (Revenue)	39.99	35.00	1.55
	Total NEH	**42.80**	**50.00**	**1.55**
	TSP (Capital)	17.63	10.00	
	TSP (Revenue)	32.99	20.00	4.49
	Total TSP	**50.62**	**30.00**	**4.49**
	SCSP (Capital)	1.61	20.00	
	SCSP (Revenue)	66.99	50.00	11.59
	Total SCSP	**68.62**	**70.00**	**11.59**
	Total Revenue (Grants in Aid-Salaries + Grants in Aid- General)	**1389.67**	**1420.22**	**887.81**
	Total Revenue + Capital	**1421.87**	**1520.22**	**888.95**

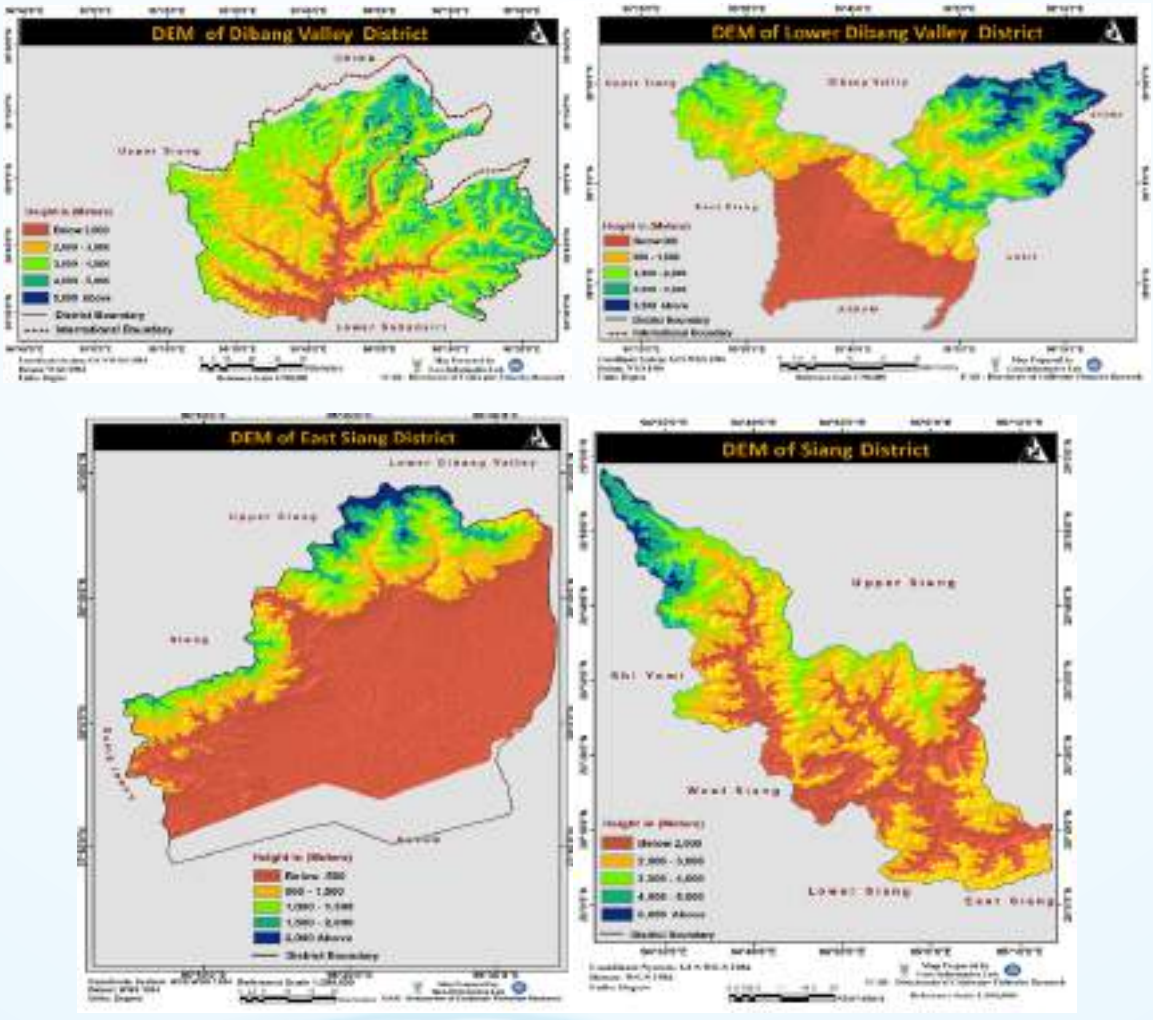
3. Research Achievements

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 2022**
Personnel:	**P.A. Ganie (PI), Kishor Kunal**
Funding Support:	**Institutional, ICAR-DCFR**

Eight districts of Arunachal Pradesh viz., Dibang valley, Lower Dibang Valley, East Siang, Siang, Lower Siang, West Siang, Upper Siang and Upper Subansiri were investigated. The aquatic resources, drainage network, land use land cover, digital elevation model, slope map and final site suitability maps for aquaculture were extracted and developed by spatial analysis tool of ArcGIS v 10.8 using satellite data, geo rectified SOI toposheets, spatial and non-spatial data.

Development of digital elevation model (DEM) and slope: The DEM and slope of the above-mentioned districts were developed using the satellite data and spatial analyst tool of ARCGIS 10.8. The purpose was to study the elevational and slope gradients of the districts for identification of the elevational and slope regimes that can be taken into account for developing potential fish farming sites (Fig. 1 and 2).



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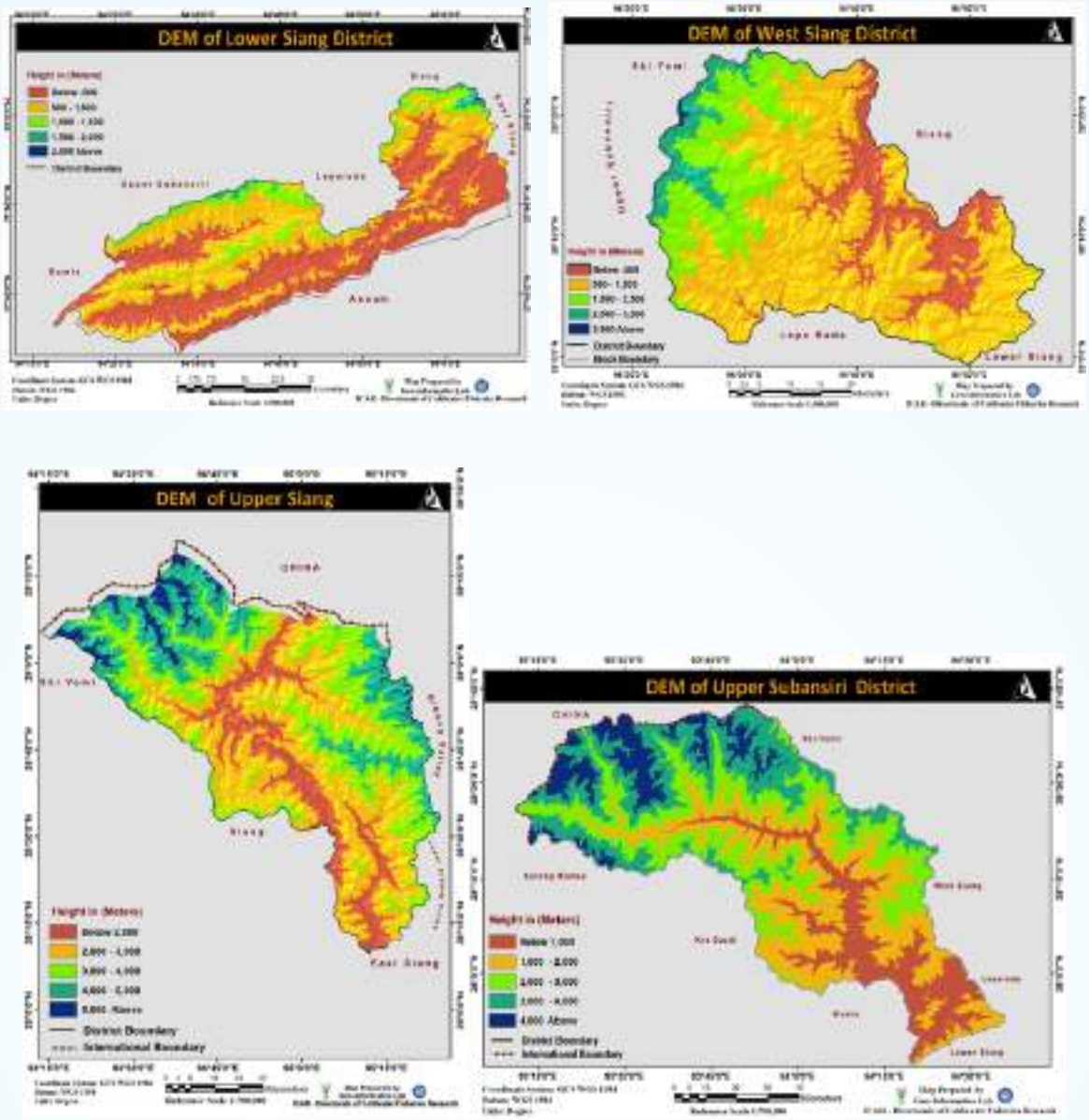
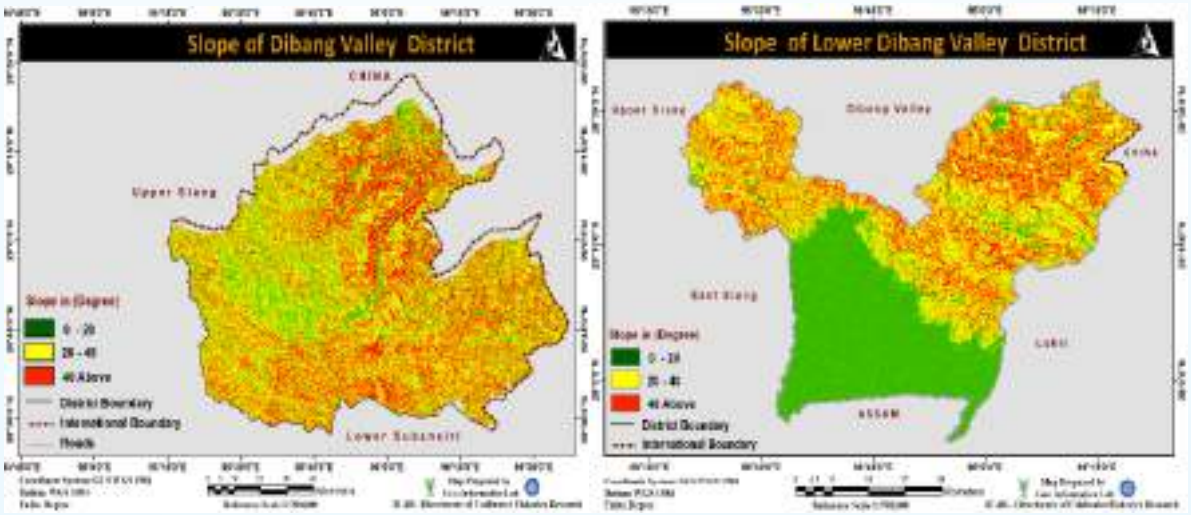


Fig. 1: Digital elevation model of the distrcits



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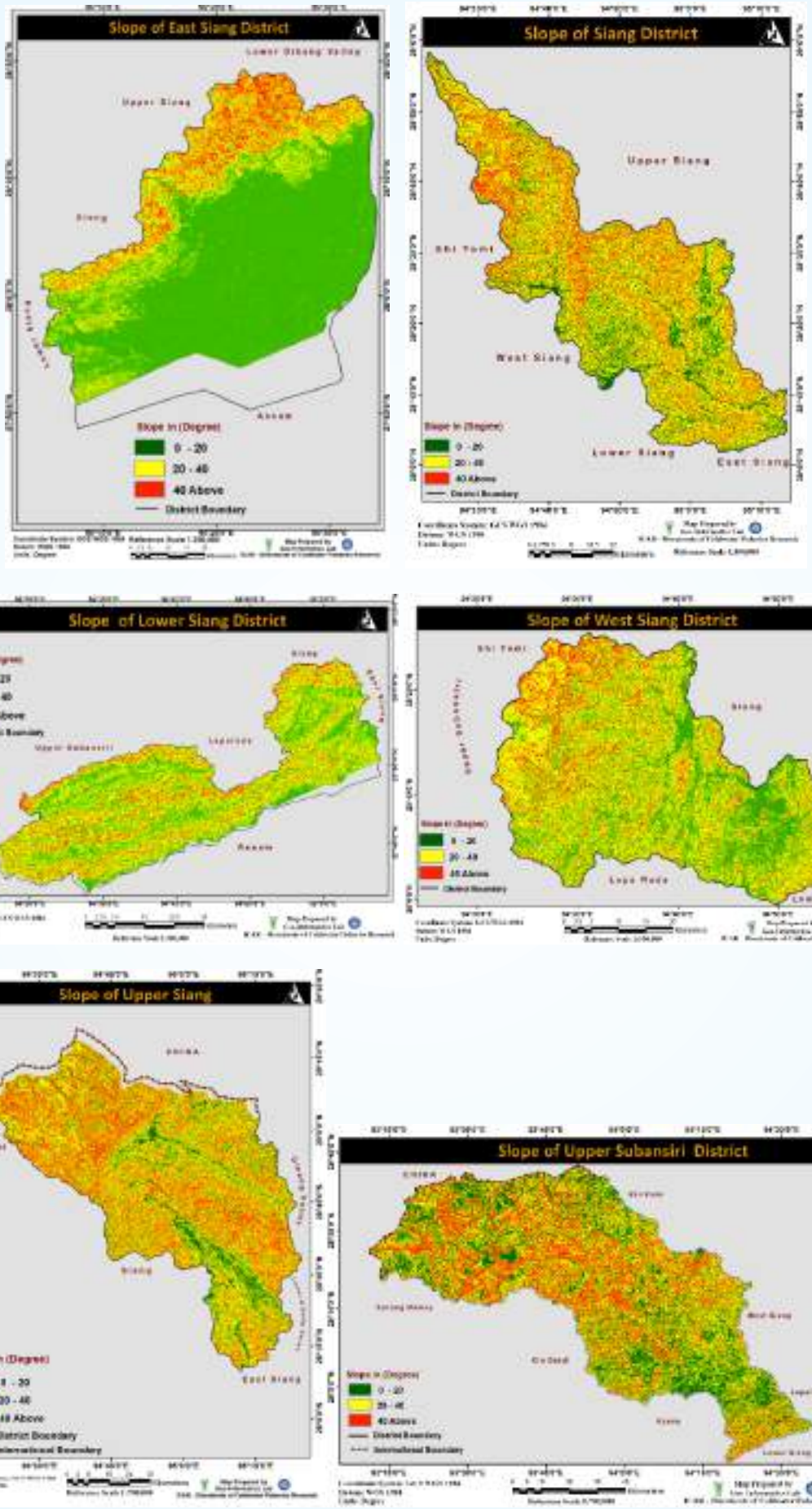

Fig. 2: Slope of the distrcits

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Stream order delineation and aquatic resources digitization: Stream network of each district was extracted using D8 point methodology and Strahler's stream ordering nomenclature was followed in assigning the orders (Fig.3). The aim was to demarcate the stream network of the districts and identify the streams that can be considered in selecting the final aquaculture suitable sites.

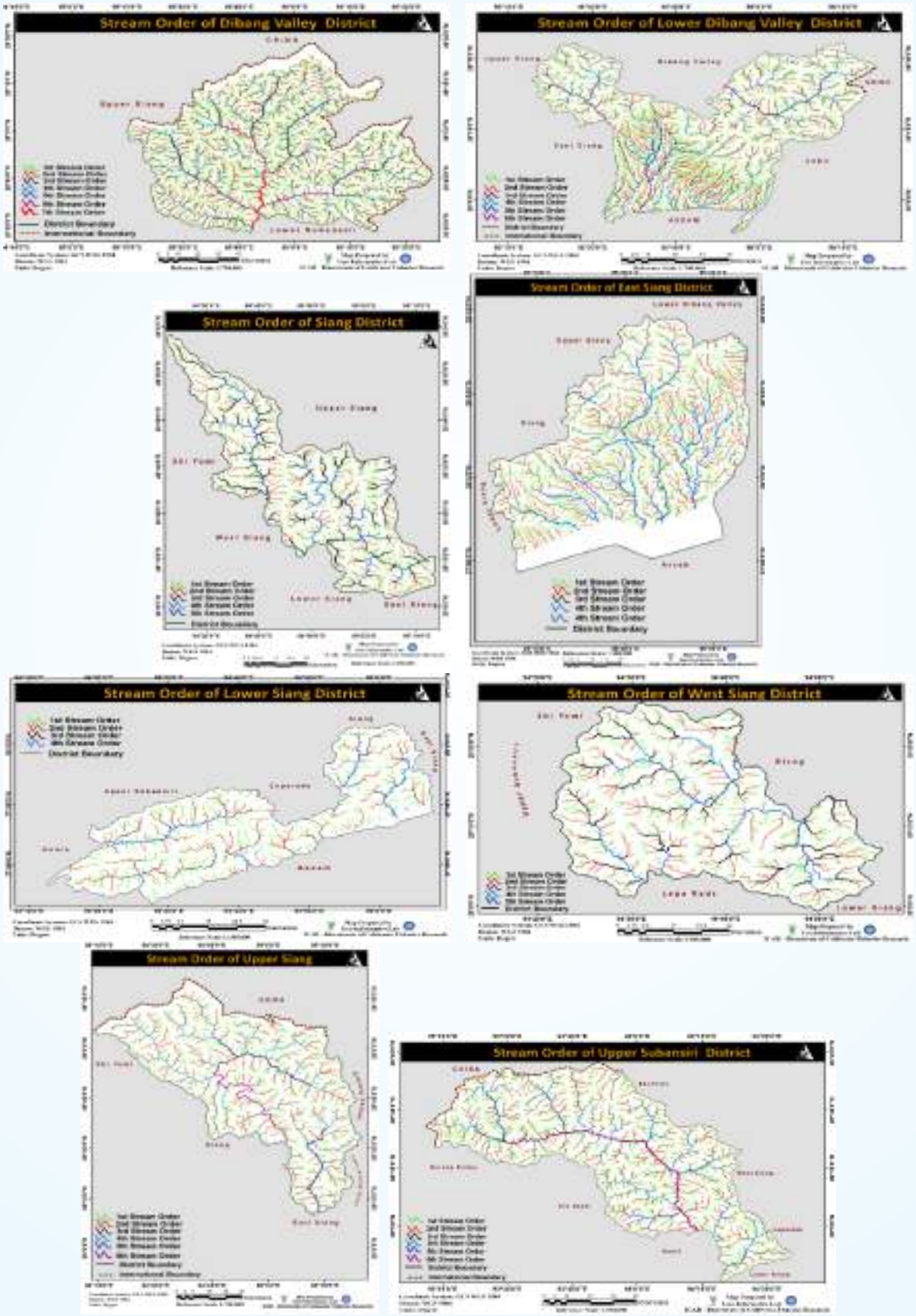

Fig. 3: Stream network of the distrcits

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Development of Land Use Land Cover (LULC) maps: LULC maps were developed for each district using LISS III satellite data, spatial analyst tool of ARCGIS 10.8 employing standardised methodology of NRSA, 1995. Eight LULC classes namely agricultural land, built up, forests, grassland and grazing land, wastelands, waterbodies, shifting cultivation and snow/glacier area were identified for the districts (Fig.4). The underlying purpose was to have a better understanding of land availability and land usage practices going on in the districts. Invariably in all the districts, forest cover dominates in land usage.

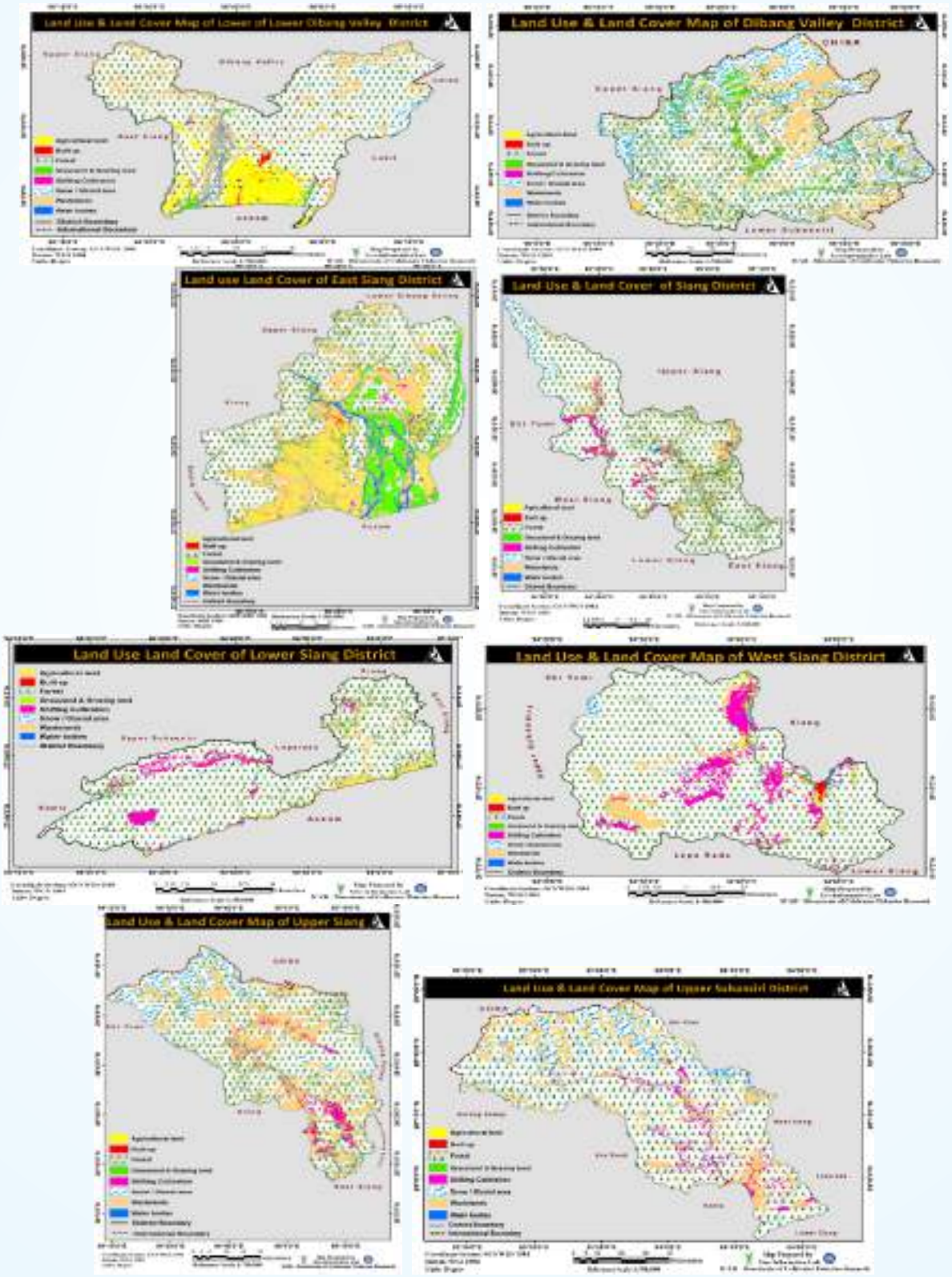

Fig. 4: LULC of the distrcits

Decision framework for final aquaculture suitability sites: Multiple input parameters based on topographic facilities (three criteria), infrastructure facilities (four criteria), soil quality (three criteria) and water quality (eight criteria) characteristics of the districts were employed indecision making. These input criteria were subjected to pair-wise comparison in the context of AHP to develop a set of relative weights for each parameter. Preferences for fisheries development with respect to the evaluation criteria were incorporated into the decision model for the relative importance of each criterion. The preferences are typically defined as a value assigned to an evaluation criterion that indicates its importance relatively to other criteria under consideration. Based on the weightages arrived for each criterion, final site suitability equation was developed. According to which, the districts were classified into different zones viz, high potential zones and moderate potential zones (Fig. 5).

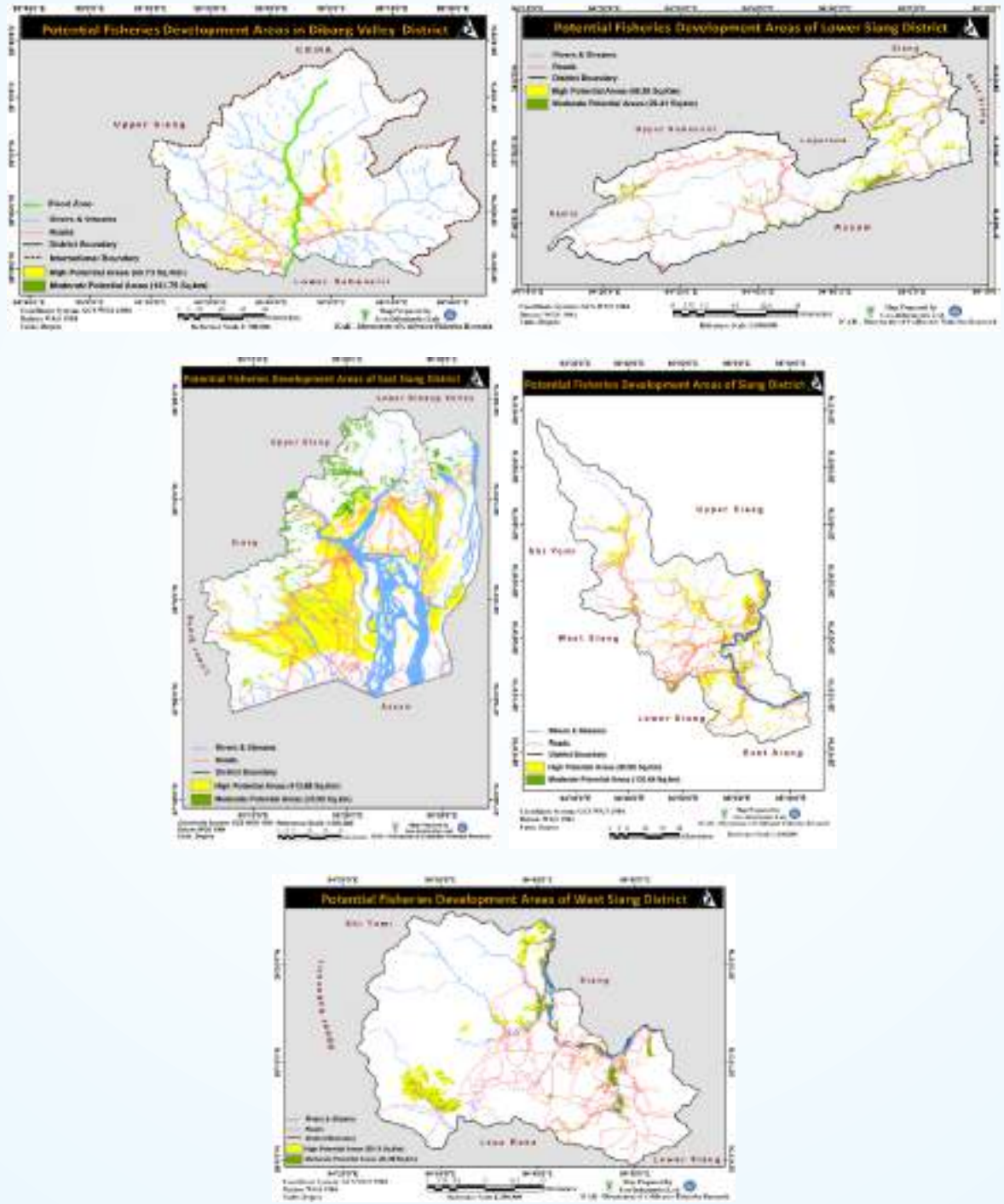

Fig. 4: Final aquaculture site suitability of the distrcits

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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**

Himalayan rivers are important Coldwater resources in the northern part of India. Uttarakhand is in the central Himalayas and among the different rivers of Uttarakhand, Saryu is one of the important rivers. It originates near the Pindar glacier near Kapkot and meets Kaali river at Pancheswar. Ichthyofaunal and plankton diversity was studied at six different stations: Kapkot, Bageshwar, Seraghat, Panar, Ghat, and Rameshwar. Among the selected stations, commercial fishery is mainly practiced at Seraghat. Sampling was carried out during November 2020 and January 2022 to record and collect piscine and hydrobiological data.

Selected sampling stations belong to first to sixth stream orders. Seven fish species were recorded with the dominance of *Schizothorax richardsonii* and *Naziritor chelynoides*. The identification was made based on barbels and mouth patterns. Total 20 characters were measured under morphometric characteristics which include total length (TL), standard length(SL), pre dorsal length (PDL), pre pectoral length (PPTL), pre pelvic length (PPL), Pre anal length (PAL), dorsal fin length (DFL), pectoral fin length (PTFL), pelvic fin length (PFL), anal fin length (AFL), dorsal fin base (DFB), anal fin base (AFB), body depth (BD), caudal peduncle length (CPL), caudal peduncle depth (CPD), head length (HL), pre orbital length (POL), eye diameter (ED), head depth (HD) and snout length (SNL).

In the case of *S. richardsonii,* the length range was 14.5 cm-24.2 cm and for *Naziritor chelynoides* length range was 16.8cm-20.2cm. The length-weight relationship was calculated for both the species, according to which for *S. richardsonii*, the relative condition factor (Kn) was 1.02±0.15, and the condition factor (K) was 0.80±0.18. For *Naziritor chelynoides*, the relative condition factor (Kn) was recorded as 1.3±0.10 and the condition factor (K) as 1.07±0.06. Twenty different physical and chemical characteristics of water such as water temperature, pH, electrical conductivity, resistance, total dissolved solids, salinity, pressure, dissolved oxygen, zinc, iron, sulfate, potassium, nitrate, phosphate, nitrite, calcium, alkalinity, total hardness, copper and magnesium were estimated at all the sampling stations.

The highest average water temperature was recorded at Ghat (16.2±1.6°C) and minimum at Pancheswar (12.0±0°C) during the sampling period. The average value of dissolved oxygen was maximum at Panar (12.3±2.2 ppm) while the minimum at Bageshwar (10.2±0.8 ppm). The pH value was recorded in the range of 8.5-9 at all the stations. Average total hardness was recorded highest at Seraghat (190±10 mg/lit) and minimum at Kapkot (97.5±5.5 mg/lit) while, alkalinity (avg.) was reported maximum at Pancheswar (120±0 mg/lit) and minimum at Kapkot (70±40 mg/lit) during the sampling. A total of 27 species of phytoplankton from 11 genera were identified with the dominance of the *Bacillariophyceae*, followed by *Chlorophyceae* and *Cyanophyceae* in River Saryu. The maximum diversity of phytoplankton was recorded at Seraghat and the minimum at Kapkot. Dominant genera of phytoplankton included *Navicula, Bacillaria, Nitzschia, Spirogyra, Oedogonium, Anabaena, Cocconies, Achnanthes* and *Cymbella.*

Fig.: Sampling at the River Saryu

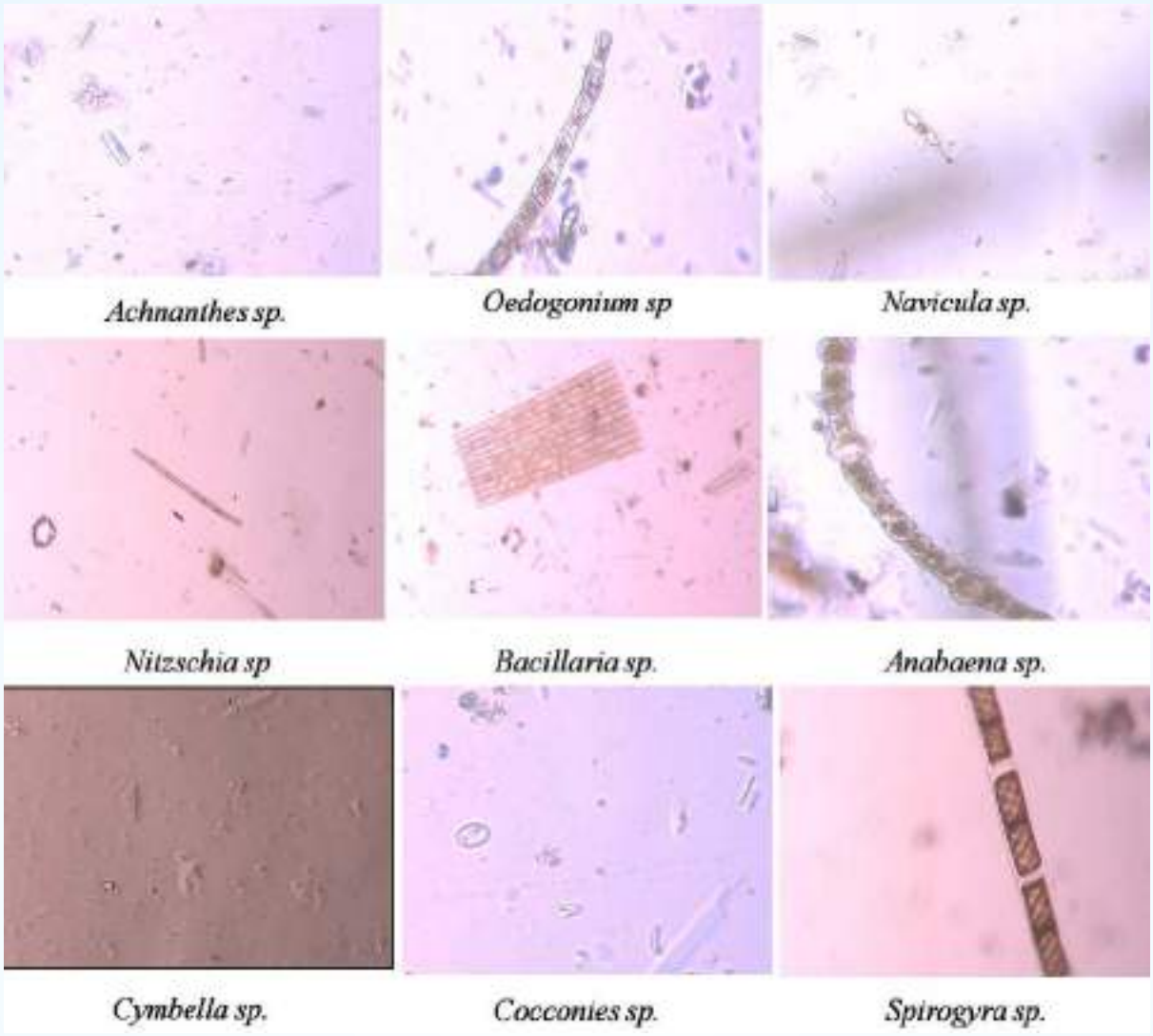

Fig.: Few dominant phytoplankton species from river Saryu

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**

The rivers and streams of the world are among the most threatened ecosystems. They possess ecological, spiritual, aesthetic, cultural, economic, and social value, along with intrinsic values independent of human will and control that are based on their health. India's rivers, especially the Himalayan rivers, have been severely overexploited and are experiencing severe pressure because of anthropogenic activities. Stream health and ecological integrity are at risk from a range of stressors, such as nutrient enrichment, pollutants, sediment accumulation, erosion, alterations in stream hydrology, and habitat changes. Assessing health of the rivers and streams periodically is essential for evaluating their actual condition and assessing their rates of change.

During the investigation, sampling was carried out at six different locations of the *River Ladhiya* (Sunne goan, Sunnkot, Reetha sahib, Baelkheth, Chalthi and Chukka) for recording and collection of species and hydrobiological data. For assessing the health of river, water quality index was standardised for River Ladhiya based on the standard methodology (Table 1 and Fig. 1). Based on this assessment, it was found out that the quality of river water varied from being good at its source, deteriorated to poor in the middle and again restored back to good towards its mouth.This might be

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probably because of more habitation and agricultural activities going on in the catchment of middle stretch of the river.

Watershed/Basin characterisation: *River Ladhiya* basin was characterised by standardising the D8 Point methodology using the satellite data (Landsat 8) and spatial analyst tool of Arcgis10.8. (Fig.2). Land use land cover (LULC) of the basin was also developed by adopting and standardising the methodology of NRSA, 1995. (Fig. 3). The study unravelled the basic structural framework of the river along with its catchment.

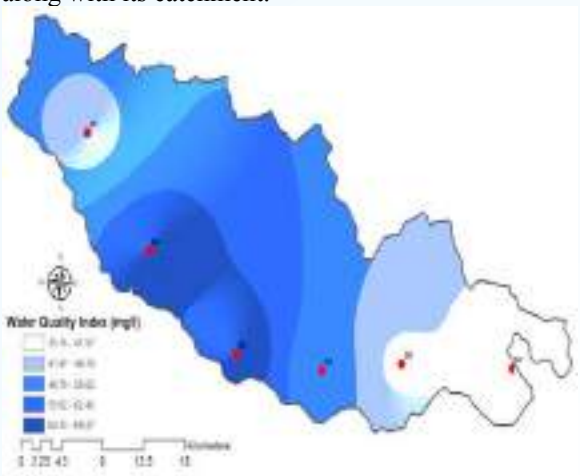

Fig. 1: Water quality index map of River Ladhiya

Table 1: WQI values of *River Ladhiya*

WQI Values of Different Sampling Sites		Grading
SITE 1	46.47	B
SITE 2	68.84	C
SITE 3	69.28	C
SITE 4	52.16	C
SITE 5	40.578	B
SITE 6	35.145	B

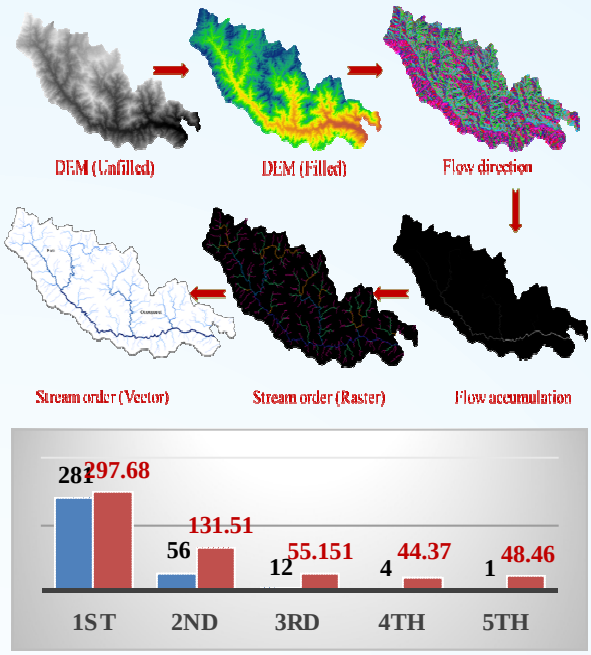

Fig. 2: D8 point methodology for watershed characterisation

Fig. 3: LULC map 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**

In the Kumoan region, field surveys were conducted in Champawat, Bageshwar and Ramnagar. The team interacted with local people, anglers, officials and collected information on status of angling (Plz bring the next sentence up)using questionnaires and one to one discussion. An inventory of 112 local and professional anglers was prepared while some were consulted online. Information on catch size, fishing spots, adoption of "catch and release" approach, conservation efforts by anglers and local people etc. was collected. Survey data revealed that most of the professional anglers practise catch and release for promoting conservation and to create awareness among locals. Secondary source data on total angling licensing, anglers, angling sites, camps organized and revenue generated were collected for the Kumoan region, covering district Almora, Bageswar, Champawat and Nainital for the period of 2014 to 2019. Data on mahseer catch size, fish size is being collected for mahseer angling at Pancheswar of River Kali for the year 1998. Catch and landing data is also being collected for mahseer angling from Ladhiya stream for further analysis. During the survey it was found that some local villagers are involved in conservation of fishes in particular sites.

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Fig.: Mahseer catch by Mr. Ramesh and his colleague anglers at Pancheswar during 1998. PHOTO courtesy Mr Ramesh

Fig: Peoples involvement in conservation of fishes in Kumoan region, Uttarakhand

Project: CF-8	**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 and field visits were carried out for the collection of mahseer germplasm from Garudh Tal, River Kosi and Shipra stream 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* gene.

Fig.: Mahseer specimen collected from Garudh Tal, Nainital district, Uttarakhand, India

A repository of voucher specimens of *Tor* spp. collected from various geographical locations of Uttarakhand was initiated at ICAR-DCFR, Bhimtal museum. Fish with different head and median lobe characteristics were collected from various locations. Presently there are 21mahseer species with unique ID deposited in the museum for future reference and identification.

Fig.: Ventral view of head of mahseer

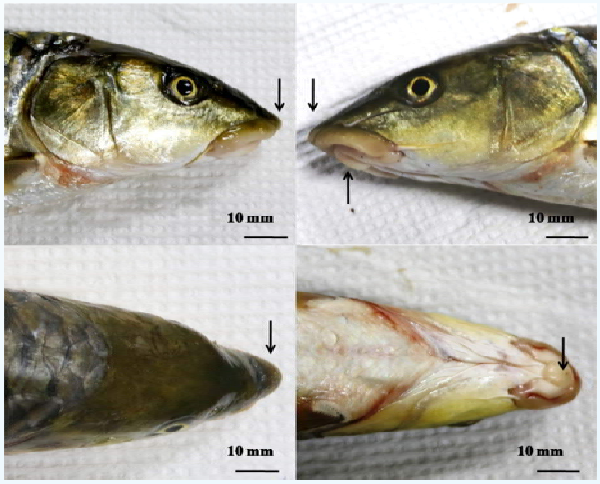

Fig.: Lateral, dorsal and ventral view of head of mahseer

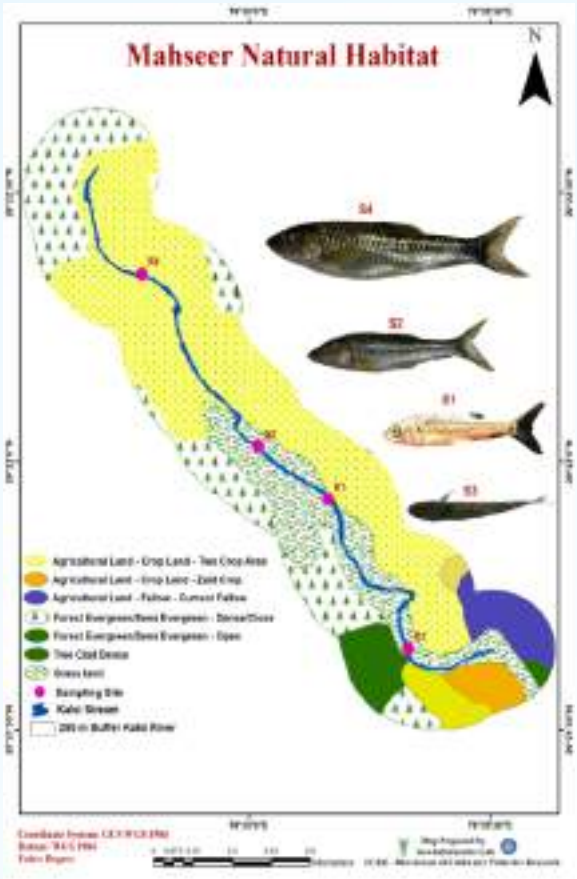

Fig.: Habitat mapping of mahseer was carried out for Kalsi stream for Naziritor chelynoides.

The collaborating partner from the College of Fisheries, Raha, Assam collected mahseer samples from the River Jia Bharali, Diyung Rivers of Assam and River Tirap of Arunachal Pradesh. Morphometric and meristic measurements were recorded and fish specimens were preserved at Department of AEM, College of Fisheries, Raha fish museum as per the standard protocol. Ten *Neolissochilus hexagonolepis* and three species of *Tor putitora* from *River* Jia bhoroli, Assam were identified by molecular methods. From River Tirap in Arunachal Pradesh, two species of *Neolissochilus hexagonolepis,* one species of *Neolissochilus hexastichus* and six species of *Tor putitora* were identified. Altogether, 22 mahseer species were identified by nucleotide sequence of *coxI* gene.

Fig.: Voucher specimens of mahseer

Department of Zoology, Manipur University, Imphal, Manipur collected 98 specimens of mahseer from Chindwin basin and Barak basin. The species collected from Chindwin basin was *Neolissochilus stracheyi* and whereas three species were collected from the Barak basin viz. *Neolissochilus hexagonolepis, Tor tor* and *Tor putitora*. The mahseer species were identified by molecular and classical taxonomy. During field surveys, awareness campaigns were also held in nearby villages from where the collections are made as shown in the figure below.

Fig.: A haul of mahseer

Fig.: Mahseer awareness campaign at Bukpi village, Pherzawl Sampling of mahseer from four river systems Umngi, Umran, Myntang and Umngot was carried out during the year 2021.

Table: Sampling locations of *Neolissochilus* sp.

River System		Sampling Location	Coordinates	Sampling Month	Sample number
Umngi	Brahmaputra drainage	Mawsadang	25°25'27.35"N, 91°38'24.36" E	Dec-Jan 2020	28+25+24=77
		Domsohpian	25°24'6.98"N, 91°34'42.66" E		
		Kenmynsaw Syntein	25°18'31.53"N, 91°32'59.76" E		
Umran	Brahmaputra drainage	Maupur Gao	26°2'6"N, 91°51'18" E	Oct-Nov 2021	42+36 = 78
		Lailad	25°57'32.4"N, 91°45'36" E		
Umngot	Barak drainage	Shnongpdeng	25°13'12"N, 91°59'45.6" E	Jul-Aug 2021	25+44 = 69
		Nongryngkoh	25°19'4.8"N, 92°2'24" E		
Myntang	Barak drainage	Mynso	25°33'7.2"N, 92°19'1.2" E	Oct-2021	36+32 = 68
		Mynkrem	25°33'35.9"N, 92°19'11.9" E		

Morphometric and meristic data of collected mahseer species have been recorded from fishes of three river systems. The work on samples collected from the *River Myntang*is in progress.

Table: Morohometric characters of the collected mahseer samples

Ratios	Umngi	Umngot	Umran
SL/BD	3.14-4.35	3.4-4.6	3.5-4.5
SL/HL	3.62-4.34	3.6-4.3	3.68-4.5
HL/ED	2.74-5.15	3.6-4.4	3.1-5.7

The gill raker count one fish sampled from *River Umngi* was different than the expected numbers (Table 4). Additional sampling and correlation with molecular genetics data are required to establish the existence of genetic variants in these river systems.

Table: Gill raker count

	Umngi	Umngot	Umran
Upper limb	2-4	2-5	2-4
Lower limb	7-9 except 11 in one sample	6-9	6-9

CoxI, *Cyto* b and *ATPase* 6/8 DNA marker sequences from fish sample of *River Umngi*have been submitted to NCBI GenBank. Work on samples of the remaining three rivers is in progress. Except one sample, the values of morphometric measurements and meristic counts, were within the values observed for *Neolissochilus hexagonolepis* in earlier studies. The gill raker count of one fish sampled from *River Umngi* was different than the expected numbers. Additional sampling and correlation with molecular genetics data are required to establish the existence of genetic variants in these river systems.

Sampling was carried out at *River* Intangki at Jalukie, Peren District, tributary of Dhansiri; River Doyang at Pangte, Wokha District (western part); River Namdi, Peren district; River *Intangki*at Jalukie village and River Mangloi river at Samzuiram village, Peren district, tributary of River Dhansiri; River Nangaqa at Surumi village, Zunheboto district, tributary of River Dikhu; River Tzula at Salulamang village, Mokokchung district, tributary of River Dikhuand River Shiyan and River Shingphang at Longleng district, tributary of River Dikhu by Department of Zoology, D. M. College of Science, Imphal, Manipur. Altogether 75 fish samples were collected and their respective ID number, meristic and morphological data have been recorded. Out of collected specimens 59 samples were *Neolissochilus* and 16 were *Tor* species. The mahseer specimens were identified by molecular and classical taxonomy.

3.2 Aquaculture Oriented Research and Development

Project: AQ-16	**Captive management of golden mahseer in perspective to aquaculture and conservation**
Sub project 4:	**Standardization of seed production protocol of chocolate mahseer through optimization of environmental condition**
Period:	**April 2018 – March 2022**
Personnel:	**Pragyan Dash (PI), D. Sarma, R.S. Tandel**
Funding Support:	**Institutional, ICAR-DCFR**

Captive breeding is one aspect of *ex-situ* species conservation efforts, which not only helps in supplementing the existing populations or rekindling the declined populations but can also present information on the ' critical life history of a species. To develop an efficient method for enhancing the spawning of *N. hexagonolepis* in captivity, two factors were examined: (1) different types of spawning substrate and (2) the area of the spawning substrate. The spawning behaviour of male and female chocolate mahseer were recorded besides seed production. The recorded behaviours were configured and coded through Solomon Coder (version beta 19.08.02). Each spawning event/episode for a female or a male was labelled separately by the maker elements. The duration or percentage of female and male behaviours during the spawning and non-spawning period were evaluated independently and statistically compared. The average time of behaviours in a single spawning event of a spawning male and female was also estimated.

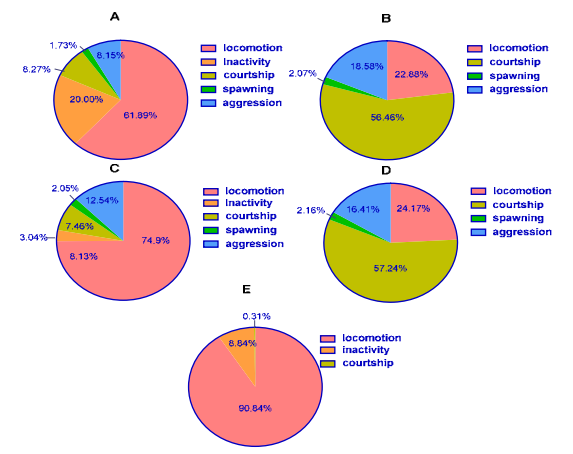

Fig.: Mean proportion of behaviours of N. hexagonolepis brood stock reared in captivity during the observed time of 292 min. A. Spawning females (n=6) B. Spawning males (n=6) C. A female showing proportion of behaviors per single spawning event D. A male showing proportion of behaviors per single spawning event E. non-spawning females and males (observed time 212 min)

The behavioural change of *N. hexagonolep* including preparation of spawning pit by ready female, a behaviour not described for cyprinids so far. Males displayed courting behaviour, including chasing, nudging, and quivering. Courting males demonstrated aggressive behaviour towards other males.

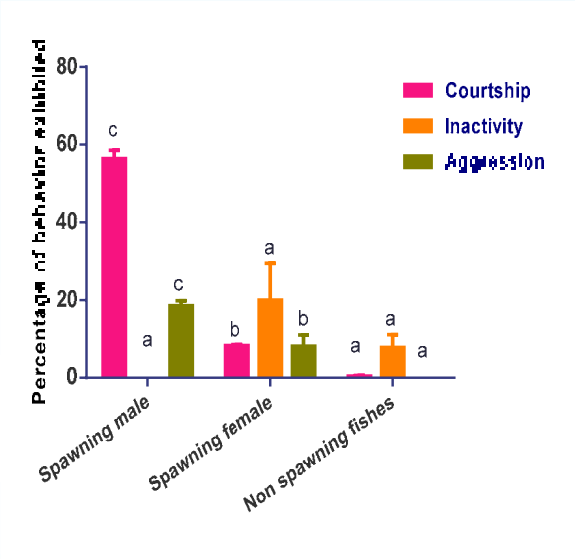

Fig.: Mean proportion of behaviours for the spawning male and female vs the non-spawning fishes of N. hexagonolepis during the total observation time of 292 min and 212 min. Bars depicting different alphabets represent significant differences (P< 0.05).

An experiment was also conducted on photoperiod and light spectra for the evaluation of health status of chocolate mahseer. Two photoperiods 12hL:12hD and 18hL:6hD with white and green light spectra were assigned as treatments. Six females and three males were kept in each tank. Temperature was maintained at 21-22°C in all the tanks. Commercial feed (40% protein, 6% lipid) coated with five other additives such as vitamins, egg albumin, yeast etc., was fed to the mahseer broodstock. Sampling was carried out for this experiment and from the samples, RNA was isolated and quantified.

Project: AQ-16	**Captive management of golden mahseer in perspective to aquaculture and conservation**
Sub project 5:	**Optimizing reproductive and spawning performance of golden mahseer for upscaling its seed production in captivity**
Period:	**April 2018 – March 2022**
Personnel:	**M.S. Akhtar (PI), Ciji,A., Rajesh, M., D. Thakuria**
Funding Support:	**Institutional, ICAR-DCFR**

To optimize reproductive competence and breeding performance, experiments were carried out which resulted in the development of captive maturation and multiple breeding technology of golden mahseer. In 2021, adults of golden mahseer were reared in indoor maturation units made of round FRP tanks installed with gravel-bed mimicking spawning substratum along with photo-thermal manipulations. The desired temperature of rearing water was maintained using 800W thermostatic water heaters. A photoperiod of 12h: 12h with 1200-1400 lux light intensity was provided throughout the rearing period. Fishes were fed *ad libitum* with a broodstock diet twice daily. Water quality parameters such as temperature, DO, pH, nitrite, ammonia, and hardness were monitored regularly. Brooders were also given prophylactic dip treatment with 0.50 ppm $KMnO_4$ from time to time. Periodic monitoring of brooders was made for stripping the eggs. The milt volume required to obtain the maximum fertilization rate in golden mahseer has also been standardized. The success rate of fertilization of golden mahseer eggs stripped from the brood fish was dependent on the amount of milt used. The maximum fertilization rate achieved was optimized. The rate of success of fertilization of golden mahseer eggs also depended on time of wait after mixing the milt with eggs as well as the duration of water hardening. A few minutes after mixing milt with eggs, and a 30 minute water hardening resulted in maximum fertilization. Multiple breeding of golden mahseer during the year was observed that could produce substantial number of eggs and fry.

Fig.: Collecting milt for the standardization of fertilization

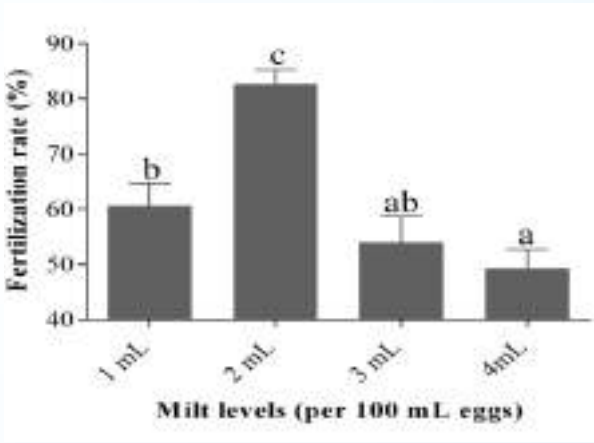

Fig.: Milt volume vis-à-vis fertilization rate (Data expressed as Mean±SD, n=3)

Fig.: Monitoring golden mahseer brooders from captive maturation unit

Fig.: Golden mahseer eggs kept for fertilization with optimized milt volume

Project: AQ-19	**Domestication, biology and breeding of selected species for species diversification in mid-hill aquaculture**
Sub project 4:	**Growth potential and breeding performance of *S. progastus* and *S. plagiostomus***
Period:	**April 2018 – March 2022**
Personnel:	**N.N. Pandey (PI), R.S. Patiyal, S. Ali**
Funding Support:	**Institutional, ICAR-DCFR**

Captive breeding of two species of snow trout

Snow trout, a potential food fish of the hilly region is a threatened fish. Therefore, remedial measures are required to prevent the depleting wild population and a major component of Ichthyofaunal diversity in mountainous streams. A successful breeding protocol was developed under captive condition. *S. progastus* occurs more widely in Eastern Himalayas and *S. plagiostomus* is distributed almost all along the Himalayas. Yearlings of both the species were collected from Alaknanda stream and reared under captive conditions for two years.

Brood stock of both the species were observed for general biology, gonadosomatic index (GSI) and breeding behaviour. Both the species demonstrated similar pattern of gonadal maturity with two breeding seasons one in April while other in September. However, higher values of GSI during September showed reproductive superiority over spring. Brooders showed maturity at the age of three years, however better breeding was recorded in the brooders of the age of 4-5 years with a size ranging between 200-450g. Sexual dimorphism was observed with the presence of nuptial organs and size of the basal sheath scale. Mature fish changed colour during the breeding time. Mature males develop tubercles on either side of the snout, faint yellow colour of the body, and reddish fins. *S. plagiostomus* was easier to breed than *S. progastus* at water temperature 15-20°C. Dry stripping method was applied for spawning. Females were checked twice a week during the spawning season. Eggs of two females were fertilized with milt from three males by stirring them gently with avian feather. Fresh water supplemented eggs are washed 3-4 times till they are clean, swollen and kept in hatching trays with water flow rate of 3-4 LPM for 10000 eggs. The fertilised eggs were sticky, orange for both species with a size ranging between 3.2-3.8 mm in *S. plagiostomus*, while 2.9-3.6 mm in *S. progastus*. Hatching takes place within 11-18 days at water temperature of 18-21°C. The average number of eggs layed by this group rangedbetween 14,000-18,000 per kg body weight in *S. plagiostomus*, while 18,000-20,000 per kg body weight in *S. progastus*. It was observed that the fully ripe eggs, that were orange started degeneration within 2-5 days, if not extruded in time. The hatching rate was higher (>80%) during September than during March (< 56%) and September/October was recorded as the best time for spawning for the both species.

1% dietary supplementation consisting a blend of Ashwagandha (*Withania somnifera*) root powder, dried powder of garlic (*Allium sativum*) and hing (*Ferula asafoetida)* is beneficial for gonadal maturity of females and better spawning under captive condition. Similarly, supplementation of Ashwagandha (*Withania somnifera*) root powder, powdered flowers of *Butea monosperma*, powdered seeds of *Mucuna pruriens* and dried powder of Jaiphal (*Myristica fragrans*) were observed to be beneficial for gonadal maturity and quality of milt in male brood stock. The mean value of sperm count per ml. of milt was observed as $4.20\pm0.34\times10^8$ spz/ml. Both the species are well adopted species for coldwater environment although the growth of both the species is not encouraging for practicing aquaculture. However, the fish showed hardy nature with a good survival rate and possibility of stocking high density. Breeding of both the species is feasible in captive condition and seed produced would be useful for enhancement of wild population.

Fig. Mature brooders of snow trout

Fig.: Fry of S.progastus

Fig.: Gravid female of S.progastus

Project: AQ-19	**Domestication, biology and breeding of selected species for species diversification in mid-hill aquaculture**
Sub project 5:	**Embryonic development, breeding and seed production of Sucker head, *Garragotyla***
Period:	**April 2018 – March 2021**
Personnel:	**R.S. Patiyal(PI),N.N. Pandey**
Funding Support:	**Institutional, ICAR-DCFR**

Breeding and seed production technology for *Garra gotyla*

Being a potential ornamental fish, remedial measures for depleting wild population and a major component of Ichthyofaunal diversity in mountainous streams, a project was conceived to standardise the breeding and seed production protocol for *Garra gotyla*. This species recognized as a biological indicator for coldwater streams, is commonly known as "stone lapping minnow'. Basically, it is a bottom feeder and a plenkty-herbivore, inhabiting in the fast-flowing streams. To achieve the objectives of the project, breeding protocol for captive reared stock was standardized, seed successfully produced from F1 generation and, different stages of egg incubation, besides recording larval development. In growth study for F1 generation, an average length of 7.05 cm and a weight of 3.7g was recorded in 12 months of culture duration. Gonadal maturity was achieved at the age of two years having average length of 7.4 cm and average weight of 5.05g with an average fecundity of 7836 eggs per fish. Habitat study was carried out including analysis of water quality and plankton community. GSI was observed to know the breeding season and different breeding indices were recorded during the breeding operations in captivity Approximately, 200-300 fish /m^3/year can be produced in small poly-tanks with a net profit of Rs. 1000-1500/m^3/year having the sale price of Rs. 10/- per piece. For the growth performance study, *Garra gotyla* seed was reared at different temperatures and initial results appear promising. Seeds produced with this protocol would be beneficial for its aquaculture, conservation and ornamental purpose. Findings of the project are useful for entrepreneurship and socio-economic benefits to the hill dwellers.

Fig.: F1 generation brooders and their selection for breeding

Fig.: Spawn of F-2 generation Garragotyla

Fig.: Rearing of Garragotylain aquarium and FRP tanks

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**

Preliminary breeding success in *Barilius vagra*

Around 20 of *Barilius vagra* fishes collected in the month of March, were maintained in captivity in two flow-through tanks. The tanks were provided with four trays consisting gravel, cobble, sand and gravel with artificial plants as substrates for spawning. Temperature was maintained at 22-23°C. Natural spawning was not observed during the breeding season. Hence, females and males both were assessed for the 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 oozed but not freely released. Females were releasing few eggs 8-10 when pressed. Intramuscular injection with ovatide at different doses was carried out. Out of five trials, one pair consisting two males with one female responded to the hormonal injection. A single female released few eggs in the aquarium tank after 20h of latency. Hatching started on the third day of incubation. Microscopic observations were carried out to study embryonic development. More trials are to be conducted for further standardization.

Fig.: An adult female of B. vagra

Fig.: Adult male of B. vagrashowing tubercles on lowerjaw

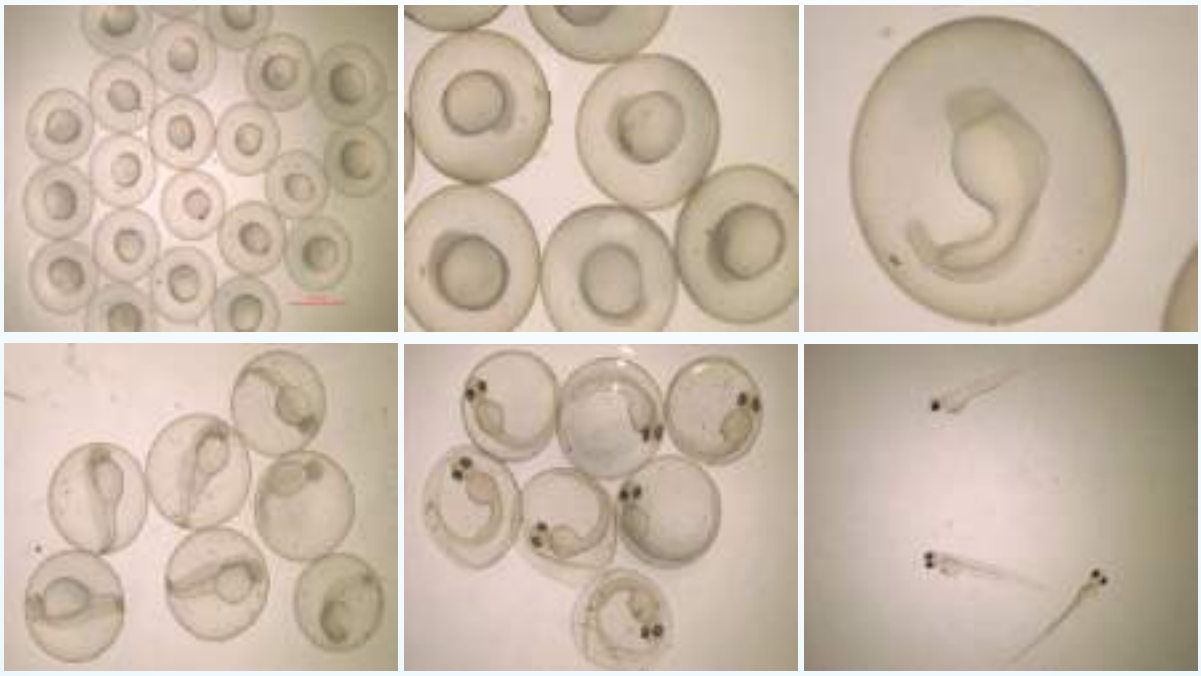

Fig.: Embryonic development of Barilius vagra

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**

Two backyard recirculating quaculture system models were designed, fabricated and validated for small scale rainbow trout production with minimal mechanical equipments (except pumps and aeration devices) to help small farmers to reduce the risk of equipment failure posssibilities and to reduce the initial investment. The system included dual drain tanks with swirl separators which removed 50% of solid generated and rest solids were filtered through gravel media which required regular backwash or cleaning. The biofilter used in the system were gravel bed media. Submersible pump pumped the water to the rearing tanks with a turnover time of 30 minutes. Aeration was provided through venturi aeration device directly in the rearing tanks. The rainbow trout fingerlings of 50 and 170 grams were stocked in rearing tanks of 3 and 7 m^3 model and cultured until market size. All the required water parameters were assesed during the growth cycle. The results indicated the potential for both this particular RAS design to culture fishes upto stocking denisty of 30 kg per m^3. However, when stocking density crosses 35 kg per m^3, a significant decrease in dissolved oxygen levels were noticed. The total suspsended solid and turbididty of the system increased when feed particle size was increased from 3 to 6 mm indicating potential research area for devloping rainbow trout RAS specific feed to improve the water quality. Trout grew to harvest size of 700g in 150 and 180 days respectively in both the system. Sensory evlauation was performed from the harvested fish. Totally 386 kg fish were harvested from both systems and were sold in the local market.

Fig.: Harvesting rainbow trout from tank

The techno-economic feasibility study showed that both systems had pay-back period of 2-3 crops (~1-2 year) and water usage of system was calcualted to 908-1082 L per kg fish produced which is 50-100 times lesser than the flow through system. Energy consumption of the system was estimated to be 13.7-14.0 kWh/kg fish produced and this indicates considerable reduction in energy usage is possible by utilization of energy effient pumps and through standardisation air lift pumps. Further small scale RAS hatchery for rainbow trout egg incubation and nursery rearing system was fabricated and being validated at EFC, ICAR-DCFR, Champawath and at Leh.

Fig.: Harvested rainbow trout in depuration tank

Fig.: Steaks of rainbow trouts produced

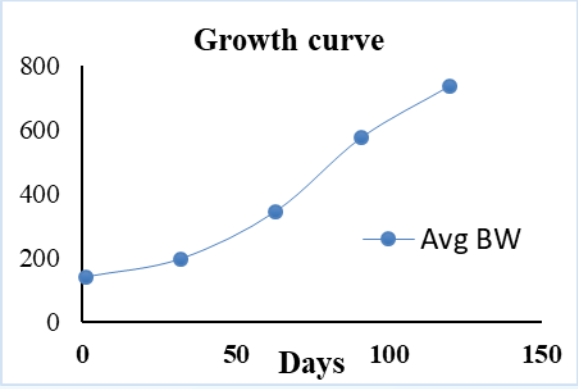

Fig.: Growth curve rainbow trout in mini RAS model in mini-RAS for sensory evaluation

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**

An 'Integrated Agri-Aquaculture Farming' (IAAF) model has been developed for pilot scale fish-vegetable production in Indian uplands. The low-cost and low-tech Coldwater recirculatory aquaponics model has been designed in such a manner that some of the components viz., hydroponic cum biofiltration unit, sump cum base addition tank etc. can be used for more than one function so as to cut short the space and cost. During the trial, indigenous methodologies and tools have been developed for the filtration of particulate and dissolved matter along with the plant seed germination and cultivation of plants in a proficient manner for a user friendly and economic Coldwater aquaponics unit. For the evaluation of plant growth performance, the deep-water culture (DWC) and two types of media beds such as crusher stones and natural river bed stones are being used as experimental unit with triplicates. For targeting the fish production of 35-40kg/m^3, rainbow trout juveniles of 25-30g weight and 130-140mm total length were stocked at 80/m^3 in three rectangular tanks with different flow rates such as Tank1: 4lpm, Tank2: 6lpm and Tank3: 8lpm. Fish were fed with commercially available rainbow trout grow out feed at 5-7% of their body weight. After 135 days of culture, the fish attained size of 375-420g with better growth performance in 8lpm unit but as the fish grows in size, the feed intake by the fish were less during the last phase of the experimental trial due to decrease in DO content.

During the experimental period, the water temperature and DO ranges from 14.3-22.7°C and 7.7-4.68 ppm respectively during February-June 2021. The salad vegetable lettuce endive (*Lactuca sativa*) seeds were purchased online (Amazon Ltd.) and germinated in both plastic and egg trays for the performance evaluation. The seeds germinated within 10-12 days of seeding and the duration of germination ranged 6-8 days with a low germination percentage of 35±5% at 13.1-17.4°C. The plantlets/saplings were transplanted to media bed and DWC units after 8-10 days of sprouting with the emergence of 1-2 true leaves. For experimental cultivation in various recirculatory aquaponic units, the planting gap/space followed was 11-12 cm with the water flow of 2l pm/bed. The media beds such as river stone and crusher stone used for the experimental trial also act as biofiltration system as there is no additional biofiltration system for the experimental aquaponics unit. The growth of the lettuce is purely based on the waste generated by the stocked fish as no external input/nutrients were provided for the better performance of the salad vegetable. Within the cultivation duration of 45 days, the plants reached a harvestable size of 23±2 cm length and 100±5 g weight with better performance for DWC unit but among two types of media beds, the crusher stone unit performs better. The second crop of the lettuce could not be harvested as expected, because the pest infestation.

Fig.: Lettuce endive (Lactuca sativa) at the the time of harvest

Fig.: A haul of rainbow trout harvested from aquaponics unit

3.3 Fish Nutrition and Feed Development

Project: AQ-21	**Coldwater fish nutrition and feed development**
Sub project 1:	**Development and validation of novel feed formulations for rainbow trout (*Oncorhynchus mykiss*) based on commercial-scale industrial by-products**
Period:	**April 2018 – March 2021**
Personnel:	**B.S. Kamalam (PI), Rajesh, M., N.N. Pandey, Ciji, A., P. Sharma**
Funding Support:	**Institutional, ICAR-DCFR**

Evaluation of methanotrophic bacteria meal as fish meal substitute in rainbow trout grow-out feeds

Sustainable growth of aquaculture is largely dependent on feed protein sources which are environment friendly, resource efficient, climate smart and nutritionally well-balanced. A novel methane oxidising bacterial biomass grown on natural gas or biogas could possibly fulfil all the above criteria, as it is produced through a controlled sustainable fermentation process, where methane, a potent greenhouse gas is transformed to high quality microbial protein with minimal use of land and water (String Bio Pvt. Ltd., Bengaluru). In this study, we evaluated the dietary fishmeal (FM) replacement potential of this novel methanotrophic bacterial protein meal (String Pro BM), in rainbow trout, based on growth, feed utilisation, digestibility, nutrient balance and histological observations. Five iso-nitrogenous (49.4-51.1%) and iso-energetic (21-22.1 MJ/kg) practical diets containing 0, 12.5, 25, 37.5 and 48% BM, corresponding to 0, 25, 50, 75 and 100% FM replacement, respectively, were fed to triplicate groups of rainbow trout juveniles for nine weeks. At the end of the feeding trial, growth rate and feed utilisation were high in all the dietary groups (i.e., thermal growth coefficient of 2.55-2.96 and feed efficiency of 1.2-1.3). Feed efficiency and protein efficiency ratio did not differ between dietary groups; however, the decreasing growth trend due to reduction in feed intake was reflected in body condition and carcass estimates of protein and lipid retention, gain and whole-body content, which decreased with increasing BM inclusion levels.

Fig.: Graphical summary of the study design and results of the bacterial protein evaluation trial

There was no significant difference in apparent digestibility of protein, although, dry matter digestibility was reduced at the 48% dietary BM inclusion. Intestinal leucine aminopeptidase activity decreased; whereas, intestinal alkaline phosphatase activity and phosphorus retention increased with BM inclusion, with favourable reduction in phosphorus loss. Histological observations of the gastro-intestinal tract, liver and kidney did not show any differences between dietary treatments. Based on these findings, we conclude that 12.5% of this novel BM ingredient can be safely included in the diets of rainbow trout, as a sustainable substitute for fish meal.

Subsequent to the growth trial in which we examined the optimum dietary inclusion level of the methanotrophic bacterial protein meal, we conducted an ingredient digestibility study to evaluate the actual digestible nutrient and energy content of two different variants of the methanotrophic bacterial protein, using diet replacement approach (i.e., 80% reference diet and 20% test ingredient). The dry matter and protein ADC of the reference and test diets ranged from 65-67% and 85-86%, respectively, with no significant differences. However, the ADC of lipid and several essential amino acids were marginally lower than the reference diet. With respect to ingredient digestibility, the ADC values of the two bacterial meal variants for dry matter was 72.2-72.3%; protein 86.2-86.5%; lipid 60.1-67.2%; energy 74.6-76.1%; lysine 84-85.5%; and methionine 81.5-81.7%. The difference in apparent digestibility of some essential amino acids between the two variants indicated that the production process of the bacterial meal may influence digestible nutrient content and its overall nutritional value. During this calendar year, we generated a revenue of Rs. 2,00,000 from the collaborative research carried out under the memorandum of understanding with SPY Agro Industries Ltd., Andhra Pradesh and String Bio Private Limited, Bengaluru, Karnataka.

Fig.: Preparation of experimental diets in the feed mill at Bhimtal

Fig.: Collection of faeces for digestibility estimation by stripping

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**

The technology for mass scale seed production of endangered golden mahseer using captive broodstock has recently been developed at ICAR-DCFR, Bhimtal. However, the reproductive competence in terms of reproductive output (fertilization, incubation time, and hatching rates), egg quality (egg size increase during hardening, biochemical composition, carotenoid content, and ovarian fluid characteristics) and larval fitness traits (growth, micro-anatomical development, survival, starvation response, and critical thermal tolerance) of progeny from captive-matured golden mahseer brooders is relatively less in comparison with wild-collected brooders, which may be linked to broodstock nutrition as reported in several other species. In this milieu, an improved broodstock diet has been formulated and prepared by incorporating some nutrients/additives to the existing broodstock diet to evaluate the reproductive performance and larval quality.

Fig.: Experimental Setup

For that, triplicate groups of golden mahseer adults (♀: 0.9 – 1.2 kg; ♂: 0.3 – 0.7 kg body weight) were fed with a control and a test diet in captive maturation units (FRP tanks) installed with gravel bed-biofilter at the mahseer hatchery complex. Feeding of test diet notably improved fertilization and hatching rates, egg and sperm quality as well as larval survival. Further, plasma, gametes (egg and milt), and larval samples have been collected and various biochemical and gene expression analyses are in progress to elucidate the effects of supplements on brooder's reproductive competence and larval fitness.

Fig.: Eggs of brooders fed with control diet

Fig.: Eggs of brooders fed with test diet

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, although a promising coldwater aquaculture venture ensures a high profit margin for the farmers, is not growing in an expected manner in the country. One main reason for its slow growth is the unavailability of healthy seed in abundance. Production of good quality seed depends on the availability of proper brooder and starter feeds. Due to the unavailability of proper broodstock feed, trout hatchery runners face spawning failures, which includes asynchronous gonadal maturation, poor fecundity and poor gamete quality. Therefore, this project was conceptualized to address rainbow trout brooder feed and to archive the target of sufficient production of quality seed at the national level. Under this project, two preliminary experiments at ICAR-DCFR, Experimental Field Centre, Champawat and few field validation experiments, in Kashmir, Himachal Pradesh and Sikkim were carried out. Under the first preliminary trial, the following improvement in spawning traits in response to newly formulated rainbow trout brooder feed was recorded.

Table 1: Brooder feed dependent spawning response

Variables	Control feed	Brooder feed
Female responders percentage	47	52
Male responders percentage	21	58
Relative fecundity/kg	877	1398
Fertilization rate	90-95	95-99
Hatching rate	75-85	90-95
Rate of Development	Slow	Fast□3 days
Egg size and carotenoids	Lower	Higher

In the second in-house trial, the response of newly formulated rainbow trout brooder feed was consistent and promising. These includes female responders (41% in control versus 51% in brooder feed fed group), improved fecundity (1431 in control versus 1696 in brooder feed fed group), egg weight (60.24 mg in control versus 69.86 mg in brooder feed fed group), and synchronization of male and female gonadal development.

Fig. 1: Glimpses of rainbow trout brooder feed trial

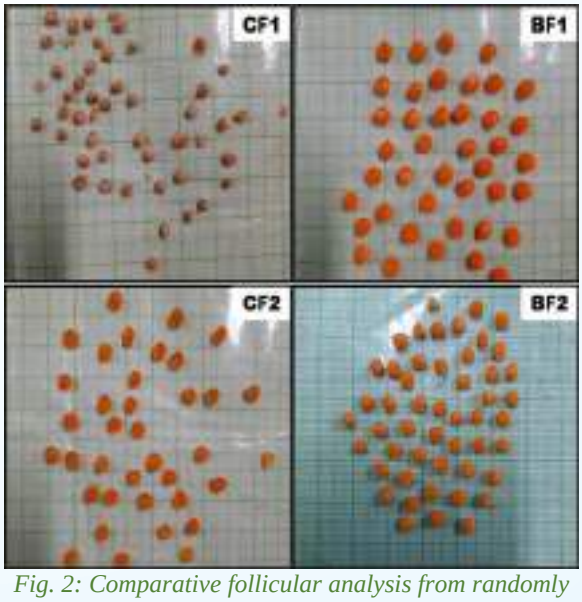

Fig. 2: Comparative follicular analysis from randomly selected rainbow trout females from control feed (CF) fed group and brooder feed fed (BF) group.

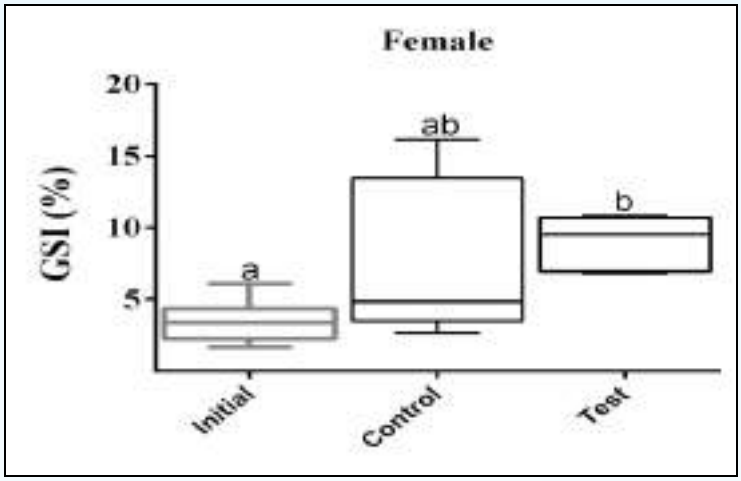

Fig. 3: Diet responsive ovarian developmental index (GSI), follicular development and maturation in brooder feed fed group are more synchronized compared to those fed with control feed

Fig. 4: Glimpses of on farm 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)**

The productivity and profitability of rainbow trout farms is exclusively dependent upon the external provision of a nutritionally complete feed. For best results, trout feeds should be tailored to suit the fish size, farming system, environment, market requirement and economic pressures. Based on the practical and scientific knowledge that we obtained over the past five years, this project has been recently taken up to formulate, refine and validate commercial rainbow trout feeds for different production stages, under different farming conditions and ultimately develop a comprehensive feed management strategy. For thorough investigations using commercial-like feeds, we have partnered with Growel Feeds Pvt. Ltd., Andhra Pradesh, through a research and development memorandum of understanding.

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

In the first on-farm experiment, we comparatively 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 - CT) 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 JK fish (535 g). However, weight gain percentage (CWT - 651 *vs.* JK - 745%) and feed conversion ratio (JK - 1.06 *vs.* CWT - 1.09) was equally good in both the groups, regardless of the genetic background.

Fig.: On-farm feed evaluation trial set-up in the flowthrough raceways at Champawat

Likewise, carcass nutritional composition and sensory characteristics of steaks was not significantly different between the two groups. Corresponding to the higher body weight, body condition factor (1.6 *vs.* 1.5) and carcass yield (71.8 *vs.* 68.4%) was higher in CWT fishes. On the contrary, interestingly, JK fishes showed higher lipid retention, nitrogen gain, cardio-somatic index and blood haemoglobin levels. Further, biochemical and molecular investigations are in progress.

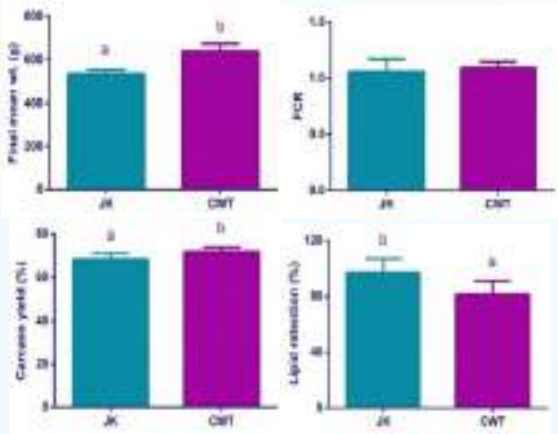

Fig.: grow-out feed performance with respect to genetic background

Effects of fish meal substitution with a blend of alternate protein ingredients

In this study, we conducted a 15-week feeding trial with four experiment diets that contained different fish meal levels, i.e., control (65% FM), T1 (50% FM), T2 (35% FM) and T3 (20% FM). Triplicate groups of rainbow trout juveniles (initial mean weight ~ 42 g) were fed the four experimental diets to visual satiation, in the glass aquaria of an experimental RAS unit. At the end of the trial, there were no significant differences between the dietary groups in feed intake (13.9 - 14.7 g/kg/day), feed efficiency (0.8-0.9), protein efficiency ratio (1.85 - 1.99), weight gain percentage (329 - 375%) and other growth indices. Likewise, body condition factor, viscero-somatic index, hepato-somatic index, whole body composition and nutrient retention / loss estimates were not significantly different between the four dietary groups. Further, biochemical, histological and molecular analyses is to be done. The phenotypic results indicate that it is possible to substantially lower fish meal inclusion levels in rainbow trout grower feeds without compromising growth and welfare of the fish.

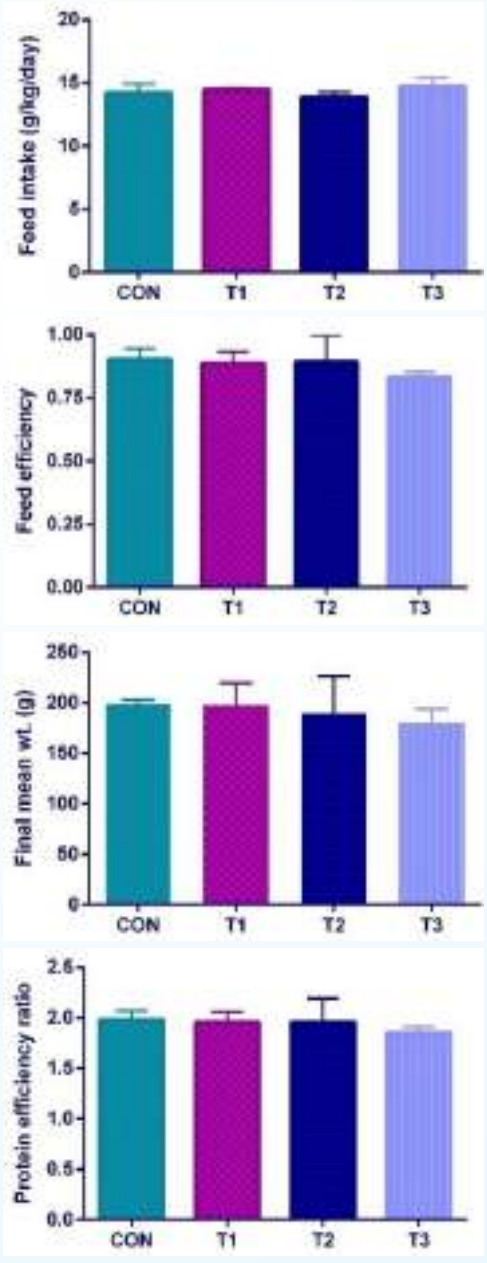

Fig.: *Effects of fish meal substitution*

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Effect of stocking density and size heterogeniety on feed performance

In this study, we carried out a 10-week feeding trial to evaluate the performance of a rainbow trout specific high energy feed, with respect to stocking density and grading. We kept triplicate groups of rainbow trout juveniles (initial mean weight 13-15 g) under three different husbandry conditions, i.e., control (normal stocking density and uniform initial size), NG (normal stocking density and variable initial size) and HSD (highstocking density and uniform initial size) in the glass aquaria of an experimental RAS loop. During the trial period, all the groups were fed twice daily to visual satiation. At the end of the trial, there was no significant differences in feed intake (17.8 - 18.2 g/kg/day) and feed conversion ratio (0.8-0.84) between the different husbandry conditions. However, final mean weight, weight gain percentage, thermal growth coefficient and other growth indices were significantly lower in the HSD group than the control and NG groups. Therefore, under an unlimited (*ad libitum*) feeding and optimum environment scenario, size variation and high stocking may not lower the feed intake and efficiency of a high quality rainbow trout feed. However, high stocking densities may limit growth performance, regardless of feed quality.

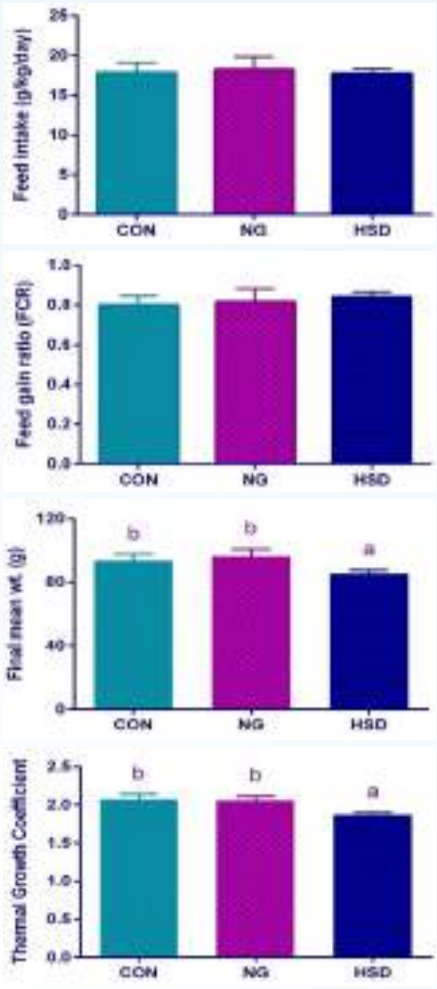

Fig.: Effect of stocking density and size heterogeniety on feed performance

3.4 Molecular Genetics and Biotechnology

Project: AQ18B	**Transcriptome based sex specific marker discovery in golden mahseer (*Tor putitora*)**
Period:	**April 2017 – March 2021**
Personnel:	**Siva, C. (PI), S. Ali, P. Sharma, Rajesh, M.**
Funding Support:	**Institutional, ICAR-DCFR**

Golden mahseer (*Tor putitora*) is the flagship species of Indian Himalayas and the most popular sports fish having aquaculture potential. However, the skewed sex ratio is a major problem in many teleosts including golden mahseer that affects population structure, viability of sensitive stocks and has negative consequences on reproductive success. The insight into molecular mechanisms that establish and maintain the male and female phenotype in golden mahseer is quite useful to understand the biased sex ratio. However, presently there is no information on the critical genes involved in sex is available in this species. Therefore, to understand the sex specific gene expression we studied the transcriptome profile of the gonads of male and female fishes. The *de novo* assembly produced a highly complete reference transcriptome with 316,548 non-redundant transcripts and an N50 of 1327 bp. Differential expression analysis identified a large set of sex-biased transcripts (17,355) between the sexes. Targeted search for candidate genes known for their supposedly conserved role in maintaining the sexual identity of other fish and vertebrate species identified 78 possible homologs that may play an essential role in *theT. putitora* sex determination/differentiation cascade. In addition, several sex-related signalling pathways were observed. RT-qPCR analysis of ten selected candidate genes showed expression patterns consistent with the transcriptome results. This study represents the first gonadal transcriptomic analysis of *T. putitora* and provides a basis for further investigation of the molecular mechanisms of sex determination in mahseer.

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Project: AQ18C	**Gender specific transcriptomics response to environmental stress in golden mahseer (*Tor putitora*)**
Period:	**April 2018 – March 2022**
Personnel:	**S. Ali (PI), Siva, C., P. Sharma**
Funding Support:	**Institutional, ICAR-DCFR**

Freshwater fishes are ectotherms, and thus, metabolically sensitive to environmental temperature. It was found that climate induced changes of the physiology of fishes are not uniform, and thus vary within species (sex and life stage) and across geographic regions due to local adaptation of populations. Himalayan or golden mahseer (*Tor putitora*) exhibits a skewed sex ratio where males are more predominant. In order to understand how different sexes of the golden mahseer respond to environmental stress (e.g. temperature), transcriptomics profiling of different tissues (e.g. gonads and brain) were carried out to identify sex specific stress responsive transcripts. DEseq was used to screen differentially expressed genes (DEGs) in gonads with a false discovery rate (FDR) adjusted p value ≤0.05. The results revealed significant gene expression changes during the course of the high-temperature treatment. However, while comparing gonads of fish exposed to normal and high temperatures, 24 DEGs were found in both sexes, suggesting that there is likely a common genetic mechanism to cope with exposure to high temperature.These DEGs were enriched in the KEGG pathways related to sex differentiation, nitrogen metabolism, glucagon signalling pathway, protein digestion and absorption, phototransduction, and adipocytokine signalling pathway. Therefore, exposure to high temperature influenced metabolism, signal transduction, cell growth and proliferation.

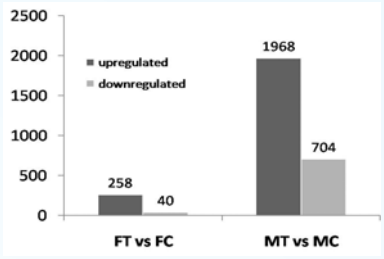


Fig.: The numbers of differentially expressed genes (DEGs) in the comparison pairs (FT:female treated; FC: female control; MT: Male treated;MC: Male control)

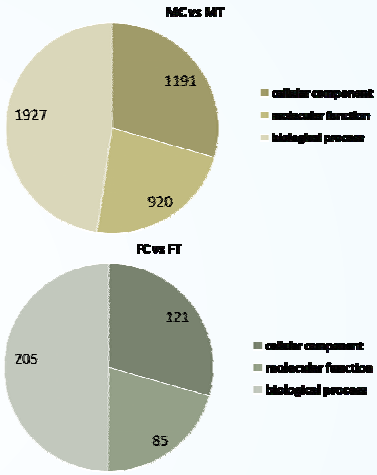


Fig: GO terms for the heat treated versus control group

Project: AQ18D	**Genome editing in common carp, *Cyprinus carpio* using CRISPR/Cas system**
Period:	**April 2019 – March 2022**
Personnel:	**Neetu Shahi (PI), S. K. Mallik, D. Sarma**
Funding Support:	**Institutional, ICAR-DCFR**

In this investigation, 12 common carp *Cyprinus carpio* and 80 WT zebrafish, *Danio rerio* brooders are maintained as live gene bank for microinjection of RNPs and for other research and academic purposes. All the initial procedures of microinjection and volume optimization were carried out in single cell fertilized embryo of zebrafish, using pulled glass capillary.

From the nucleotide sequence of *dnd* gene of common carp, sgRNA template was synthesized. This sgRNA template was transcribed *in vitro* and mixed with Cas9 protein at different concentrations and volumes. These RNPs were used to microinject the fertilized eggs using pulled glass capillary under stereo zoom microscope, along with fluorescent tracers. Subsequent hatchability, survivability and deformity were evaluated in RNPs injected common carp embryo.

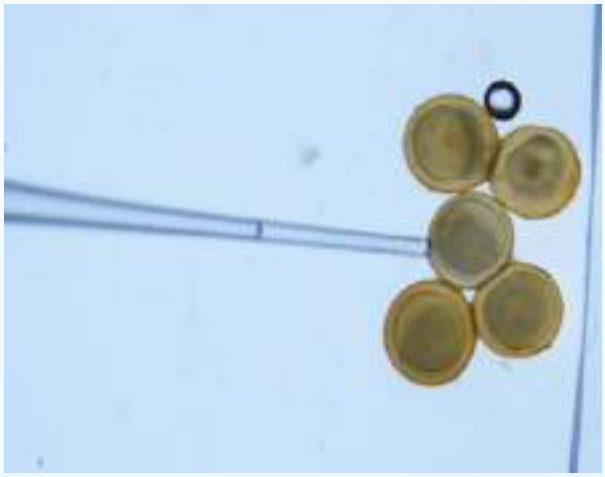
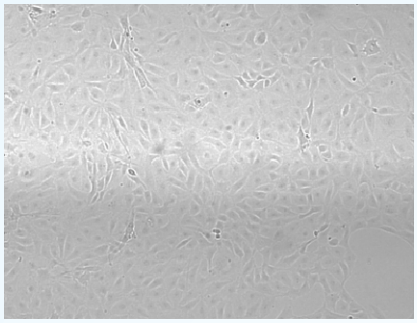
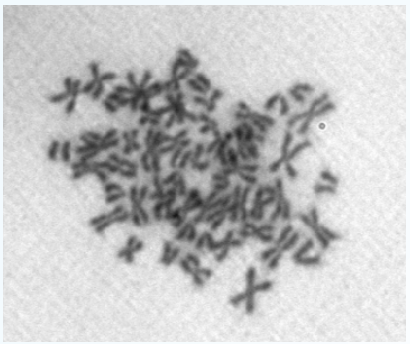


Fig.: Microinjection of RNPs into common carp eggs for knocking out the dnd gene

Project: AQ18E	**Development of cell lines from different organs of rainbow trout**
Period:	**April 2019 – March 2022**
Personnel:	**Amit Pande (PI), D. Thakuria**
Funding Support:	**Institutional, ICAR-DCFR**





A cell line was developed from rainbow trout heart cells and named as RBT-H. The cells are maintained and cryopreserved in the cell culture laboratory of ICAR-DCFR. The cells were deposited at National Repository for Fish Cell-lines (NRFC) NBFGR Lucknow where they were characterized and authenticated by PCR amplification of cytochrome oxidase-I. The PCR product was sequenced (GenBank Acc. No. MW832714) and the authenticated (accession number NRFC075) by National Repository for Fish Cell-lines, NBFGR Lucknow. These cells are available for research purpose from ICAR-DCFR as well as NRFC, NBFGR, Lucknow. This is the first cell line developed at ICAR-DCFR that has paved the way for the development of more Coldwater fish cell lines in future

Project: AQ18F Sub project 6:	**Fish without water: *In vitro* meat**
Period:	**June 2021 – March 2024**
Personnel:	**Amit Pande (PI), K.V. Chanu**
Funding Support:	**Institutional, ICAR-DCFR**

Having established the process of developing cell line from a Coldwater fish, an institute project with a wild idea was taken up that would pave the way for the production of *in vitro* fish meat. An attempt was made to develop a cell line from fish muscles. To begin with, primary culture of muscle cells was attempted from snow trout. Two methods of primary culture were attempted. In the first method, muscle tissue was trypsinized for isolating muscle cells but this method proved futile as only few cells could be recovered. Therefore, explant culture of snow trout muscle was attempted for culturing the muscle cells. Cell radiation could be observed from the explants incubated at 27°C after 14 days. Muscle cells so obtained were sub-cultured and so far, maintained up to 19th passage and preserved in liquid nitrogen at different passages.

Further, an attempt was made to culture the muscle cells under suspension employing non-adherent cell culture flasks. Cells under suspension appeared normal up to four days after which cell death began and, after six days, almost all the cells were dead suggesting that cells could be cultivated in suspension for a very short span.

Moreover, 3D culture of muscle cells was attempted in 12.5cc non adherent tissue culture flasks along with unique scaffolds. The growth of the cells was visualised in the flasks by change in the pH of the medium. Flasks with scaffolds and cells had their medium acidic while the ones with scaffolds but no cells turned slightly basic with time which was usually 5-6 days after the culture. The scaffolds were analysed for metabolic activity of cells by resazurin assay. Viable cells with active metabolism can

reduce resazurin into the resorufin product which is pink and fluorescent. To test whether the cells were present over the scaffolds, scaffolds with or without cells cultured in 12.5 cc flasks were transferred in a 24-well plate and resazurin was added to them. After 24 hours in the wells that had the scaffolds with cells rather than the controls in which the medium turned pink, the cells were established

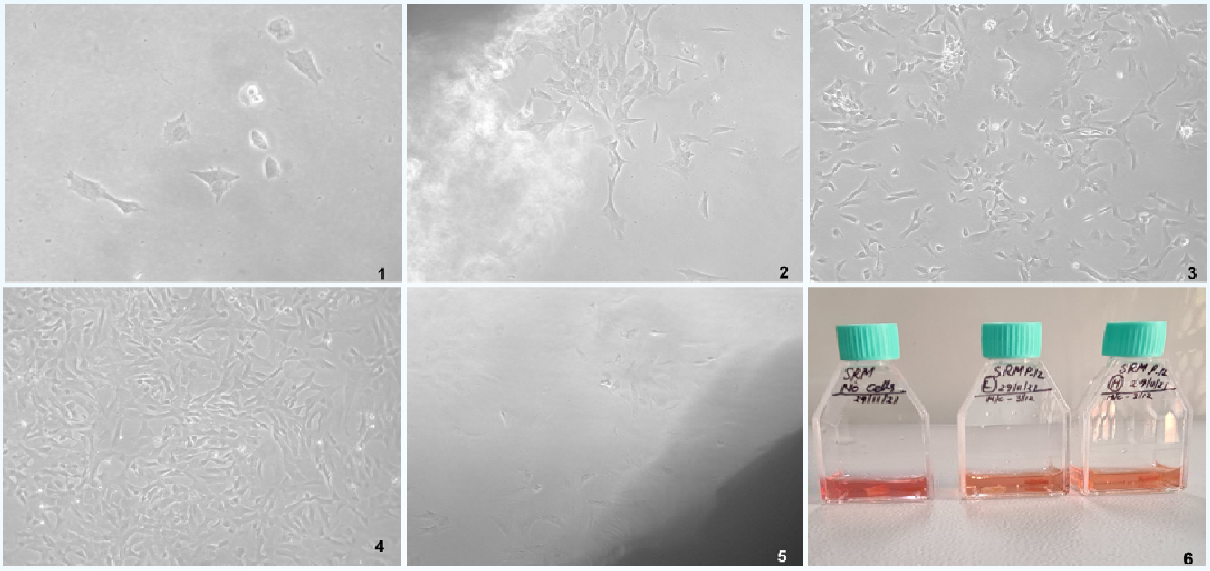


Fig.: Cells obtained after trypsinization (1); Cells radiating from an explant (2);growth after first passage (3) Snow trout muscle cells (4); Cells migrated from scaffolds to tissue culture flask's surface (5);Flasks with scaffolds and cells (6)

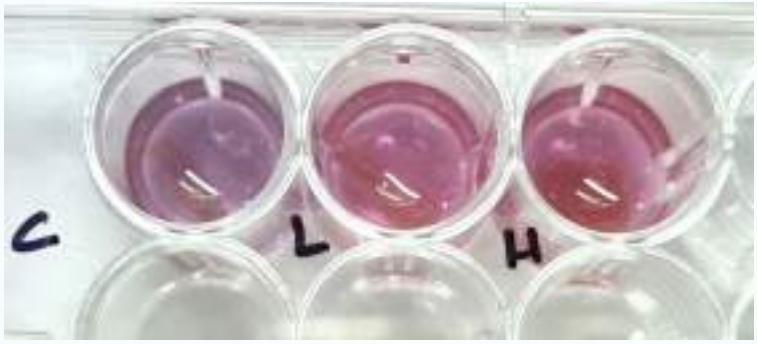


Fig.: Resazurin assay

Project: AQ18G 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**

The piscine diversity of the Himalayan region is unique in terms of both variety as well as endemism. Conservation, protection and rehabilitation of species begins with their correct and unambiguous identification and characterization. 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. As a standardized and universal method, DNA barcoding have been widely advocated 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 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, and quickly assembled. Therefore, species characterization of fish species

based on complete mitochondrial genome using NGS technology will provide more reliable and useful data for molecular systematics, species identification, and conservation.

Fish samples of the target species namely *Bangana dero*, *Labeo dyocheilus and Naziritor chelynoides* were collected from the hatchery and wild. Genomic DNA was isolated from 50mg muscle tissue sample by the phenol-chloroform procedure. 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 have been stored for further analysis.

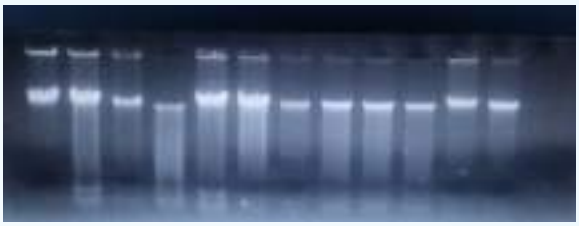


Fig.: Genomic DNA of targeted species

Project: AQ18H 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**

Cargo carrying capacity of polyhexamethylene biguanide:

Delivery of gene into fish cells is a challenging task as fish generally have a lower body temperature than mammals. In this study, a polymer, polyhexamethylene biguanide was evaluated for its gene carrying capacity inside fish cells. First, the polymer – DNA interaction study was carried out at pH 7.4 and 12 to find out optimal ratio of polymer and plasmid DNA for *in vitro* transfection. The cationic polymer was found to interact with plasmid DNA at the ratio greater than 1:2 (plasmid: polymer, w/w). Tansfection using the polymer and green fluorescent protein gene (GFP gene) result demonstrated that the polymer has cargo (GFP gene) carrying capability as indicated by expression ofgreen fluorescent protein in the fish cells.

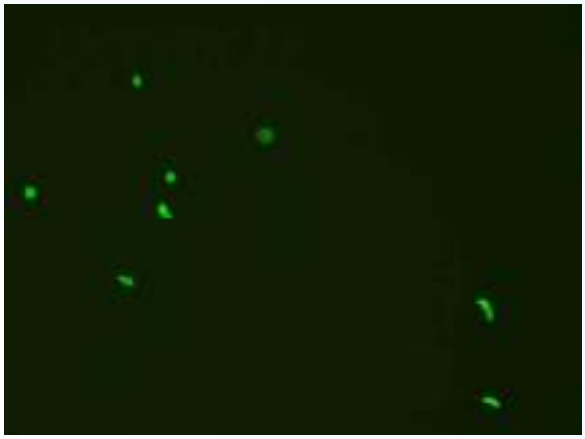


Fig.: EPC cells expressing green fluorescent protein (GFP)

3.5 Disease Surveillance and Health Management

Project: AQ-20	**Development of diagnostic & therapeutic measures for rainbow trout pathogens**
Sub project 1:	**Development of rapid assays for detection and identification of Saprolegnia species**
Period:	**July 2017-March 2021**
Personnel:	**K.Victoria Chanu (PI), D. Thakuria, R.S. Tandel**
Funding Support:	**Institutional, ICAR-DCFR**

Fluorescent in situ hybridization (FISH) using PNA probe labelled with FITC

In situ hybridization was carried out to detect *S. parasitica* using species specific PNA probe labelled with FITC. The cultured hyphae from GY broth were washed twice with sterile deionized water and fixed in ethanol fixative. Ethanol fixed hyphae were washed twice with hybridization buffer and resuspended in 0.5 ml of hybridization buffer containing probe. Control hyphae with no probe were resuspended in hybridization buffer only. The samples were incubated at 60°C for 1h in dark and washed in SET buffer. The samples were mounted onto poly-L-lysine-coated microscope slides and observed with light and epifluorescence microscopy. In light microscopy, oomycete hyphae were observed in all tested samples. Under fluorescence, hyphae could be observed only in case of *S. parasitica*. This indicates that the probe was specific to *S. paraitica* and fluorescent *in situ* hybridization (FISH) could be used to identify *S. parasitica*.

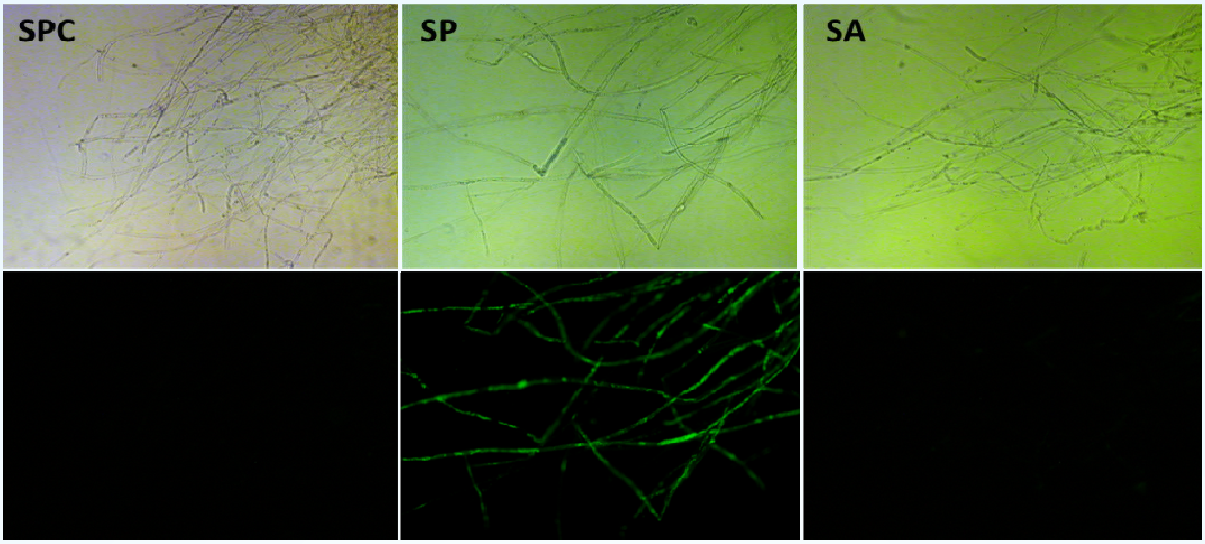


Fig.: Fluorescent in situ hybridization: Light micrographs (top) and epifluorescent micrographs (bottom). SPC: S. parasiticacontrol without probe, SP: Saprolegnia parasitica, SA: Saprolegniaaustralis

Identification and antifungal assay of *Fusarium equisetti* isolated from lesion of *Saprolegnia* infection

During isolation of *Saprolegnia* samples from infection site, *Fusarium equisetti* was isolated. The isolate had orange coloured colony on potato dextrose agar. Microscopic examination showed the macroconidia had around 5 to 6 septa which is a characteristic of *F. equisetti*. ITS region of the isolate was sequenced to confirm the species and the nucleotide sequence submitted to NCBI (Accession number MT907512). The isolate was found to be sensitive to Ketoconazole (0.064 µg/ml), but not to itraconazole, caspofungin, clotrimazole, anidulafungin even at 32 µg/ml.

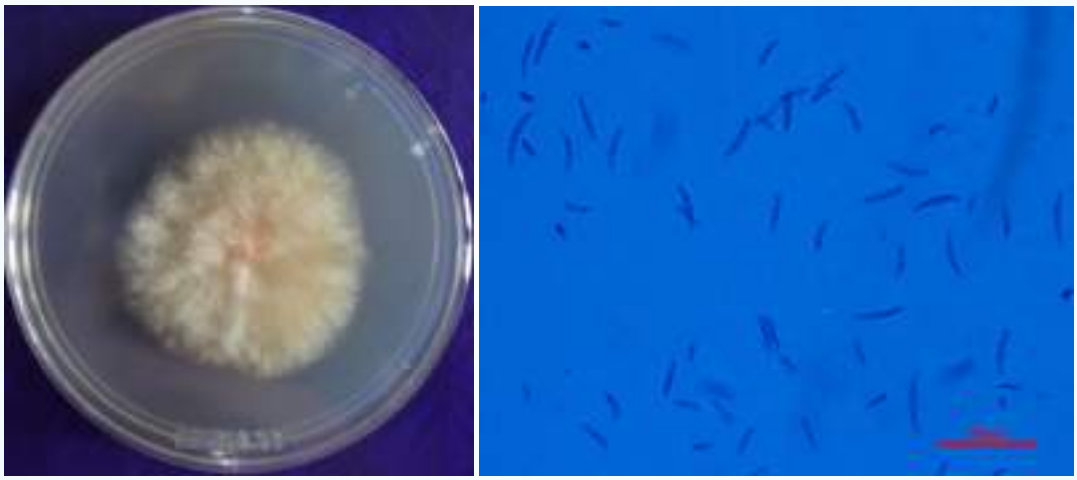


Fig.: Fusarium equisetti on potato dextrose agar. Macroconidia with 5 to 6 septa

Project: AQ-20	**Development of diagnostic & therapeutic measures for rainbow trout pathogens**
Sub project 2:	**Evaluation of antimicrobial activities of nano and polymer-based formulation against Saprolegniasis**
Period:	**July 2017-March 2021**
Personnel:	**D. Thakuria(PI), K.Victoria Chanu, R.S. Tandel**
Funding Support:	**Institutional, ICAR-DCFR**

Anti-oomycete activity of polymer-based formulation:

A polymer-based formulation was tested for its anti-oomycete activity against *Saprolegnia parasitica*. In *in vitro* evaluation, minimum inhibitory concentration (MIC) of the formulation was found to be 50ppm against zoospores of *Saprolegnia parasitica* and *Saprolegnia australis*. The formulation also inhibited hyphal growth at 500 ppm in *S. australis* and 350 ppm for *S. parasitica*. It was also found to prevent colonization and germination of spores at 50ppm for both *S. australis*

and *S. parasitica*. Further, an *in-vivo* efficacy/ cytoxotoxity assay of the formulation was carried out using rainbow trout eggs at Experimental Field Centre, ICAR-DCFR, Champawat. It was found that rainbow trout eggs treated with 10 ppm of the formulation for 10 min was protected from *Saprolegnia* infection and had a hatching rate of 90%. The results indicated that polymer has potential in controlling saprolegniasis. However, further studies are required to evaluate the anti-saprolegnia activity at a lower dose.

Fig.: In-vivo efficacy/toxicity study of polymer based formulation using rainbow trout eggs

Anti-oomycete effect of Chlorhexidine

Saprolegniosis is one of the most catastrophic diseases of freshwater fishes, caused by oomycetes in the genus *Saprolegnia*, and is associated with huge losses in global aquaculture industry. A study was carried out to know the anti-oomycete activity of antifungal/antiseptic agent chlorohexidine (CHX) as an effective alternative treatment for saprolegniosis with minimum adverse impact. *S. parasitica* was tested for their *in vitro* susceptibility towards CHX. The minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) of CHX against *S. parasitica* was found to be 50 mg/L. The results of the present study indicated that chlorhexidine could be a potential agent for controlling *S. parasitica*.

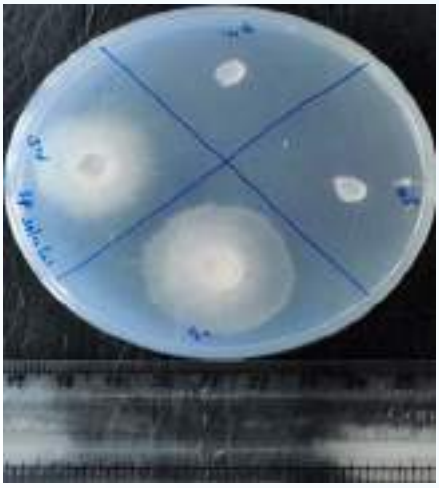


Fig.: Determination of minimum fungicidal effect of chlorhexidine on S. parasitica

Project: AQ-20	**Development of diagnostic & therapeutic measures for rainbow trout pathogens**
Sub project 3:	**Evaluation of available anti-fungal agents and herbs for their efficacy against oomycetes infection in farmed rainbow trout**
Period:	**April 2017-March 2021**
Personnel:	**R.S. Tandel (PI), R.A.H. Bhat, S.K. Mallik, P. Dash**
Funding Support:	**Institutional, ICAR-DCFR**

This project was taken up to screen the available anti-fungal drugs/chemicals for their efficacy against different life stages of oomycetes under *in-vitro & in vivo* conditions, further field validation for most promising drugs/chemical/herbs in respect to various life stages of rainbow trout. Oomycetes was isolated and identified from different life stages of coldwater fishes and also from water in which trout was cultured. Around nine available antifungal drugs/chemical and five herbal bioactive molecules were tested against four isolated species from different life stages of rainbow trout. Four *in vivo* experiments were designed to test the efficacy of boric acid/ formalin to the safety of continuous exposure of rainbow trout egg, sac stages and fry to delineate at what concentration this chemical/ drug/ product protect rainbow trout fry from becoming infected by *Saprolegnia* spores during a natural outbreaks of Saprolegniasis. The effectiveness of five natural plant extract compounds, Curcumin (CUR); Eugenol (EUG), Cinnamaldehyde (CIN), Stigmasterol (ST) and Morin (MOR) on two species of *Saprolegnia*; *Saprolegnia parasitica* and *S. australis*, were investigated. Selective compounds were screened for the minimum inhibitory concentration against zoospores and hyphae. Immunostimulatory potential activity protocol were standardised for the compounds and tested in head kidney leukocytes of rainbow trout, *Oncorhynchus mykiss*. Molecular docking of effective compounds was carried out with effector proteins, plasma membrane ATPase, V-type proton ATPase, TKL protein kinase, and host targeting protein 1 of *S. parasitica* to investigate the target binding sites. Among all, CUR, CIN and EUG could completely inhibit zoospore production and significantly inhibit hyphal growth against *S. parasitica* and *S. australis*. ST and MOR did not show antioomycete activity. The molecular docking results were consistent with *in vitro* studies, possibly due to the binding with the vital proteins of *S. parasitica*. CUR and CIN showed increased nitric oxide production and higher peroxidase activity. Moreover, acute toxicity of the most effective *Thymus linearis* leaf extract, the

hemato-biochemical analysis and the behavioural changes in the early stage of golden mahseer, *Tor putitora* were also examined. An *in-vivo* experiment was conducted to test the safety of continuous exposure of live eggs to different concentrations of *Thymus linearis*, to test the efficacy regarding its ability to control the spread of *Saprolegnia parasitica* infections between rainbow trout eggs/ yolk sac.

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**

In the present study, we have developed a consensus computational framework for identifying potential target proteins and their inhibitors besides subsequent experimental validation of selected compounds by *in vitro* approach. About 255 ligands were downloaded from Pubchem and converted into PDB file format by using OPENBABEL software. The ligand followed Lipinski's "rule of five" that estimated its drug-likeness property. The grid parameters of the aerolysin were identified as centerX: -3.7201 Y: 63.0793; Z 27.7383 with dimensions (angstrom) X: 52.2359, Y: 37.6187 and Z: 25.000. The ligand and protein receptors were prepared and converted to pdbqt file format by using Autodock vina MGL tools. 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. Several compounds have shown good interactions with the aerolysin, and among them, ligand X & Y were studied for detailed 2D interactions. The interaction of ligand X&Y with amino acid residues of *A. salmonicida* aerolysin is shown in Fig 1 and Fig 2. The ligand X &Y showed a strong affinity with Aerolysin with a binding energy of -6.3 and -5.8 kcal/mol -1, respectively. The docked complex showing the lowest binding energy was further analysed for 2D and 3D interactions. The number of hydrogen bonds between ligand X and aerolysin is 1, with seven amino acids involved in hydrophobic interactions (fig. 1). In the case of ligand Y and aerolysin, nine amino acids of receptor were involved in hydrophobic interactions without the presence of a hydrogen bond (Fig. 2).

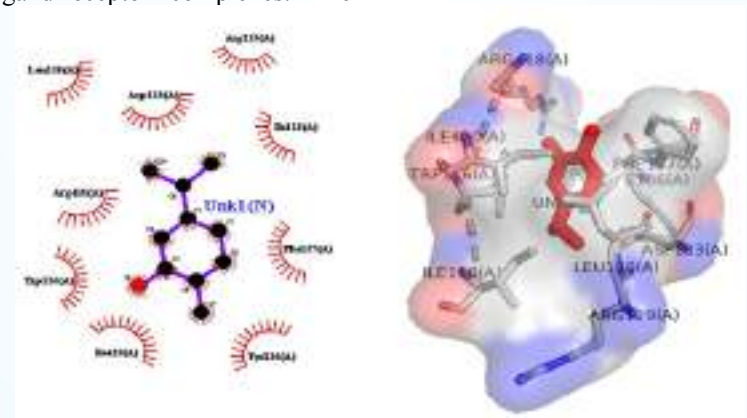


Fig. 1: Interaction of A. salmonicida aerolysin amino acids with ligand X depicted in 2D and 3D

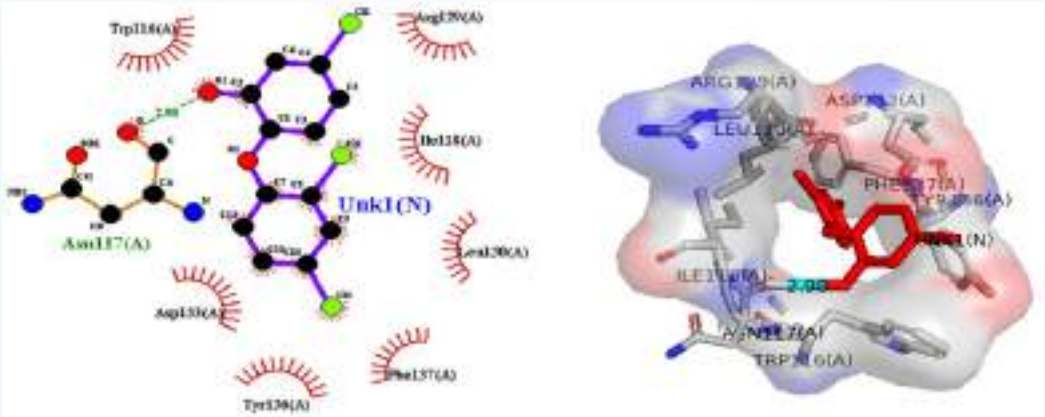


Fig. 2: Interaction of A. salmonicida aerolysin amino acids with ligand Y depicted in 2D and 3D

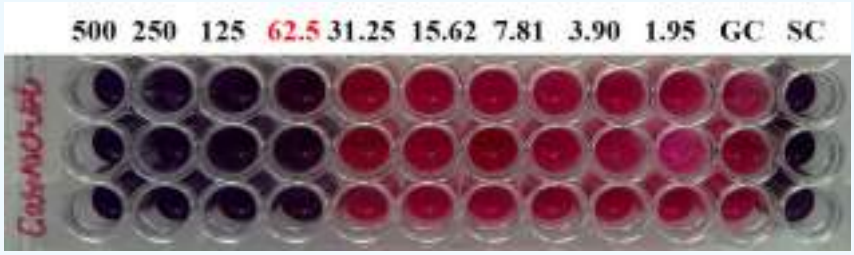


Fig. 3: Minimum inhibitory concentration of ligand X against A. hydrophila. Concentration is given in ppm, GC: growth control, SC: sterility control

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

Rainbow trout rout farms located in Jagthana in Bageshwar, Bairgna and Talwadi, in Chamoli and brooder raceways in Koteshwar area were investigated. To begin with, a progressive fish farmer's raceways in Jagthana were selected. Large scale mortality (25-30%) of adults and brooders was reported in the month of June- July during elevated water temperature of 21°C coupled with impaired water supply of 150-200LPM. The water temperature in last week of December was 11.2°C, TDS 162 and pH 7.6. Typical clinical symptoms were discharge of yellowish fluid from the genital opening along with rotting of gills and posterior celomic cavity. The problem subsided with onset of monsoon. A few dead trout with similar symptoms was dissected at farm and hemorrhagic liver and lower alimentary canal was observed. The samples have been collected for further laboratory investigation.

Fig.: Trout farm of Jagthana, Bageshwar

Fig.: Hemorrhagic alimentary canal

Samples of eggs and brooders from Talwadi and Bairgna were collected in January and December, 2021 to document the major health problem during seed production. The brooder raceways were in size range of 25 x 3 x 2.5 meter and stocked at 10-15 fingerling/sq m. Different stages of fertilized eggs are incubated at 3000-4000/tray in a battery of thirty six trays. It was recorded that about 21-32% fertilized eggs turned white within 24 hours of fertilization. From 24 hours onwards till the formation of eyed ova, average 10-15% egg mortality was observed. On an average, a range of 0.6 -1.5% eggs/day turned white or disfigured which may vary between hatcheries depending on the health of brooders and water quality parameters. The weight of fertilized eggs ranged between 56-91.25mg indicating the difference in brooders age. Water temperature parameters in hatchery water were 10.1-13.0 °C, Dissolved Oxygen 7.0- 10.5 ppm, pH 7.5-7.6, TDS 40-60 ppm, conductivity 90-92 µ/cm, total ammonia 0.2-0.8ppm and chlorides 20-50ppm. Although stripped eggs are larger in older females however, the fertilization rate is below average as compared with brooders that are 3-5 years old.

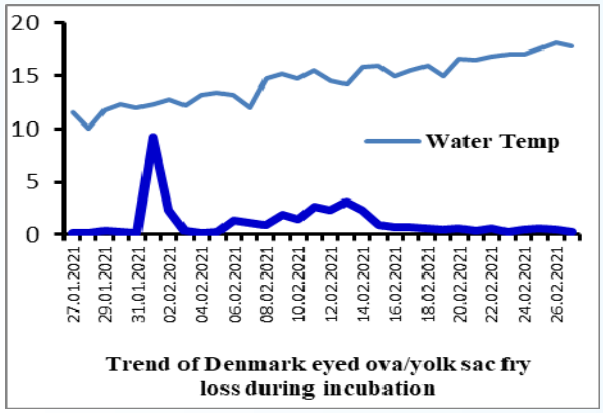
Fig.: The newly fertilized eggs

Fig.: Large scale whiting of eggs

Fig.: Observation on the incuated eggs

Observation on transport and acclimatization of rainbow trout eyed ova

Six lakh eyed ova imported from Denmark were acclimatized and quarantined at Bairagna trout farm, Chamoli. About 0.01% eyed ova were found damaged during the transportation and were acclimatized as per the recommended protocol of OIE. Later eggs were reared in an isolated hatchery with the provision of disinfecting the discharged water. A batch of eyed ovawere reared for 33 days indoor under controlled conditions at Bhimtal. A survival rate of 62.38% from eyed stage to fry was achieved at a rearing water temperature ranging between 10.1-12.0°C. In a duration of first 25 days of rearing, average growth was 66.5 mg, later in subsequent months the growth was 3.58 g(1), 10.72g(2), 25.20g(3), 55.37g(4) at a stocking density of 350/m^3 in an elevated water temperature range of 18.0-23.5. In prolonged water temperature range of 23.0°C, reared rainbow juveniles showed stress and mortality observed. The growth and survival data from trout farm of Chamoli is being collected.



Trend of Denmark eyed ova/yolk sac fry loss during incubation

***Table 2:** Observation on the survival of Denmark eyed ova from yolk sac to fry stage

Total days of rearing	Total Eggs reared	Minimum water Temp.°C	Maximum Water Temp.°C	Total eggs loss	Total% egg /fry loss
11+22	1050	10.1	18.1	395	37.62

**The result would be compared with the other trout hatcheries survival rate before arriving to any conclusion.*

Installation of disposal pipe as a biosafety measures to hold the outgoing water

Cleaning of rearing egg trays

Water holding tank

Packed imported eyed ova with one dead ova

Project: AQ-20	**Development of diagnostic & therapeutic measures for rainbow trout pathogens**
Sub project 6:	**Evaluating the effect of immunization against oomycetes infection in rainbow trout, *Oncorhynchus mykiss***
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 formulation having both antifungal and health promoting properties against saprolegniasis or cotton wool disease. Saprolegniasis an oomycetes leads to a serious condition that has a significant impact on rainbow trout aquaculture. Around three natural compounds have been screened from Himalayan plants having anti-oomycetes and immunostimulatory activity. A protocol for *in vitro* batch screening was also standardised for immunisation against two species of *Saprolegnia* in rainbow trout. Around eight anti-inflammatory cytokines, adaptive immunity cytokines, the non specific and specific gene markers also designed to study the immune and antioxidant gene expression in rainbow trout. It was found that to increase the stability, storage and efficacy, nano-emulsion is a stable delivery system for natural compounds within nanometric size. The work is in progress for development of nano formulations against saprolegniasis.

Project: AMR	**Network programme on antimicrobial resistance (AMR) in fishes under INFAAR**
Period:	**April 2018-March 2021**
Personnel:	**S.K. Mallik (PI) and N. Shahi**
Funding Support:	**Nodal Agency -ICAR-NBFGR(ICAR-FAO Network Programme on AMR)**

Ninety eight water samples collected from carps and rainbow trout farms in Uttarakhand and Himachal Pradesh were processed for isolation of *Aeromonas* group and *Escherichia coli*. From 61 water samples of Uttarakhand, 54 *Aeromonas* spp and 14 *E. coli* were isolated. All the isolates were tested for antimicrobial resistance by screening against a panel of antibiotics by disk diffusion method. The results demonstrated that maximum antibiotic resistance of 78.6% was observed against ampicillin for *Aeromonas* group followed by Cefoxitin (35.7%) (Fig.1). In case of *E. coli*, maximum resistance was shown against Cephalothin (83.3%) followed by Cefoxitin (66.7%) (Fig.2).

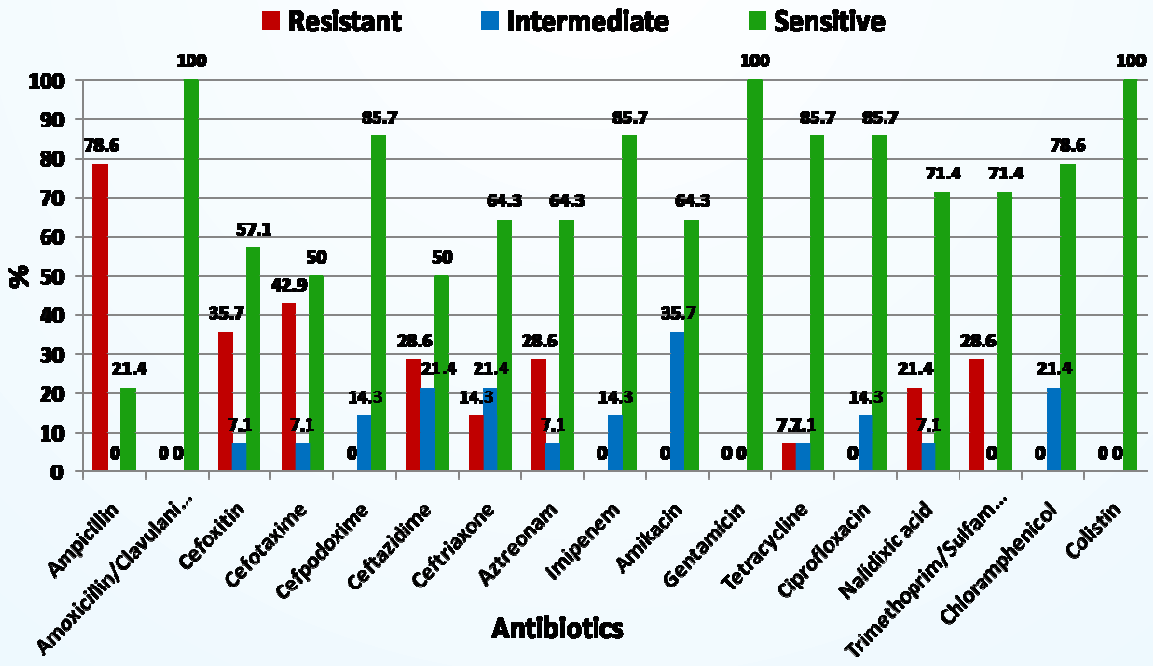


Fig. 1: Antibiotic resistance pattern of Aeromonas spp.(n=54) isolated from water samples of Uttarakhand, India

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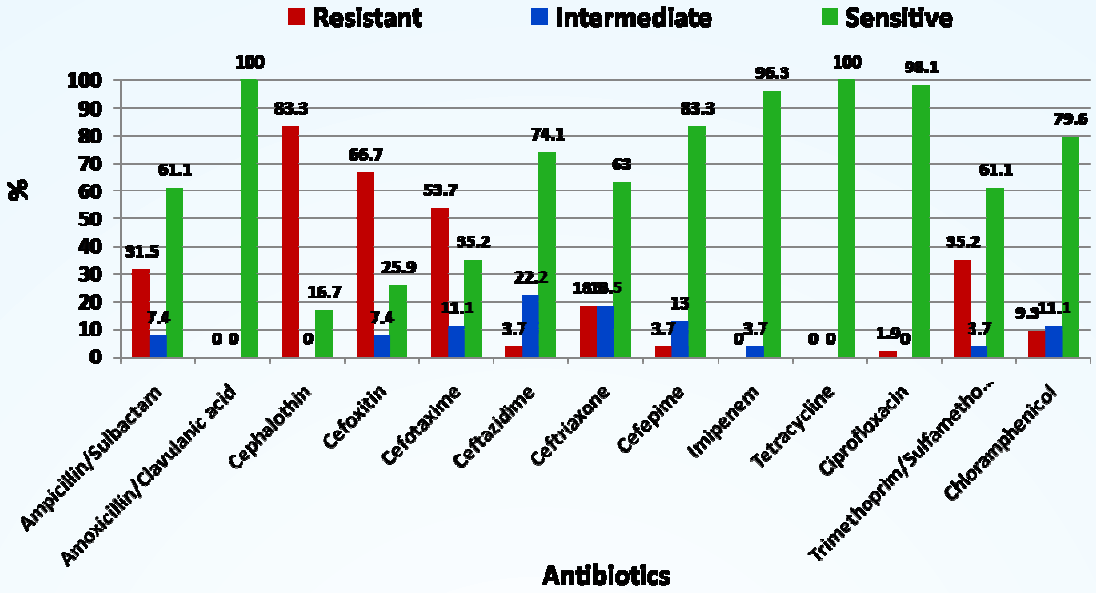

Fig. 2: Antibiotic resistance pattern of E.coli(n=14) isolated from water samples of Uttarakhand, India

Similarly, from 37 water samples of Himachal Pardesh, total number of *Aeromonas* spp and *E. coli* isolated were 34 and 19 respectively. All the isolates were subjected to antimicrobial resistance by screening against panel of antibiotics using disk diffusion method. The results demonstrated that there was a maximum antibiotic resistance (57.9%) against ampicillin in *Aeromonas* group followed by Cefoxitin (36.8%) (Fig.3). However, in *E. coli*, maximum resistance was shown against Cephalothin (88.2%) followed by Cefoxitin (52.9%) (Fig.4).

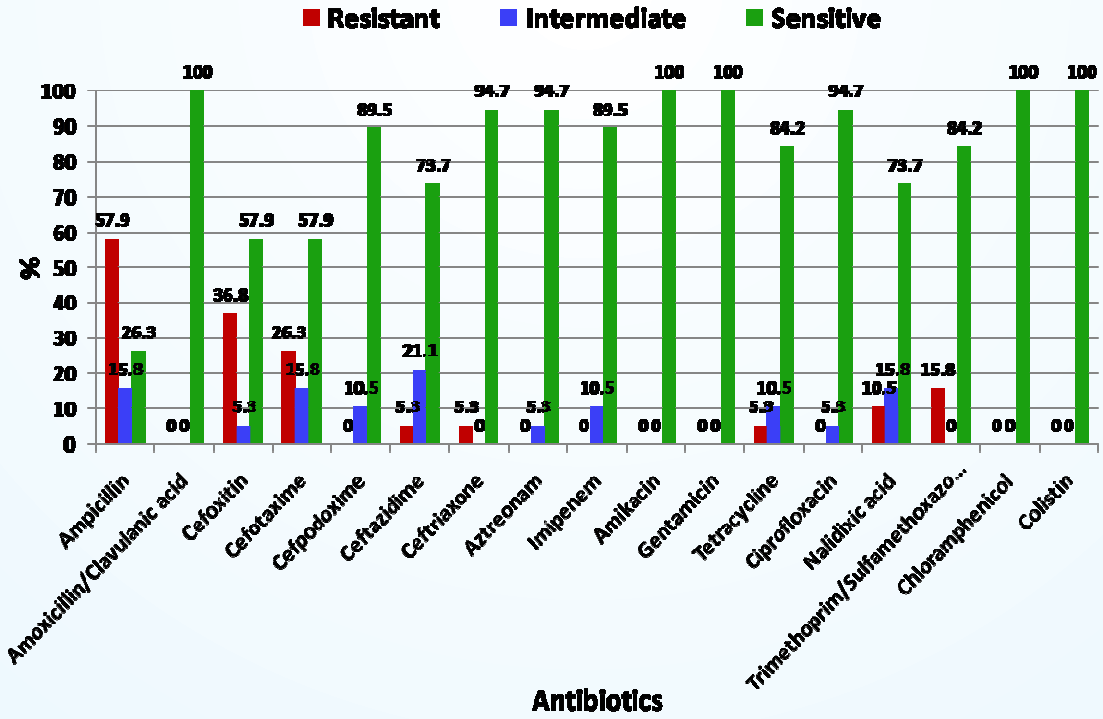

Fig. 3: Antibiotic resistance pattern of Aeromonas spp.(n=34) isolated from water samples of Himachal Pradesh, India

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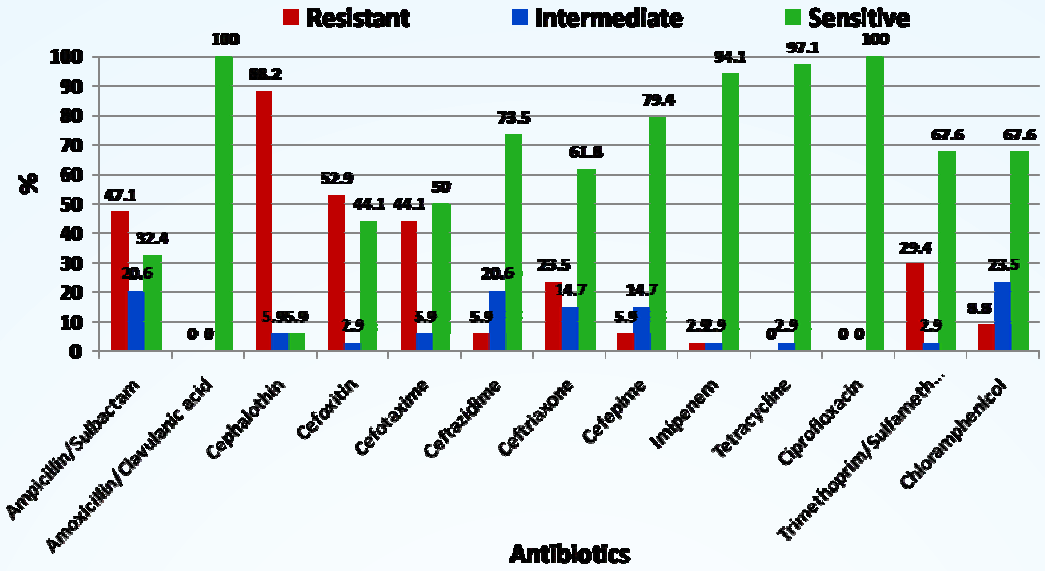

Fig. 4: Antibiotic resistance pattern of E.coli(n=19) isolated from water samples of Himachal Pradesh, India

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 2014-March 2021**
Personnel:	**S. Chandra (PI), S.K. Mallik, R.S. Tandel, R.A.H. Bhat**
Funding Support:	**Nodal Agency -ICAR-NBFGR**

Disease surveillance was carried out in 32 carp and trout farms, hatcheries; six trout grow out raceways in Chamoli, Almora and Nainital Districts of Uttarakhand. Advisories and essential know-how on fish health management was provided to the hill fish farmers by means of online and physical programs organized by the Directorate. *Saprolegnia* sp. was prominent in fertilized eggs and fry of rainbow trout. whitening of eggs and cotton wool like growth over the skin and tail of rainbow trout was reported from the trout rearing facilities at Bairgana, Chamoli and Bhimtal, Nainital with an infection rate of 18-20% in eggs/yolk sac fry and 2-3% in fry rearing tanks/raceways. *Saprolegnia parasitica* was identified. Further, detailed laboratory study was carried out on *Argulus* infection in *Schizothroax* sp., and frequent incidences of Ich infection in rainbow trout fry resulting to large scale fry loss. Tail and fin rot in grass, silver carp and gold fish with whitening and ulceration of caudal peduncle and anal fin, eroded fins was also observed. *Aeromonas hydrophila* isolated and characterized as the primary pathogen which caused a mortality of 5-6%.

Fig. 1: Tail and fin rot in cage reared silver carp

Fig. 2: Infected gold fish with hemorrhagic fins

Fig.3: Sampling of a newly released trout fry

Fig. 4: Trout egg sampling and awareness generation on Trout and carp diseases management

Fig. 5: A carp pond covered for sampling at village Nankayalikot in Kapkot Blockof Bageshwar

***Argulus japonicus* infection in coldwater fish**

Argulus was collected from the various parts of the infected cage reared snow trout, *Schizothorax richardsonii*, showing clinical and gross pathological signs, abnormal swimming, excessive mucus production, fin erosion and inflamed skin wounds over body surfaces Based on the morphological characters such as dorsal ridges of the carapace, respiratory areas, teeth on the basal plate of 2nd maxillae, presence or absence of bilobed protuberances on 2nd swimming appendage in male position, shape of peg and boot-shaped lobe on 4th swimming appendage in male and female, the parasites were identified as *Argulus japonicus*. The 18S rDNA gene sequences of the *Argulus* isolated from snow trout were amplified, and the sequences obtained in this study are consistent with the existing sequences of *A. japonicus*. The sequences were submitted to NCBI. The isolates had a close phylogenetic relationship with *A. japonicus* species reported from different species confirming the species. The results of molecular identification were consistent with the morphological observations.

Fig. 6: Adult Argulus japonicas

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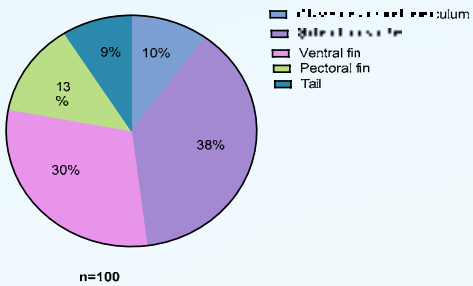


Fig. 7: Percentage distribution of Argulus in different body parts of infected fish

Viral Screening

Periodic disease surveillance for viral diseases in fish farms and hatcheries was carried out in selected districts of Uttarakhand. Briefly, total RNA was isolated from the tissue samples of Rainbow trout using Trizol™ reagent (Invitrogen, USA). The mRNA pool was converted to its complementary DNA using the Revert Aid™ Reverse Transcriptase First Strand cDNA Synthesis kit (Fermentas, USA) as per the manufacturer's instructions. PCR Screening: The samples were screened for the presence of IPNV using the primer IPNV F1 5′ GTGCTGGCCACAAACGACAAC 3′, IPNV-R1: 5′ GTTTGGGATCAGCTCGTAGTTGGACAC 3′. Screening of fish samples for IHNV was done by using primers IHN-UP-F: 5′ AGA-GAT-CCC-TAC-ACC-AGA-GAC 3′ and IHN-UP-R: 5′ GGT-GGT-GTT-GTTTCC-GTG-CAA3′ The samples were screened for the presence of VHSV using the primer VN-F: 5′ ATG-GAA-GGA-GGA-ATT-CGT-GAA-GCG 3′, VN-R: 5′ GCG-GTG-AAG-TGC-TGC-AGT-TCC-C 3′. All the clinical samples subjected to RTPCR were negative for IPNV, IHNV and VHSV.

Mass Awareness on Coldwater Fish Health Management

Awareness on fish health management and water quality monitoring was conducted during seed distribution to fish farmers and in the Kisan Ghosti on balanced use of fertilizers in aquaculture at ICAR-DCFR, Bhimtal. 80 farmers participated physically and virtually in the program. Measures to minimize health problems during culture period were also discussed with participating farmers in order to create awareness among farmers on good health management practices. During the period eight awareness cum interaction meets were organized to sensitize hill fish farmers towards good health management practices involving about 180 fish farmers.

Fig. 8: Farmers getting acquainted with water and soil analysis techniques in lab

Project: AINP	**All India Network Project on Fish Health- AINP-FH**
Period:	**April 2015-March 2021**
Personnel:	**S.K. Mallik (PI), N. Shahi, R.S. Tandel**
Funding Support:	**Nodal Agency-ICAR-CIBA**

Pharmacokinetics of florfenicol mediated feed administered in rainbow trout juvenile (avg wt. 118g) fed at 15 mg/kg body weight demonstrated maximum deposition of the antibiotics in liver and gill at 0h and 6h. Florfenicol content was maximum in intestine that gradually increased with time (24-128 h), (Figure 1A: Principal component analysis), whereas florfenicol amine indicating as residue of florfenicol was present in maximum amount in kidney at 48-128h time point (Figure 1B: Principal component analysis).

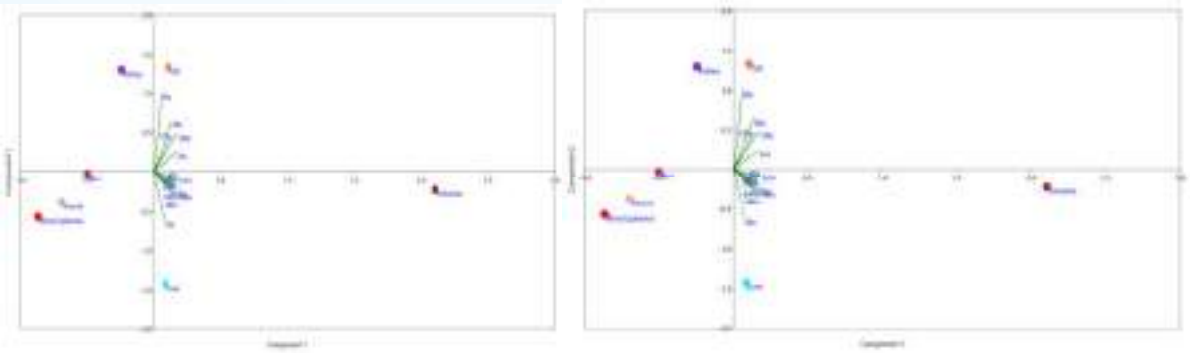


Fig. 1A: Principal components analysis of Florfenicol

Fig. 1B: Principal components analysis of Florfenicol Amine

Project: NICRA	**Development of climate resilient rainbow trout and innovative trout farming strategies to mitigate climatic stressors**
Period:	**April 2017-March 2021**
Personnel:	**D. Sarma (PI), R.S. Patiyal, B.S. Kamalam, Rajesh, M., P. Sharma, R.S. Tandel, S.K. Mallik, M.S. Akhtar, N. Shahi, Ciji, A., A.K. Giri, Siva, C., R.S. Haldar**
Funding Support:	**Nodal Agency-ICAR-CRIDA**

Intensive production of rainbow trout achieved in the pilot RAS facility at Bhimtal

Generally, rainbow trout is cultured in flow-through raceways in India, where one to two lakh litres of water are used to produce one kilogram of fish. However, with climate change related extreme events and environmental fluctuations, and ever-increasing competition for the available freshwater resources, greater emphasis has been laid on efficient utilisation of water in aquaculture production systems. Under NICRA project, the Directorate has taken the lead to develop, validate and promote climate resilient Coldwater re-circulating aquaculture systems for rainbow trout farming. A pilot scale RAS facility was recently established and is repeatedly being tested for intensive culture of rainbow trout at Bhimtal. This facility has four large grow-out tanks, eighteen experimental tanks, solid removal system, drum filter, moving bed biofilter, reservoir, UV filter and oxygen cones; with corresponding equipment for water pumping, oxygenation, electrical control and real-time system monitoring. At present, we have achieved a unit productivity of 35 kg fish per cubic metre (which is 2-3 times higher than the average national productivity in conventional flow-through raceway system) by standardizing operating procedures related to water filtration, feeding, cleaning and health management. Concurrently, water use per kilogram fish production has been reduced by hundred-fold and culture duration has been reduced to 5-6 months under optimal rearing conditions, due to quicker growth rates and efficient feed conversion. In the previous production cycle (2020-21), a production of more than 1000 kg of 400-600 g size fish was achieved and sale revenue of approximately Rs. 3,00,000. Optimization of rearing conditions for higher unit productivity and harvest size is in progress in the present experimental crop cycle which was initiated from October 2021.

Fig.: Intensive culture of rainbow trout inthe RAS facility at Bhimtal

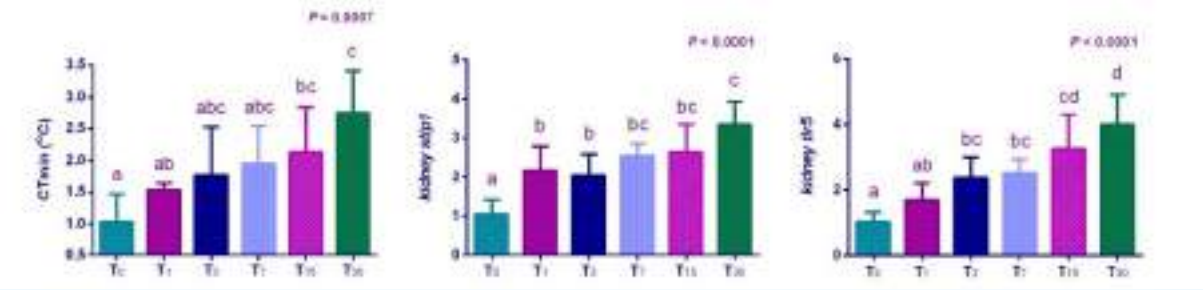
Fig.: Harvesting of market size rainbow trout in the RAS facility at Bhimtal

Elucidation of thermal adaptation mechanisms in rainbow trout

To better understand the molecular mechanisms which regulate thermal safety margins and adaptive responses of rainbow trout at temperatures above physiological optimum, we simultaneously investigated the time course of changes in critical thermal tolerance thresholds and associated hepatic and renal transcript abundance of molecular markers related to cellular stress response, after high temperature exposure. The experimental fish were initially acclimated to 17^0C and later exposed to a gradually raised elevated temperature regime (22□) for a period of 30 days. CT_{max}, CT_{min} and mRNA expression of candidate markers were examined before the thermal challenge (T0) and over the time-course (days) of high temperature exposure (T1, T3, T7, T15 and T30). With respect to organismal response, CT_{max} was significantly elevated at T3, but the degree of gain in heat tolerance was not persistent. Contrarily, we observed a gradual loss in cold tolerance with highest CT_{min} estimate at T30.

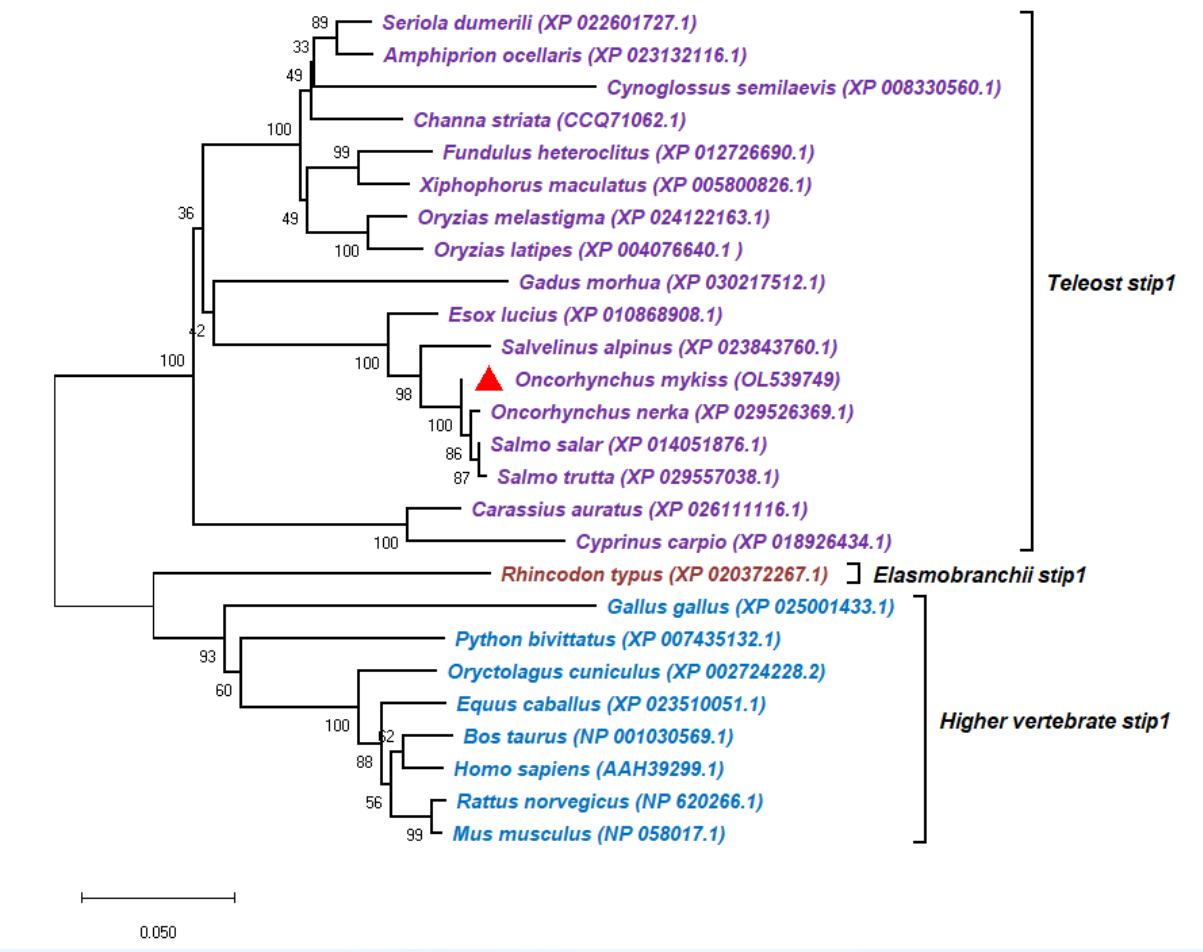
Based on the time-course of mRNA expression, the studied markers could be categorized into those which were persistently elevated (*hsp70a*, *hsp70b*, *hspa5*, *hsp90a*, *hsp90b*, *stip1* and *serpinh1* in kidney and *hsp90b* in liver); those which concurred with changes in CT_{min} (*hspbp1*, *hsp90b*, *stip1*, *gr1*, *hif1a*, *hyou1*, *tnfa* and *tlr5* in kidney); and those which concurred with changes in CT_{max} (*hsp90a*, *serpinh1*, *tlr5* and *lmo2* in liver). Apparently, transcriptional changes in kidney and liver reflected $CT_{min}$and CT_{max} trend, respectively. Expression profile of *stip1* and *tlr5* suggest that they are potential novel markers which could reflect thermal limits in rainbow trout. Hepatic metabolic markers were either initially elevated (*alt*, *glud*, *g6pase1*) or down-regulated at different time-points (*ast2*, *gls1*, *fas*, *cpt1b*, *mtor*),

linked to gluconeogenesis and metabolic depression, respectively. Whereas, growth-axis markers showed no significant differences. Overall, this time-course analysis has revealed potential associations in organismal and tissue-specific cellular response to high temperature acclimation in the thermally sensitive rainbow trout.



Characterization of thermal tolerance related biomarkers in rainbow trout

We characterized the mRNA sequences of three potential biomarkers of thermal tolerance in rainbow trout, namely stress induced phosphoprotein (*Omstip1* - OL539749, complete), hypoxia upregulated protein (*Omhyou1*- OL539750, complete) and a heat shock protein 40 family member (*Omdnajc16* - OL539748, partial). The *Omstip1* amplified product was 3096bp long and contained a 1632bp ORF region that encodes a putative protein of 543 amino acids. The *Omstip1*sequence also covered 1193bp and 271 bp in the 3′ and 5′ untranslated region (UTR), respectively. The*Omhyou1* amplified product was 3421bp long and contained a 3063bp ORF region that encodes a putative protein of 1020 amino acids. The *Omhyou1* sequence also covered 120bp and 238bp in the 3' and 5' UTR, respectively. The *Omdnajc16* amplified product was 2528bp long and contained a partial coding sequence of 2356 bp that encoded a start codon (ATG) and 785 deduced amino acids and covered 172bp in the 5' UTR. As expected, phylogenetically, the *Omstip1, Omhyou1 and Omdnajc16*showed high nucleotide sequence homology with other salmonids. With respect to their transcriptional regulation during high temperature acclimation, the mRNA expression of *Omstip1*, *Omdnajc16* and *Omhyou1* showed significant upregulation in gills. This indicates the potential role of the three proteins inthe thermal acclimation process in rainbow trout.



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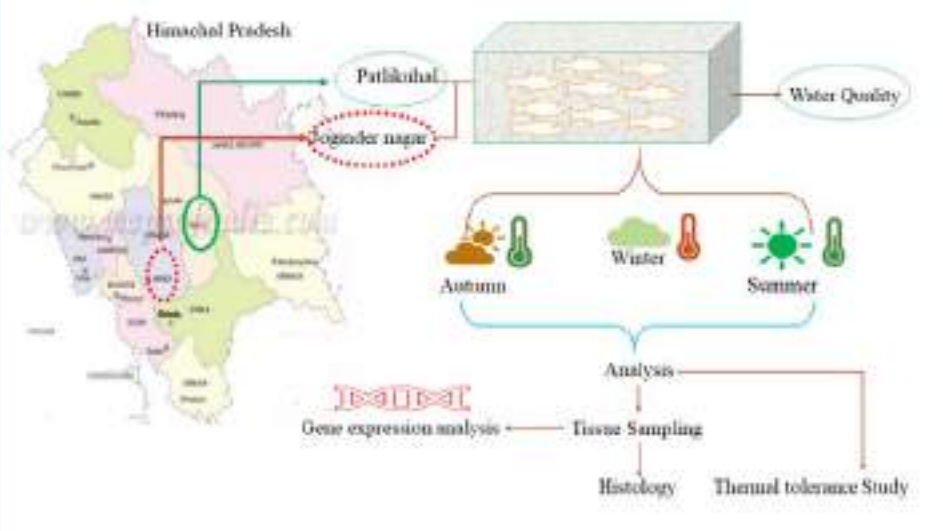
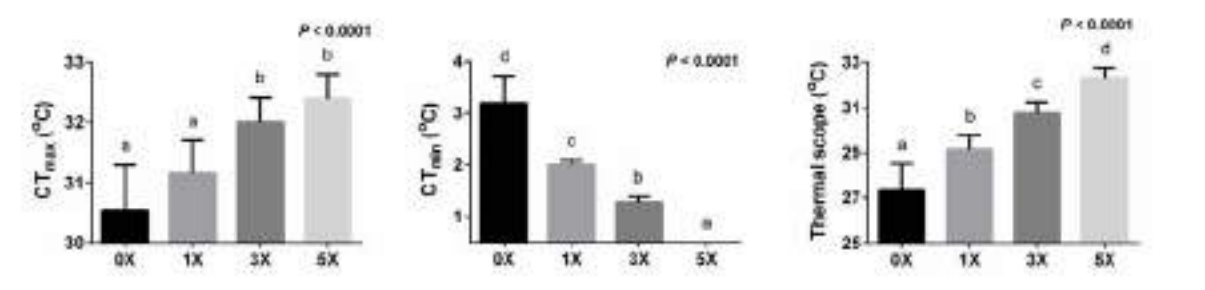
Investigation on the interactional effects of microclimatic variations and seasons

Field observation of seasonal changes in important abiotic water quality indices were carried out in twelve private rainbow trout farms in two distinct micro-climatic zones in Kullu and Mandi districts of Himachal Pradesh. Baseline information of periodic water quality changes was generated for twelve farms for a two-years. Based on distinct microclimatic variations (low *vs.* high), we studied the interactional effects of seasons and microclimatic conditions on the upper thermal tolerance limit, body condition, tissue indices, cellular / molecular adaptation and tissue micro-anatomical changes in rainbow trout grown in two geographically isolated farms. The magnitude of seasonal fluctuation in water temperature was found to be a strong determinant of the fish's upper thermal tolerance limit, with significant interaction between microclimatic zone and season. Tissue indices suggests strong changes in energy metabolism and substrate preference during different seasons. Indicative of a significant cold stress response, mRNA levels of stress biomarkers in different tissues (kidney, gills, heart, spleen and liver) were coherently up-regulated in winter, particularly in the fishes exposed to high degree of microclimatic fluctuations. Overall, our findings emphasize the importance of the magnitude of climatic variation over the different seasons on the physiological well-being of farmed rainbow trout.



Nutritional interventions to mitigate heat stress

Development and use of functional feeds is a practically feasible option to mitigate climate change related stressors in rainbow trout farming. In this regard, we conducted eight-week feeding trial to evaluate the effectiveness of different dietary levels of anti oxidant vitamin supplementation (0X, 1X, 3X and 5X) to enhance the thermal acclimation capacity of rainbow trout, when reared 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. 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 more than 4°C). Further, plasma and tissue samples have been collected and various biochemical and gene expression analyses are in progress. Similarly, another study was conducted to assess the effect of dietary β-glucan on thermal adaptive capacity and well-being of rainbow trout juveniles. Triplicate groups of rainbow trout juveniles were fed with a diet containing 0, 0.1, 0.3, or 0.6% β-glucan for 45 days in an experimental RAS system. At the end of the feeding trial, growth (weight gain percentage), body indices (condition factor, hepato/viscero-somatic indices), blood chemistry (haemoglobin and haematocrit), and oxygen consumption were similar in all the dietary groups. Fish fed with highest level of β-glucan (0.6%) recorded high FCR. Regarding critical thermal limits, dietary β-glucan intake slightly extended the thermal tolerance limits at both the ends of the temperature spectrum (CT_{min} and CT_{max}).



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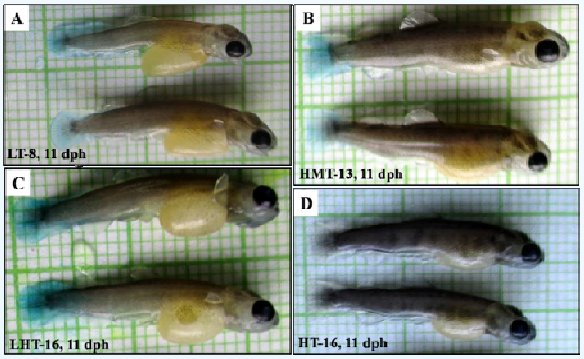
Early life temperature-responsive changes in developmental morphology and muscle cellularity in rainbow trout

In this study, we assessed 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, 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-8group 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. Incubating the eyed-ova at 16ºC advanced hatching by six days, synchronized hatching duration and minimized hatchlings' size-variation. However, HT-16 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. Post-hatch shifting of sac-fry to high and medium temperatures, respectively from the initial low and high regimes, differentially affected the length and weight of fish. The effect on length was immediate and temporary, but changes in weight were persistent. Red muscle hypertrophy was observed to be high in HT-16 and HMT-13 individuals (high-temperature incubated groups). White muscle hypertrophy was high in HT-16 and LHT-16 individuals (high post-hatch rearing temperature groups). The effect of early-life temperature regimes on developmental morphology was found to be strong at 22 dph (82.5%), and comparatively weak at 52dph (65%). The post-hatch rearing temperature had an immediate but temporary effect on fin development, mainly pectoral, caudal and anal fin (seen only at 22dph, not at 52dph). Contrarily, incubation temperature affected fin position, in a delayed but persistent manner (subtle at 22dph, but stronger at 52dph). Overall, this study provides new insights on temperature-dependent changes in developmental morphology, muscle cellularity and larval growth in rainbow trout, and shows that the incubation temperature affects ontogeny profoundly than post-hatch thermal regimes.



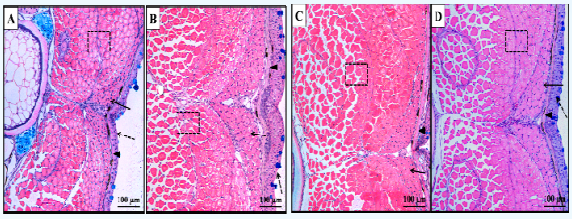


Fig.: Photomicrographs of the lateral muscle from pre-caudal region of 52 dph rainbow trout from the different early life thermal regime groups (A, LT-8; B, HMT-13; C, LHT-16; D, HT-16)

Field investigation in the rainbow trout farming cluster at Urgam, Chamoli

A group of ten rainbow trout farmers were adopted under NICRA in Urgam village, Joshimath, Chamoli district, Uttarakhand. The impact of abiotic changes on farm operations and fish production was periodically monitored. Selected farmers were provided critical inputs (feed) and scientific advisories onwater quality/quantity monitoring, biomass/feed management, basic disease control and post-harvest marketing. During the initial visit, every farm was geo-tagged and spot measurements of important water quality parameters such as temperature, dissolved oxygen, pH, ammonia, alkalinity, hardness, carbon dioxide, conductivity, total dissolved solids, salinity and other farm operational details were collected. The farmers were also provided a monthly record sheet for monitoring the entire production cycle, growth, feed use and farm monitoring.

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Project: DBT-8	**Immunomodulation in golden mahseer (*Tor putitora*) broodstock under captive conditions**
Period:	**September 2018-September 2021**
Personnel:	**M.S. Akhtar, Ciji, A., Rajesh, M.**
Funding Support:	**DBT, New Delhi**

In order to elucidate the immune-modulatory potential of β-glucan on golden mahseer broodstock under captive conditions, an experimental trial has been carried out with four treatment groups (control, 0.5% β-glucan, 1.0% β-glucan, 1.5% β-glucan). Forty-eight female (average weight: 943±180 g) and twenty-four male (average weight: 564±231 g) adult golden mahseer were randomly distributed into four dietary treatment groups in duplicates. The fish were kept in round fibre reinforced plastic (FRP) broodstock tanks in order to accommodate six females and three males (2:1) in each tank. A 13-hour (06.00 to 19.00 hours) photoperiodicity was maintained in all the treatment groups with an intensity of 1000 - 1200 lux using 9W LED bulbs. Each brooder tank was provided with a 15 cm thick gravel-bed (2 - 6 mm river gravels) biofilter connected with submerged power-heads to ensure water quality and an 800W submersible thermostatic water heater to maintain the water temperature (25 ^{0}C) required for maturity induction and breeding. Initial acclimation of fishes was done for 21 days with a control diet followed by 130-days of the experiment. Using an air compressor, an external aeration was provided to maintain optimum dissolved oxygen level around the clock. Broodstock tanks were cleaned regularly (once a week) to assure water quality and overall hygiene. The physico-chemical parameters of water were monitored. The reproductive performance and breeding output of brooders fed with different β-glucan levels were assessed during the experimental period. At the end of the experiment, tissue, blood/plasma, and seminal samplings were done to estimate different physiological and molecular signatures. Results demonstrated that the β-glucan supplementation in the diet enhanced the immune status. However, at higher dose (1.5%), the expression of non-specific immune genes of brooders was very high and resulted in enhancement of anti-oxidative genes and cortisol levels. The reproductive performance and output of brooders was obtained best at 0.5% beta-glucan supplementation. β-glucan had positive transgenerational effects on growth performance, thermal tolerance, non-specific immunity, and fitness of golden mahseer F1 fry. Moreover, only administration of 0.5% β-glucan to brooders had exerted transgenerational effects, whereas the higher doses of β-glucan exerted either no effect or negative consequences in the brooders. The inclusion of β-glucan (0.5%) in the diet of male golden mahseer brooders improved testicular anti-oxidative potential and sperm quality in terms of increased sperm count, motility rate, and duration with less number of abnormal spermatozoa. On the contrary, a higher level of β-glucan (1.5%) provisioning in the diet negated the sperm quality traits. In a nutshell, β-glucan supplementation @ 0.5% in brooders enhances immune status, reproductive output, exerts transgenerational plasticity to their progeny and disease resistance, whereas dietary inclusion of β-glucan (1.0%) is efficient in improving immune function, thermal tolerance and disease resistance of golden mahseer fry during nursery rearing. Overall, the findings may be an empirical answer to develop healthy and efficient golden mahseer broodstock for hatchery operations and quality seed production in captivity for achieving higher success of stock enhancement and conservation program of endangered golden mahseer in open water bodies.

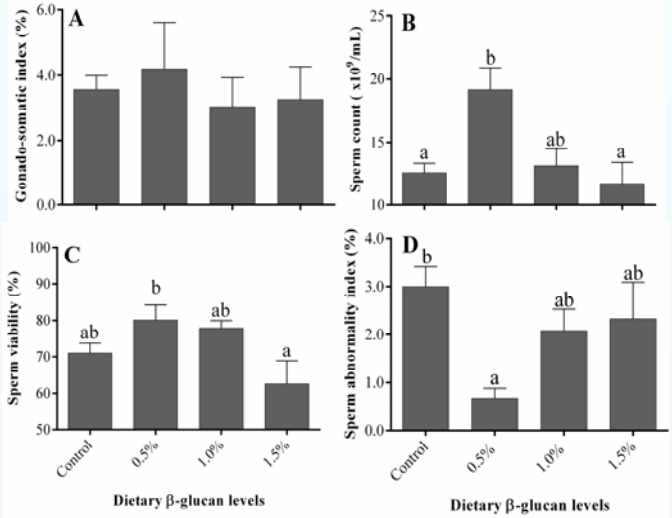

Fig. 1: Effect of dietary β-glucan on gonado-somatic index (A); sperm count (B); sperm viability (C) and sperm abnormality index (D) of golden mahseer brooders. Different superscripts (a, b) above the bars in each panel, if any, indicate significant difference ($p < 0.05$). Data expressed as Mean±SE, n = 6.

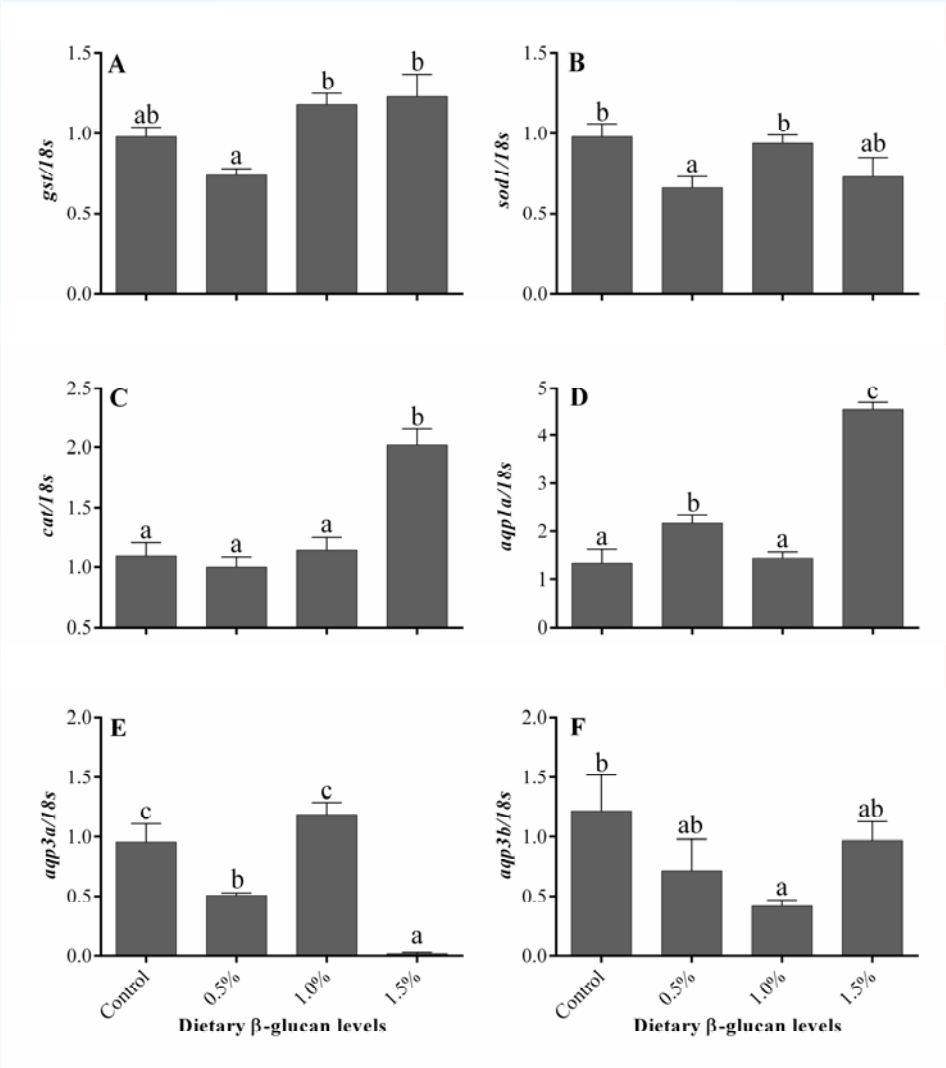

Fig. 2: Effect of dietary β-glucan on testicular mRNA expression of glutathione-s-transferase (A); superoxide dismutase 1 (B); catalase (C); aquaporin 1a (D); aquaporin 3a (E) and aquaporin 3b (F) in golden mahseer brooders. Different superscripts (a, b, & c) above the bars in each panel indicate significant difference ($p < 0.05$). Data expressed as Mean±SE, n = 6.

Project: DBT-9	**Bio-engineered synthetic antimicrobial peptides as alternative to antibiotics for use in aquaculture**
Period:	**April 2019-April 2022**
Personnel:	**D. Thakuria, A. Pande, K.V. Chanu**
Funding Support:	**DBT, New Delhi**

Fourpeptides (KK12YW, KK12FW, KY12WY and RH12) out of seven peptides designed and synthesized in the laboratory have been evaluated for its antimicrobial activities against different bacterial pathogens including antibiotic resistant bacteria. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) values were determined against selected fish bacterial pathogens.These peptides showed antimicrobial activities against *A. sobria, A. hydrophila, E. tarda, S. aureus, V. parahaemolyticus, P. aeruginosa, E.coli*and *A. salmonicida*. The MIC values ranged from 0.98 to 500 µM for KK12YW; 0.49 to 500 µM for KK12FW; 0.98 to 500 µM for KY12WY; 0.98 to 500 µM for RH12 and MBC ranged from 5 to 650 µM for KK12YW; 2 to 600 µM for KK12FW; 2 to 600 µM for KY12WY; 10 to 600 µM for RH12. The peptides retained antimicrobial activities at higher temperatures. Besides, the peptides showed their activities in the presence of physiological salts and serum.The peptides were found to be least hemolytic. The bacterial live-dead assays revealed that the peptides interfered with bacterial membrane integrity.

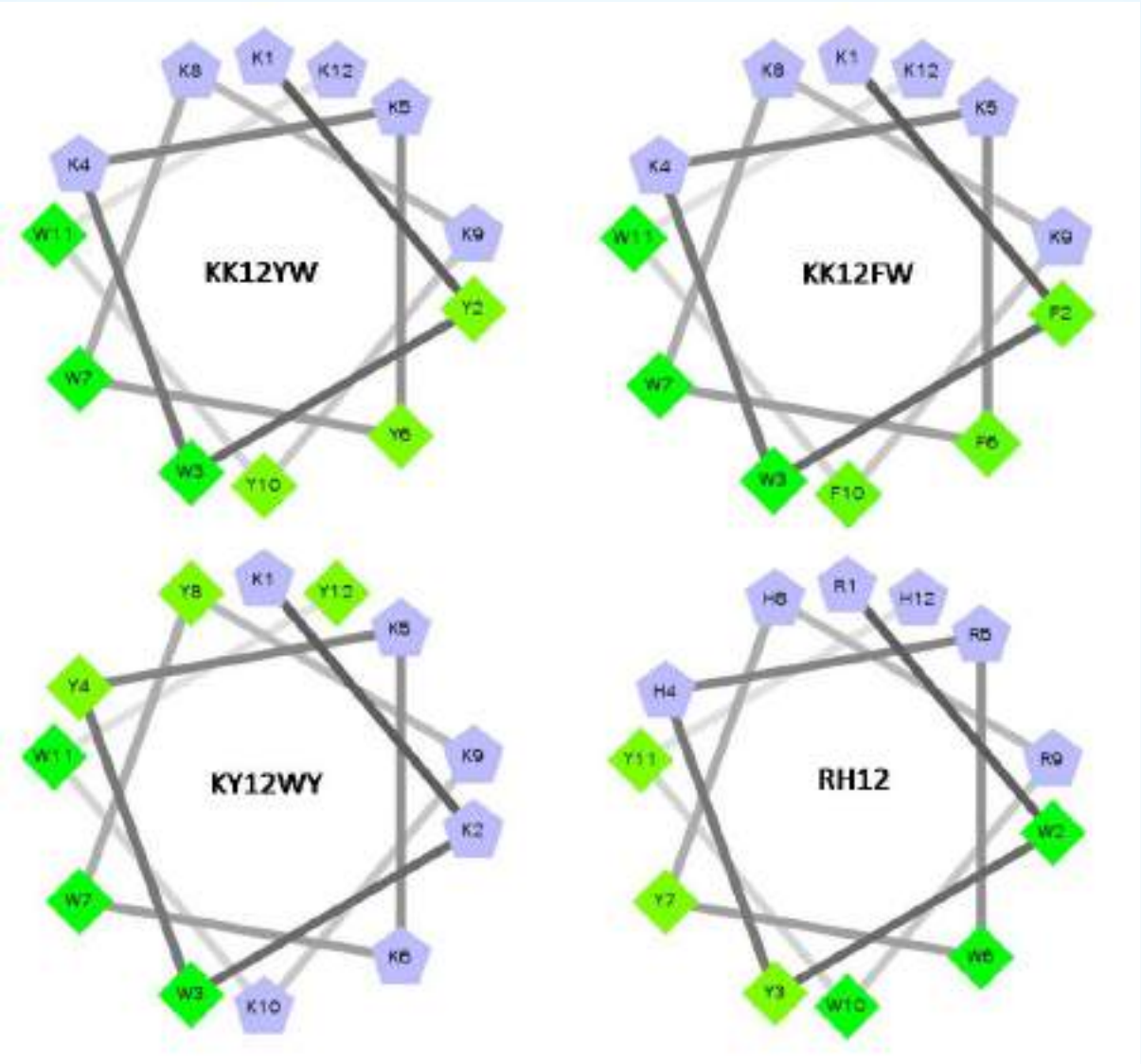

Fig.: Helical wheel structures of KK12YW, KK12FW, KY12WY and RH12 peptides

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4. Technology Development

4.1 Captive maturation and multiple breeding of golden mahseer

A technology of captive maturation and multiple breeding of endangered golden mahseer (*Tor putitora*) has been developed by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal ensuring sustainable seed production for its rehabilitation and conservation. An Indian patent entitled "System for year-round repeated breeding and higher robust fry production of golden mahseer" has been filed. The inventors of this technology are Dr M. S. Akhtar, Dr Rajesh M, Dr Ciji Alexander and Dr Debajit Sarma. An application (application no. 4855227) for registration of a 'trademark' of this technology has also been submitted. Furthermore, the technology has already been evaluated by ICAR-Agrinnovate for its commercialization, and it is in the final stage of commercialization with M/s Das and Kumars, D 63/10, Mahmoorganj, Varanasi-221010.

4.2 Designing of re-circulating egg incubation and larval rearing system

Suitability and economic feasibility study were conducted for rainbow trout farming in recirculating aquaculture system. The result suggested that, it is possible to produce rainbow trout in RAS at stocking density of 30-35 kg/m^3 when aeration used as oxygen source. At the current production level nearly 1.1 m^3 of water was used for producing kg of fish which 30-100 times lesser than traditional flow through system. Based on the current production, production costs per kg fish were calculated. Production cost due to Feed and energy were Rs. 150 and Rs. 90 per kg fish, respectively. The production cost per kg trout is calculated to Rs. 250 (excluding labor cost).

A re-circulating egg incubation and larval rearing system was designed and fabricated for rearing trout eggs at ICAR-DCFR, Bhimtal, mainly to improve egg and larval survival. The preliminary study suggested that above 90% survival of eggs could be achieved using thermal controlled recirculating system with reduced temperature related abnormalities. Further, same system could be utilised for larval rearing up to 0.5 g larvae. Three more such RAS hatchery were installed at ICAR-DCFR, field centre, Champawat and 2 system were installed at Leh to address problem due to fluctuating and low temperature resulting in reduced egg survival and long incubation period.

Fig.: RAS hatchery set up being validated at farmers field at Leh

Fig.: Harvesting rainbow trout from small-scale RAS

Fig.: Small-scale RAS set-up at Experimental Field Centre, Champawat

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	2022
	Sub project 6: Ichthyofaunal diversity and health assessment of Central Himalayan River Saryu, Uttarakhand	**Kishor 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	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)** **Neetu Shahi** R.S. Haldar	2020	2023
B. Aquaculture oriented research and development				
AQ-16	Captive management of Golden mahseer in perspective to aquaculture and conservation			
	Sub-project 4: Standardisation of seed production protocol of chocolate mahseer through optimization of environmental condition	**P. Dash** D. Sarma R.S. Tandel	2018	2022
	Sub-project 5: Optimizing reproductive and spawning performance of golden mahseer for upscaling its seed production in captivity	**M.S. Akhtar** Ciji, A. D. Thakuria Rajesh, M.	2018	2022
AQ-19	Domestication, biology and breeding of selected species for species diversification in mid-hill aquaculture			
	Sub-project 4: Growth potential and breeding performance of *S. progastus* and *S. plagiostomus*	**N.N. Pandey** R.S. Patiyal S. Ali	2018	2022
	Sub-project 5: Embryonic development, breeding and seed production of Sucker head, *Garra gotyla*	**R.S. Patiyal** N.N. Pandey	2018	2021
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

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D. Fish Nutrition and feed development				
AQ-21	Sub project 1: Development and validation of novel feed formulations for rainbow trout (*Oncorhynchus mykiss*) based on commercial-scale industrial by-products	**B.S. Kamalam** Rajesh, M. N.N. Pandey Ciji, A. P. Sharma	2018	2021
	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				
AQ-18B	Sub project 2: Transcriptome based sex specific marker discovery in golden mahseer (*Tor putitora*)	**Siva, C.** S. Ali P. Sharma Rajesh, M.	2017	2021
AQ-18C	Sub project 3: Gender specific transcriptomics response to environmental stress in golden mahseer (*Tor putitora*)	**S. Ali** Siva, C. P. Sharma	2018	2022
AQ-18D	Sub project 4: Genome editing in common carp, *Cyprinus carpio* using CRISPR/Cas system	**Neetu Shahi** D. Sarma S.K.Mallik	2019	2022
AQ18 E	Sub project 5: Development of cell lines from different organs of rainbow trout	**Amit Pande** D. Thakuria	2019	2021
AQ18 F	Sub project 6: Fish without water: *In vitro* meat	**Amit Pande** K.V. Chanu	2021	2024
AQ18 G	Sub project 7: Development of complete mitochondrial genome and phylogeny of selected coldwater fish species	**Shahnawaz Ali** Siva, C. N.N. Pandey	2021	2024
AQ18H	Sub project 8: Polymer based approach for *in vitro* transfection in fish cells	**D. Thakuria** Amit Pande K.V. Chanu	2021	2024
F. Disease surveillance and health management				
AQ-20	Development of diagnostic & therapeutic measures for rainbow trout pathogens			
	Sub-project 1: Development of rapid assays for detection & identification of *Saprolegnia* species	**K.V. Chanu** D. Thakuria R.S. Tandel	2017	2021
	Sub-project 2: Evaluation of antimicrobial activities of nano and polymer-based formulation against Saprolegniasis	**D. Thakuria** K.V. Chanu R.S. Tandel	2017	2021
	Sub-project 3: Evaluation of available anti-fungal agents and herbs for their efficacy against oomycetes infection in farmed rainbow trout	**R.S. Tandel** R.A.H. Bhat S.K. Mallik P. Dash	2017	2021
	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

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	Sub-project 6: Evaluating the effect of immunization against oomycetes infection in rainbow trout, *Oncorhynchus mykiss*	**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	2018	2021
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)	**S. Chandra** S.K. Mallik R.S. Tandel R.A.H. Bhat	2014	2021
AINP-Fish Health	All India Network Project on Fish Health- AINP-FH	**S.K. Mallik** N. Shahi R.S. Tandel	2015	2021
NICRA	Development of climate resilient rainbow trout and innovative trout farming strategies to mitigate climatic stressors	**D. Sarma** R.S. Patiyal B.S. Kamalam Rajesh, M. P. Sharma R.S. Tandel S.K. Mallik M.S. Akhtar N. Shahi Ciji, A., A.K. Giri Siva, C. R.S. Haldar	2017	2021
DBT-8	Immunomodulation in golden mahseer (*Tor putitora*) broodstock under captive conditions	**M.S. Akhtar** Ciji, A. Rajesh, M.	2018	2021
DBT-9	Bio-engineered synthetic antimicrobial peptides as alternative to antibiotics for use in aquaculture	**D. Thakuria** A. Pande K.V. Chanu	2019	2022
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

6. Institute Technology Management Unit (ITMU)

The Institute Technology Management Unit (ITMU) is actively engaged in the management, protection, transfer and commercialization of intellectual assets and technologies generated by the Scientists of the Directorate. The various activities of ITMU are carried out under the ICAR National Agriculture Innovation Fund scheme, duly following the guidelines of ICAR Intellectual Property and Technology Management (IP & TM) unit. The decisions regarding inventions and technologies are made by the Institute Technology Management Committee (ITMC) and approved by the competent authority. During the reporting period, the ITMU specifically performed the activities listed below:

6.1 Important Activities

- Assisted scientists in the preparation of documents related to transfer or commercialization of prospective DCFR technologies, through ICAR Agrinnovate.
- Assisted scientists in patent prior art search and drafting of IPR registration applications.
- 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.

6.2 Patent applications filed

- 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 D. Sarma. The filed patent awaits publication.
- 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 D. Sarma. The filed patent was published on 12.02.2021. It currently awaits First examination report (FER).

6.3 Trademark registered

- Application no. 4820881, "ICAR - Directorate of Coldwater Fisheries Research (DCFR)" logo under Class 44.Certificate No: 2772668 dated 18.06. 2021
- Application no. 4868952, "DCFR Lg (*Lactococcus garvieae*) kit" logo under Class 5. Certificate No: 2792774 dated 17.07. 2021
- Application no. 4868953, "DCFR Aqua FSD fish anaesthetic" logo under Class 5.Certificate No: 2795130 dated 19.07. 2021
- Application no. 4855227, "Captive maturation and multiple breeding of Golden Mahseer - an ICAR-DCFR technology" logo under Class 44. Trademark filed on 09.02.2021. Responded to Examination report on 03.03.2021 (Due for hearing).

6.4 Memorandum of Understanding (MoU) signed

- ICAR-DCFR, Bhimtal signed MoU with Central Agricultural University, Imphal, Manipur on 18th November, 2021 for collaboration in the area of fisheries research and knowledge sharing and M.F.Sc dissertation and Ph.D. thesis research work in the areas related to coldwater aquaculture, upland fisheries resource management, aquatic biodiversity and environmental impact assessment, fish biochemistry & biotechnology, fish genetics and molecular biology, fish nutrition, fish health and other relevant areas.
- ICAR-DCFR, Bhimtal signed MoU with Tamil Nadu Dr J. Jayalalithaa Fisheries University, Nagapttinam, Tamil Nadu on 9th September, 2021 for collaboration in the area of fisheries research and knowledge sharing and M.F.Sc dissertation and Ph.D. thesis research work in the areas related to coldwater aquaculture, upland fisheries resource management, aquatic biodiversity and environmental impact assessment, fish biochemistry & biotechnology, fish genetics and molecular biology, fish nutrition, fish health and other relevant areas.
- ICAR-DCFR, Bhimtal signed MoU with Acharaya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya, UP on 16th November, 2021 for collaboration in the area of fisheries research and knowledge sharing and M.F.Sc dissertation and Ph.D. thesis research work in the areas related to coldwater aquaculture, upland fisheries resource management, aquatic biodiversity and environmental impact assessment, fish biochemistry & biotechnology, fish genetics and molecular biology, fish nutrition, fish health and other relevant areas.

Fig.: ICAR-DCFR Bhimtal signed MoU with Acharaya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya, UP

- MoU was signed between ICAR-Directorate of Coldwater Fisheries Research, Bhimtal and the Agrinnovate India Limited, Delhi for commercialisation and marketing of DCFR Lg Kit, jointly developed by Dr Neetu Shahi, Mr. Sumanta K Mallik, Mr. Krishna Kala and Debajit Sarma.

6.5 Participation in External Quality Assurance Scheme (EQAS) (EQAS 1 and EQAS 2) conducted by Christian Medical College (CMC) & Hospital, Vellore

Mr Sumanta Kumar Mallik, Scientist, and Dr Neetu Shahi, Sr Scientist, Diagnostic Bacteriology Laboratory, Fish health Section, ICAR-DCFR, Bhimtal participated in External Quality Assurance Scheme (EQAS) (EQAS 1 and EQAS 2) of Christian Medical College (CMC) & Hospital, Vellore to identify unknown bacterial cultures and to develop antibiotic susceptibility and resistance profile of the culture provided under the ICAR-FAO collaboration project 'Network Programme on Antimicrobial Resistance in Fisheries, sent by CMC, Vellore.

6.6 Important meetings organized

- Institute Technology Management Committee meeting was held on 27th January 2021 at ICAR-DCFR, Bhimtal. It was presided by Dr Debajit Sarma, Director (Acting), ICAR-DCFR; attended by Dr R.S. Patiyal, member secretary, ITMC; and other ITMC member scientists. Agenda related to the evaluation and approval for patent filing of "System for year-round repeated breeding and higher robust fry production of Golden Mahseer"; technology commercialisation of DCFR *Lg* kit; initiating trademark registration of DCFR*Lg* Kit and Aqua FSD were discussed and recommended for further action.
- An online techno-commercial assessment meeting was held with Agrinnovate India Limited, New Delhi on 17th February 2021 to discuss the technical and commercial feasibility of ICAR-DCFR technologies, handholding requirement, preferred modes of commercialisation and to develop standard terms. The meeting was attended by Dr Debajit Sarma, Director (A), ICAR-DCFR; Dr Sudha Mysore, CEO, Agrinnovate; ITMU team, inventor scientists and representatives from both organisations. Particularly, the technology details and licensing terms for the commercialisation of "Captive maturation and multiple breeding of Golden Mahseer" developed by Dr M.S. Akhtar and team and "DCFR Lg kit" developed by Dr Neetu Shahi and team was discussed in detail.
- The ITMU team, Dr R.S. Patiyal, Dr Biju Sam Kamalam and Dr Ann Pauline attended the 'Sensitization workshop and annual review of ZTMU/ITMU/PME' organized by ICAR-CIFT, Kochi on 8th October 2021. In this workshop, Dr R.S. Patiyal presented the annual progress report of ICAR-DCFR.
- The second Institute Technology Management Committee meeting was held on 8th November 2021 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. Agenda related to the approval for the revised terms of trade for the commercialisation of "Captive maturation and multiple breeding of Golden Mahseer", in response to the expression of interest given by M/s Das and Kumars; and the technologies to be listed in DCFR technology brochurewere discussed and recommended for further action.

Fig.: Institute Technology Management Committee meeting

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7. Extension Activities, Consultancy and Services

7.1 Extension Activities

7.1.1 Programmes organized under *Mera Gaon Mera Gaurav* (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	22	08	05	Yes

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	85	740
2.	Interface meeting/ *Goshthies*	31	1250
3.	Trainings conducted	12	358
4.	Mobile based advisories	65	840
5.	Literature support provided	9	580
6.	Awareness created	28	1520
7.	Linkages developed with other agencies	08	180

S.No.	Name of activity	Quantity (q)/No.	Area (ha)	No. of farmers benefitted
1.	No. of demonstrations laid out	22	4.0	116
2.	Input support provided like seed, planting material, fertilizers, etc.			
	i. Seeds (q)	Rainbow eyed ova- 5 lakh	3.7	25
	ii. Planting material (No.)	Ornamental seed - 600 Carp seed -44,450 nos.	3.5	72
	iii. Fertilizers (q)	-		
	iv. Any other (pl specify)			
	Pelleted trout and carp feed	8000kg	4.5	35
	Water analysis kits	12 types of kits	3.0	35
	Medicines	366 packets		366

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	Dr S. Ali, Sr Scientist (Aquaculture) Dr Ritesh S.Tandel, Scientist (Fish health) Mr. Parviz A.Ganie., Scientist(FRM) Mr R.K.raya, Tech. officer	Khairola Pandey gaon (Bhimtal), Malla Ramgarh, (Ramgarh) Nail (Almora)	3

Team 2	Dr Amit Pande Principal Scientist	Dr Biju Sam Kamalam, Scientist (Fish Nurtition) Mrs. Pragyan Dash, Scientist (Aquaculture) Dr Siva C, Scientist (Fish Genetics and Breeding) Dr R.S. Haldar, CTO	Padampuri, Chaphi, Talla Dhungil, Chonauti	4
Team 3	Dr N.N.Pande Principal Scientist	Dr D. Takhuria, Scientist (Biochemistry-Animal Science) Dr Rajesh M Scientist Raja A.H.Bhat, Scientist Mr Santosh Kumar, Sr Tech. Officer Dr Prakash Sharma, Scientist	Jyurkafun, Vinayak, Maldhan Chaur, Amritpur	4
Team 4	Dr Suresh Chandra Principal Scientist	Dr Neetu Shahi Sr. Scientist(Biotechnology-Animal Science) Dr Ciji Alexender, Scientist (Fish Nutrition) Mr Abhay.K.Giri Scientist (Aquacuture) Mr T.M.Sharma	Harinagar, Berijala, Saladi, Boharakun	4
Team 5	Dr R.S.Patiyal Principal Scientist	Dr M.S. Akhtar, Sr. Scientist (Fish & Fishery Science) Sh. S.K. Mallik, Scientist(SG) (Aquaculture) Dr Victoria Chanu, Scientist (Biochemistry-Animal science) Dr Prakash Sharma, Scientist (Fish Nutrition) Dr Partha Das, Tec. Asst.	Sangudi, Pangu, Amrukhurad	3
Team 6	Mr Kishore Kunal Scientist	Mrs Garima, Scientist (FRM) Mr Ravinder Kumar, Tech. Officer Mr Hansa Datt, Tech. Officer	Mudyani, Banlakh, Dudhpokhara, Saktipur bunga	4

List of villages adopted under MGMG by the Institute

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	12
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

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Details of demonstration conducted under MGMG by the Institute

S.No.	Title of demonstrations	No. of demonstration	Area covered under demonstration (ha)/ number of units, etc.)	No. of farmers benefitted
1.	Rainbow trout farming in raceways	4	8 raceways	5
2.	Carp polyculture in midhill polylined tanks	8	38 fish tanks	30
3.	Breeding and seed production of ornamental fishes	3	5 fish farms	24
4.	Production trials with Grass carp as a major species.	5	45 fish tanks	27
5.	Value addition of fishery products	02	65 fish farmers	30

Fig.: A fish pond developed at village Harinagar

Fig.: Training cum awareness at Harinagar

Details of Input support provided under MGMG by the Institute

S.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-	5.0lakh	1.0	25
2.	Ornamental seed ii. Planting material	600 nos.	0.4	27
3.	Carp seed fingerling size(under SCSP)	44,450 nos.	2.6	45
4.	Pelleted trout and carp feed(Under SCSP)	8000kg	3.0	35
5.	Water analysis kits	12 types of kits	3.0	35
6.	Medicines (disinfectants)	366 packets	3.0	366

Details of trainings conducted under MGMG by the Institute

S.No.	Topic of training	Duration of training (No. of days)	No. of farmers participated in training
1.	Carp pond management	3 days	22
2.	Rainbow trout farming in raceways	01	35
3.	Production trials with Grass carp as a major species	01	15
4.	Peelleted feed based carp farming	01	21
5.	Bigger size seed stocking for doubling of fish farmers income	01	40
6.	Use of balanced fertilizers in aquaculture	01	31
7.	Ecofriendly natural fish farming techniques	01	60
8.	Soil and water analysis methods	01	18
9.	Disease prevention in trout and carp farms	01	32
10.	Breeding techniques of ornamental fishes	01	08
11.	Culture and breeding of common carp	01	46
12.	Value addition of fishery products	01	30


Goshti on pond maintenance at Village Harinagar Feed distribution at Nai village

Details of literature support provided under MGMG by the Institute

S.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	80
2.	Rainbow trout ki aakh aur muh kei Beemari, Hand out in Hindi	leaflet	70
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	100
4.	Argulosis in coldwater fish, DCFR Pamphlet No. 31.	leaflet	95
5.	White spot disease in coldwater fish, DCFR Pamphlet No 32.	leaflet	145
6.	Good Management Practices (GMP) for trout and carp farming in mid hills, DCFR Pamphlet No. 33	leaflet	70

Details of linkages created under MGMGby the Institute

S.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 identifying the suitable need based beneficiary.
2.	ICICI Bank	For providing technical support.
3.	State Agriculture Department	Imparting trainings and technical guidance.
4.	HESCO(NGO)	Providing technical knowhow.
5.	Bhimtal Nagar Panchyat	Providing technical assistance in ranching of Natural 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 integrated fish farming activities.

Details of awareness created under MGMGby the Institute/SAU

S.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	110
2.	Sanitation drive in MGMG adopted village	130
3.	Use of balanced fertilizers in aquaculture	31
4.	Eco-friendly natural fish farming techniques	60
5.	Climate resilient agriculture	147
6.	RAS in aquaculture	560
7.	Bigger size seed stocking for doubling of fish farmers income	40
8.	Awarness on trout and carp farming, and pond/raceway management	402
9.	Disease prevention in trout and carp farms	40

Details of problem diagnosed under MGMG by the Institute/SAU

S.No.	Name of village	General problem	Agricultural problem
1.	Harinagar, Malla Ramgarh	High gradient of water source	Frequent fish tanks and raceways loss by flooding
2.	Malla Ramgarh	Input	Trout feed and seed shortages
3.	Malla Ramgarh	Income	Table size trout sale
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

Details of any other activity organised under MGMG by the Institute/SAU

S.No.	Name of activity	No. of farmers benefitted
1.	Orientation of hill farmers towards fish farming	230
2.	Value addition of fish products for increasing fish farmers income	60
3.	Awareness on one health	180


मछली को भी निरोगी रखना है जरू

मत्स्य विभाग की ओर से सिकुड़ा में मत्स्य पालकों को दिया गया प्रशिक्षण

News clip: 23.12.2021


वैज्ञानिकों ने मत्स्य पालन के गुर बताए

News Clip: 25.12.2021

Participant in MGMG programme at Harinagar and Chamoli

7.1.2 Awareness cum training programme on fish farming at Jyur Kafun, Almora

ICAR-Directorate of Coldwater Fisheries Research conducted Awareness cum training programme to fish farmers at Jyur Kafun, Almora under MGMG programme. Hands-on training was provided to the farmers for fish farming in polytanks. Technical advice was given to the farmers for use of azolla for feeding to growing grass carp. Farmers are also doing vegetable cultivation by using the fish pond water for irrigation. The growth of the grass carp and common carp was observed as 500-700g in 12 months. Growth and survival for silver carp was adversely affected in winter season.

Demonstration on fish feed preparation and fish seed stocking method

7.1.3 Awareness for fish farming & vermi composting at Village Talla Ramgarh, Nainital

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal organised a awareness on fish farming under the "*Mera Gaon Mera Gaurav*" programme at Government Inter College, Talla Ramgarh, Nainital. On this occasion, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, addressed the farmers and highlighted the livelihood support through fish farming in this village. Dr N. N. Pandey explained the methodology of vermin composting and use of farm waste for making mannure. Mr. S. K. Dubey, Principal, govt. Inter college, Mr. Basant Lal Sah, gram pradhan, Bohrakot village, Mr. Yaspal Arya, BDC member, Dr Vishal Dutta, fisheries department incharge, Bhimtal, and Mr. R. K. Gurrani, NSS incharge, graced the occasion and emphasised upon the fish farming for additional family income, ornamental fishery in small polytanks as aqua gardening and need for the household and farm waste management. Approximately 50 farmers, members of local civic bodies, teachers, scientists, technical staff, students and other stakeholders attended the programme. The programme ended with a formal vote of thanks by Dr Ciji Alexander, ICAR-DCFR.

Remarks by Dr P.K. Pandey, Director, ICAR-DCFR Discussion on vermi-composting

Discussion for fish farming in polytanks Highlighting benefits of fish farming

7.1.4 Hon'ble Prime Minister's interaction with MGMG adopted farmers

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised a "Scientists-Farmers interface on climate-resilient varieties, technologies and practices on 28th September 2021. The session started with the virtual inauguration of the ICAR-National Institute of Biotic Stress Management (NIBSM), Raipur and the release of 35 crop varieties with unique traits by Honorable Prime Minister of India. In the inaugural address, Dr Pramod Kumar Pandey, Director, ICAR- DCFR, Bhimtal, spoke about the importance of climate-resilient crops to address general challenges associated with climate change to participants. Dr Suresh Chandra Pr. Scientist coordinated the programme. Dr Amit Pande, Pr. Scientist, ICAR-DCFR, Bhimtal, delivered a lecture on climate-resilient agriculture. He said that droughts, floods, and other extreme events make farming more challenging and threaten crop yields worldwide. To cope with the changing climatic conditions, he highlighted the climate-resilient crop varieties and technologies developed by ICAR institutes would help to achieve long-term higher productivity and farm. Several progressive farmers including public representatives shared their experiences about fish farming and highlighted the profitability of the venture and the support given by the ICAR-DCFR, Bhimtal. The programme was organised as a part of the *"Bharat Ka Amrut Mahotsav"* to commemorate *75 Years of India's Independence*. The event witnessed a gathering of 147 participants, including 105 farmers of MGMG adopted villages, officials, scientists, students, staff members, and stakeholders. A formal vote of thanks was proposed by Dr Suresh Chandra, Pr. Scientist, ICAR-DCFR, Bhimtal.

MGMG adopted village's farmers participation in the meeting

Distribution of medicinal plant to a fish farmer of village Harinagar

7.1.5 National Campaign on Antimicrobial Resistance in Fish

ICAR–Directorate of Coldwater fisheries Research, Bhimtal organised six programmes at different locations in Nanital district during 18-24 November, 2021 on the occasion of 'World Antibiotic Awareness Week (WAAW)' and "National campaign on antimicrobial Resistance in fish" under "National campaign on antimicrobial Resistance in fish" which aims to increase awareness on antimicrobial resistance and to encourage best practices among the general public, fish farmers, fisheries department officials, students and policy makers to avoid the emergence and spread of antimicrobial resistant bacteria. Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, expressed concern on the rising tide of antimicrobial resistance in the world and encouraged the scientists of the Directorate to organise awareness programmes on AMR for the general public, fish farmers, fisheries officials and office staff. The following programmes were organised under the National campaign on AMR. Along with Dr S. K. Mallik, Scientist, Nodal officer, National Campaign on AMR, all the activities under the campaign were jointly coordinated by Dr Suresh Chandra, Principal scientist, Fish Pathology, Dr Neetu Shahi, Senior scientist, Animal Biotechnology, and Dr R. S. Tandel, Scientist, Fish Pathology & Microbiology and Dr Raja Aadil H. Bhat Fish Pathology & Microbiology and Mr Partha Das, Technical assistant, ICAR-DCFR.

7.1.6 Farmers Scientist meets on Antimicrobial resistance in Aquaculture at Harinagar

A Farmers Scientist meet was organised on 23rd November, 2021 for the fish farmers of Saladi, Harinagar, Berijala, and Khairola villages to encourage the adoption of best practices among the fish farmers in day to day life and fish farming. The farmers were sensitised about the demerits of dumping large antimicrobials in the aquaculture ponds without proper consultation with the experts. They were advised to adopt good aquaculture practices to prevent the emergence of diseases in their farms. Moreover, they were also informed about the cons of taking antimicrobials without prescription. About 55 fish farmers, including 30 women farmers, participated in the programme. The programme ended with a formal vote of thanks.

Scientist-farmers' meet on Antimicrobial resistance

7.1.7 Awareness camp on Antimicrobial resistance and one health approach in fisheries and aquaculture

The ICAR-DCFR organised another awareness camp on Antimicrobial resistance and one health approach in fisheries and aquaculture for the rural and agganbadi women workers at Bohrakoon, Bhimtal on on 24th November, 2021. The rural women were informed to seek advice from the health care professional before taking antibiotics. The scientist of the Directorate sensitised the participants about the importance of sustainable aquacultures practices for one health approach. About 70 women participated in the programme.

Participants in the awareness on antibiotics at village Boharakun, a MGMG adopted village, in Bhimtal, Uttarakhand

7.1.8 Essay writing competition on antimicrobial resistance in aquaculture at ICAR-DCFR, Bhimtal

An essay writing competition was organised on antimicrobial resistance in aquaculture among the staff of the Directorate on 22nd November, 2021. About 50 staff members, including scientists, SRF, technical and administrative staff, participated in the programme and wrote an essay about antimicrobial resistance and its impact in aquaculture.

Essay writing competition on antimicrobial resistance

7.1.9 Awareness camp on prudent use of chemicals and drugs in Hill aquaculture at Mouna village, Ramgarh

An awareness programme on prudent use of chemicals and drugs in Hill aquaculture at Mona village, Ramgarh, Nanital was organised on 23rd November, 2021 in collaboration with the Department of fisheries Uttarakhand. The farmers were told to use antibiotics and chemicals judiciously in aquaculture and were encouraged to adopt good management practices in their fish ponds to avoid unnecessary use of antibiotics and chemicals. Dr Vishal Dutta, Senior Fisheries Inspector, DOF, Nanital, gave an overall brief idea about the ongoing aquaculture practices in the Kumaon region. About 50 participants attended the awareness programme.

Awareness camp on prudent use of chemicals and drugs in Hill aquaculture

7.1.10 Slogan writing competition on Antimicrobial resistance in fish

A slogan writing completion was organised on 24th November, 2021 for the staff of the Directorate. About 60 participants were present in the competition.

Slogan writing competition on Antimicrobial resistance in fish

7.1.11 Group discussion on use of chemicals and drugs in Hill aquaculture with state fisheries officials of Uttarakhand

A group discussion was held with the fisheries officials of DOF Uttarakhand at Bhimtal on 24th November, 2021 to make them aware of the banned antibiotics and chemicals in aquaculture. They are advised to encourage the Hill farmers to adopt best management practices for fish production and timely report about the incidence of disease for proper medication and treatment. The Department officials were informed that high levels of AMR already seen in the world today are the result of overuse and misuse of antibiotics and other antimicrobials in humans, animals (including farmed fish), and crops. As per the reports, every year globally, almost 700,000 lives are lost. More than 58,000 children die every year in India alone from antibiotic-resistant infections. Thus we should take utmost care to prevent the misuse of antibiotics and chemicals in aquaculture for achieving the goal of one health approach. Seven state department officials were present.

Group discussion on use of chemicals and drugs in Hill aquaculture with state fisheries officials

On this occasion, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal expressed his concern over injudicious use of drugs, chemicals and antibiotics in aquaculture, which may lead to develop antimicrobial resistance in fish. He emphasized on prudent use of any aquadrugs for production and health management in fish farming practices. He also encouraged the scientists of the Directorate to conduct more awareness programmes on AMR for the general public, fish farmers, fisheries officials and staff in near future. Along with Dr S. K. Mallik, Scientist, Nodal officer, National Campaign on AMR, all the above said activities under the campaign were jointly coordinated by Dr Suresh Chandra, Principal scientist, Fish Pathology, Dr Neetu Shahi, Senior scientist, Animal Biotechnology, and Dr R.S. Tandel, Scientist, Fish Pathology & Microbiology and Dr Raja Aadil H. Bhat Fish Pathology & Microbiology and Mr Partha Das, Technical assistant, ICAR-DCFR.

7.1.12 Rehabilitation and conservation of endangered golden mahseer

Mighty mahseer especially *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-Directorate of Coldwater Fisheries Research (DFCR), Bhimtal has consistently been doing 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 successfully organized a seed ranching programme of golden mahseer in Naukuchiatal lake, Nainital and in Suyal river (at Vishwanath ghat), Almora during 17th and 23rd February, 2021 respectively. In these events, five thousand fingerlings in Naukuchiatal lake and two thousand fingerlings/yearlings in Suyal river were stocked.

Dr Dilip Kumar, Former Director, ICAR-CIFE, Mumbai, Dr S.N. Ogale, Lonawala, and Sh. Anil Chanotiya, Member, Bhimtal Nagar Panchayat graced the occasion (at Naukuchiatal lake) and emphasized upon the need of people's participation in the conservation of mahseer. An awareness programme was also organized at Vishwanath ghat (Suyal river) to take necessary measures to save golden mahseer by protecting its breeding grounds. On this occasion, aquaculture inputs such as feed and aqua-medicine were also distributed among farmers. Dr Debajit Sarma, then Director (Acting), ICAR-DCFR, Bhimtal expressed his concerns to save golden mahseer in the natural water bodies of Kumaun region.

More than 30 (at Naukuchiatal) and >100 participants (at Suyal river) including scientists, fisheries department officials, farmers and local people participated in these events. Both the programmes were coordinated by Dr M. S. Akhtar, Senior Scientist and Dr Suresh Chandra, Principal Scientist.


Ranching of golden mahseer fingerlings in Naukuchiatal lake and River Suyal at Vishwanath Ghat, Almora, Uttarakhand

Interaction by Dr D. Sarma, Principal Scientist, ICAR-DCFR

7.1.13 Scientific and technical support to fish farms in Ramgarh

To promote aquaculture initiatives in Nainital district, scientific guidance and input support were provided for upcoming fish farmers in Ramgarh, namelyMr. Prithvi Singh, Mr. Kamlesh Harnwal, Mr. Abhishek Harnwal and Mr. Naveen Lal Shah. This includes farm visits, guidance in the construction of new raceways, water quality analyses, stocking and biomass monitoring, feed management and farm operation. Efforts are also being made to support and reinitiate rainbow trout farming in places affected by the flash floods in October 2021. This activity was coordinated by Dr Rajesh, M., Dr Biju Sam Kamalam, Dr R.S. Haldar and Dr Debajit Sarma.

Fig.: (a) Water quality assessment at Mr. Naveen Lal's farm & (b) Flood impact assessment at Mr. Prithvi's farm

7.1.14 Collaborative work in PPP mode with ICICI Foundation

ICAR-DCFR is undertaken collaborative work in PPP mode with ICICI Foundation for upliftment of rural livelihood security of hill fish farmers in different villages of Nainital and Almora districts of Uttarakhand. Under this programme one day training was organized in the month of March 2021 to the selected farmers to knowhow of the scientific fish farming. First training was organized at Kothalgaon village of Molekhal Block (Almora District) of Uttarakhand during 28th March 2021 in collaboration with the ICICI Foundation for Better Growth. In total 16 farmers were participated in which 13 male and 3 female from Kothalgaon, Bairangkhal, Basadi, Kotali Mali, Musauli, Arari Rijwar, Dugholi and Arari Bisht village of Molekhal Block. Second training was organized among the selected fish farmers of Ramnagar Block (Nainital District) of Uttarakhand. In total 26 selected fish farmers were present in which 14 male and 12 female from Udaipuri Bando Basti, Berajhal, Nathupur Chhoi, Shankarpur Bhud, Rajpur, Malpuri, Shivnath pur, Jassa Ganja, Narayanpur Muliya and Nandpur villages of Ramnagar Block (Nainital District). The training was organized at National Rural Livelihood Mission (NRLM) Meeting Hall at Ramnagar

During the occasion the trainees were trained about the primary requirements for fish farming, construction of different type of ponds, eradication of aquatic weeds, cleaning of unwanted fishes from culture ponds, production of natural food for fish, water quality management, stocking of fish ponds with quality seed, enhancement of productivity of pond, feeding of fish, integrated fish farming with hen, poultry, goat, cow etc., overall management of fish ponds, common diseases of fish and their control, harvesting of fish and marketing etc. and briefed them about the MGMG programme also. The programmes were coordinated by Dr R.S. Haldar, Chief Technical Officer of this Directorate. Mr. Santosh Kumar, Technical Officer, ICAR-DCFR and Mr Rahul Saxena, Development Officer, ICICI Foundation was also present during the training programme.

Training programme organized in collaboration with the ICICI Foundation

7.2 Exploratory survey, field visit, farm advisories, awareness campaign

- A.K. Giri as a co-nodal officer, conducted awareness cum input distribution program and distributed ornamental fish seed, carp feed and rainbow trout feed to the participated fish farmers of Uttarakhand under TSP on the eve of 34th Foundation Day and Farmers-Scientists Interactive Meet at ICAR-DCFR, Bhimtal on 24.09.2021.
- A.K. Giri as committee member, conducted awareness cum input distribution program and distributed carp feed, rainbow trout feed, mixed carp seed, disinfectant and water testing kits to the participated 30 tribal farmers under TSP on the eve of National Fish Farmers' Day on 10th July, 2021.
- A.K. Giri conducted an exploratory survey/ field visit along with Dr N. Shahi and Mr. S.K. Mallik at Chaffi river, Bhimtal for the

exploration of germplasm resources and collected of fish species such as *Barilius bendelisis*, *Schizothorax richardsonii* and *Garra spp.* along with the target species, *Naziritor chelinoides*f or stock development and research purpose as well.

- Amit Pande conducted awareness programs on "Community waste disposal sites and cleaning of manure pits" at Government Primary School, Tirchakhet on 29th December, 2021.
- Amit Pande conducted awareness programs during Swachata Pakkhwara on: "Waste Management" at Naukuchiyatal and Chanuti village on 27th December, 2021.
- Amit Pande visited the trout raceways of some beneficiaries and the proposed site for hatchery and centre of excellence for rainbow trout farming at Mechuka. To see the feasibility of establishing a trout hatchery at Mechuka, a six acre site in the nearby village Dechenthang (Lat 28.63197, Long 94.07913, altitude 1997 m) was visited and found suitable as it was having ample water supply for the proposed hatchery.
- Ciji Alexander, M S Akhtar, N. N. Pandey, R. S. Patiyal, and R. S. Haldar organized an awareness programme on 'Waste to Wealth' and a cleanliness drive at Government Inter College, Talla, Ramgarh, Nainital on 12th October, 2021.
- Dr R.S. Haldar visited Mr. Jagat Ram, Mr. Prithviraj, Mr. Kamlesh, Mr. Naveen Sah etc. trout growers at Ramgarh area, Nainital District time to time and observed growth of rainbow trout being reared in their raceways under the technical support of this Directorate. The water quality was also analyzed and advisory was given to them regarding best management for trout farming.
- Field adaptation trial was conducted for farming of rainbow trout at Ramgarh, Uttarakhand and regular farm advisory and inputs were given to farmer Mr. Pratvi Singh, Mr. Naveen Lal Shaha, Kamalesh Harnval by Rajesh M., Biju Sam Kamalam, and R.S. Haldar.
- Garima and Kishor Kunal provided feed advisory and scientific guidance to the trout farmers and state fisheries departments of Uttarakhand in calculating the feed requirements; choosing the right feed for the production size and stage; providing nutritional composition recommendations; facilitating the procurement of DCFR-Growel feeds; and suggesting feeding schedules.
- Kishor Kunal & Garima conducted Farm advisory programme on "Brood stock management of carps" conducted at village-Banlekh, Champawat on 19 January, 2021.
- Kishor Kunal and Garima co-coordinated organisation of fish farmers day on 10th July, 2021 in which one One-day seminar was organised at Experimental Fish Farm, Champawat in the presence of all the staff members. This seminar was attended by 30 farmers from Mudiyani, Pati, Bigrakot, Khunari, Salli, Lohaghat, Banlekh, Dudhpokhara, Chaukuni-Bora, Chauda Sethi, Chauki and Fungar village. A brief session on fish diseases, their symptoms, prevention, cures and fish farming. On the same day fish seed was also distributed to 12 fish farmers of locality.
- Kishor Kunal and Garima organised and conducted one day awareness programme cum field day on "Poly-culture of carps in mid hills" at village- Shaktipur Bunga, Champawat on 4th January, 2021.
- Kishor Kunal and Garima organised and conducted one day awareness programme cum field day on "Poly-culture of carps in mid hills" at village- Shaktipur Bunga, Champawat on 4th January, 2021.
- Kishor Kunal and Garima organised and co-ordinated Farm advisory programme on "Health management of carps in mid hills" conducted at village- Shaktipur Bunga, Champawat on 5th August, 2021.
- Kishor Kunal and Garima organised and co-ordinated Farm advisory programme on "Water quality management in carp ponds" conducted at village- Mudiyani, Champawat on 26th July, 2021.
- Kishor Kunal and Garima organised and co-ordinated one day awareness cum demonstration programme on "Polyculture of carps in mid hills" conducted at village-Dudhpokhra, Champawat on 18th Oct., 2021.
- Kishor Kunal and Garima organised and co-ordinated one day awareness programme on "Food and feeding habits of carps" conducted at village- Dudhpokhra, Champawat on 9th December, 2021.
- Kishor Kunal and Garima organised and co-ordinated one day awareness cum demonstration programme on "Estimation of water and soil quality parameters of carp ponds" conducted at village - Chaukuni Bora, Champawat on 6th September, 2021.
- Kishor Kunal and Garima organised and co-ordinated one day awareness programme cum Farm advisory programme on "Nursery management of carps" conducted at village-Kaflang, Champawat on 20th January, 2021.
- Kishor Kunal and Garima organised and co-ordinated one day awareness programme cum Farm advisory programme on "Brood stock management of carps" conducted at village-Banlekh, Champawat on 19th January 2021.
- Kishor Kunal conducted Farm advisory programme on "Nursery management of carps"

conducted at village- Kaflang, Champawat on 20th January, 2021.

- Kishor Kunal participated and represented ICAR-DCFR in one day farmer's fair and farmers conference organised by KVK, Lohaghat on 03rd February, 2021 and installed a stall to exhibit coldwater fish farming and some value-added products (viz. fish cutlet, fish pickle) from the fishes.
- M. S. Akhtar organized a participatory awareness and ranching programme of golden mahseer in Naukuchiatal lake, Nainital on 17th February, 2021.
- M. S. Akhtar organized an awareness and ranching programme of golden mahseer in Suyal river near Vishwanath Ghat, Almora on 23rd February, 2021.
- N.N. Pandey organized essay writing competition & slogan writing competition on 'Antimicrobial Resistance in Aquaculture' with participation of 50 students/research scholars.
- N.N. Pandey organized group discussion on "Use of chemicals & drugs in hill Aquaculture" with participation of fifteen departmental personnel.
- N.N. Pandey organized Scientists-Farmers Interface scheduled programme of the Prime Minister with participant of 102 farmers with a talk on "climate Resilient Agriculture" on 28th Sept. 2021.
- Pragyan Dash, D. Thakuria, V. Chanu, R.S. Tandel conducted a awareness programme on carrier opportunities in agriculture and fisheries to the school students of Govt. school, Mehragaon, Bhimtal under National campaign on Agriculture and Environment: The citizen Face on 26th November, 2021.
- Pragyan Dash, R.S. Tandel, Prakash Sharma and Siva C. conducted Swachhata Pakhwada activity at Surya gaon, Bhimtal, Uttarakhand on 20th December, 2021.
- R.S. Patiyal organized exhibition on Aquaculture practices in Foot hill region of Kumoan region at khateema, Udhamsingh nagar on dated 18th December, 2021.
- R.S. Patiyal conducted exposure visit of tribal farmers at the farm site of a progressive farmer, Shri Malkhan Singh, on 1st February, 2021.
- R.S. Patiyal coordinated An awareness cum input distribution program was organized for tribal farmer at Bhimtal on 24th September, 2021.
- R.S. Patiyal coordinated An input distribution program was organized at Munshyari on 28th September, 2021.
- R.S. Patiyal coordinated Awareness programs under TSP in the areas of Leh, Nubra and Drass of Ladakh UT, on 22.08.2021, 24.08.2021 and 28.08.2021.

- R.S. Patiyal coordinated feed distribution program under TSP on 18th August, 2021 at vill- Mushalpur, Baksa, Assam.
- R.S. Patiyal coordinated One-day training and input distribution program was at US Nagar on 10th July, 2021.
- R.S. Patiyal coordinated three days Training cum Feed Distribution programmewas at Anantnag district of J&K during 20-22 March 2021.
- R.S. Patiyal organized National campaign for Bharat ki Azaadi ka Amrit Mahotsav On Ecosysytem management for sustainable fishery in hills and national Fish farmers Day on 10th July 2021.
- R.S. Patiyal coordinated input distribution program at Drass of district Kargil, Ladakh UT in collaboration with Leh Fisheries Department on 25th November, 2021.
- R.S. Patiyal coordinated A demonstration program on 19th December, 2021 at the pond site of Mr Laxman Singh, in village Amarukhurd, Khatima,US Nagar
- Rajesh M served as member of input distribution committee in the Kisan Mela organised by the by ICAR-DCFR, Bhimtal during 17-18th March, 2021
- Rajesh M served as member secretary of farm and hatchery visit committee of "Foundation Day celebration" organised by the by ICAR-DCFR, Bhimtal on 24th September, 2021.
- Rajesh M. conducted Field adaptation trial for farming of rainbow trout at Ramgarh,

Uttarakhand and regular farm advisory and inputs were given to farmer Mr. Pratvi Singh, Mr. Naveen Lal Shaha, Kamalesh Harnval by Rajesh M., Biju Sam Kamalam, and R.S. Haldar.

- S. Ali and Siva C. conducted an exploratory survey/field visit on 24.02.2021 at Chaffi river, Bhimtal for the exploration of species diversity and collection of targeted species for genetic stock study.

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. But due to COVID 19 this Directorate has participated in some limited exhibitions only which is mentioned below:

Name of the programme	Organizer	Duration	Place/venue
Kisan Mela	ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (Uttarakhand)	9th October, 2021	ICAR-VPKAS Experimental Farm, Hawalbagh.
XV Agricultural Science Congress	Banaras Hindu University, Varanasi	13-16th November, 2021	BHU, Varanasi

Dr Pramod Kumar Pandey, Director, ICAR-DCFR interacted with Mr. Ajay Tamta, Hon'ble Minister of State for Textiles, Govt. of India visited the ICAR-DCFR stall during Kisan Mela at ICAR-VPKAS, Almora

- Dr R.S. Haldar, CTO, coordinated and displayed the Institute's exhibition in the "Pusa Krishi Vigyan Mela - 2021" organized by ICAR-Indian Agricultural Research Institute, New Delhi during 25-27 February, 2021 at IARI Mela Ground, New Delhi.
- Dr R.S. Haldar, CTO, coordinated the Institute's exhibition in the "SMART AQUA EXPO INDIA 2021" organized by SMART AGRIPOST & AQUA POST, P2C Communications, J-10, Green Park Main, New Delhi-110016 during February, 6-12, 2021 at Delhi.
- Dr R.S. Haldar, CTO, coordinated and displayed the Institute's exhibition during two days orientation workshop cum Farmers' Meet and Kisan Mela which was organized by this Institute during 17-18th March, 2021 at DCFR complex, Bhimtal under the SCSP & TSP activity.

7.4 Visitors

7.4.1 Students / Farmers/ others' visit

- A group of 20 students along with two faculty members from St. Joseph's College, Nainital (Uttarakhand) visited ICAR-DCFR, Bhimtal during November 08, 2021 and interacted with scientists.

A group of students from St. Joseph's College, Nainital visited ICAR-DCFR, Bhimtal on November 08, 2021, and interacted with scientists.

- Twenty nine (29) Fish farmers visited the Experimental Field Centre, Champawat, under ATMA Yojna of District Fisheries Department on 30th January, 2021.
- G. Susheel, President, Wild Life Association of South Bangalore visited at Experimental Field Centre, Champawat, Champawat on 13th October, 2021.


Visit of farmers at EFC, Chmapawat

- Thirty-two (32) IAS & IFS trainees (probationers) visited Experimental Field Centre, Champawat, on 28th December, 2021 and learned about fish culture in mid hills.


Visit of IAS & IFS trainees (probationers) at Experimental Field Centre, Champawat

7.5 Consultancy & Other Services

7.5.1 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

[Dr Debajit Sarma, Dr M.S. Akhtar and R.S. Patiyal]

The habitat ecology and biodiversity of mahseer and other indigenous fish species were studiedin river Yamuna at the Vyasi Hydroelectric Project site, Dakpatthar, Dehradun, Uttarakhand during August- December, 2021. Physico-chemical parameters viz. dissolved oxygen, free CO_2, pH, temperature, total dissolved solids (TDS), ammonia, nitrate and nitrite were recorded at the site. The plankton and periphyton observation showed the dominance of Bacillariophyceae on both the upstream and downstream of the river. Stone fly larvae and dragon fly larvae were observed in the benthic study. During the ichthyofaunal diversity exploration, *Tor putitora*, *Tor tor*, *Schizothorax richardsonii*, *Barilius bendelisis*, *Barilius vagra*, *Glyptothorax pectinopterus*and *Naemacheilis botia* were recorded. A high CPUE was witnessed at the downstream site which shows the abundance of the fish species caught during the sampling period and a lower CPUE was recorded at the upstream site. The length-weight and condition factor of the species showed that the species are healthy and in good condition at the selected sites. The morphometric and meristic counts of all the fish specimen was analyzed exhibiting isometric pattern and confirmed that the test specimen were the same as the collected species. For the estimation of food and feeding habit, the gut content was also analyzed. The breeding ground of the indigenous species was also identified in the upstream site of the dam. The voucher specimens of the collected and identified species are also preserved in the ICAR-DCFR museum.

Vyasi Hydroelectric project site, Dakpatthar, Dehradun

Vyasi Hydroelectric project site, Dakpatthar, Dehradun

Estimation of water quality parameters and Sampling of fishes

7.5.2 Consultancy -Advisory and technical support for rainbow trout hatchery operation at Munnar, Kerala

[Dr Biju S. Kamalam, Dr Rajesh, M and Dr Debajit Sarma]

Under the memorandum of understanding signed with Kanan Devan Hills Plantations Company Pvt. Ltd., Munnar, Kerala, the ICAR - Directorate of Coldwater Fisheries Research continues to provide scientific guidance and technical support to enhance seed productionin the heritage rainbow trout hatchery established at Rajamallay tea estate in 1932. The feed andnutritional interventions recommended by the Directorate's scientists has resulted in significant increase in the size of brooders and growth rate of juveniles. However, maturation and breeding were seriously limited due to higher ambient water temperature during the breeding season (14-15^{o}C) and unusually less rainfall during the preceding months. Therefore, to support and sustain the rainbow trout hatchery operation in Munnar hills, the Directorate provided 50,000 eyed ova from the Experimental Fish Farm at Champawat, during February 2021, in kind. Nearly 8000 juveniles of 6-inch size were produced from this consignment and were ranched in their natural habitat (Gravel Banks) in Munnar. Some of these fishes are also maintained in the brooder fish units to develop a fresh batch of brooders. Baseline information of monthly changes in water quality (temperature, dissolved oxygen, etc.) is continuously being collected from October 2019 to December 2021, based on the hands-on training provided to the concerned KDHP personnel. This activity was coordinated by Dr Biju Sam Kamalam, Dr Debajit Sarma, Dr Rajesh, M. and Dr Kishor Kunal.

Eyed ova consignment provided to the rainbow trout hatchery at Rajamallay, Munnar

Rainbow trout fry from ICAR-DCFR eyed ova consignment at Munnar

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Ranching of juveniles from ICAR-DCFR eyed ova consignment at Munnar, Kerala

7.5.3 Rainbow trout feed advisory activities

[Dr Biju Sam Kamalam, Dr Rajesh, M., Dr Prakash Sharma, Dr N.N. Pandey and Dr Ciji, A.]

Keeping in mind the economic significance of feed management in rainbow trout farming, the Directorate is continuously providing feed advisory and scientific guidance to the trout farmers and fisheries department officials of Himachal Pradesh, Jammu & Kashmir, Uttarakhand, Sikkim, Ladakh and Nagaland. This includes guidance and support in choosing the right feed for the production size and stage of fish; calculating the feed requirements; providing nutritional composition recommendations; facilitating the procurement of DCFR-Growel feeds; and suggesting feeding schedules. For rainbow trout producing states with feed mills, advisory was given on ingredient sources, quality specifications and feed composition. With the recent research and development collaboration with M/s Growel Feeds, the commercial supply and use of ICAR-DCFR formulated and validated rainbow trout feeds is progressively increasing and has reached more than 160 metric tonnes in the last calendar year. The rainbow trout feed advisory activity was carried out by Dr Biju Sam Kamalam, Dr Rajesh, M., Dr Prakash Sharma, Dr N.N. Pandey and Dr Ciji, A.

7.5.4 Technical assistance in implementation of biosafety measures and rearing of imported eyed ova

Implementation of biosafety measures and technical assistance was provided for rearing of imported Denmark eyed ova to Government of Uttarakhand. Six lakh orange eyed ova were brought on 24th January 2021 at Bairangana trout farm, Chamoli in presence of staff members Sh. Abshik Mishra, Sh. Jagdamba, Sh Kanak Saha. About 0.01% eggs were found damaged during the transportation while rest were acclimatized as per the prescribed protocol. Later eggs were reared in an isolated hatchery facility with a provision of disinfecting the outgoing water. A batch of eyed eggs was reared for 33 days under indoor control conditions at Bhimtal. A survival of 62.38% from eyed stage to fry was achieved at a rearing water temperature range of 10.1-12.0 °C. In a duration of first 25 days of rearing, average growth was 66.5 mg, later in subsequent months growth was 3.58 g (1), 10.72 g (2), 25.20 g (3), 55.37 g (4) at a stocking density of 350 nos/cubic m in an elevated water temperature range of 18.0-23.5. In prolonged water temperature range of 23°C, reared rainbow juveniles exhibited stress with unique mortality. The growth and survival data from trout farm of Chamoli is being collected. The activity was carried out by Dr Suresh Chandra, Principal Scientist.

Acclimatization of imported eyed ova at Bairagna trout farm, Chamoli

7.5.5 Other Services provided/Revenue generated

- Experimental Field Centre, Champawat supplied ten thousand (10,000) Rainbow trout eyed ova to Bhimtal for research uses on 10th Feb. 2021.
- Experimental Field Centre, Champawat Supplied one lakh fifty thousand (1,50,000) Rainbow trout eyed ova to Fisheries department, Sikkim and 50,000 to Munnar, Kerala on 12th Feb 2021.
- Experimental Field Centre, Champawat Supplied one lakh (1,00,000) Rainbow trout eyed ova to Munsiyari under TSP on 16th Feb 2021.

- Experimental Field Centre, Champawat supplied one lakh (1,00,000) Rainbow trout eyed ova to Fisheries department, Arunachal Pradesh on 20th February, 2021.
- Experimental Field Centre, Champawat supplied eighty thousand (80,000) Rainbow trout eyed ova to Bhimtal for maintenance at Mahseer hatchery on 10th March, 2021.
- Experimental Field Centre, Champawat sold 5000 Rainbow trout fingerlings to state fisheries department, Champawat, Uttarakhand on 17th March, 2021
- Experimental Field Centre, Champawat distributed around 3200 fish fingerlings and 900 kg of fish feed to farmers under various extension programmes.
- Rajesh M. provided Guidance on feasibility of rainbow trout farming in RAS and suggestions on design considerations were provided to Mr. Vishwanath Raju, KARVIS AQUA, Hyderabad; Mr. Aditya Rithvik Narra, SMARTGREEN AQUACULTURE, Hyderabad; Mr. Sanjeev K. Pal, Mr. Amit K. Shukla, Bareilly, (U.P.); Mr. Siddharth, Rudrapur, Uttarakhand; Mr. Rohan Navik, Zeal Aqua Ltd, Surat, Gujarat, Arun Kumar Sivan, Fountain Clean, # 72, Viman Nagar, Hyderabad. Mr. Ashish Saini, Chandigarh,
- A community RAS hatchery was designed, fabricated and established in the farm facility of Mr. Zubair, Chuchot Leh under TSP programme. Further guidance is provided for operation of hatchery RAS system. This activity was coordinated by Rajesh M, Biju Sam Kamalam and R.S.Patiyal.

Revenue generated

- Experimental Field Centre, Champawat coordinated in generating a revenue of Rs. 4,75,280.00 (Rupees Four lakh seventy-five thousand two hundred eighty only) through the sale of fishes (fingerlings and grow-out) raised at the farm to different fish farmers, government and private agencies. (Sale of Rainbow trout growouts –Rs 2,09,140.00, sale of Rainbow trout fingerlings –Rs 2,53,180.00, Sale of common carp seeds –Rs 10,600.00, Sale of ornamental fishes –Rs 2,360.00).
- ICAR-DCFR generated revenue of Rs. 15,490.00 with the sale of fish and vegetables from experimental low-tech Coldwater Re-circulatory Aquaponics unit (reported by Mr. A.K. Giri, Scientist)

Fish sale and distribution

- Fish seed distribution is an important out-reach activity of the farm. Under this activity, fish seed are distributed in different farmer-oriented awareness and training programmes of the Directorate. During the reporting period about 1000 numbers of fingerlings each of common carp and rainbow trout fingerlings were distributed to the fish farmers of the district Champawat. In addition to this farm raised rainbow trout (table size: 480 kg) were sold generating a revenue of Rs 1,92,000.00 (Rupees one lakh ninety-two thousand only). Also, advanced fingerlings of rainbow trout about 5000 numbers were sold fetching a revenue of Rs 50000.00 (Rupees Fifty thousand only).

Fish seed distribution to the farmers

Selling of the fish at the farm

7.6 Success Stories

Shri Rajendra Singh Kaida is resident of the village Todera, District- Almora, Uttarakhand. He is an army retired person and use to do the farming activities at his native village mainly for vegetable cultivation and cow keeping. He came in the contact of ICAR-DCFR Bhimtal and started fish farming and vegetable cultivation with scientific method. Previously, the fish production from the polytank of the size of 100 m^2 was only 30 kg, while he produced 45 kg fish from the same pond and built a new fish pond also. He also used the fish pond water for the vegetable plots and got the double production of the vegetables having nutrient rich irrigation water. He started seed production of radish and coriander and got the better earning.

Status before intervention

Component Description		Benchmark (Baseline period 2016-17)			
Components	**Names**	**Area (m^2)/Number**	**Production (kg/Liter/No.)**	**Gross Income (Rs.)**	**Net Income (Rs.)**
Field Crop 1	Maduwa	600 m^2	100 kg	5000	4000
Hort. Crop 1	Radish Radish seed	200 m^2 400 m^2	300 kg 6 kg	3000 7200	2000 6000
Hort. Crop 2	Coriander	200 m^2	30 kg	3000	2000
Livestock 1	Cow	2 no.	1600 L	20000	12000
Fish Farming	Fish	100 m^2	30 kg	3000	2000
Total		1500 m^2		41200	**28000**

Present status

Component Description		Period 2020-21			
Components	**Names**	**Area (m^2)/ No**	**Production (kg/Liter/No.)**	**Gross Income (Rs.)**	**Net Income (Rs.)**
Field Crop 1	Maduwa	600 m^2	180 kg	9000	7000
Hort. Crop 1	Radish Radish seed	200 m^2 400 m^2	500 kg 10 kg	5000 20000	4000 16000
Hort. Crop 2	Coriander	200 m^2	50 kg	7000	6000
Livestock 1	Cow	2 no.	1700 L	25000	18000
Fish farming	Fish	200 m^2	90 kg	15000	10000
Total		1600 m^2		81000	**61000**

The farmer used to get annual income of Rs. 28000/- from crop, horticulture, milk & fish etc. He faced problems like water for irrigation etc. With scientific interventions like fish polytanks, radish seed production etc., he is getting annual income of Rs. 61000/-. In addition, there is cost saving of Rs. 8000/- in the production of radish and coriander cultivation.

[Dr N.N. Pandey, Principal Scientist, ICAR-DCFR]

Shri Har Singh Bisht is resident of the village Jyurkafun, district Almora, Uttarakand. He is an army retired person and do farming activities at his native village mainly for vegetable cultivation and cow keeping. He came in the contact of ICAR-DCFR Bhimtal and started fish farming and vegetable cultivation with scientific method. Previously, the fish production from the polytank of the size of 100m^2 was only 35 kg, while he produced 50 kg fish from the same pond and built a new fish pond also. He also used the fish pond water for the vegetable plots and got the double production of the vegetables having nutrient rich irrigation water.

Status before intervention

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	0.25	600 kg	9000	Domestic use
Field Crop 2	Maduwa	0.25	400 kg	16000	10000
Hort. Crop1	Citrus, Kinnu Potato	20 no. 500 m^2	800 kg 200 kg	3000 2000	2000 1000
Livestock 1	Cow	no.1	500 L	7500	6000
Fish Farming	Fish	100 m^2	35 kg	5000	4000
Total				42500	**23000**

Present status

Component Description		Period 2020-21			
Components	**Names**	**Area (acre/m^2) / Number**	**Production (kg/Liter/ No.)**	**Gross Income (Rs.)**	**Net Income (Rs.)**
Field Crop 1	Paddy	0.25	700 kg	11000	self use
Field Crop 2	Maduwa	0.25	500 kg	8000	self use
Hort. Crop 1	Citrus, Kinnu	30 no.	1000 no.	5000	5000
Hort. Crop 2	Potato Vegetables	500 m^2 500 m^2	250 kg 500 kg	5000 20000	3000 12000
Livestock 1	Cow	2 no.	1200 L	24000	18000
Fish farming	Fish	200 m^2	100 kg	15000	12000
Total				87000	**50000**

The farmer used to get annual income of Rs. 23000/- from crops, horticulture & milk etc. He faced problems like water for irrigation etc. With scientific interventions like fish pond, vegetable cultivation etc., he is getting annual income of Rs. 50000/-. In addition, there is cost saving of Rs. 6000/- in the production of vegetable having fish pond.

[Dr N.N. Pandey, Principal Scientist, ICAR-DCFR]

Fish farming at Jyur Kafun, Almora, Uttarakhand

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8. Coldwater Fish breeding and Seed Production

8.1 Seed production of golden mahseer

Breeding and seed production of golden mahseer for its conservation and rehabilitation is a core activity of the Directorate. During the year 2021, multiple breeding and seed production of golden mahseer, matured in captive conditions through photo-thermal manipulations, were done throughout the year and striped a total of 18,4200 eggs. We observed a fertilization rate of 82-88%, hatching rate of 83-87% and 80-86% survival rate. The nursery rearing was done in the flow-through hatchery. After three months of nursery rearing, the fry were stocked into the nursery pond of the Mahseer Hatchery Complex of the Directorate to raise them into yearlings/yearlings. Ranching of seven thousand fingerlings was done into Naukuchiatal lake and Suyal river, Almora. Around 16000 eggs and fry were used for different research purposes in the Directorate. The entire activities were coordinated by Dr M.S. Akhtar.

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

Stripping of eggs from a golden mahseer brooder matured in captivity

Golden mahseer fry produced in captivity

Fertilized eggs to be kept for incubation

8.2 Breeding and seed production of Rainbow trout at Experimental Fish Farm, Champawat

Breeding, seed production and culture of rainbow trout is an important activity at the Experimental Fish Farm, ICAR-DCFR, Champawat. At present, 3000 adult (1.2-4.8 kg), and 1500 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 Dec, 2019-Feb, 2020. Eight lakh eyed ova and 6000 fingerlings of Rainbow trout were produced at EFF, Champawat using 780 kg female brooders and 690 kg male brooders. Recorded fertilization rate was about 80-85%. With the use of a new low-cost RAS system for incubation of Rainbow trout eggs designed and developed by a team of scientists (A.K. Giri, Rajesh M, Biju S, Garima and Kishor Kunal) at ICAR-DCFR the survival rate of70% (green egg to hatching) could be achieved, which was earlier around 20-25% in the old flow through system at EFF, Champawat.The activities of seed production and rearing of rainbow trout were coordinated by Mr. Kishor Kunal and Ms Garima at EFF, Champawat.

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

Sexual dimorphism in Male and Female rainbow trout brooders during breeding season

Stripping male brooders for milt

Stripping female brooders for ova

Mixing of ova and milt for fertilization

Incubation of fertilized eggs

Eyed ova stage Fig.: Fingerlings

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8.3 Breeding and seed production of *Bangana dero* and *Labeo dyocheilus*

Breeding and seed production of *Bangana dero* and *Labeo dyocheilus* had been carried out at ICAR-DCFR, Bhimtal in three phases on 22.07.2021, 28.07.2021 and 12.08.2021. During 1st phase, 2 females of 550g and 1300g and 7 males of size range 300-780g were selected and intramuscularly injected with inducing agent, Aquaprim (ICAR-DCFR produced synthetic hormone) @ 0.5ml/kg body weight to female and @ 0.3ml/kg body weight to male and released to the spawning pool with continuous water flow @6 lpm with shower arrangement but there was no success. During the 2nd phase, 3 females (350-730g) and 5 males (220-470g) were intramuscularly injected with Ovatide @ 0.7ml/kg body weight to female and @ 0.4ml/kg body weight to male and released to the spawning pool with continuous water flow @6 lpm with shower arrangement. About 2.5 lakh eggs and 2.0 lakh spawn were produced with fertilization and hatching rate of about 50% and 80% respectively. During the 3rd phase, 3 females (250-350g) and 5 males (250-500g) were selected and intramuscularly injected with the same inducing agent with similar dosages and kept in spawning pool with similar arrangements. About 1.5 lakh eggs and 1.2 lakh spawn were produced with fertilization and hatching rate of about 60% and 85% respectively. The entire program was conducted by Dr N.N. Pandey and Mr. A.K. Giri.

[Report by: Mr. A.K. Giri, Scientist, ICAR-DCFR]

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

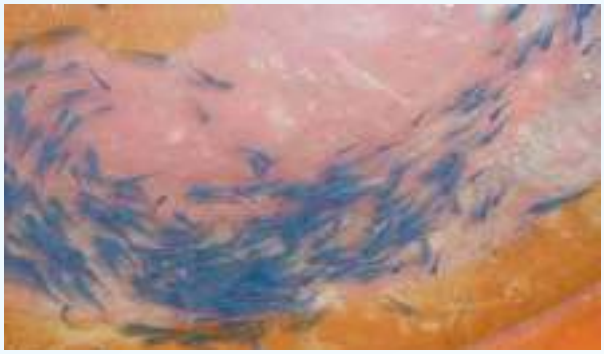
Most farmers in the mid hills possess small to medium size fish ponds where fish growth can be expected only for about 6-8 months in a year. For the small earthen ponds, common carp (*Cyprinus carpio*) is one of the most promising candidate fish in mid Himalayan region. It is being cultured widely either alone or in polyculture system in the central and lesser Himalayan region in cemented as well as earthen tanks, ponds etc owing to its growth potential and minimal maintenance. In order 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 during the year 2007. These species were found more suitable than other carp varieties for mid-hill farming due to their faster growth, wide temperature tolerance (5-32°C) and minimal maintenance. Breeding and seed production of improved common carp was carried out at EFF, ICAR-DCFR, Champawat following conventional hapa breeding method without hormone administration. Male and female brooders were stocked in the ratio 2:1 in the hapa for breeding in the brooder ponds itself. Eggs were collected using plastic twines extracted from unused plastic sacks put inside the breeding hapa. About 150-200g of twines per kg of female was used for collection of eggs. Fertilized eggs of these carps are adhesive, pale yellowish in colour and have diameter ranging from 1.2-2.1 mm. Recorded fecundity was about 0.5-1.0 lakh eggs/kg body weight. Hatching of the fertilized eggs is also a temperature dependent phenomenon. At 15-21° C, it took 80-120hrs post fertilization to hatch out and yolk absorption was observed at 70-90 hrs post hatching. The survival percentage of egg to spawn and spawn to fry was found 40-45% and 30-35%, respectively. A total of 1-1.2 lakh fry (30 dph) were produced from the improved Hungarian strains of common carp during June-July 2021. A total of 120 numbers of female brooders of size range 220g to 414 g were used for the breeding purpose. The breeding program was jointly coordinated by Mr. K. Kunal and Mrs. Garima.

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

Pond preparation

Battery of breeding HAPA

Common carp brooder



Common carp fry

Koi carp brooder

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

Seed production of popular ornamental fish species viz. koi carp and gold fish was carried out at the farm during the month of June- August. For the breeding purpose 45 female brooders of Koi carp and 63 female brooders of gold fish were used in separate hapas with their respective male brooders (Male: female = 2:1). The weight of koi carp female brooders varied between 70-290 gand that of gold fish from 58-123g. About 3000-4000 nos. of fingerlings (5-8 cm) of koi carp and 2000-3000 nos. 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 Mr. 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]

Koi carp and gold fish fingerlings

Nursery pond preparation

Gold fish brooder

Egg collection in plastic twine

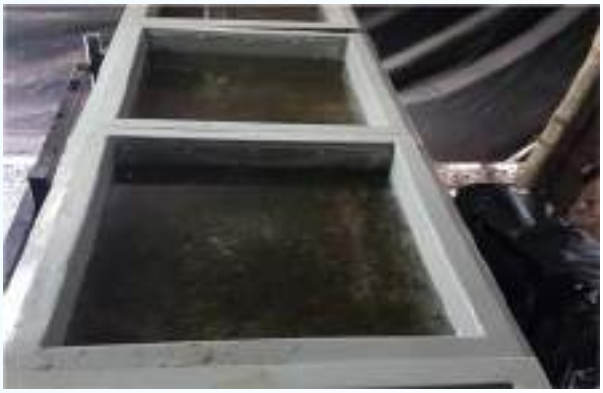
8.6 Breeding of rainbow trout at Ramgarh, Nainital district (Uttarakhand):

For the first time rainbow trout breeding was done on 2nd January, 2021 at farmers' pond at Ramgarh village of Nainital District, Uttarakhand. About 200 fingerlings of rainbow trout were stocked in the raceways of Mr. Jagat Singh Harnwal, Ramgarh village during February, 2019 and they were fed by DCFR prepared trout feed. Within 22 months of rearing the fishes were attains 1200-1450 g in weight and were used for stripping. Five female fishes were stripped and the eggs were fertilized by the milt of male fishes by dry method. In total about 5000 eggs were fertilized and were kept in temporary established trout hatchery for further development/ hatching. During the stripping the water temperature was recorded 9.5^{0}C. Utmost care was taken for best hatchery management during the hatching period. After successful hatching about 4000 seeds were transferred in the nursery pond. Finally 2500 fingerlings were sold by Mr. Jagat Singh to different trout growers in the locality and rest 1000 fingerlings

are being reared in his own raceway. The fishes were fed by the DCFR formulated trout feed. All technical as well as financial inputs (trout seed and feed) were provided by this Directorate. This programme was coordinated by Dr R. S. Haldar, Chief Technical Officer and Incharge, Extension of this Directorate and also participated by Dr N.N. Pandey, Principal Scientist, ICAR-DCFR.

[Report by: Dr R.S. Haldar, CTO, ICAR-DCFR]

Collection of brooders Fig.: Stripping of eggs



Rearing of fry in flow through system

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9. Tribal Sub Plan (TSP) Activities

The directorate has undertaken various activities in the state of Mizoram, Nagaland and Uttarakhand as a means of training and skill development of rural tribal farmers for their livelihood security during the reporting period. Farm input distribution has also been made during the programme to provide support for the fish farming and production enhancement. The details of activities undertaken are listed hereunder.

9.1 Stakeholder meetings and field exploration in Ladakh

The ICAR-Directorate of Coldwater Fisheries Research (DCFR), Bhimtal, Uttarakhand has been entrusted the responsibility to explore and formulate a road map and strategic action plan to sustainably develop and harness the potential of fisheries and aquaculture for providing nutritional security and livelihood for the tribal population inhabiting the harsh high-altitude cold arid regions of Ladakh, under the flagship Pradhan Mantri Matsya Sampada Yojana (PMMSY) scheme. For the said purpose, a team of scientists led by Dr Pramod Kumar Pandey, Director (DCFR) and comprising Dr R.S. Patiyal (Nodal Officer, TSP), Dr Biju Sam Kamalam (Co-Nodal Officer, TSP) and Mr. Parvaiz Ahmad Ganieundertook an exploratory visit to Ladakh from 20-30 August 2021, on the invitation of Shri. Sagar Mehra, Joint Secretary (Inland Fisheries), Government of India and direction of Dr J.K. Jena, DDG (Fisheries), ICAR.

In a joint meeting of all the concerned higher officials, the Honourable Lieutenant Governor of Ladakh, Shri Radha Krishna Mathur emphasised on capacity building, sustainable development of aquaculture, conservation of endemic aquatic biodiversity, ornamental fisheries, strong cooperation between stakeholders and conveyed his confidence in the lead taken by ICAR-DCFR.

Joint meeting with the Honourable Lieutenant Governor of Ladakh

During the stakeholders' convergence meeting with research and developmental organisations and fish farmers in Ladakh, Dr Pandey (Director, DCFR) briefed about the prioritized aquaculture technologies and biodiversity conservation plans of ICAR-DCFR for the development of fisheries in Ladakh and also assured that necessary action would be taken to address immediate challenges related to input (seed and feed) availability and capacity building of farmers and department personnel. On the ground, firstly, the scientific team of ICAR-DCFR visited Pangong Tso lake on 21st August 2021, collected baseline limnological data, and fish and aquatic invertebrate specimens that inhabit this high altitude brackishwater lake.

Field exploration and data collection at Pangong Tso Lake

Following that, the team visited all the functional government and private fish farms in Leh, Nubra valley, Kargil and Drass, including those in the border villages of Ladakh and assessed the source-specific water quality conditions and documented the farming practices and challenges in fish production. Besides, the team also gathered snapshot information on the water quality conditions prevailing in the major riverine drainages of Indus, Zanskar, Shyok and Suru in Ladakh. This Ladakh exploration was ably supported by the Department of Fisheries, Ladakh and Dr Mohd. Iqbal Mir. Based on the information gathered during this exploratory visit, ICAR-DCFR has drafteda road map for fisheries and aquaculture development in Ladakh with practical solutions and location-specific strategies that would support policies and action plans to effectively boost fish production and conservation under the flagship PMMSY scheme.

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Survey and data collection from trout farms at Nubra, Kargil and Drass

9.2 First RAS based rainbow trout hatchery established in Ladakh

In Ladakh, ICAR-Directorate of Coldwater Fisheries Research has established the firstscientifically designed and validated Recirculating Aquaculture System (RAS) based rainbow trout hatchery at DCFR adopted farmer Mr. Zabir Ahmad's farm in Chuchot Shamma village, Leh (above 3000 msl), during November 2021.With a production capacity of 50,000 advanced fry, this hatchery can support the production of healthy stock-size fish under controlled environmental conditions. Eventually, this RAS based hatchery model will effectively help in overcoming the inherent climatic challenges in Ladakh, enable timely production and availability of rainbow trout seed, promote self-reliance in rainbow trout culture in the high-altitude cold arid regions of Ladakh.The hatchery operation in this RAS unit will commence during the 2021-2022 breeding season, with eyed-ova from ICAR-DCFR Experimental Fish Farm, Champawat.Based on the success of this RAS hatchery, the Directorate plans to establish more units in different parts of Ladakh to facilitate the exponential growth in fish production. The designing and setting-up of this RAS based hatchery was carried out by Dr Rajesh, M., Dr Biju Sam Kamalam and Dr R.S. Patiyal.

RAS-based rainbow trout hatchery set-up at Chuchot, Leh

9.3 ICAR-DCFR developed rainbow trout feed distribution and demonstration

In a major effort to cater to the input requirements of the tribal fish farmers in Ladakh, the ICAR-Directorate of Coldwater Fisheries Research arranged and distributed 8040 kg (worth Rs. 11.2 lakh) of high energy rainbow trout feed developed by ICAR-DCFR in collaboration with Growel Feeds. With active support from the Department of Fisheries, Union territory of Ladakh, different sizes of rainbow trout feed were supplied to 31 farmers spread across Leh, Nubra, Kargil and Drass, to support entire production cycle in one raceway. The performance of this feed is also being demonstrated to the tribal fish farmers in the Department Trout Farms in Leh and Kargil districts. The ultimate aim of this activity is to promote the use of high-performance inputs to maximise fish production in a relatively shorter culture period. This activity is being monitored and coordinated by Dr Biju Sam Kamalam, Dr R.S. Patiyal, Dr Rajesh, M and Mr. Abhay Kumar Giri.

Feed distribution to tribal fish farmers in Leh

9.4 Training on 'Best management practices for rainbow trout farming in high altitudes

ICAR-Directorate of Coldwater Fisheries Research organised a one-day training on 'Best management practices for rainbow trout farming in high altitudes' at Government Trout farm, Chuchot, Leh, on 27th November 2021. In total, 50 tribal farmers, fisheries department officials and interested public participated in the training. Mr. Ghulam Mehdi, Executive Councillor for Fisheries and Minority Affairs, LAHDC, Leh; Dr Mohammad Iqbal, Chief Animal Husbandry Officer; Mr. Mirza Hussain, Councillor, Chuchot; and Mr. Mohammad Amin Lone, Assistant Director of Fisheries, Leh graced the occasion. During the training, DCFR scientists explained various critical aspects of rainbow trout farming such as production system design, water quality monitoring, feed management, biomass estimation, grading, cleaning, health management, record keeping and production economics to the gathering. This training was coordinated by Dr Biju Sam Kamalam, Dr Rajesh, M. and Dr R.S. Patiyal.

Pictorial presentation delivered during the training

TSP Activities in Uttarakhand

9.5 On-farm demonstration of 'Rainbow trout breeding and culture' at Munsyari, Uttarakhand

For the promotion of rainbow trout culture as a means for livelihood security and socio-economic empowerment, ICAR-Directorate of Coldwater Fisheries Research organised an on-farm demonstration of rainbow trout breeding and culture practices in the remote tribal area of Munsyari, Pithoragarh district, Uttarakhand, during 4-6 February 2021, in collaboration with the Department of Fisheries, Pithoragarh. The trout farm of Mr. Aanad Singh served as the demonstration site for rainbow trout brooder maintenance and breeding. About 3000 eggs of rainbow trout were stripped out and the breeding procedure was successfully demonstrated to four trout farmers in the locality. Further, different aspects of brood stock management and breeding preparations were explained to the farmers to make them self-reliant in trout seed production.This demonstration was coordinated by Dr R.S. Patiyal and Dr N.N. Pandey.

Practical demonstration of rainbow trout breeding procedure

9.6 Training and input distribution programmes at Uddam Singh Nagar, Uttarakhand

A one-day training programme was organized by ICAR-DCFR, Bhimtal on 'Aquaculture for economic upliftment and livelihood security of tribal farmers in Uttarakhand'at village Danpur, Udham Singh Nagar, Uttarakhand on 1st February, 2021. Shri Bishan Singh, Gram Pradhan of village Gadarpur and 19 tribal farmers from three blocks Bajpur, Sitarganj and Gadarpur participated in the training programme. During the scientist-farmer interaction, the farmers shared their personal experiences in fish farming and also flagged the constraints and challenges faced by them. The scientists addressed all the queries of the farmers during this session. Additionally, a field visit to the farm site of a progressive farmer, Shri Malkan Singh, was organized for the participants, where he shared his experience and the potential ways to succeed. On this occasion, inputs such as carp feed and seed were distributed to selected tribal fish

farmers. Further, on 10th July 2021, another one-day training cum input distribution programme was organized at Udham Singh Nagar, where 34 tribal fish farmers participated. During the event, 1680 kg of carp feed, carp seed and potassium permanganate were distributed to 34, 10 and 20 beneficiaries, respectively. These training and input distribution programmes were coordinated by Dr R.S. Patiyal and Mr. Abhay Kumar Giri.

Farmers' training and input distribution programme at Danpur

9.7 Kisan mela, awareness workshop and input distribution at ICAR-DCFR, Bhimtal

In order to promote aquaculture awareness and provide inputs for tribal beneficiaries, the Directorate organised a two-day Kisan Mela and awareness workshop at Bhimtal during 17-18 March 2021.About 125 fish farmers and officers from state fisheries department of Uttarakhand participated in the programme. During the event, different aquaculture operations, farm input management and value addition prospects were explained to the participants. Fish farming related exhibitions were also set-up for creating awareness among the farmers. On the occasion, farm inputs such as 3600 kg (90bags) of carp feed, 120 kg (6bags) of trout feed, potassium permanganate and watertesting kits were distributed to the tribal farmers.Similarly, during the Directorate's foundation day celebrationat Bhimtal, on 24 September 2021, 1600 kg of carp feed and ornamental fish seed were distributed to 17 tribal beneficiaries. These activities were coordinated by Dr R.S. Patiyal, Mr. Abhay Kumar Giri, Dr Biju Sam Kamalam,Dr Rajesh, M. and Dr R.S. Haldar.

Fig.: Input distribution for tribal beneficiaries at Bhimtal

9.8 Exhibition, on-farm demonstration and input distribution at Khatima, Uttarakhand

The Directorate organised an exhibition, demonstration and input distribution programme for tribal farmers at Khatima, Udham Singh Nagar, during 18-19th December 2021. Nearly 225 tribal farmers and villagers of that area visited the exhibition stall of DCFR. Theon-farm demonstration was organized at the pond site of progressive farmer Shri Laxman Singh, Amarukhurd, Khatima, where fish farm management and harvest were practically demonstrated to 15 farmers of that locality. Along with that, 12000 numbers of carp seed and 1600 kg of carp feed were distributed to 6 tribal fish farmers of Khatima. This activity was coordinated by Dr R.S. Patiyal, Mr. Abhay Kumar Giri and Mr. Santhosh Kumar.

Farmers' visiting DCFR exhibitions stall at Khatima, Uttarakhand

9.9 Training and input distribution programme sat Pithoragarh, Uttarakhand

The Directorate organised training cum skill development programmes for the tribal fish farmers of Dharchula block, Pithoragarh, during 17-18th June 2021. In total, 25 and 40 tribal fish farmers from Pangu and Dugtu villages, respectively, took part in this training. With respect to input distribution, 400 kg of carp feed was distributed to 5 tribal farmers of Pangu, Dharchula. Subsequently, 680 kg of rainbow trout feed and seed was distributed to 5 tribal fish farmers of Munsyari, on 28th September 2021. This activity was coordinated by Dr R.S. Patiyal.

Trout seed release in farmer's raceway at Munsyari

TSP Activities in Jammu & Kashmir

9.10 Training cum feed distribution program at Anantnag

ICAR-DCFR organized a three days training cum feed distribution programme at Anantnag district, Jammu & Kashmir, during 20-22nd March 2021. A total of 10 tribal fish farmers including two female trout growers of Anantnag district from Develgam, Dachigam and Amadwagad villages participated in the programme. During the training, 2000 kg of rainbow trout feed of different sizes were distributed to the participating trout farmers (200 kg each). The training and feed distribution activity was coordinated by Dr Raja Aadil Hussain Bhat, Mr. Parvaiz Ahmad Ganieand Dr Biju Sam Kamalam.

Training and DCFR trout feed distribution at Anantnag

TSP Activities in North-East States

9.11 Training and field demonstration programme at Kohima, Nagaland

ICAR-DCFR organised a two days training and field demonstration programme on 'Socio-economic development through scientific fish farming' for tribal farmers at Kohima, Nagaland during 29-30th January 2021. In total, 30 tribal fish farmers participated in the programme. This activity was coordinated by Dr R.S. Haldar.

9.12 Training cum feed distribution programme at Mamit, Mizoram

ICAR-DCFR organised a one-day training cum feed distribution program at Darlak village, Mamit district, Mizoram on 13th April 2021. In total, 62 tribal fish farmers participated in the programme. 10,000 kg of carp feed was distributed to the tribal farmers, in collaboration with the Department of Fisheries, Mizoram. This activity was coordinated by Mr. Abhay Kumar Giri and Dr R.S. Haldar.

9.13 Training cum input distribution programme at Ri-Bhoi, Meghalaya

ICAR-DCFR organised training cum input distribution programmes for tribal fish farmers of Meghalaya in the Krishi Vigyan Kendra premises at Ri-Bhoi, on 9th and 15th April 2021. A total of 25 tribal farmers from Madan Nonglakhiat village and 25 farmers from Poham Shkem village participated in the programmes. During the occasion, inputs such as fish seed, 10,000 kg of carp feed, lime and nets were distributed to the tribal beneficiaries. This activity was coordinated by Mr. Abhay Kumar Giri and Dr R.S. Haldar.

9.14 Field visit and feed distribution program at Baksa, Assam

ICAR-DCFR organised a field visit and feed distribution programme for tribal farmers at Mushalpur village, Baksa, Assam, on 18th August 2021. In total, 89 tribal farmers participated and benefitted from the programme. 13,000 kg of carp feed were distributed to the identified tribal beneficiaries. This activity was coordinated by Dr Dimpal Thakuria.

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10. North East Hill Activities (NEH) Activities

Research and development activities in the North Eastern Hills is an integral component of ICAR-DCFR. Several activities weretaken up in the northeast region for the promotion of scientific fish farmingbesides species diversification programme. Training and skill development programmes were organised for the transfer of technical know-how to farmers and different stakeholders. An exploratory survey was conducted to accomplish a challenging task of establishing a trout hatchery at Mechuka. The details of the programmes carried under NEH are enlisted as follows:

10.1 Development and promotion of trout farming in Arunachal Pradesh- Distribution of Rainbow trout eyed ova

In January 2021, about 4.5 lakhs eyed ova of rainbow trout were supplied to the Department of Fisheries, Govt. of Arunachal Pradesh for the development of rainbow trout farming in Tawang and West Kameng districts. The said eyed ova were hatched in Nuranang and Shergaon trout hatcheries. Some fingerlings of the rainbow trout were distributed among the trout growers of West Kameng district while rest are being reared in the government trout farm in Shergaon and Nuranang. The programme was co-ordinated by Dr R.S. Haldar, Chief Technical Officer.

Incubation and hatching of rainbow trout eggs

Eyed ova of rainbow trout supplied to Department of Fisheries, Govt. of Arunachal Pradesh

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10.2 Establishment and promotion of rainbow trout farming in Nagaland- Distribution of Rainbow trout eyed ova

About 0.5 lakhs eyed ova of Rainbow trout were supplied to the Department of Fisheries & Aquatic Resources, Govt. of Nagaland in January, 2021 for the development of rainbow trout farming in Kohima district. The said eyed ova were hatched in Dzuluke trout hatchery. The fingerlings are being reared in the Govt. trout raceways in Dzuluke (Kohima district) that are being reared to have brooders. The programme was co-ordinated by Dr R.S. Haldar, Chief Technical Officer.

Supply of rainbow trout eggs to Department of Fisheries & Aquatic Resources, Govt. of Nagaland

Rearing of fry of rainbow trout

A houl of rainbow trout

10.3 Establishment of trout raceways in Nagaland

To initiate therainbow trout farming in Nagaland, three trout raceways were established during 2018 for rearing of trout to get quality brooders at Dzuleke, Kohima district, Nagaland with technical and financial support from ICAR-DCFR in collaboration with the Department of Fisheries & Aquatic Resources, Govt. of Nagaland. To popularize rainbow trout farming in the state, three more trout raceways were constructed at villageTekhwekhwi (near Dzuleke) in Kohima district. The technical and financial support for the said activity was provided by ICAR-DCFR.Dr R. S. Haldar, Chief Technical Officersupervised the establishment of the trout raceways.

Established trout raceways at Nagaland

10.4 Distribution of rainbow trout eyed ova to Sikkim

About 3.5 lakh eyed ova of rainbow trout were supplied to the Department of Fisheries, Govt. of Sikkimin February, 2021. The eyed ova were provided for the development of rainbow trout farming in West Sikkim and North Sikkim districts. The eyed ova were hatched in the government trout hatchery at Uttarey in West Sikkimand Rabum in North Sikkim. The fingerlings are being reared in raceways of the government trout farms at Uttery and Rabum. Some fingerlings were also distributed among the trout growers of Uttery and Rabum. The programme was co-ordinated by Dr R.S. Haldar, Chief Technical Officer.

Supply of rainbow trout eyed ova to Sikkim

Rearing of rainbow trout fry and distribution

10.5 Distribution of DCFR made trout feed

ICAR-DCFR formulatedstarter feed of rainbow trout (10kg) was provided to the Department of Fisheries & Aquatic Resources, Government of Nagaland in January, 2021. The feed was provided to feed rainbow trout stocks being reared in raceways at Dzuleke, Kohima. The feed was formulatedto acheive better growth and survival of the species. Dr R.S. Haldar, Chief Technical Officerco-ordinated the programme.

10.6 Fish diversity studies in Northeast region

A collaborative Network Project in Mahseer entitled "Species and stock validation of mahseer species of genus *Tor* and *Neolissochilus* from central and eastern Himalayan region of India for its propagation and conservation" has been undertaken in collaboration with the Department of Aquatic Environment Management, College of Fisheries, Assam Agricultural University, Raha, Nagaon district (Assam); Department of Zoology, Manipur University, Imphal (Manipur); Department of Fisheries & Biotechnology, St. Anthony's College, Shillong and Department of Zoology, D.M. College of Science, Imphal (Manipur) under the financial assistance of ICAR-DCFR with the following objectives:

- To determine the mtDNA diversity within and in between mahseer species collected from various geographical locations of Central and Eastern Himalayan region of India.
- To find out the intraspecific population structure and gene flow pattern in populations of *Tor* and *Neolissochilus.*
- To resolve the species and stock dilemma of mahseer found in Central and Eastern Himalayan region of India.
- Habitat mapping of mahseer resources through GIS platform to develop strategies for conservation and propagation.

To achieve the said objectives, sampling was carried out and molecular studies conducted. Mahseer samples were collected from River Jia Bharali & River Diyung (Assam); River Umngi of Barak Drainage basin (Meghalaya); Dutah stream, a tributary of the Yu River (Chindwin Basin) & Lokchao River (Chindwin River Basin) in Manipur and Intanke river & Doyang River in Nagaland.Fin clippings were collected from some of the sampled *Tor* and *Neolissochilus species*. Morphometric data of collected fish specimen were carefully obtained and the fish specimens preserved. Molecular characterization of the species is under progress. Further, second review meeting of the project was organized on 30th January, 2021 to discuss the progress made under the said project

A hands-on training on "Molecular Biology techniques in DNA Barcoding" was organized at ICAR-DCFR, Bhimtalduring 1-6 March, 2021. The programme was organised to train the Young Professionals working in the project.

Sampling station – River Jia Bhoreli and River Diyung

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Collection of mahseer from river basin

Some of the collected species of mahseer from different river

10.7 Exploratory survey for establishment of trout hatchery at Arunachal Pradesh

A survey of Mechuka, Shi-Yomi district (Arunachal Pradesh) during 15th-16th November, 2021 in connection with to explore the feasibility of establishing a trout hatchery was conducted by Dr Amit Pande, Principal Scientist and Dr R. S. Haldar, Chief Technical Officer. The Director, Department of Fisheries, Govt. of Arunachal Pradesh, Deputy Directors, Assistant Directors and District Fishery Development Officers also accompanied during the survey. Mr J. Taba, Director, Dept. of Fisheries, Arunachal Pradesh, briefed the team about the immense potential of trout farming at Mechuka as 62 raceways had already been constructed by ten beneficiaries with the help of Department of Fisheries and around 100 applications were awaiting sanction. He stressed upon the limitations of the Department in providing trout seed to the beneficiaries that could only be possible by establishing a trout hatchery. Mr Tapan Dutta, District Fishery Development Officer, Shi-Yomi district stressed that the farmers were self-motivated and were desperate to make Mechuka a trout hub not only in the North East but also in the country.

To experience the ground reality, the team from ICAR-DCFR along with the Director, Department of Fisheries, Arunachal Pradesh, Deputy Directors, Assistant Directors and District Fishery Officers visited some raceway sites in villages Barangang, Sekyor, Dorjeeling, Upper Baranagang. The beneficiaries had abundant water supply near their raceways with a potential for trout farming and ecotourism.

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The team also visited Lhaullung village (Lat 28.59071, Long 94.13042, altitude 2002 m), which is about 12km away from the town of Mechuka. The proposed site for a "Centre of Excellence in Trout farming" was also visited. The Director, Department of Fisheries, informed that 12 hectares of land earmarked for this purpose was happily being donated by Sri Dala Nansang and his family. Moreover, team also visited proposed trout hatchery site in village Dechenthang (Lat 28.63197, Long 94.07913, altitude 1997 m) for the establishment of a trout hatchery by the Department of Fisheries, Govt. of Arunachal Pradesh under the assistance of ICAR-DCFR, Bhimtal.

Proposed site for centre of excellence

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The team also visited village Dechenthang (Lat 28.63197, Long 94.07913, altitude 1997 m) where a trout hatchery was proposed to be establishedby the Department of Fisheries, Govt. of Arunachal Pradesh with the assistance of ICAR-DCFR, Bhimtal. The site had ample fresh water supply from a nearby rivulet and Sri Pema Onge, one of the beneficiaries was donating around six acres of land for the establishment of a hatchery.

Proposed site for trout hatchery in village Dechenthang

10.8 Training Programme on "Entrepreneurship development on ornamental fish breeding and culture"

A training programme on "Entrepreneurship development on ornamental fish breeding and culture" was organised under NEH activity by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal in collaboration with the Department of Fisheries, Government of Tripura at Lembucherra Fish Seed Centre, Agartala, Tripura. Sri Mevar Kumar Jamatia, Hon'ble Minister of Fisheries, Government of Tripura inaugurated the programme as the Chief Guest.Sri Dilip Kumar Chakma, Director of Fisheries, Tripura and Dr Pramod Kumar Pandey, Director, ICAR-Directorate of Coldwater Fisheries Research, Bhimtal also graced the occasion.

Hands-on training was provided to 20 participants by the scientists from ICAR-DCFR Mr. Abhaya K. Giri and Dr Pragayan Dash in making of aquarium besides providing basics of culture and breeding of ornamental fish. The participants were provided inputs for making of new aquariums like glass for aquarium (5mm thickness) size: 2.0 x 1.0 ft each (3 nos. per aquarium/ person); glass for aquarium (5mm thickness) size: 1.0 x 1.0 ft each (2 nos. per aquarium/person); silicon tube glue (280 ml); silicon gun; glass thermostat (100 watt); Power head (15 watt); aquarium cover (fibre); marble stone (8 mm/10 kg. per bag); Hand net (6"); back poster (both side 2 x 1ft); plants (8"); PVC pipe (20 mm) 20 ft; Siphon pipe set; Masking tape (20 m); PVC L Bow (20 mm); PVC T (20 mm); diamond knife, training kit and training manualwere distributedamong the 20 participated fish farmers of the area. The programme was coordinated by Dr Amit Pande, Principal Scientist, and Dr R. S. Haldar Chief Technical Officer.

10.9 Training Programme on "Best management practices on trout culture"

A training programme on "Best management practices on trout culture" was organised under NEH activity by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal in collaboration with the Department of Fisheries, Government of Arunachal Pradesh at Convention Centre, Mechuka, Shi-Yomi district (Arunachal Pradesh). In total 78 persons were present during the training. The programme was inaugurated by Mr. Mito Dirchi, Deputy Commissioner, Shi-Yomi district as Chief Guest. Mr. Jaysil Taba, Director of Fisheries, Govt. of Arunachal Pradesh was present as Guest of Honour.

During the technical programme, power point presentation was delivered by Dr Amit Pande and Dr R.S.Haldar and "Best management practices of rainbow trout farming" were discussed at length including the selection of site, construction of raceways, identification of male-female brooders, breeding of trout, hatching, feeding of larvae to adult, water management, etc. The training programme was coordinated by Dr Amit Pande, Principal Scientist, and Dr R. S. Haldar Chief Technical Officer.

Mr. Mito Dirchi, Deputy Commissioner, Shi-Yomi district addressing the participants.

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11. Scheduled Caste Sub Plan (SCSP) Activities

The programme conducted by ICAR-DCFR under the Scheduled Caste Sub Plan (SCSP) component are mentioned below

During the period, total seventeen orientations cum farmers' fair/trainings /mass awareness /field demonstrations /scientist- farmers interactions meet were organized in Nainital, Almora Chamoli and Bageshwar District of Uttarakhand involving total about 704 SC farmers. Brief detail is presented in table (1). All together, about 329 SC farmers were given critical input support in form of pelletted trout and carp feed (17,780 kg), trout and carp fingerlings (45,400nos.), therapeutic medicines (556) water analysis kits (371) etc. The detail is presented in Table-2. Under prevailing Covid 19 pandemic and restricted movement, routinely about 131 Scheduled Cast fish farmers of four districts of Uttarakhand received technical and inputs support from the directorate. The technical and other possible supports were extended to flood affected SC farmers of Chamoli and Nainital to minimize theeir loss. Frontline demonstration on rainbow trout farming in raceways, carp polyculture in midhill polylined tanks, rearing, breeding and seed production of ornamental fishes, production trials with grass carp as a major species, pelleted feed based carp farming and fingerlings/juveniles stocking for achieving better growth, survival and production.

11.1 Training cum awareness program organized under Scheduled Cast Sub Plan (Jan-Dec., 2021)

Sl. No.	Date	Village/ Place/ District	Topic	Nos. of participants/ beneficiaries attended
1.	17-18. 03.2021	Bhimtal, Nainital	Orientation cum Kisan Mela	90
	13.04.2021	Harinagar, Bhimtal, Nainital	Management measures for carp seed stocking	60
2.	18.06.2021	Bhimtal, Nainital	Fish farming and Demonstration on soil testing during Balanced use of fertilizers in aquaculture	12
3.	29.06.2021	Harinagar, Bhimtal, Nainital	Upkeep and maintenance of carp ponds	18
4.	02.07.2021	Harinagar, Bhimtal, Nainital	Demonstration On control of fish diseases	12
5.	10.07.2021	Bhimtal, Nainital	Health and hygiene maintenance in aquaculture	35
6.	29.07.2021	Nai, Bhumka Okhalanda, Nainital	Sensitization of villagers towards fish farming	30
7.	28.08.2021	Nai, Bhumka, Okhalanda, Nainital	Carp farming techniques	98
8.	17.09.2021	Bhimtal, Nainital	Awarness on integarted fish farming	32
9.	24.09.2021	Bhimtal, Nainital	Awareness on coldwater aquaculture	38
10.	28.09.2021	Bhimtal, Nainital	Farmers'-Scientists'-Interaction session on climate resilient fish farming	42
11.	28.10.2021 30.10.2021	Harinagar, Bhimtal Nainital	Training on Carp pond management measures	18
12.	20.12.2021	Sukada village Almora	Goshti and Interaction meet on carp faming for livelihood organized	61
13.	21.21.2021	Chachai, Kapkot Bageshwar	Goshti and training on trout and carp farming in Bageshwar	52
14.	23.12.2021	Bairgana trout hatchery, Chamoli	Goshti and training on rainbow trout breeding for seed production and raceways management	60
15.	25.12.2021	Urgam village, Joshimath, Chamoli	Training cum awareness program on rainbow trout farming for livelihood and nutrition	18
16.	29.12.2021	Harinagar, Bhimtal, Nainital	Awareness program at Harinagar and farmers tanks visit	28
			Total	**704**

11.2 Input distributed to SC beneficiaries

Sl. No.	Date	Area covered	Feed	Total quantity In kg	Water analysis Kit Nos.	Medicine packets	Seed nos. C/T/O**	Nos of farmers
1.	13.04.2021	Harinagar	15 bags @40kg/bag	600	-	10	5700 (c)	36
2.	02.07.2021	Harinagar	8 bags @40/bag	320			2500(T)	6
3.	10.07.2021	Bhimtal, Ramgarh	30 bags @40kg/bag	1200	30	20	2000 (c)	26
4.	29.7.2021	Bhumka, Okhalanda	02 bags@ 40kg/bag	80	50	40	2000 (c)	30
5.	15.08.2021	Almora	80 bags@ 40kg/bag	3200	50	10	1500(c)	28
6.	17.08.2021	Sarna, Padampuri	10 bags @40kg/bag	400	30	4	-	10
7.	17.08.2021	Pithoragarh	40 bags @40kg/bag	1600	50	10	-	20
8.	24.08.2021	Chamoli	40 bags @40kg/bag	1600	50	10	-	22
9.	25.08.2021	Harinagar	22 bags @ 40kg/bag	880	20	20	12800 c	22
10.	28.08.2021	Bhumka, Nai	25bags @40kg/bag	1000	60	22	15,000(c)	22
11.	29.08.2021	Pauri	40bags @40kg/bag	1600	50	10	-	23
12.	08.10. 2021	Ramgarh	12bags @40kg/bag	480	50	5	2500(c)	8
13.	27.11.2021	Harinagar, Bhimtal	-	-	-	-	400 (O)	21
14.	20.12.2021	Almora	40bags @40kg/bag	1600	40	80	-	40
15.	21.12.2021	Chachai, Bageshwar	40bags Carp feed & 4 Trout feed bags @40kg/bag	1680	86	100	-	34
16.	23.12.2021 & 2512.2021	Fish feed distribution to Chamoli fish farmers	20 Carp feed bags @40kg/bag 37 trout feed bags @20kg/bag	1540	20	40	-	23
		Total	424 Carp pelleted feed bags & 41 trout pelleted grow out feed	17,780	556	371	45,400	329

C= Carp; T = rainbow trout ; O = Ornamental fish



Interaction cum input distribution programe organised at Bairgana, Chamoli for SC fish farmers during 22-23.12.2021


Carp Fingerling stocking in Harinagar area

SC farmers at Bairgana Chamoli receiving feed, water analysis kits and medicines packs


Interaction and feed distribution meet with SC farmers at Chachai village in Kapkot block of Bageshwar on 21.12.2021


Transportation of carp and trout through horses to remote village in Kapkot block of Bageshwar on 21.12.2021

11.3 Propagation of cluster based carp farming in Harinagar SC village

Harinagar village near Bhimtal is situated in a steep hill and about 7-10 km away from the main city. Most of the male villagers are daily wage workers and women are involved in agriculture and livestock activities. The village is dominated by Schedule Cast population. The perennial outgoing Bhimtal Lake water channel also known as Ghatigar, offer good scope for small scale fish farming. To tap this available resource in more scientific way for uplifting the socioeconomic conditions of the resident population, a group of Harinagar farmers were adopted under SCSP program. Presently there

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are total 27 beneficiaries in the cluster. The average tank area varies between 50-200 sq m (total 40 tanks). Before adoption of the these tanks, field survey revealed that embankments were damaged with seepage problem and average fish yield in culture duration of 12-18 months ranged between 150 g-280g/sqm(15kg-28 kg/100sqm). With the scientific interventions including regular technical assistance and guidance for better upkeep of pond embankment, water depth and water quality, good quality carps fingerlings stocking, providing regular pelletted feed to fish and utilizing local resources for better disposal of carp produce, improved results have been achieved. Fish growth and production showed significant increase. An average production ranging from 600-1000 g/sq m during the same duration has been achieved thereby increasing income from Rs 8-12,000 to 35-40,000/ 100 sq meters per tank. Better growth and income is motivating fish farmers towards fish farming and few more tanks are under construction. However, during the reporting period due to excessive flooding, six adopted fish farmers also lost their fish tanks and stock. To minimize the loss critical input support like water pipes and seed are being provided under SCSP scheme.


Cluster based carp farming in Harinagar, Uttarakhand


A new initiative for doubling income through Ornamental fish stocking in carp polyculture pond in Harinagar cluster

11.4 Training cum input distribution program at village Bhumka - Nai, Nainital under SCSP

Under Schedule Cast Sub Plan training cum critical input distribution program was organized at village Nai, Bhumka on 28 August, 2021. The remote village is located in Okhalkanda block of Nainital district at an altitude of 6180 feet above mean sea level with latitude and longitude of N-29' 22" 328, E 079' 45'' 92. A walking distance of about 5.0 km from the road has to be covered before reaching to village. Bhumka is a SC dominated, blessed with unique landscape with full of rich land and aquatic resources, and about 250 families are residing. A cluster of potential twenty three fish tanks in size range of 40-200 sq meters is available in village. The village has been selected on 29.07.2021 after first visit for undertaking fish farming activities under SCSP scheme of the direct.

During the program villagers were sensitized towards fish farming and scientist discussed about the basic farming techniques suitable for the area, PMMSY and ongoing directorate SCSP scheme for the welfare and upliftment of SC farmers. Farmers were encouraged for integrated fish farming, ornamental fisheries and value addition along with carp polyculture. With an objective to provide direct benefit to farmers, total about 15,000 fingerlings, pelleted carp feed 25 bags each with 40 kg packing (total 1000kg) along with water quality monitoring kits for 10 parameters and KMnO4 packets as fish and pond disinfectant were distributed to 23 SC fish

farmers. The transportation of inputs from road to village was carried out with the help of horses. A scientist farmer's interaction meet was also arranged to address the farmer's quarries. Live demonstration on application of feed, and disinfectants and fish pond water analysis was given to participants. Total 98 villagers including students, Gram Pradhan, public representative and 45 perspective farmers were present in the meeting. The Program was carried out under the guidance of Director Dr Pramod Kumar Pandey and coordinated by Dr Suresh Chandra, Principal Scientist & Nodal Officer SCSP and Ritesh S.Tandel, Scientist & Co-Nodal officer, SCSP.

ICAR-DCFR Scientist interacting with farmers

11.5 Three days Training-cum-Awareness program organized

Under the SCSP scheme, a three days Training cum Awareness Program was organized during 28-30 October, 2021 to sensitize the SC fish farmers of Dungsil and Hari Nagar area on "*Management Measures for Carp Culture Ponds"*. A cluster of potential twenty two fish tanks in the size range of 50-100 sq meters is available in the Harinagar village. The village has been selected under SCSP scheme of the directorate for undertaking fish farming activities. On first day farmers were informed about the hill fish farming, species suitable for the area, measures to be taken before collecting and stocking the ponds with fish seed, their growth potential and on judicious use of water and other inputs to reduce the fish production cost. On second day farmers were taken to a fish pond and demonstration on seed stocking, feeding, health monitoring was undertaken. Quarries of fish farmers were also addressed at the pond site. On third day farmers were exposed to water quality monitoring, seed stocking, feeding, and marketing and health management techniques. A special session was arranged for the affected fish farmers on how to save and minimize the fish tank and fish loss during the natural calamities as experienced during 17-19 October, 2021. It was informed that about 8 fish tanks of Harinagar area were completely washed away and fish loss in other 13 fish tanks was reported by adopted SC fish farmers. During the discussion an evaluation in terms of standing fish crop loss was estimated and found that about 550 kg of fish washed away costing to Rs 1.13 lakh from the 21 fish tanks. Completely damaged 8 fish tanks @ Rs 75,000/ tank along with 13 minor danged fish tanks @20,000 in size range of 50-100 sq meter together is estimated to Rs 8.6 lakh with total revenue loss to a tune of Rs 9.73 lakh due to incessant rain that took place during 17-19 October,2021 has been reported.

Scientist–farmer's interaction

A scientist-farmer's interaction meet was also arranged to address the farmer's quarries and measures to be adopted to save the pond during natural calamities. Live demonstration on application of feed, and disinfectants and fish pond water analysis was given to participants. Total 31 villagers attended the training. For measuring total dissolved solids and water temperature TDS meter was also distributed under SCSP.

The Program was carried out under the guidance of Director Dr P.K. Pandey and coordinated by Dr Suresh Chandra, Principal Scientist & Nodal Officer SCSP. Ms. Rashmi Rautela, Sr. Fisheries Inspector, Uttarakhand State Fisheries Department and in- charge Harinagar also delivered talks on Govt. schemes under PMMSY and also interacted with fish farmers during the training programe. The programe ended with farmer's feedback.

11.6 Socioeconomic upliftment of Scheduled Caste community of Thekeraguri village, Nagaon & Morigaon district, Assam through scientific fish farming and fish based ecotourism interventions

The Project "Socioeconomic upliftment of Scheduled Caste community of Thekeraguri village, Nagaon & Morigaon district, Assam through scientific fish farming and fish based ecotourism interventions" was implemented by ICAR-DCFR, Bhimtal and College of Fisheries, AAU, Raha under the Scheduled Caste Sub Plan Programme at Thekeraguri village, Nagaon & Morigaon district in the year 2021. The project benefitted 720 numbers of SC beneficiaries of the village. Socioeconomic upliftment of the SC population of the village was facilitated by Scientific fish farming interventions of the project. A total number of 160 SC beneficiaries of the village were trained on different aspects of Scientific Fish culture through a series of 4 Skill development training programme organised during 5th October 2021 to 21st October 2021. Experts from different fields of Fisheries Science and Veterinary Science conducted theory and practical classes for the trainees. A training manual was also developed and distributed for benefit to the trainees during the training programmes.

FRP fish watching boats

Training programme organized

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Demonstration on Scientific Fish Farming was conducted to provide hands-on practical exposure to the villagers on Semi-intensive carp culture. A total of 36 beneficiaries having total fish ponds area of 3.5 ha were covered under scientific fish farming in pond culture systems. Successful demonstration of semi-intensive carp culture showed doubling of fish production at farmers' pond from 200-250 kg/bigha to 500 – 548 kg/bigha during this programme. Two community fish ponds of the village were also renovated and semi-intensive carp culture demonstration was successfully carried out in these ponds under this project.

For enhancing additional income of the people of the Thekeraguri village, an eco-tourism unit was developed at 48 no. Thekeraguri *beel* under this project. A total of 9 nos. of unutilized FRP boats were repaired and made available for that purpose as a part of this programme. A fish watching deck facility was developed for ecotourism purpose. Cage culture demonstration was also conducted in a battery of 4 GI cages in 48 no. Thekeguri *beel* as an intervention of this programme. For providing supplementary livelihood support to the beneficiaries Scientific Duck farming inputs like Ducklings (Variety Khaki Campbell), Duck Feed, Medicine etc. were distributed along with technical support during this programme. The program was co-ordinated by Dr Debajit Sarma, Dr D.Baruah and Dr R.S.Haldar.

11.7 Rural Livelihood and Socio-Economic improvement among Scheduled Caste population of Nagaon district, Assam by adapting to scientific interventions in fish farming practices

A collaborative programme was undertaken by ICAR-DCFR with Nowgong Girls' College, Nagaon (Assam) on "Rural Livelihood and Socio-Economic improvement among Scheduled Caste population of Nagaon district, Assam by adapting to scientific interventions in fish farming practices". Three villages namely Rangalumukh, Lomati and Sukotipota were visited under Tulshideuri Gaon Panchayat belonging to Pakhimoriya Development Block of Nagaon district, Assam. The study villages are licated between latitude 26ª21954' N to 26ª22935' N and longitude 92ª67506' E to 92ª68668' E. It is also known that all residents of the villages belong to Schedule Caste community only and in which 40 fish farmers were selected for the implementation of the project. During the period a two days capacity building programme was organized in the Rangalumukh LP School. Almost all the selected farmers participated the two days workshop. The participants were imparted the basics of fishery and integrated fish culture in the workshop. The participating farmers were trained to culture fish in their small pons using quality seeds and feed along with requirement of various inputs. A booklet has been prepared in vernacular language for all the selected farmers as training materials which is expected to immensely benefit the farmers of the area. The inputs like quality fish seed, feed, fertilizer, lime, fishing gears, ducks etc were distributed among the selected fish farmers under the project. The programme was coordinated by Dr R. S. Haldar, Chief Technical Officer of this Directorate with the Nowgong Girls' College.

Selection of beneficiaries

Input distribution programme organized

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11.8 Two days Orientation Workshop cum Farmers' Meet and Kisan Mela at ICAR-DCFR

Two days Orientation Workshop cum Farmers' Meet and Kisan Mela was organized during 17-18th March, 2021 under the SCSP activity of this Directorate. All about 150 Scheduled caste Fish farmers participated in the programme from different parts of Uttarakhand state. Shri Arvind Hayanki, Commissioner, Kumaun Region, Uttarakhand state graced the occasion as Chief Guest. Shri Bashir Bhatt, Director, Department of Fisheries, Govt. of Jammu and Kashmir; Dr A.K.Singh, Former Director, ICAR-DCFR, Bhimtal; Dr R. S. Chauhan, Dean, College of Fisheries, GBPUAT, Pantnagar; Shri Amit Tandon, Growel Feeds Pvt. Ltd, Andhra Pradesh was also present in the said programme as a Guest of Honour. During the occasion awareness cum training programme was organized to the SC fish farmers. Hands on training on fish value added products like fish cutlet, fish pickle preparation training was also organized for the benefit of the fish farmers. A quiz competition was also organized among the farmers. During the end of the programme fish feed (Carp feed and trout feed), water testing kit, $KMnO_4$ etc. were distributed among all the SC farmers present here. For the overall benefit of the farmers ICAR-IVRI, Mukteswar, ICAR-CITH, Mukteswar, ICAR-VPKAS, GB Pant Institute of Himalayan Environment & Development, Almora also participated.

Address by Shri Arvind Hayanki, Commissioner, Kumaun Region, Uttarakhand

Farmers' participation and display of exhibition

Distribution of inputs to the farmers during Kisan Mela

11.9 Hands-on training programme on ornamental fish culture for livelihood upliftment" under Scheduled Caste Sub Plan (SCSP) at EFF, Champawat

Hands-on training programme on ornamental fish culture for livelihood upliftment" under

Scheduled Caste Sub Plan (SCSP) was organised at Experimental Fish Farm, Champawat on 8th November, 2021 Total number of 30 farmers participated from various villages of Champawat such as Mudiyani, Furkiyajhala, Chauki, Narsinghdanda, Poth, Thulakot and Pati, among them 5 were women and 25 were men. In the end 10 seeds of ornamental fishes were distributed to each farmer present in programme.

11.10 Other activities under SCSP

- Visit to 10 adopted SC farmers raceways in Urgam, Chamoli on 24-25 December, 2021. About 24 rainbow trout raceways each with 20x2 m. owned by 10 SC farmers of Urgam in Joshimath were provided regular input and technical support under SCSP

- First time stocking of rainbow trout advance fry in Sri Hem Chandra fish tank, a progressive SC fish farmer of Bhimtal are and view of his carp farm.

- Pelleted feed distribution to SC fish farmers of Almora district on 20.12.2021.

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12. Training and Capacity Building

12.1 Training cum awareness programme on "Integrated Coldwater Fish farming"-under PMKVY at EFC, Champawat

Under outreach cum extension training programme of this Directorate, one day training cum awareness programme on "Integrated Coldwater Fish farming" was organised by Experimental Fish Farm, ICAR-DCFR, on 21st January, 2021 at village Chowki, Champawat. A total of 125 participants including the active fish farmers, entrepreneurs, students, fisheries department officials were present in the programme. A detailed lecture on the topic 'Integrated Coldwater Fish farming' was delivered by Mr Kishor Kunal, Scientist wherein prospects and challenges of integrated Coldwater fish farming was discussed with the participants. Mr Parvaiz Ahmad Ganie, Scientist addressed the gathering about the activities carried out by the farm and the role of ICAR-DCFR in promoting Coldwater fish farming in the hill sates of the country. Mr Sanjeev Kumar, District Fisheries development officer, Department of Fisheries, Uttarakhand gave detailed information about the terms and conditions of PMMSY along with other fisheries schemes. The programme concluded with a vote of thanks by Mrs. Garima, Scientist. The programme was coordinated and conducted by Mr Kishor Kunal, Scientist, Mr Parvaiz Ahmad Ganie, Scientist, Mrs Garima, Scientist of EFF, ICAR-DCFR, Champawat. Mr Hansa Dutt, Technical officer and other supporting staff of the EFF, ICAR-DCFR, Champawat were also present in the programme.

Participants in the training cum awareness programme

12.2 One day virtual training on Recirculating Aquaculture System

ICAR-DCFR, Bhimtal conducted Virtual Training on "Recirculating Aquaculture System for Intensive Farming of Rainbow Trout" on 29th January, 2021 which was attended by 525 number of participants including entrepreneurs, farmers, state officials, scientists, consultants and students. The programme was coordinated by Rajesh M and Biju Sam Kamalam. Debjit Sarma, Director (Act) delivered introductory remark and followed by special remarks by J. K.Jena, DDG (Fy). Rajesh M. delivered a training lecture on the practical aspect of RAS, its basics, component, design and economic feasibility while Biju Sam Kamalam provided standard operating protocols to be followed to reduce the risk factors in operating of RAS and N. N. Pandey briefed about importance of RAS for rainbow trout farming and also delivered vote of thanks.

12.3 Hands-on training on molecular biology techniques in DNA barcoding

Under network programme "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",

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal has organised six days hands on training on "Molecular Biology Techniques in DNA Barcoding" from 1 to 6th March 2021. This training was organised for seven young professionals of four partner institutes from north-east states of College of Fisheries, Raha, Assam; D.M. University, Manipur; Manipur University, Manipur and St. Anthony's College, Shillong, Meghalaya.Under this training programme, trainees were given the exposure of isolation of DNA from fish samples, PCR, agarose gel electrophoresis, sequencing procedure, bioinformatic analysis of sequence and habitat mapping. This programme was coordinated by Dr Debajit Sarma, Dr Neetu Shahi, Dr R.S. Haldar, Mr Sumanta Kumar Mallik and Mr. Parvaiz Ahmad Ganie.

Participants in the Hands-on training on molecular biology techniques in DNA barcoding

Certificate distribution to the participants of the traning

12.4 Training programme on Recirculating Aquaculture System to the government officials

ICAR-DCFR, Bhimtal conducted hands on training programme for officers from department of fisheries Himachal Pradesh, on Re-circulating Aquaculture System during 4-7th April, 2021. The programme was attended by three deputed officers from departments of fisheries Himachal Pradesh. The training included the lecture series on basics, components, design aspect of RAS and practical demonstration of the operation and the SOP in RAS followed by hands on training in water quality analysis and interpretation. Certificates were issued to the participants after the completion of the training. The programme was coordinated by Rajesh M and Biju Sam Kamalam, and assisted by Anupam Pandey, Vignesh and Varun.

Practical demonstration to the trainee

12.5 One day virtual training on Recirculating Aquaculture System for aquaculture entrepreneurs

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal organized one day online training for entrepreneurs on *"Recirculating Aquaculture System for Intensive Farming of Rainbow Trout"* during 17th Sept, 2021. The programme was attended by nearly hundred participants. Pramod Kumar Pandey, Director, ICAR-DCFR, delivered introductory remarks. Rajesh M and Biju Sam Kamalam deliberated various aspects of recirculating aquaculture system, such as basics, components, design, economics, SOP and risk management systems. Debajit Sarma briefed about importance of RAS for hill aquaculture and the programme ended with good interaction session between the participants and the resource persons. The programme was co-ordinated by Rajesh M. and Biju Sam Kamalam.

Virtual training programme on Recirculating Aquaculture System

12.6 Training on 'Best management practices for rainbow trout farming in Ladakh'

Under the Tribal Sub-Plan scheme, the ICAR - Directorate of Coldwater Fisheries Research organised atraining on 'Best management practices for rainbow trout farming in high altitudes' at the Chuchot government trout farm, Leh, on 27th November 2021, in collaboration with the Department of Fisheries, Leh, Ladakh. Nearly 50 tribal farmers and fisheries department officials participated in the training. Mr. Ghulam Mehdi, Executive Councillor for Fisheries and Minority Affairs, LAHDC, Leh; Dr Mohammad Iqbal, Chief Animal Husbandry Officer, Ladakh; Mr. Mirza Hussain, Councillor, Chuchot; and Mr. Mohammad Amin Lone, Assistant Director of Fisheries, Leh graced the occasion. During the training, Dr Biju Sam Kamalam and Dr Rajesh, M.presented and explained various critical aspects of rainbow trout farming such as production system design, water quality monitoring, feed management, grading, cleaning, health management, record keeping and production economics to the gathering. On the occasion, the tribal farmers were also provided rainbow trout feed developed by ICAR-DCFR in collaboration with Growel Feeds, to support production cycle in one raceway. This training was coordinated by Dr Biju Sam Kamalam, Dr Rajesh, M. and Dr R.S. Patiyal.

12.7 Virtual training on 'Rainbow trout nutrition and feeding'

The ICAR-Directorate of Coldwater Fisheries Research organized a virtual training on 'Frequently asked questions (FAQs) on rainbow trout nutrition and feeding' for farmers, fisheries officials and other stakeholders, on 4th December 2021. The training was attended by nearly 70 participants from Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Ladakh, Tamil Nadu and Kerala. The training commenced with the introductory remarks of Dr Pramod Kumar Pandey (Director, ICAR-DCFR), wherein, he emphasized on the economic significance of feeds and feed management in rainbow trout farming. Following that, a team of scientists from the Directorate shared and discussed various practical aspects of rainbow trout nutritional requirement, feed preparation, diet composition, feed

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types, feeding schedule and feed management strategies based on field observations, farmers' queries and feed manufacturers' inputs. At the end of the program, farmer representatives from Himachal Pradesh, Jammu & Kashmir and Sikkim shared their positive feedback and experience of using ICAR-DCFR developed rainbow trout feeds, in partnership with Growel Feeds Pvt. Ltd. Andhra Pradesh. This training was coordinated by Dr Biju Sam Kamalam, Dr Rajesh, M., Dr Prakash Sharma and Dr N.N. Pandey.

12.8 Virtual training program on "Use of Histological Tool in Aquaculture and Fisheries Research

A virtual training program on "Use of Histological Tool in Aquaculture and Fisheries Research" was organized on 15th December 2021. In this training programme Dr Prakash Sharma delivered a detailed lecture on basics, methods and spatial use of histology in fisheries and aquaculture, using images from previous research and case studies, and actively answered queries raised by the participants.

Participants in the virtual training programme

12.9 Other Trainings / Capacity building programme / Webinars conducted

- A.K. Giri and R.S. Patiyal organized one day training program for the livelihood security and economic upliftment of the tribal fish farmers at village Danpur, U.S. Nagar, Uttrakhand on 1st February, 2021. Shri Bishan singh, Gram Pradhaan of village Gadarpur including 19 tribal farmers from three blocks *viz* Bajpur, Sitarganj and Gadarpur of U.S. Nagar participated in the programme.
- A.K. Giri organized One day Training and feed distribution program under TSP at vill-Darlak, Distt.-Mamit, Mizoram on 13.04.2021 where 62nos. of tribal fish farmers were participated. During the program, 10 tons of carp feed were distributed to the participated farmers.
- A.K. Giri organized two days Orientation-cum-Training and input distribution programme under TSP at the premise of KVK, Ri-Bhoi on 09.04.2021 and 15.04.2021 for the fish farmers of vill-Madan Nonglakhiat and vill-Poham Shkem respectively where 50nos of tribal farmers, 25nos. from each of the villages participated. During the programme, inputs like fish seed, 10 tons of carp feed, lime and nets were distributed to the farmers.
- A.K. Giri organized Two days Training and capacity building programme under TSP for the tribal fish farmers of vill-Pangu and vill-Dugtu of Dharchula block of Pithogarh, Uttarakhand on 17.06.2021 and 18.06.2021 respectively. 25 tribal fish farmers of vill-Pangu and 40 farmers of vill- Dugtu had taken part in the programme.
- A.K. Giri organized two days Training and Field demonstration programme at vill-Kohima, Nagaland during 29-30 January 2021 under TSP, where 30nos. of tribal fish farmers participated.
- Amit Pande Coordinated a webinar on the occasion of Rastriya Ekta Diwas on "Sardar Bhai Patel: An Architect of United India" on 31st October, 2021.
- Dimpal Thakuria, K Victroria Chanu R.S.Tandel, and Pragyan Dash organised campaign on the theme of "Agriculture and Environment: the citizen face" to commemorate "AzadikaAmritMahotsav", by interacting with school of children Government High School, Sattal Road, Mehragaon, Bhimtal, District Nainital, Uttarakhand on 26.11.2021.
- Kishor Kunal conducted one day training programme on "Integrated Coldwater Fish Farming" at Chauki, Champawat on 21st January, 2021.
- Kishor Kunal conducted training programme for the job role Freshwater Aquaculture Farmer for 20 farmers from Champawat, Uttarakhand from 08.03.2021 to 16.03.2021 as a certified Master Trainer (ASCI).
- Kishor Kunal organized and conducted thirty one (31) days orientation training programme for Dr S Arul, Scientist and Ms Garima from 01.03.2021 to 31.03.2021 at EFF, Champawat. (F.no. 1-1(30)/Office Order/2010 VOLII-411 dated 25.02.2021)
- N.N. Pandey conducted collaborative awareness cum training programme on scientific fish farming by college of fisheries Raha AAU, KVK Lakhimpur and ICAR-DCFR, Bhimtal on 28th November, 2021 at Lakhimpur (Assam) with participation of 50 farmers under SCSP programme.
- N.N. Pandey conducted three days hands-on training on "coldwater fish farming" and distributed water analysis kits to 17 SC farmers at village Harinagar, Saladi during 28-30 October, 2021 under SCSP activity.
- Amit Pande, Pragyan Dash, A.K. Giri and R.S. Haldar conducted three days hands-on training on "Entrepreneurship development in ornamental fish breeding and culture" at Fish Seed Centre, Dept. of Fisheries, Govt. of Tripura, Lembucherra, Agartala during 11-13 November, 2021 under NEH activity.

- Amit Pande and R.S. Haldar conducted training for 66 farmers/ departmental personnel on "Best management practices of Rainbow trout" in collaboration with the Department of Fisheries, Government of Arunachal Pradesh at Convention Centre, Mechuka.
- N.N. Pandey organized HRD training on "Draft Writing, Editing and Presentation Skill" at ICAR-DCFR during 31st Aug. 2021 to 2nd September, 2021 with participation of 40 staff members/ students.
- N.N. Pandey organized online training on "FAQs on rainbow trout nutrition and feeding" with participation of 65 trout growers of five hill states.
- N.N. Pandey organized virtual training on re-circulatory aquaculture system for rainbow trout farming with 261 registered participants including international participation from Indonesia, Bangladesh and Spain.
- N.N. Pandey organized virtual training on snow trout breeding for Himachal Pradesh farmers and state fisheries department officials on 8th September, 2021.

- Prakash Sharma and R.S.Tandel conducted international webinar on Fish reproduction on 22 January 2021
- R.S Patiyal conducted a webinar/ virtual training on RAS for rainbow trout on 29th Jan. 2021.
- R.S. Patiyal organized 2 days Orientation workshop and Klisan mela progranmm under TSP/ SCSP activities at ICAR-DCFR Bhimtal on dated 17-18 March, 2021.
- R.S. Patiyal organized webinar meet with Aggrinnovate, Techno Commercial Assessment to develop standard forms for the ICAR-DCFR Technology on 17th February, 2021 at DCFR Bhimtal.
- R.S. Patiyal organized a demonstration program on the breeding and culture of rainbow trout at remote area Munshyari in collaboration with Dept. of Fisheries, Pithoragarh, UK during 4-6 February 2021.
- R.S. Patiyal organized by One day Training program on Livelihood security and economic upliftment of the tribal fish farmers at village Danpur, U.S. Nagar, Uttarakhand on 1st February, 2021.
- R.S. Patiyal organized exposure visit of B.Sc. (Ag) student of Banaras Hindu University.
- R.S. Patiyal coordinated A training on 'Best management practices of rainbow trout farmingat high altitude' was organized at Chuchot Govt farmin collaboration with Leh Fisheries Department on December 2021
- R.S. Patiyal coordinated One day Training and feed distribution program at vill-Darlak, Distt.-Mamit, Mizoram on 13th April, 2021.
- R.S. Patiyal coordinated Two days Orientation cum Training and Input distribution programme at the premise of KVK, Ri-Bhoi on 9th April, 2021.
- R.S. Patiyal coordinated Two days Training and capacity building programme for the tribal fish farmers of vill-Pangu and vill-Dugtu of Dharchula block of Pithogarh, Uttarakhand on 17-18th June, 2021.
- R.S. Patiyal coordinated Two days Training and Field demonstration programme at vill-Kohima, Nagaland during 29-30 January 2021.
- R.S.Tandel, Pragyan Dash Prakash Sharma and Raja Aadil Hussain Bhat organised Awareness on utilization of organic wastes and the generation of wealth from the waste at village Suryagaon, Bhimtal, Distt. Nainital, Uttarakhand under Swachhta Pakhwada on 20.12.2021
- S. Ali, R.S. Tandel and N.N. Pandey organized expert talk being on "Strategies for doubling farmer's income in the hill region: Technological options" by an eminent speaker Prof. M. Premjit Singh, Former Vice-Chancellor, Central Agricultural University, Imphal on 3rd July, 2021under Azadi Ka Amrut Mahotsav celebrations.
- S. Ali, R.S. Tandel and N.N. Pandey organized talk on 'Agricultural Transformation for Nutritional Security' delivered by Padma Bhushan Dr Ram Badan Singh on the occasion of Azadi Ka Amrut Mahotsav' on 7th August 2021.
- S. Ali, R.S. Tandel and N.N. Pandey organized talk on "Diversification in Aquaculture" by Prof. A.P. Sharma, Former Director, ICAR-CIFRI, Barrackpore, on the occasion of Azadi Ka Amrut Mahotsav' on 1st September, 2021
- S. Ali, R.S. Tandel and N.N. Pandey organized talk on "Food and Nutrition for Farmers" by Prof. R.S. Chauhan, Dean, College of Fisheries, G.B. Pant Univ. of Agri. & Tech, Pantnagar, UP, on the occasion of Azadi Ka Amrut Mahotsav' on 26th August, 2021.

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12.10 Lectures/Talks delivered

- Amit Pande delivered a talk on "जलवायु अनुकूल कृषि" during the Scientists-Farmers' interface on climate resilient agriculture" on 28th September, 2021.
- B.S. Kamalam and Rajesh, M. delivered a talk on 'Best management practices for rainbow trout farming in high altitudes' for tribal farmers during the ICAR-DCFR TSP training program organised in Leh, Ladakh, on 27th November, 2021.
- B.S. Kamalam delivered a talk on 'Importance and contribution of fish in human nutrition' for the students of Green Mount Global School, Kwerali, during the commemoration of World Food Day, on 16th October, 2021.
- B.S. Kamalam delivered a talk on 'Nutrition and feed management in rainbow trout farming' during the international webinar on Recent advances in coldwater fish farming technologies, jointly organised by the Ministry of Fisheries, Animal Husbandry & Dairying, National Fisheries Development Board and ICAR-DCFR, on 24th February, 2021.
- B.S. Kamalam delivered a talk on 'Standard operating procedures of recirculating aquaculture systems' during the PMMSY virtual training programme on Recirculating Aquaculture System for intensive farming of rainbow trout, organised by ICAR-DCFR, on 29th January, 2021.
- B.S. Kamalam delivered a talk on 'Standard operating procedures of recirculating aquaculture systems' for fisheries department officials of Himachal Pradesh, as part of their hands-on training programme at Bhimtal during 4th-7th April, 2021.
- B.S. Kamalam delivered a talk on 'Standard operating procedures of recirculating aquaculture systems' during the ICAR-DCFR online training program on Recirculating Aquaculture System for intensive farming of rainbow trout, on 17th September, 2021.
- Debajit Sarma delivered talk as a Resource Person to the farmers and state fisheries officers organized by National Co-operative Development Corporation, Dehradun on 29th November, 2021 in presence of Minister of Fisheries, Govt. of Uttarakhand.
- Debajit Sarma participated and delivered talk in DISTF Agriculture and Technology Conclave, 2021 at Regional Science Centre, Dehradun on 28th November, 2021 "Diversification of aquaculture: Way Forward for Blue Revolution in Hilly Region".
- Kishor Kunal delivered a lecture on "Common diseases and their management in fishes" to the farmers and entrepreneurs in the training programme organised by SBI, RSETI, Champawat on 8th March, 2021.

- Kishor Kunal delivered a lecture on "Food and feeding management of fishes in aquaculture" to the farmers and entrepreneurs in the training programme organised by SBI, RSETI, Champawat on 8th March, 2021.
- Kishor Kunal delivered a lecture on "Water quality management in aquaculture" to the farmers and entrepreneurs in the training programme organised by SBI, RSETI, Champawat on 6th March, 2021.
- Kishor Kunal delivered a lecture on the topic "Rainbow trout farming: Avenues and opportunities in entrepreneurship development" and was felicitated as "Guest of Honour" in Indo-Bangladesh International Webinar on Aquaculture and Fisheries celebrating Fish Farmers Day on 10th July, 2021 organized by The Neotia University, Kolkata.
- Kishor Kunal delivered an invited lecture to 1st Year Master Degree student of Aquaculture Division, ICAR-CIFE Mumbai, on the topic "Practical learning and reflections on breeding and larval rearing of coldwater fishes" on 20th March, 2021.
- Kishor Kunal delivered an invited lecture to I year B.Tech. (Biotechnology) students of TNJFU, Chennai campus on the topic "Culture and breeding of Coldwater Fishes" along with virtually showcasing all the facilities available at ICAR-DCFR, Champawat on 24th March, 2021.
- Kishor Kunal delivered an online invited lecture to Bachelor Degree students of Neotia University, Kolkata, on the topic "Practical learning and reflections on breeding and larval rearing of coldwater fishes" on 18th September 2021.
- Pragyan Dash delivered a lecture to the students of govt. school on organic waste utilization under Swachhata Pakhwada activity at Surya gaon, Bhimtal, Uttarakhand on 20th December, 2021.
- Pragyan Dash delivered five lectures on Breeding and seed production of important ornamental fish, Setting up of breeding tanks, Feed preparation and aquarium management, Aquarium and under-gravel filter fabrication, and culture of infusuria in training programme of "Enterpreneurship development in

ornamental fish breeding and culture" at Lembucherra, Agartala, Tripura under 11-13th November, 2021.

- Prakash Sharma delivered a talk in an invited lecture series conducted by Aquatic and Fisheries Science Talk (AFS Talk 36)] on "Use of Histological Tools to Study Fish Biology: Application of Spatial Micro-Visual Approach" on 20th November, 2021.
- R.S. Patiyal delivered a lecture on" Prospectus of ornamental fish culture" during Prime minister farmers Interaction programme organised by ICAR-DCFR on dated 28th September, 2021.
- R.S.Patiyal delivered invited lecture on "breeding and conservation of coldwater fishes of India" during workshop on cutting edge technology in fisheries and aquaculture for food and national security (cetfaq-13-22 Dec. 2021) organised by PMFGR Center, ICAR-NBFGR Cochin on 14th December, 2021.
- R.S.Patiyal delivered a lecture on "IPR Issues in coldwater fisheries" during Review and Sensitization Workshop organised by ZTMU ICAR-CIFT Cochin on 8th October, 2021.
- R.S.Patiyal, delivered a invited lecture on" promotion of trout culture in remote tribal areas of district pithoragargh at Dugtu village Orgonised by district administretion Pithoragarh on 17-18th June, 2021.
- Raja Adil H. Bhat delivered five lectures on Best management practices (BMPs) of Rainbow trout farming in the training programme organised for the tribal fish growers of Dist. Anantnag, J&K from 20-22th March, 2021.
- Raja Adil H. Bhat delivered four lecture during Antimicrobial resistance awareness week in three villages of Uttarakhand under National campaign on antimicrobial resistance from 22-24th November 2021.
- Rajesh M. delivered a training lecture on Re-circulating Aquaculture System for Intensive Farming of Rainbow Trout in training programme conducted by Ministry of Fisheries, Government of India on 24th Feb, 2021.
- Rajesh M. deliveredonline and offline expert lectures on 'Re-circulating aquaculture System: Basics and components and design' for graduate students of Chandrasekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh; College of Fisheries, CAU, Tripura; Dr M.G.R. Fisheries College and Research Institute, Tamil Nadu; Dr J. Jayalalithaa Fisheries University, Chennai and College of Fisheries Science, Rajendra Bhuvan Road Veraval, Gujarat during on 24th July 2019; 30th April 2020; 2nd May, 2020; 15th May 2020 and 30th January 2021, respectively.
- Rajesh M. served as a resource person in the webinar on "Frequently asked questions (FAQs) on rainbow trout nutrition and feeding" conducted by ICAR-DCFR, Bhimtal on 4th December, 2021
- Rajesh M. served as a resource person to train undergraduate students from College of Fisheries, Orissa University of Agriculture and Technology, India for Junior Research Fellowship examination with special reference to Fish Nutrition and Biochemistry on 3rd August, 2021.
- RS.Tandel delivered four lecture during Antimicrobial resistance awareness week in three villages of uttarakhand under National campaign on antimicrobial resistance from 22-24th November 2021.
- RS.Tandel delivered lecture on utilization of organic wastes at village Suryagaon, Bhimtal, Distt. Nainital, Uttarakhand under Swachhta Pakhwada on 20th December, 2021.

12.11 Student Guided

- Anupam Pandey is pursuing his PhD from Kumaon University under the supervision of Dr D. Sarma, Dr B.S. Kamalam and Dr M.S. Akhtar on the topic 'Molecular and phenotypic investigation of thermal adaptation in a coldwater fish, rainbow trout (*Oncorhynchus mykiss*)'.
- Priyanka H. Tripathi is pursuing her PhD from Kumaon University under the supervision of Dr M. S. Akhtar and Dr Ciji Alexander on the topic 'Molecular investigation of selected immune and reproductive genes in golden mahseer, *Tor putitora* during ontogeny and in response to dietary β-glucan under DBT project.
- M. Junaid Sidiq 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.
- Ms. Nahida Rasheed is pursuing her PhD research at ICAR-DCFR under the supervision of Dr N.N. Pandey and Dr B.S. Kamalam, 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.
- Mr. Sivaramakrishnan, T., is pursuing 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. Gulgul Singh carried out a part of her PhD research at ICAR-DCFR under the supervision of Dr N.N. Pandey and Dr B.S. Kamalam, on the topic 'Comparative evaluation of $FeSO_4$ and $ZnSO_4$ nanoparticles on growth, physiology and gene expression of Jayanti Rohu'; registered at GB Pant University of Agriculture and Technology, Pantnagar.
- Ms. Surabhi Rawat, a Ph.D. Biotechnology student (registered under biotechnology discipline at DBT campus, Kumaun University, Bhimtal) under the guidance of Dr Neetu Shahi (as major guide), has submitted her thesis on the research topic "Characterization of bacterial isolates from coldwater bodies of Himalayan region of Uttarakhand for their algicidal property against *Microcystis* spp" on December 2021.
- Mr Krishna Kala, (registered under biotechnology discipline at DBT campus, Kumaun University, Bhimtal) a Ph.D. Biotechnology student under the guidance of Dr Neetu Shahi (as co-guide), has submitted his thesis on the research topic "Study on efficacy and bio safety level of OTC in selected coldwater fish species" in September 2021.
- Mr Mohan Singh, (registered at DBT, Sir J. C. Bose Technical Campus, Bhimtal, Kumaun University, Nainital) a M.Sc. Microbiology student under the guidance of Dr Neetu Shahi (as major guide) has submitted his thesis on the research topic "Isolation and characterization of bacteria and fungi pathogen from diseased rainbow trout (*Oncorhynchus mykiss*) with associated clinical sign of abdominal distension" in August 2021.
- Manisha Gupta (registered under biotechnology discipline at DBT campus, Kumaun University, Bhimtal) Ph.D student is working under the supervision of Dr Neetu Shahi (major guide), on the topic "Study on antimicrobial resistance in *E. coli* associated with fish farms and markets in Central and Western Himalayan regions and screening of beta-lactamase inhibitor from medicinal plants" for her dissertation work at Diagnostic Bacteriology Laboratory of ICAR-DCFR, Bhimtal.
- Ms. Vandana Pandey undergoing training under Rajesh M, on "Molecular techniques involved in isolation characterisation of selected transcripts and gene expression studies in rainbow trout" since 1st September, 2021.
- Ms Richa Upadhyay students of Banasthali Vidyapith completed Masters of Science (Applied Microbiology and Biotechnology) on 'Antimicrobial and immune-stimulatory potential of natural compounds against oomycetes and fungal pathogens' under major guidance of Dr R.S.Tandel, Scientist.
- Ms. Amarjeet Kaur, a Ph.D. Student from Dept. of Zoology & Environmental Science, Punjabi University, Patiala, Punjab is pursuing her Ph.D. on the topic "A study on transcriptome profiling and evaluation of differentially expressed genes related to thermal stress in golden mahseer (*Tor putitora*)" under the co-supervision of Dr S. Ali, Sr. Scientist

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13. Events and Meetings

13.1 Republic Day celebration

The Republic Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate. The Director 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. The National Flag was unfurled by Mr. Kishore Kunal, Scientist. All the staff were sensitized on the importance of celebrating 26th January, as the Republic day.

Celebration of Republic day at ICAR-DCFR, Bhimtal

Celebration of Republic day at Experimental Field Centre, Champawat

13.2 Research Advisory Committee (RAC) meeting

The institues RAC was held online on 26th March, 2021 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 Dam Roy, Former Director, CIARI, Port Balir, Andaman & Nicobar Islands; 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 D. Sarma, Director, ICAR-DCFR and Dr S. Chandra, member secretary, ICAR-DCFR. The chairman and members joined the meeting on Google meet and reviewed the progress of different projects. The Director (Acting), ICAR-DCFR presented the progress and achievements made by the Directorate durng the last year. 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. The Scientists participated online from their respected offices and the meeting was held keeping COVID-19 guidelines. The member secretary presented the vote of thanks.

13.3 Awareness cum Farmers Goshti on balanced use of fertilizers in aquaculture organized at Bhimtal

One day webinar cum physical training on "Balanced use of fertilizers in aquaculture" was organized on 18th June, 2021 at Bhimtal. Forty-eight fish farmers of Uttarakhand and Uttar Pradesh besides staff of UP Department of Agriculture took part in the Awareness cum Goshti. Dr K.M.Rai, Scientist ICAR-NBPGR, Bhowali delivered a talk on importance of using balanced manures and fertilizers in aquaculture and agricultural crops. Dr D. Sarma welcomed the participants and highlighted the importance of organic farming. Demonstration on field collection of soil samples and their analysis by Sri Hem Chandra Joshi, Asst. Agriculture Officer was given in the State soil analysis lab physically to fourteen farmers. An interaction meet was also arranged and farmer's quarries were addressed. Dr S. Chandra Principle Scientist, ICAR-DCFR, coordinated the programme.

13.4 International Yoga Day celebration

International Yoga Day was celebrated by all the staff and research scholars of the Directorate and its Experimental Field Centre, Champawat on 21st June 2021. Yoga has been beneficial in keeping the body and mind in sound health. The United Nations theme for this year is "**Yoga for well-being**", which takes into account how the practice can promote the holistic health of every individual.

13.5 Institute Research Committee Meeting (IRC)

The Institute IRC meeting was held on 23rd to 25th June 2021 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. The Scientists participated.

13.6 Farmer Scientist meet cum fish seed & fish feed distribution

A farmers-scientist interactive meet and fish seed-feed distribution program was arranged on 29th June, 2021 at EFF, Champawat. Farmers were distributed with 80 kg fish feed and 50 fish seed. Farmers were made aware about fish farming, fish diseases, and their treatment. Various problems faced by farmers during fish culture were also discussed during the meet. Twenty-two farmers from Mudiyani, Pati, Bigrakot, Khunari, Salli, and Lohaghat participated in the program. A tree plantation programme was also organised to mark the first visit of Dr Pramod Kumar Pandey, Director ICAR-DCFR after resuming his office. Dr N. N Pandey, Mr. Kishor Kunal, Mr. P. A. Ganie and Ms. Garima, Scientists of the institute participated in the said program.

Dr Pramod Kumar Pandey Director, ICAR-DCFR planting the "Tejjpatta" and distributing inputs to farmers at EFF, Champawat

Group photograph with the farmers

13.7 21st National Fish Farmers' Day celebration at ICAR-DCFR, Bhimtal and Champawat

ICAR-DCFR celebrated National Fish Farmers' Day on 10th July, 2021. The day is commemorated in remembrance of scientists Dr K.H. Alikunhi and Dr H.L. Chaudhury, who successfully demonstrated induced breeding (Hypophysation) technology in Indian Major Carps on 10th July 1957. This event is also a part of the ongoing celebrations for the upcoming 75th Independence Day of India named 'Azadi ka Amrut Mahotsav'. The theme for the event was 'Ecosystem Management for Sustainable Fisheries'. Dr Debajit, Sarma, Principal Scientist, ICAR-DCFR, Bhimtal welcomed all the participant's officials, scientists, professionals, fish farmers, entrepreneurs and stakeholders on the occasion. In the inaugural address, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, underlined the importance of induced breeding in fishes that paved the way for assured seed supply and sustainable aquaculture development in the country.

Prof. Tej Partap, Vice-Chancellor, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, was the Chief Guest on this occasion. He emphasized on developing the market linkages and distribution channels of cultured fish in Uttarakhand. He also underlined the Institute's role in achieving food and nutritional security. Prof. Ajay Rawat, Kumaon University, Nainital was Guest of Honour on this occasion. He urged studying and combining traditional wisdom and modern technology in fish farming. Dr R.P. Singh, Director, Directorate of Foot and Mouth Disease, IVRI Campus, Mukteswar, Kumaon Nainital urged the farmers to take up the integrated fish farming and value addition technology for doubling the income.

Dr J.K. Jena, DDG, ICAR (Fisheries division) presided over the interaction through the virtual platform and stated about the technological advancements made in the field of freshwater aquaculture. Further, He spoke about the importance of ecosystem management for the conservation of fish biodiversity and species diversification in the future. Several fish farmers of the Kumaon region shared their experiences and highlighted the profitability of the venture. On this occasion, Fish feed, seed and field kits for measuring water quality parameters were distributed among the farmers. The event witnessed a gathering of 170 participants, including 85 fish farmers, officials, scientists, entrepreneurs, and stakeholders were present in the programme participated in the programme. Vote of thanks was proposed by Dr N.N. Pandey, Principal Scientist, ICAR-DCFR, Bhimtal.

Inauguration of programme

Address by DDG (Fisheries Sciences)

Address by Director, ICAR-DCFR and Felicitation of fish farmer by Chief Guest

Celebration of National Fish Farmer Day at Experimental Field Centre, Champawat

On 10th July 2021 on the occasion of Fish Farmers Day a 'One-day Fish Farmer Seminar' was organised at Experimental Fish Farm, Champawat in the presence of all the staff members. This seminar was attended by 30 farmers from Mudiyani, Pati, Bigrakot, Khunari, Salli, Lohaghat, Banlekh, Dudhpokhara, Chaukuni-Bora, Chauda Sethi, Chauki and Fungar village. A brief session on fish diseases, their symptoms, prevention, cures and fish farming and its associated problems was taken by Scientist and Office in charge Mr. Kishor Kunal. Fish farmers were also briefed upon various state government schemes for the well being of fish farmers. Apart from these sessions fish seed was also distributed to 12 fish farmers of locality. The event was attended by all the staff (permanent and contractual) of the farm.

13.8 Celebration of ICAR Foundation day at Experimental Field Centre, Champawat

On the Occasion ICAR Foundation day a tree plantation programme was organised on 16th July, 2021 at Experimental Fish Farm, Champawat. On this occasion 25 citrus, 25 walnut, 25 grape, 50 deodar, 50 tejpattaand 25 morpankhi saplings were planted in the premises of Experimental Fish Farm, Champawat. The event was attended by all the staff (permanent and contractual) of the farm.

13.9 Independence Day Celebration

The 75th Independence Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate. The Director 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. Further, Dr Pramod Kumar Pandey, Director, ICAR-DCFR congratulated and felicitated the scientists who participated in COVID-19 testing duties at IVRI, Mukteshwar.

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Independence Day celebration at ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat

13.10 International year of Millets 2023 campaign on Nutri garden and tree plantation

ICAR-DCFR celebrated "International year of Millets 2023 campaign on Nutri Garden and tree plantation" on 17th September, 2021. On this occasion a talk on importance of coarse cereals in human nutrition was presented by Prof. Archana Kushwaha, GBPUA&T, Pantnagar. The programme was attended by all scientists and staff of the Directorate. A live streaming of The Hon'ble PM speech was also heard by all staff and invited farmers.

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13.11 Hindi Saptah Samaroh

Hindi Saptah was organized ICAR-DCFR, Bhimtal from 14th to 19th September, 2021. On this occasion different programmes such as quiz, easy competition, Hindi typing, Hindi translation were organized. The programme was coordinated by Mr. Amit Joshi, Hindi Officer, Dr N.N. Pandey, Dr R.S. Patiyal, Dr Amit Pandey, Principal Scientists, ICAR-DCFR. All the staff and students participated in the programme following all the necessary guidelines of COVID-19. 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. The programme ended with prize distribution to the winners.

13.12 Celebration of 34th Foundation Day of ICAR-DCFR

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, celebrated its 34th foundation day on 24th September, 2021. 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 scientists, progressive fish farmers, and stakeholders who were part of the momentous 33 years journey of the ICAR-DCFR success story.

The Chief Guest, Shri Dinesh D. Kulkarni, National Organising Secretary, Bhartiya Kisan Sangh, applauded the Director and scientific staff of ICAR-DCFR on the momentous occasion. He appreciated the commendable work done by the scientists of this 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 Honor, Shri Bhuwan Vikram Dabral, member of National Executive Committee, Bhartiya Kisan Sangh, 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.

The Institute released the "Annual Report 2020" and two leaflets on "captive breeding & seed production of *Garra* species." The occasion held a stall exhibition displaying the various activities and showcasing the technologies of the DCFR, KVKs, ICAR institutes, G.B. Pant agricultural university and private companies. Dignitaries also visited the exhibition stalls, museum, ornamental and RAS units established in the directorate and interacted with the scientists. The Farmers'-Scientists'-Interaction session was also held to address the problems faced by the fish farmers. Several progressive famers have shared their experiences about the fish farming and highlighted the profitability of the venture and the support rendered by the DCFR. On this occasion, fish feed and seed were distributed among the farmers. The event witnessed a gathering of 220 participants, including 85 fish farmers, officials, scientists, students, entrepreneurs, and stakeholders. Vote of thanks was proposed by Dr Amit Pande, Pr. Scientist, ICAR-DCFR, Bhimtal.

Inauguration of programme

Release of publications


Distribution of aquaculture inputs to farmers


Inauguration of Exhibition and visit to farms and hatchery

13.13 Celebration of Gandhi Jaynti at Experimental Field Centre, Champawat

Gandhi Jaynti on 2nd October, 2021 was celebrated at Experimental Fish Farm, Champawat. On this occasion Mahatma Gandhi was remembered and his views about Swacchata was shared to all. The event was attended by all the staff (permanent and contractual) of the farm.

13.14 Special National Swachhta Campaign organised by ICAR-DCFR at Village Talla Ramgarh, Nainital

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal organised a programme on 'Waste to Wealth' under the "Special National Swachhta Campaign" of Govt. of India in association with Fisheries Department, Bhimtal and National Service Scheme (NSS),Ramgarh, at Government Inter College, Talla Ramgarh, Nainital on 12th October, 2021. On this occasion, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, addressed the gathering and reminded about the responsibility of every citizen to keep the environment clean and healthy. He further stressed upon the significance of converting kitchen and farm waste into compost, complying with the theme "Waste to Wealth". Dr N. N. Pandey and Dr Amit Pande, Principal Scientists, ICAR-DCFR encouraged young students and farmers to efficiently manage household and farm waste. Dr Pandey also explained the methodology of vermicomposting. A quiz competition was also conducted for the benefit of school students. Mr. S. K. Dubey, Principal, GIC, Mr. Basant Lal Sah, gram pradhan, Bohrakot village, Mr. Yaspal Arya, BDC member, Dr Vishal Dutta, fisheries department incharge, Bhimtal, and Mr. R. K. Gurrani, NSS incharge, graced the occasion and emphasised upon the need for the household and farm waste management to keep the environment clean and at the same time get monetary benefits out of the waste. Everyone participated in the cleaning of the college premises. Dr R. S. Patiyal, Principal Scientist, Dr M. S. Akhtar, Sr. Scientist, Dr R. S. Haldar, ACTO and Mr. Santosh Kumar, Technical officer, DCFR Bhimtal also attended the programme.

Approximately 200 participants, including students, farmers, members of local civic bodies,

teachers, scientists, technical staff and other stakeholders, attended the programme. The programme ended with a formal vote of thanks by Dr.Ciji Alexander, ICAR-DCFR.

13.15 ICAR-DCFR celebrated Mahila Kisan Diwas

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised a "Mahila Kisan Diwas" on 15th October 2021 as a part of the "Azadi Ka Amrut Mahotsav" to commemorate 75 Years of India's Independence. Mrs. Pragyan Dash, Scientist ICAR-DCFR. Welcomed all the Women farmers and congratulated them for playing a multi-dimensional role in agriculture and allied sectors. In the inaugural address, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal highlighted the incredible contribution of the women workforce in Indian agriculture. He said that women in India undertake about 80 percent of farm work.

Dr Shweta Rai, Assistant professor, Department of Foods & Nutrition, G.B. Pant University of Agriculture & Technology, Pantnagar, delivered a lecture on value addition in fruits and vegetables. She highlighted about post-harvest losses in horticultural produce and envisaged that the farm produce should be subjected to value addition to prevent post-harvest losses in agriculture. Approximately 120 participants, including women farmers, students, scientists, technical staff and other stakeholders, attended the programme. The programme ended with a formal vote of thanks by Dr K. Victoria Chanu, Scientist ICAR-DCFR.

13.16 World Food Day organised by ICAR-DCFR at Green Mount Global School, Bhimtal

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal celebrated 'World Food Day' under the "National level Campaign" of Govt. of India in association with Green Mount Global School, Kwerali, Bhimtal as a part of the ongoing celebrations of 75 years of independence being celebrated as "Azadi Ka Amrut Mahotsav" on 16th October, 2021. On this occasion, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, addressed the gathering and highlighted the importance of

celebrating World Food Day. He said that our country needs collective action to combat the issue of hunger and ensure healthy diets for all and encouraged the students to include fish in their diet for boosting brain development and other health benefits.

Dr Biju Sam K., Scientist, ICAR-DCFR, Bhimtal, delivered a talk on the role of fish in food & nutrition. He stated that fish is filled with omega-3 fatty acids, minerals and vitamins and is the best way tasty way to add protein and healthy fats to your diet. Mrs. Yoshodhara Bisht, Director Green mount global school, Dr Debajit Sarma and Dr N.N. Pandey, Principal Scientists, ICAR-DCFR, graced the occasion and emphasised upon eating healthy foods for overall health and development. A quiz competition was also conducted for the benefit of school students. Approximately 100 participants, including students, teachers and scientists, attended the programme. The programme ended with a formal vote of thanks.




13.17 Workshop on 'Climate resilient and efficient rainbow trout farming' at Urgam village, Chamoli, Uttarakhand

Under the National Innovations in Climate Resilient Agriculture (NICRA) project, ICAR - Directorate of Coldwater Fisheries Research organised a workshop on 'Climate resilient and efficient rainbow trout farming' for a group of ten adopted SC farmers in Urgam village, Joshimath, Chamoli district, Uttarakhand during 29-30th October, 2021. During the workshop, different practical aspects and challenges in farm operation, feed management, disease control, water quality monitoring, post-harvest marketing and government support mechanisms were elaborated to the farmers by Dr Biju Sam Kamalam, Mr. Anupam Pandey and Mr. Maneesh Kumar Dubey. Certain standard operating methods like water flow monitoring and fish biomass management were practically demonstrated at the farm site. Each of the farmers were also provided different sizes of ICAR-DCFR formulated and validated rainbow trout feed to support complete production cycle in one raceway. During the field exploration, every farm was geotagged and spot measurements of important water quality parameters such as temperature, dissolved oxygen, pH, ammonia, alkalinity, hardness, carbon dioxide, conductivity, total dissolved solids, salinity and other farm operational details were collected. The farmers were given a growth, feed use and farm monitoring monthly record sheet for monitoring the entire production cycle. This programme was coordinated by Dr Biju Sam Kamalam, Dr Debajit Sarma, Dr Rajesh, M and Dr Prakash Sharma.

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13.18 Activities undertaken under Special campaign for disposal of pending matters

Under the 'Special campaign for disposal of pending matters and cleanliness drive' during 02-31st October, 2021, a total of 155 files have been reviewed and 55 of them have been identified for disposal at the Directorate. During the period, various *shramdaan* activities for weeding out of files and scraps were carried out at different facilities such as laboratories, hatchery, ornamental unit, recirculatory aquaculture system, library, institute premises, etc. Additionally, an outdoor programme on 'Waste to Wealth' was organized at Government Inter College, Talla Ramgarh, Nainital. A total of 200 participants, including students, farmers, members of local civic bodies, teachers, scientists, technical staff and other stakeholders, attended the programme. The methodology of vermin-composting was briefed and the customized materials provided by NRM Division of ICAR, depicting conversion of farm and kitchen waste into compost/wealth were distributed and displayed to the participants. A quiz competition was also conducted for the benefit of school students. Dr Ciji Alexander acted as the nodal officer.

13.19 ICAR-DCFR celebrated "Rashtriye Ekta Diwas"

ICAR-DCFR celebrated Rashtriye Ekta Diwas on 31st October, 2021 on the occasion of birth anniversary of Sardar Vallabh Bhai Patel. On this occasion all the scientists taken oath on Rashtriye Ekta Diwas and attened a virtual talk on the life and achievements of Sardar Vallabh Bhai Patel. The talk was given by Dr. Tej Pratap Singh from Banaras Hindu University, Varanasi.

13.20 ICAR-DCFR organized campaign on the theme of "Agriculture and Environment: the citizen face"

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised campaign on the theme of "Agriculture and Environment: the citizen face" to commemorate "Azadi ka Amrit Mahotsav", by interacting with school children on 26th November, 2021. The programme was conducted at Government High School, Sattal Road, Mehragaon, Bhimtal, District Nainital, Uttarakhand. In the programme, more than 100 persons including 90+ students from class 6 to 10 have participated. Dr Pragyan Dash, Scientist ICAR-DCFR explained about Indian Council of Agricultural Research and ICAR-DCFR to the students. Dr Kh. Victoria Chanu, Scientist ICAR-DCFR discussed about the courses of agriculture and allied sectors that can be taken up after 10+2, eligibilities, benefits and its job opportunities. There was also a drawing competition among the students on the theme of "Agriculture and Environment" and prizes to three best drawings were given. The programme was coordinated by Dr Dimpal Thakuria, Dr Kh. Victoria Chanu, Dr Pragyan Dash and Dr Ritesh Tandel.

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13.21 Swachhata Pakhwada at Experimental Field Centre, Champawat

A series of events were undertaken during 16-31 December, 2021 under display of Banner at the prominent places, taking Swachhata pledge, Stock taking & briefing of the activities to be organized during the Pakhwada, plantation of trees under Swachhta Pakhwada on 16.12.2021, Cleanliness and sanitation drive in MGMG adopted village (Mudiyani village) under Swachhta Pakhwada on 18.12.2021, Celebration of Special Day (Scientists and Farmer's Interaction meet). Experience sharing on Swachhata initiatives by farmers and civil society officials under Swachhta Pakhwada on 23.12.2021, Swachhata awareness at local level organizing Sanitation Campaigns involving and with the help of the farmers, farm women and village youth in new villages not adopted under any scheme by Institutes/establishments under Swachhta Pakhwada on 24.12.2021.


13.22 Awareness camp on technology demonstration of agriculture technology for conversion of Waste to Wealth"

A program of Swachhaata Abhiyan on 22nd December, 2021 was organized at Khirola Pandey Village in Nainital District. 40 villagers participated in the program including 14 lady participants. Dr D. Sarma, Dr Neetu Shahi, Dr Sumanta Mallik from DCFR organised the program. Mr. Bhuvan Chandra Palaria, Gram Pradhan of the village participated in the program and expressed his positive views. During the program in Gram Panchayat Hall, several

discussions were made with the village people on the Swachhata Mission and its importance. The theme of the program was "technology demonstration of agriculture technology for conversion of waste to wealth".

13.23 National Campaign on Azadi Ka Amrut Mahotsav- Lecture Series

13.23.1 Talk on "Strategies for doubling farmer's income in the hill region: Technological options"

As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the 75 years of India's Independence, a talk on "Strategies for doubling farmer's income in the hill region: Technological options" was delivered by an eminent speaker Prof. M. Premjit Singh, Former Vice-Chancellor Central Agricultural University Imphal, on 3rd July 2021.The programme was organised by the ICAR-Directorate of Coldwater Fisheries Research (ICAR-DCFR), Bhimtal, Nainital, Uttarakhand under 'DARE-ICAR for India @75. Dr S. Ali, Senior Scientist, ICAR-DCFR, Bhimtal welcomed Prof. M. Premjit Singh and all the participants, officials, scientists, professionals, entrepreneurs, and stakeholders on the occasion. More than 60 participants from different ICAR Institutes, KVKs, SAUs and other universities attended the lecture through virtual mode. In the inaugural address, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, spoke about the outstanding contribution of the distinguished speaker to the agricultural sector and highlighted his contribution in developing methods for increasing farmer's income through Integrated Pest Management and Large scale demonstration on Zero tillage cultivation, which had contributed and continue to contribute immensely to food, economic and livelihood securities. He informed that Prof. Singh has received different national and international awards and honours in recognition of his immense contribution to new knowledge, human resource development and science-led transformation of agriculture towards the increasing farmers' income.

In his lecture, Prof. M. Premjit Singh emphasised about the agricultural productivity enhancements through integrated farming involving livestock and fisheries. He suggested ways and means of doubling farmers' income and shared some of the proven tehnologies which has shown encouraging results at field level. He also talked about rainwater harvesting and micro-irrigation, location specific farming system, income generation through secondary agriculture, post-harvest technology and value addition as well as promotion of high value crops and fishes.

The Director DCFR thanked Prof. M. Premjit Singh for his valuable talk on a special occasion. The programme ended with a vote of thanks.

13.23.2 Talk on "Agricultural Transformation for Nutritional Security"

As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the 75 years of India's Independence, a talk on "Agricultural Transformation for Nutritional Security" was delivered by an eminent speaker Padma Bhushan Dr Ram Badan Singh, Former Chancellor, Central Agricultural University, Imphal, on 7th August 2021. The programme was organised by the ICAR-Directorate of Coldwater Fisheries Research (ICAR-DCFR), Bhimtal, Nainital, Uttarakhand under 'DARE-ICAR for India@75. Dr S. Ali, Senior Scientist, ICAR- DCFR, Bhimtal welcomed Padma Bhushan Dr R.B. Singh and all the participants, officials, scientists, professionals, entrepreneurs, and stakeholders on the occasion. More than 100 participants from different ICAR Institutes, KVKs, SAUs and other universities attended the lecture through virtual mode. In the inaugural address, Dr Pramod Kumar Pandey, Director, ICAR- DCFR, Bhimtal, spoke about the outstanding contribution of the distinguished speaker to the agricultural sector and highlighted his contribution in developing widely adopted modern varieties of wheat, rice, pulses, oilseeds and cotton, which had contributed and continue to contribute immensely to food, economic and livelihood securities. He informed that in recognition of Dr Singh's immense contribution to new knowledge, human resource capital and the science-led transformation of agriculture towards the alleviation of hunger and poverty in India and the Asia Pacific Region, he has been awarded the *Padma Bhushan* by the Hon'ble President of India – one of India's highest civilian honours that recognizes distinguished service of a high order to the Nation in any field, in 2003.

In his lecture, Padma Bhushan Dr R.B. Singh emphasised that agricultural transformation could help to improve food and nutritional security in rural areas. He said that India being second largest agrarian economy of the world needs transformation to ensure nutritional security through agricultural production. He laid emphasis on by increasing farm income from growing urban demand for farm products, and making farming commercially viable by strengthening interlinkages 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.

In his address, Dr Dilip Kumar, Former Vice-Chancellor and Director ICAR-CIFE congratulated Dr R.B. Singh for the outstanding presentation. He also emphasised his contribution to the development of agriculture in our country. Dr Gopal Krishna, VC and Director, ICAR-CIFE, also expressed his views on the lecture. Dr J. K. Jena, Deputy Director General (Fisheries Sciences) ICAR, concluded the session and congratulated Director, ICAR-DCFR, Bhimtal, for bringing the country's stalwarts on the same platform. He said it was a privilege to hear Dr R.B. Singh and mentioned his lecture as informative and motivational. The programme was ended with a vote of thanks.

13.23.3 Talk on "Food and Nutrition for Farmers"

As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the @75 years of India's Independence, and a National Campaign on "Food and Nutrition for Farmers", ICAR-Directorate of Coldwater Fisheries Research (ICAR-DCFR) has organized a webinar on the topic "Food and Nutrition for Farmers" on 26th August 2021. A talk on the above topic was delivered by Prof. R.S. Chauhan, Dean, College of Fisheries, GBPUA&T, Pantnagar. Dr S. Ali, Senior Scientist, ICAR- DCFR, Bhimtal coordinated the programme. Dr Pramod Kumar Pandey, Director, ICAR-DCFR welcomed the speaker and participants. More than 100 participants from different ICAR Institutes, KVKs, SAUs and other universities attended the talk through virtual mode. In his lecture, Prof. R.S. Chauhan highlighted

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that along with food production its nutritional value is also important. He explained the importance of fish as dietary requirement for farmers and also emphasized that integrated fish farming can be a better model for increasing production and nutrition. The participants also interacted with the speaker on various aspects of the fisheries and aquaculture. The programme ended with vote of thanks.

13.23.4 Talk on "Diversification in Aquaculture"

In commemoration of 75 years of India's independence (Bharat ka Amrit Mahotsav) and a National Campaign on "System Diversification in Aquaculture" a talk on **"Diversification in Aquaculture"** was organized by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, on 1st September 2021. A talk on the above topic was delivered by Dr A.P. Sharma, Former Director, ICAR-CIFRI, Barrackpore. Dr S. Ali, Senior Scientist, ICAR- DCFR, Bhimtal coordinated the programme. Dr Pramod Kumar Pandey, Director, ICAR-DCFR welcomed the speaker, and Dr J.K. Jena, DDG, ICAR (Fisheries Sciences) and all the participant's, officials, scientists and professionals. More than 75 participants from different ICAR Institutes, KVKs, SAUs and other universities attended the talk through virtual mode.

In his talk, Dr A.P. Sharma, emphasized that diversification of aquaculture will enable us to cope with future changes and challenges of the sector. He highlighted that climate changes, dietary diversity, resource fluctuations and food security issues are key global drivers for diversification in aquaculture. Further, he underlined that system diversification seeks to distribute the risks and add economic, social and ecological insurance to aquaculture systems. He pointed out the importance of the newly launched flagship scheme, Pradhan Mantri Matsya Sampada Yojana (PMMSY) by Govt. of India, which marks the historically largest investment in the Fisheries sector and aims to drive ecologically healthy, economically viable, and socially inclusive growth of the fisheries sector. Dr J. K. Jena, DDG, ICAR (Fisheries Sciences), presided over the interaction through the virtual platform and stated about the technological advancements made in the field of freshwater aquaculture. Further, he informed that today all the Fisheries institutes of ICAR are organising the lecture series under the National Campaign "System Diversification **in Aquaculture"** to commemorate the ongoing Azadi ka Amrit Mahotsav celebrations. The programme ended with vote of thanks

13.24 Swachhta Pakwara -16-31 December, 2021

Swachhta Pakhwada for the period 16.12.2021 to 31.12.2021 initiated at this Institute with a pledge on swachhata taken by all the members of staffs & farmers on 16.12.2021 followed by lectures/ messages on swachhata by the Director and Prof.

Kaman Singh, Former Dean, School of Physical and Decision Sciences, Baba Saheb Bhimrao Ambedkar University, Lucknow. The various activities to be taken up during the pakhwada were also briefed. Swachhata awareness message has also been displayed at the notice board and institute website. The activities taken up will be displayed at the social media platforms. Banners displayed at the prominent places and trees were planted inside the premises of ICAR-DCFR Field Centre, Champawat followed by cleaning of the farm campus.

Activities on 16.12. 2021

Display of Banner at the prominent places, taking Swachhata pledge, Stock taking & briefing of the activities to be organized during the Pakhwada, plantation of trees.

Activities on 17.12.2021

Basic maintenance: Stock taking on digitization of office records/ e-office implementation. Review of progress on weeding out old records, disposing of old and obsolete furniture's, junk materials Cleanliness drive including cleaning of offices, corridors and premises.

Activities on 18.12.2021

Sanitation and SWM. Cleanliness and sanitation drive in the villages adopted under the Mera Gaon Mera Gaurav Programme and/or other schemes by ICAR Institutes involving village community. Reviewing the progress made under ongoing Swachhta activities including implementation of Swachhta Action Plan (SAP) and providing at the spot solutions.

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Cleanliness campaign was organized by the staff members of ICAR-DCFR Field Centre, Champawat with the involvement of villagers at Mudiyani village adopted under MeraGaonMeraGaurav and they were briefed about the importance of sanitation and hygiene for a healthy lifestyle. Swachhata activities were also taken up inside the Experimental farm.

Activities on 19.12.2021

Cleaning and sanitation activities were taken up inside office campus, nearby roadside, adjoining streets, residential colonies. Residents of the colony also took part in the cleanliness campaign and they were briefed about the disposal of biodegradable and non-biodegradable wastes as well as plastic waste, which is very harmful for health and the environment. Swachhata activities were also taken up at the Field Centre, Champawat.

Activities on 20.12.2021

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal organized an "Awareness on utilization of organic wastes and generation of wealth from the waste" on December 20, 2021 as a part of the *swachhata pakhwada celebration at village Suryagaon, Bhimtal, Distt. Nainital*. The programme was conducted with the support of Government High School, Suryagaon. More than 25 persons, including 23 students and teachers from class VI to VIII have participated.

Swachhata campaign was also organized by the staff members of ICAR-DCFR, teachers, students and villagers in the school campus and Suryagaon village. They were briefed about the importance of cleanliness for a healthy life and awareness given on adopting waste management, generation of wealth from waste by utilizing the organic waste.

Activities on 21.12.2021

An Awareness programme on utilisation and recycling of waste water was organised at Mehragoan, Bhimtal, Uttarakhand with the involvement of village people. The participants were briefed about the importance of water in life, ways and right approaches for its conservation. They were also made aware of the practical utility of waste water.

Activities on 22.12.2021

The programme was organized at Village: Khairola Pandey in Nainital District. 40 participants including scientists and other staffs of ICAR-DCFR, Gram Pradhan and residents of the village participated in the programme. The programme was organized in Gram Panchayat Hall.

Lectures were given by the scientists of the Institute on swachhata and maintaining cleanliness in their daily lifestyle. An interaction with the participants, particularly village people, local shopkeepers was also made on conversion of waste to wealth, safe disposal of all kinds of wastes with special focus on plastic wastes, which is very hazardous to human health and the environment.

Activities on 23.12.2021

The activities were taken up at the ICAR-DCFR Field Centre, Champawat in which the Scientist Incharge alongwith the staffs of the Field Centre participated in cleanliness campaign at Village Banlekh, Champawat, Uttarakhand with the active participation of village people. An interactive meeting of Scientists' & farmers' was also organized.

Another interactive session with the farmers' was organized at Village Chachi, Bageshwar, Uttarakhand under a field demonstration of water quality management for fish culture at the village. Further, they were also made aware of the importance of swachhata for their healthy lifestyle. A cleanliness campaign was also organized at Bypass road near Vikas Bhavan, Bhimtal.

Activities on 24.12.2021

A swachhta awareness program on “plastic waste management” was organised at village Doodhpokhra, champawat wherein participants were made aware of plastic pollution and its consequences on environmental health. Besides this, sanitation drive was organised at the link road of village Aanu, Bhimtal, Uttarakhand. Also the cleanliness drive was conducted in the premises of Experimental fish farm, Champawat, Uttarakhand.

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Activities on 25.12.2021

A cleanliness drive was organised at the famous Tarkeshwar Shiv Mandir, Chhirapani, Champawat. It is one of the major and famous tourist attraction of the region owing to its location and religious connection. The locals as well as visitors perform various religious rituals at the place. Which eventually pollutes the surroundings of the mandir. Awareness was also created among the visitors about the cleanliness campaign initiative of the GOI. Also, cleanliness drive was organised at Gorakhpur market, Bhimtal.

Activities on 26.12.2021

Competitions were organised for the research scholars, contractual staff and local youth in the committee room of the Institute. The competition on Essay and slogan writing was based on the theme "Swachh Bharat Abhiyan" followed by an extempore competition on the topic "Plastic pollution: impacts and mitigation". The winners of the respective competitions were rewarded accordingly.

Activities on 27.12.2021

The activities were taken up in Chanauti village and Naukuchiatal boat stand to conduct an awareness programme on waste management under the Swachhata Pakhwada. During the programme the local people were made aware to prevent throwing of garbage in and around the lake and manage the waste according to its category. They were advised to segregate the waste material into degradable (waste vegetables/eatables) and non-degradable like plastics bottles/cans etc. and restrict the use of Single Use Plastic (SUP). Awareness given on utilization of biodegradable waste by means of composting for preparing manure, which can be used for enriching the soil for cultivation of vegetables etc. Moreover the boatmen were advised to place a little dustbin in every boat so that the tourists make use of them rather than dropping the waste rappers/bottles, eatables etc. into the lake.

Sh. Anil Chanautiya, Member, Zila Panchayat, Nainital also graced the occasion and express his concern over the littering of the place, which is adversely affecting the ecosystem of the Naukuchiatal lake. He stressed upon maintaining cleanliness in and around the lake as it is the only source of income for the local boatmen as well as shopkeepers, who are dependent on tourists.

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Activities on 28.12.2021

A campaign on cleaning of water lines, recycling of waste water was organized in the village Saungaon, Bhimtal with the participation of the staff members of the Institute and villagers. Knowledge shared with the village community on importance of swachhata and maintaining hygiene for a healthy life. Swachhata activities were also taken up in the village.

Though the villagers are already utilizing waste water for agriculture, horticulture, kitchen gardens and polyhouses, they were encouraged to use natural farming, which has a significant impact on soil health and the nature as well.

Activities on 29.12.2021

As an important activity of the Swachhata Pakhwada, an awareness programme on community waste management and compost pits cleaning was organized at the Government Primary School, Tirchakhet, Distt. Nainital with the involvement of DCFR staffs, teachers & students of the school and local residents. The students and gathering in the school were made aware about waste management and the efficient use of biodegradable material. The students were motivated and advised to prevent littering in and around their houses as well as school and segregate the waste material into degradable (waste vegetables/ eatables) and non-degradable like plastics bottles/cans etc. The biodegradable waste converted into manure can be used for enriching the soil in agriculture, horticulture, floriculture and kitchen gardens. Moreover, the students were advised to have discussion with their parents and neighbours for segregation of wastes. Cleaning activities were also taken up in the school premises and adjoining location.

Activities on 30.12.2021

The programme was organized in the main office campus of the Institute. The Hon'ble Vice Chancellor, GBPUAT, Pantnagar alongwith other faculty members and dignitaries were present on the occasion. They were briefed about the various activities carried out by the Institute during the Swachhata Pakhwada. The efforts put in by the Institute under swachhata pakhwada at different places as per the action plan of the Council were very much appreciated specially awareness given on

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recycling of waste water for use in agriculture/ horticulture application, kitchen gardens, use of kitchen waste for making compost, promoting clean & green technologies, natural farming was very commendable. The activities were published on institute website as well as social media platforms; facebook, twitter, instagram.

Activities on 31.12.2021

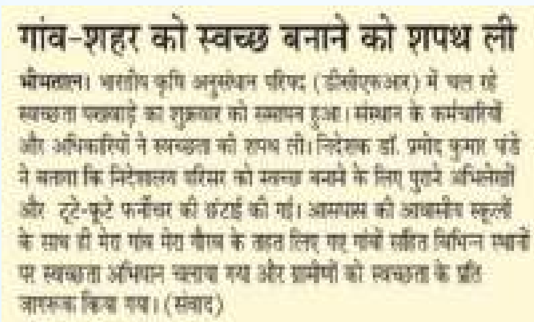
Organization of press conference for highlighting the activities of Swachh Bharat Pakhwada by involving all stakeholders including farmers/VIPs/press and electronic media.

आइसीएआर में मनाया गया स्वच्छता पखवाड़ा, रोपे पौधे

संवाद, भीमताल : भारतीय कृषि अनुसंधान परिषद ने 16 से 31 दिसंबर तक स्वच्छता पखवाड़े का आयोजन किया। स्वच्छता पखवाड़े का आरंभ भारतीय कृषि अनुसंधान परिषद के सभी स्टाफ सदस्यों ने स्वच्छता की प्रतिज्ञा लेने के साथ ही प्रायोगिक चंपावत परिसर में पौधारोपण के साथ किया। निदेशालय परिसर में जगह खाली करने के लिए पुराने अभिलेखों की छटाई, टूटे-फूटे फर्नीचर एवं जंग लगी सामग्री को निपटाने की समीक्षा की गई। परिसर और आसपास की गलियों, सार्वजनिक पार्क आदि स्थानों पर स्वच्छता अभियान चलाया गया।

भाकृअप के स्वच्छता पखवाड़े का समापन

भीमताल। भारतीय कृषि अनुसंधान परिषद में चल रहे स्वच्छता पखवाड़े का शुक्रवार को समापन हुआ। इस दौरान संस्थान के कर्मचारियों व अधिकारियों ने स्वच्छता की प्रतिज्ञा ली। पखवाड़े के तहत चंपावत परिसर में पौधरोपण किया गया। निदेशक डॉ. प्रमोद कुमार पांडे ने बताया कि निदेशालय में कार्यालय के अभिलेखों का डिजिटाइजेशन किया जा रहा है। निदेशालय परिसर को स्वच्छ बनाने के लिए पुराने अभिलेखों व टूटे-फूटे फर्नीचर की छंटाई की गई। आसपास की आवासीय स्कूलों के साथ ही मेरा गांव मेरा गौरव के अंगीकृत किए गए गांवों सहित विभिन्न स्थानों पर स्वच्छता अभियान चलाया गया। बागवानी में उपयोग के लिए अपशिष्ट जल के महत्व के बारे में लोगों को जानकारी दी गई।



गांव-शहर को स्वच्छ बनाने को शपथ ली

भीमताल। भारतीय कृषि अनुसंधान परिषद (डीसीएफआर) में चल रहे स्वच्छता पखवाड़े का शुक्रवार को समापन हुआ। संस्थान के कर्मचारियों और अधिकारियों ने स्वच्छता की शपथ ली। निदेशक डॉ. प्रमोद कुमार पांडे ने बताया कि निदेशालय परिसर को स्वच्छ बनाने के लिए पुराने अभिलेखों और टूटे-फूटे फर्नीचर की छंटाई की गई। आसपास की आवासीय स्कूलों के साथ ही मेरा गांव मेरा गौरव के तहत लिए गए गांवों सहित विभिन्न स्थानों पर स्वच्छता अभियान चलाया गया और ग्रामीणों को स्वच्छता के प्रति जागरूक किया गया। (संवाद)

13.25 Other events and meetings organized

- A virtual international webinar on "Fish Reproduction" on 22nd January, 2021 organized by ICAR- Directorate of Coldwater Fisheries Research, Bhimtal, India. In this webinar Dr Tapas Chakraborty, Assistant professor, Kyushu University, Japan delivered a talk on Germ cell in fish: Basic to application. All the scientist, researchers from DCFR and other research organization participated in the webinar.

- ICAR-DCFR organized a webinar on the topic "Recent advances in cold water fish farming technologies" on 24th February, 2021. In this webinar talks were delivered on different topics like "Rainbow trout culture in re-circulating aquaculture system by Dr Rajesh, M. Scientist, ICAR-DCFR; Best management practices in rainbow trout farming by Dr Nityanand Pandey, Principal Scientist, ICAR –DCFR; Nutrition and feed management in rainbow trout farming by Dr Biju Sam Kamalam, Scientist, ICAR-DCFR; and Health management in cold water fish farming, Dr S. Chandra, Principal Scientist, ICAR –DCFR. The programme was graced by Dr J.K. Jena, DDG (Fisheries Sciences), ICAR, Shri Sagar Mehra, Joint Secretary (Inland Fisheries), MoFDA, GoI. All the scientist, researchers from DCFR and other research organization participated in the webinar.

- ICAR-DCFR Experimental Fish Farm, Champawat participated in Nutri-garden and Tree Plantation which was organised on 17th

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September, 2021 at Experimental Fish Farm, Champawat with respect to International Year of Millets 2023. A total number of 100 saplings were planted in the premises of Experimental Fish Farm, Champawat.

- ICAR-DCFR celebrated World Soil Day at ICAR-DCFR, Bhimtal with special talk by Dr Anjuli Agrawal, Professor, GBPU&T, Pantnagar on 4th December, 2021.

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14. Awards, Honours and Recognitions

- Dr Biju Sam Kamalam was selected as a young leading scientist in fish nutrition by the International Symposium on Fish Nutrition and Feeding (ISFNF 2021) organising committee, Busan, Korea.
- Dr R.S. Haldar, Chief Technical Officer was conferred the "Best Performance Award" for the year 2020-21 by this Institute for outstanding contribution in the field of Fish and Fisheries on the occasion of Orientation Workshop cum Farmers' Meet and Kisan Mela organized by this Directorate during 17-18th March, 2021.

Receiving the "Best Performance Award" from Shri Arvind Hyanki Commissioner, Kumaon Region, Uttarakhand

- Dr Raja Adil H. Bhatt has been recognized as external examiner for B.F.Sc courses for the College of Fisheries, Birsa Agricultural University, Kanke Ranchi-834006.
- Dr Neetu Shahi Invited as a key speaker to represent ICAR-DCFR, Bhimtal in virtual meeting "AQUAPRENEURSHIP" Institute Industry Interface organised by Agrinnovate+ICAR on 25th February, 2021. The purpose of this meeting was to conduct a branding and marketing exercise to spread awareness about aquaculture and fisheries technology developed by Fishery based ICAR institutes.
- Dr N. N. Pandey is nominated as member for the Board of Study, department of Zoology, Kumaon University, Nainital, Uttarakhand for the period of three years.
- Dr S. Ali received appreciation certificate for performing COVID-19 testing duty at ICAR-IVRI, Mukteshwar, during 15th May to 7th June 2021.
- Dr Prakash Sharma received appreciation certificate for performing COVID-19 testing duty at ICAR-IVRI, Mukteshwar, during 15th May to 7th June 2021.

Dr Prakash Sharma and Dr S. Ali received appreciation certificate from Director, ICAR-DCFR for performing Covid-19 testing duty

- Mr. S.K. Mallik received appreciation certificate for performing COVID-19 testing duty at ICAR-IVRI, Mukteshwar, during 15th April to 15th May.

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 socities 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, Dehradun
- Tehri Hydro Development Corporation Ltd.
- Sashastra Seema Bal (SSB), Ministry of Home Affairs, Govt. Of India, Champawat

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

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

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- Deen Dayal Upadhaya Gorakhpur University, Gorakhpur, U.P
- Central Agricultural University, Imphal, Manipur
- Acharaya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya, UP

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

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ICAR-DCFR in Media

डीसीएफआर ने भुमका के ग्रामीणों को बांटे मछली बीज

गांव-शहर को स्वच्छ बनाने को शपथ ली

भीमताल। भारतीय कृषि अनुसंधान परिषद (डीसीएफआर) में चल रहे स्वच्छता पखवाड़े का शुक्रवार को समापन हुआ। संस्थान के कर्मचारियों और अधिकारियों ने स्वच्छता की शपथ ली। निदेशक डॉ. प्रमोद कुमार पांडे ने बताया कि निदेशालय परिसर को स्वच्छ बनाने के लिए पुराने अभिलेखों और टूटे-फूटे फर्नीचर की छंटाई की गई। आसपास की आवासीय स्कूलों के साथ ही मेरा गांव मेरा गौरव के तहत लिए गए गांवों सहित विभिन्न स्थानों पर स्वच्छता अभियान चलाया गया और ग्रामीणों को स्वच्छता के प्रति जागरूक किया गया। (संवाद)

महिला किसान दिवस का आयोजन

संस, भीमताल : शीतजल मात्स्यकी अनुसंधान निदेशालय में महिला किसान दिवस पर जीबी पंत कृषि विवि की सहायक प्रोफेसर डा. श्वेता राय ने महिलाओं के सशक्तीकरण, कृषि में महिलाओं की भागीदारी तथा पोषण एवं आजीविका को बढ़ाने में महिलाओं की अहम भूमिका पर व्याख्यान दिया। संस्थान के निदेशक डा. पीके पांडे ने उनका स्वागत किया।

लद्दाख में मछली पालन को लेकर कवायद शुरु

निदेशक डा. पांडे के नेतृत्व में लद्दाख पहुंची टीम

भीमताल डीसीएफआर के वैज्ञानिक जलीय कृषि के विकास पर भी करेंगे कार्य

डगीम घाटी में मछली उत्पादन पर प्रशिक्षण आयोजित

आइसीएआर में मनाया गया स्वच्छता पखवाड़ा, रोपे पौधे

संस, भीमताल : भारतीय कृषि अनुसंधान परिषद ने 16 से 31 दिसंबर तक स्वच्छता पखवाड़े का आयोजन किया। स्वच्छता पखवाड़े का आरंभ भारतीय कृषि अनुसंधान परिषद के सभी स्टाफ सदस्यों ने स्वच्छता की प्रतिज्ञा लेने के साथ ही प्रायोगिक संयंत्र परिसर में पौधारोपण के साथ किया। निदेशालय परिसर में जगह खाली करने के लिए पुराने अभिलेखों की छटाई, टूटे-फूटे फर्नीचर एवं जंग लगी सामग्री को निपटाने की समीक्षा की गई। परिसर और आसपास की गलियों, सार्वजनिक पार्क आदि स्थानों पर स्वच्छता अभियान चलाया गया।

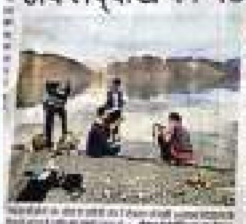
16 कुंतल निःशुल्क मत्स्य आहार बांटा

मत्स्य पालन से अपनाएं स्वरोजगार

भीमताल (नैनीताल)। शीतजल मात्स्यकी अनुसंधान निदेशालय भीमताल में किसानों को वीडियो कांफ्रेंसिंग के माध्यम से प्रधानमंत्री मोदी के संवाद से जोड़कर आधुनिक कृषि को लेकर जागरूक किया। निदेशक डॉ. प्रमोद कुमार पांडे ने किसानों को जलवायु अनुकूल कृषि करने का आह्वान किया। कहा कि किसान मत्स्य पालन से खुद की आजीविका को मजबूत कर रहे हैं। डॉ. अमित पांडे ने जलवायु अनुकूल कृषि पर विस्तार से जानकारी दी। इस दौरान प्रधान वैज्ञानिक डॉ. सुरेश चंद्रा, डॉ. देबाजीत शर्मा, डॉ. एनएन पांडे, डॉ. आरएस पतियाल, डॉ. अखिल भट्ट, डॉ. आरएस हालदार मौजूद रहे। (संवाद)

अब लद्दाख को मछली पालन का तरीका सिखाएगा उत्तराखंड

शीतजल मात्स्यकी अनुसंधान निदेशालय की टीम पहुंची लद्दाख, वहां के लिए उपयुक्त मत्स्य प्रजाति विकसित करने की योजना



6 दैनिक जागरण हल्द्वानी, 25 सितंबर, 2021

मत्स्य पालकों की स्थिति में हो सुधार

संस, भीमताल : शीतजल मात्स्यकी अनुसंधान निदेशालय (डीसीएफआर) के 34वें स्थापना समारोह को संबोधित करते हुए मुख्य अतिथि ... डॉ कुलकर्णी ने मत्स्य पालकों की सामाजिक व आर्थिक स्थिति को सुधारने पर जोर दिया। कुलकर्णी ने डीसीएफआर के निदेशक डा. पीके पांडे समेत सभी वैज्ञानिकों की चर्चा की। संस्थान के निदेशक डा. प्रमोद कुमार पांडे ने कहा कि डीसीएफआर देश का एकमात्र ऐसा प्रमुख अनुसंधान संस्थान है जो सतत विकास प्रबंधन और संरक्षण, नदियों में मछलियों के संरक्षण की दिशा में काम कर रहा है।

खाद्य व पोषण सुरक्षा में सुधार होना चाहिए

संस, भीमताल : केंद्रीय कृषि विवि इंफाल के पूर्व उपकुलपति पद्मविभूषण डा. रमबदन सिंह ने कहा कि ग्रामीण क्षेत्रों में खेती को व्यावहारिक बनाकर खाद्य व पोषण सुरक्षा में सुधार होने चाहिए। उन्होंने किसानों की आय को दोगुना करने के लिए नवीन सोच और विषय विशेषज्ञता के लिए स्मार्ट कृषि पद्धतियों के महत्व को रेखांकित किया।

डा. सिंह भारत की आजादी के 75 वर्ष पूर्ण होने के उपलक्ष्य में आजादी का अमृत महोत्सव के तहत शीतजल मात्स्यकी अनुसंधान निदेशालय भीमताल द्वारा आयोजित कार्यक्रम को संबोधित कर रहे थे। इस मौके पर निदेशक डीसीएफआर डा. प्रमोद पांडे ने कहा कि भारत और एशिया प्रशांत क्षेत्र में भूख और गरीबी को कम करने की दिशा में कृषि में परिवर्तन के लिए वर्ष 2003 में तत्कालीन राष्ट्रपति ने डा.रमबदन सिंह को पद्मविभूषण से सम्मानित किया गया था। निदेशक सीआइएफई डा. दिलीप कुमार ने भी विचार रखे।

कृषकों से जलवायु अनुकूल खेती करने पर जोर

भीमताल। शीतजल मात्स्यिकी अनुसंधान निदेशालय (डीसीएफआर) भीमताल में कृषकों के लिए कृषक-वैज्ञानिक संवाद का आयोजन किया गया। जिसमें कृषकों को वीडियो कॉन्फ्रेंसिंग के माध्यम से प्रधानमंत्री के संवाद का प्रसारण सुनाया गया। कृषक-वैज्ञानिक परिचर्चा में अनुसंधान निदेशालय के निदेशक डा. प्रमोद कुमार पांडे ने कृषकों का स्वागत करते हुए जलवायु अनुकूल खेती करने पर जोर दिया। उन्होंने कृषकों से कृषि वैज्ञानिकों द्वारा तैयार बीजों व विधियों का कृषि कार्य में उपयोग करने से कम लागत में अधिक उत्पादन [illegible] है। इस दौरान डा. [illegible]

तलहटी में किसानों को बांटा मत्स्य आहार

डीसीएफआर ने भुमका के ग्रामीणों को बांटे मछली बीज

उत्तर उजाला संवाददाता

भीमताल। शीतजल मत्स्य अनुसंधान निदेशालय, डीसीएफआर की ओर से ओखलकांडा के दूरस्थ गांव भुमका के ग्रामीणों को निःशुल्क मछली के बच्चे एवं चारा वितरण किया गया। डीसीएफआर ने एक हजार मछली के बच्चे, दस कुंतल चारा, जांच किट, दवाई किट एवं खाद आदि निःशुल्क उपलब्ध कराई।

भुमका में ग्रामीणों को मछली के बीज प्रदान करते मत्स्य वैज्ञानिक

वैज्ञानिक एवं नोडल अधिकारी डा सुरेश चंद्रा ने ग्रामीणों को ऑक्सीजन की जांच, तालाबों, पानी की गुणवत्ता, पौष्टिक आहार का प्रयोग व रोगों पर नियंत्रण आदि के बारे में बताया। डॉक्टर [illegible], प्रधान मुकेश बौद्ध ने शीत जल निदेशक डॉ प्रमोद कुमार पांडे को अनुसूचित जाति उपयोजना के तहत गांव का चयन करने के लिए आभार प्रकट किया। उन्होंने निदेशक से ग्राम वासियों को रंगीन मछली निःशुल्क वितरित किये जाने की मांग की। यहां डा. सिंह, मनमोहन सिंह, सरपंच पुष्पा देवी, उप प्रधान तारा देवी, मोहन चंद्र, पनी राम, धनी राम, नवयुवक मंगल दल अध्यक्ष गोपाल चंद्र, दीक्षित [illegible], राकेश चंद्र, वेद प्रकाश, जीवन लाल, रविंद्र कुमार, विपिन चंद्र, खीम राम, [illegible] राम, महेश चंद्र, [illegible], दीवान राम, हरीश चंद्र, हेम चंद्र, नवीन चंद्र, कैलाश चंद्र, भोपाल आदि लोग उपस्थित रहे।

भाकृअप के स्वच्छता पखवाड़े का समापन

भीमताल। भारतीय कृषि अनुसंधान परिषद में चल रहे स्वच्छता पखवाड़े का शुक्रवार को समापन हुआ। इस दौरान संस्थान के कर्मचारियों व अधिकारियों ने स्वच्छता की प्रतिज्ञा ली। पखवाड़े के तहत चंपावत परिक्षेत्र में पौधारोपण किया गया। निदेशक डॉ. प्रमोद कुमार पांडे ने बताया कि निदेशालय में कार्यालय के अभिलेखों का डिजिटाइजेशन किया जा रहा है। निदेशालय परिसर को स्वच्छ बनाने के लिए पुराने अभिलेखों व टूटे-फूटे फर्नीचरों की छंटाई की गई। आसपास की आवासीय स्कूलों के साथ ही मेरा गांव मेरा गौरव के अंतर्गत लिए गए गांवों सहित विभिन्न स्थानों पर स्वच्छता अभियान चलाया गया। बागवानी में उपयोग के लिए अपशिष्ट जल के महत्व के बारे में लोगों को जानकारी दी गई।

अल्मोड़ा न्यूज : मत्स्य पालकों को 29 कुंतल निःशुल्क मत्स्य आहार का वितरण

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अल्मोड़ा न्यूज़ : मत्स्य पालकों को 29 कुंतल निःशुल्क मत्स्य आहार का वितरण

घर के कचरे से खाद बनाना बताया

रामगढ़। तल्ला रामगढ़ के जीआईसी में मंगलवार को डीसीएफआर भीमताल ने धन की बर्बादी पर कार्यक्रम का आयोजन किया।

डीसीएफआर निदेशक डॉ. प्रमोद कुमार पांडे ने कहा कि पर्यावरण को स्वच्छ रखने के लिए रसोई और खेत के कचरे को खाद में बदलना होगा। डॉ. एनएन पांडे और डॉ. अमित पांडे ने कचरे को खाद बनाने की विधि बताई। इस दौरान प्रधानाचार्य एसके दुबे, प्रधान बसंत लाल साह, बीडीसी सदस्य यशपाल आर्य मौजूद रहे। (संवाद)

स्वच्छता पखवाड़े का शुभारंभ

भीमताल। डीसीएफआर में गुरुवार को स्वच्छता पखवाड़े का शुभारंभ हुआ। जिसमें कृषकों एवं संस्थान के स्टाफ द्वारा प्रतिज्ञा ली गई। इस अवसर पर भीमताल क्षेत्र के आसपास के लगभग 50 कृषकों ने भाग लिया। संस्थान निदेशक डॉ प्रमोद कुमार पांडे ने कृषकों का स्वागत किया तथा अपने दैनिक जीवन में ऑर्गेनिक एवं प्राकृतिक कृषि को अपनाने पर जोर दिया। साथ ही स्वच्छता की महत्ता पर प्रकाश डाला। कार्यक्रम का संचालन डॉ एनएन पांडे ने किया।

वैज्ञानिकों ने मत्स्य पालन के गुरु बताए

मत्स्य पालकों को दी विजीत पांडे का आयोजन किया

आत्मनिर्भरता के लिए मछली उत्पादन करें

मत्स्य आहार और बीज वितरित किए

बुधवार 18 08 2021

भीमताल (नैनीताल)। मत्स्य विभाग उत्तराखंड सरकार और शीतजल मात्स्यिकी अनुसंधान निदेशालय की ओर से अनुसूचित जाति के कृषकों को मत्स्य आहार और मत्स्य बीज वितरित किए गए। इस मौके पर डीसीएफआर निदेशक प्रमोद कुमार पांडे, नोडल अधिकारी प्रधान वैज्ञानिक डॉ. सुरेश चंद्र, मत्स्य निरीक्षक कुंवर सिंह बगड़वाल, मुकेश गिरी, नदीम उल्ला, इंदर लाल आदि मौजूद रहे। (संवाद)

किसानों को बताया ऑक्सीजन की जांच का तरीका

हम लोग

अब भीमताल में रेनबो ट्राउट मछली का स्वाद

मत्स्य किसानों की आर्थिक स्थिति ठीक करने पर जोर

16. Publications

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16.4 Policy papers

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16.5 Bulletins, Leaflets and Manuals

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- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC04 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. GeneBank: OK040238.

- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021) *Tor chelynoides* isolate TC23 (DCFRMU0132) cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. GeneBank: OK030208.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021) *Tor chelynoides* isolate TC19 (DCFRMU0130) cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. GeneBank: OK030206.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021) *Tor chelynoides* isolate TC21 (DCFRMU0131) cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. Gene Bank: OK030207.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC24 (DCFRMU0133) cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. GeneBank: OK030209.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021) *Tor chelynoides* isolate TC05 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. GeneBank: OK040239.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC06 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. Gene Bank: OK040240.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC07 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. Gene Bank: OK040241.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC08 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. Gene Bank: OK040242.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC09 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. Gene Bank: OK040243.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC11 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. Gene Bank: OK040244.
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- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC02 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. GeneBank: OK040236.
- Shahi, N., Sarma, D., Singh, B., Ganie, P.A. and Haldar, R.S. (2021). *Tor chelynoides* isolate TC03 cytochrome c oxidase subunit I (COX1) gene, partial cds; mitochondrial. GeneBank: OK040237

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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 13.05.2021to 31.12.2021:

S.No.	Purpose	Date
1.	SFC Presentation-Fisheries Science under the Chairmanship of Secretary, DARE and DG, ICAR.	24.05.2021
2.	SFC Presentation-Fisheries Science under the Chairmanship of Secretary, DARE and DG, ICAR.	25.05.2021
3.	Dedication of ICAR Technologies to Farmers and Kritagya Hackathon Award Ceremony under the chairmanship of Hon'ble Agriculture Minister Shri Narendra Tomar ji	31.05.2021
4.	"Food and Dietary concepts of Ayurveda-Indian traditional wisdom of food for better nutrition and Health" on the occasion of 'Azadi Ka Amrut Mahotsav', lectured by Dr S.K. Sharma, Former Advisor, Ayurveda for Ministry of Ayush for Govt. of India, on the occasion of 75 years of India's Independence..	01.06.2021
5.	Workshop on "EFC presentation and preparation" under the Chairmanship of Secretary, DARE and DG, ICAR.	04.06.2021
6.	SFC Discussion of 3 Schemes of Fisheries SMD.	05.06.2021
7.	Lecture on ""Public-Private Partnerships for sustainable irrigation: Roles of government, users & the private sector"" by Dr Steve Goss, Economics Advisor to World Bank and FAO on the occasion of 75 years of India's Independence.	07.06.2021
8.	Lecture on "Fostering Enabling Environment for Agribusiness" by Dr Farbod Youssefi, Senior Agriculture Specialist, South Asia, World Bank on the occasion of 75 years of India's Independence.	09.06.2021
9.	Discussion on projects under PMMSY with Sh. G. Rathanraj, Executive Director, NFDB Hyderabad convened by ICAR-DCFR Bhimtal. (with presence of official staff Dr N.N.Pandey, P.S, Sh. Rajesh M., Scientist, Dr Biju S Kamalam, Scientist, Mrs. Garima, Scientist, and Sh. Kishor Kunal Scientist).	10.06.2021
10.	Meeting on the issue of centralized release of data related to fisheries sectors in India under the chairmanship of the Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying.	15.06.2021
11.	Lecture on Towards a better future for food systems by Mr Devinder Sharma, Distinguished Food and Trade Policy Analyst on the occasion of 75 years of India's Independence.	15.06.2021
12.	Twenty Seventh meeting of the National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the Chairmanship of Shri Sagar Mehra, Joint Secretary (Inland Fisheries).	16.06.2021
13.	Lecture on "Know your Dairy Food" by Dr A.K. Srivastava, Member, ASRB on the occasion of 75 years of India's Independence.	17.06.2021
14.	Virtual Meeting of SLAMC under Pradhan Mantri Matsya Sampada Yojna (PMMSY) for approval of projects proposed for FY 2021-22 is scheduled to be held in chairmanship of Secretary Fisheries, Govt. of Uttarakhand, Dehradun, Uttarakhand.	18.06.2021
15.	Organizing Farmers Awareness Compaign on BALANCED USE OF FERTILIZER IN AQUACULTURE by the Institutes under Fisheries Sciences Division, ICAR on the occasion of 75 years of India's Independence.	18.06.2021
16.	ICAR institutes at Uttrakhand-preliminary meeting organized by ICAR-IISWC Dehradun	19.06.2021
17.	IRC Meeting at ICAR-DCFR Bhimtal.	23.06.2021 to 25.06.2021

18.	Lecture on Rishi Krishi by Sh. Pratap Chandra Sarangi, Hon'ble Minister of State, Animal Husbandry, Dairying and Fisheries and Micro, Small and Medium Enterprises on the occasion of 75 years of India's Independence.	24.06.2021
19.	Lecture on How to Overcome Stress by Gurudev Sri Sri Ravi Shankar, on the occasion of 75 years of India's Independence.	28.06.2021
20.	IRC Meeting at ICAR-DCFR Field Centre, Champawat.	28.06.2021 to 29.06.2021
21.	Meetings of Directors & Senior Officers of Fisheries SMD.	01.07.2021
22.	ICAR-Director Conference under the chairmanship of Secretary DARE & DG ICAR.	02.07.2021
23.	Lecture on Strategies for doubling farmers income in the hill region: Technological options by Prof. M. Premjit Singh, Former Vice Chancellor, Central Agricultural University, Imphal, Manipur convened by ICAR-DCFR Bhimtal on the occasion of Azadi ka amrut mahotsav.	03.07.2021
24.	98th Foundation Day of ICAR-VPKAS Almora.	04.07.2021
25.	Review Meeting on Regulatory Compliance Burden under the chairmanship of Secretary DARE & DG ICAR.	14.07.2021
26.	Nation-wide campaign on tree plantation and awareness on the eve of ICAR's Foundation Day under the chairmanship of Secretary DARE & DG ICAR.	16.07.2021
27.	Launching of Tree Plantation Campaign Hosted by ICAR-CAFRI under the chairmanship of Dr A. Arunachalam, Director, ICAR - Central Agroforestry Research Institute, Jhansi, U.P	
28.	93rd ICAR Foundation day and award function of ICAR	16.07.2021
29.	Meeting of Fisheries SMD & Directors of ICAR Fisheries Institutes with Director & Senior Officers of Department of Fisheries, Govt of Bihar under the chairmanship of DDG (F.S), ICAR, New Delhi.	20.07.2021
30.	28th Meeting of National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the chairmanship of Joint Secretary (Inland Fisheries) through VC.	23.07.2021
31.	Mid Term Review for XXVI Meeting of ICAR-Regional Committee No. V comprising the States of Punjab, Haryana and Delhi convened by ICAR-IASRI New Delhi.	27.07.2021
32.	Meeting with Additional Secretary DARE regarding Final EFC presentation.	29.07.2021
33.	CIFRI: Remembrance with Reverence on the occasion of First Lecture of the ICAR-CIFRI Platinum Jubilee Lecture Series under the chairmanship of Dr S. Ayyappan, Former Secretary (DARE) and DG ICAR convened by ICAR-CIFRI Barrackpore.	03.08.2021
34.	Lecture on Agricultural Transformation for Nutritional Security by Dr R.B.Singh, Former Chancellor, Central Agricultural University, Imphal, Manipur Former Chairman, ASRB, Former ADG & Regional Representative for Asia and the Pacific, FAO convened by ICAR-DCFR Bhimtal on the occasion of Azadi ka amrut mahotsav.	07.08.2021
35.	Presentation of Project Proposal under PMMSY scheme with Sh. Sagar Mehra, JS (I.Fy.)	12.08.2021
36.	Monthly Meeting of Fisheries SMD & Directors of Institutes under the chairmanship of DDG (FS), ICAR, New Delhi.	13.08.2021
37.	Ph.D Viva Voce Examination of Sh. Ritesh Tandel, Scientist.	16.08.2021
38.	29th Meeting of National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the chairmanship of Joint Secretary (Inland Fisheries) through VC.	19.08.2021
39.	XXVI Meeting of ICAR Regional Committee No. VII comprises the States of Maharashtra, Madhya Pradesh, Chhattisgarh and Goa 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 and Shri Kamal Patel, Hon'ble Minister of Agriculture Govt. of MP would also participate in the meeting as the Guests of Honour convened by ICAR, New Delhi.	25.08.2021
40.	Celebration under Azadi Ka Amrit Mahotsav- National level campaign theme "Food and Nutrition for Farmers" under the chairmanship of Prof. R.S.Chauhan, Dean, College of Fisheries, GBPUA&T, Pantnagar convened by ICAR-DCFR Bhimtal.	26.08.2021
41.	PMMSY-Fourth meeting of the Project Monitoring and Evaluation Unit (PMEU) under the chairmanship of Joint Secretary (M.Fy) and Joint Secretary (I.Fy) under the Central Sector Component of PMMSY.	27.08.2021
42.	Celebration under Azadi Ka Amrit Mahotsav- "Diversification in Aquaculture" under the chairmanship of Dr A.P. Sharma, Former Director, ICAR-CIFRI, Barrackpore convened by ICAR-DCFR Bhimtal.	01.09.2021

43.	Monthly meeting conveyed by DDG (F.S).	11.09.2021
44.	XXVII Meeting of ICAR Regional Committee No. VIII comprising the states of Karnataka, Kerala, Tamil Nadu and UT's of Lakshadweep and Puducherry 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 and Shri Kamal Patel, Hon'ble Minister of Agriculture Govt. of MP would also participate in the meeting as the Guests of Honour convened by ICAR, New Delhi.	14.09.2021
45.	Meeting with the Directors of Fisheries Research Institutes on 17th September 2021 for discussions on organisation on Campaign on Nutri-garden and Tree Plantation	16.09.2021
46.	Preliminary Meeting of the Task Force Committee constituted for ACZ-1 (Western Himalayas) as per the PM review meeting under the chairmanship of Dr Tej Pratap Singh, Hon'ble Vice Chancellor & Chairman of Task Force Committees, GBPUA&T, Pantnagar.	16.09.2021
47.	Nutricereals Multi-stakeholders Mega convention, and Poshan Vatika and Tree plantation Campaign event for International Year of Millets 2023 under the chairmanship off DDG (FS), ICAR, New Delhi.	17.09.2021
48.	Recirculating Aquaculture System for Intensive Farming of Rainbow Trout organized by ICAR-DCFR Bhimtal.	17.09.2021
49.	30th Meeting of National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the chairmanship of Joint Secretary (Inland Fisheries).	23.09.2021
50.	Preparatory Meeting of SFC presentations of FS Division under the chairmanship off DDG (FS), ICAR, New Delhi.	27.09.2021
51.	Celebration under Azadi Ka Amrit Mahotsav-Future Proofing the Drylands by Dr Jacqueline d'Arros Hughes, Director General of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR.	05.10.2021
52.	Monthly Meeting of Fisheries Science Division conveyed by DDG (F.S).	21.10.2021
53.	Review meeting on special Campaign on Swachhta and Pending matters hosted by ICT Unit, ICAR under the chairmanship of Sh. N.S. Tomar, Hon'ble AM.	27.10.2021
54.	Interaction Meeting of ICAR Scientists with Secretary, DARE & DG, ICAR.	28.10.2021
55.	31st Meeting of National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the chairmanship of Joint Secretary (Inland Fisheries) through VC.	02.11.2021
56.	Monthly Meeting of Fisheries Science Division conveyed by DDG (F.S).	02.11.2021
57.	Celebration under Azadi Ka Amrit Mahotsav- Talent Search for Manning Agriculture TREE (teaching, research and extension education) under the chairmanship of Dr C D Mayee, Formerly: Chairman, Agricultural Scientists Recruitment Board, New Delhi, Agri. Commissioner, Min of Agriculture, Govt.of India, New Delhi.	11.11.2021
58.	Participation in XV Agricultural Science Congress at Banaras Hindu University, Varanasi	13.11.2021 to 16.11.2021
59.	Celebration under Azadi Ka Amrit Mahotsav- Protection of plant varieties, the key to improved agricultural commerce & growth by Dr K.V. Prabhu Chairperson, Protection of Plant Varieties and Farmers' Rights Authority, Govt. of India under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR.	01.12.2021
60.	Virtual training on 'Rainbow Trout Nutrition and Feeding' by ICAR DCFR	04.12.2021
61.	World Soil Day	05.12.2021
62.	XXV Meeting of ICAR Regional Committee No. III comprising the states of comprising the States of Assam, Sikkim, Mizoram, Arunachal Pradesh, Nagaland, Tripura, Meghalaya and Manipur under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR organized by ICAR Research Complex for NEH Region, Umiam - Meghalaya at ICAR-Krishi Bhawan, New Delhi.	11.12.2021
63.	Meeting to discuss the program of Honourable PM Hosted by ICT Unit, ICAR under the chairmanship of Dr T.Mohapatra, Sec, DARE and DG, ICAR.	13.12.2021
64.	Meeting on "Coldwater Fisheries: Untapped Resource" organized by Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India, Krishi Bhawan,New Delhi.	22.12.2021

Dr Pramod Kumar Pandey, Director, ICAR-DCFR participated as session Chairman in the XV Agricultural Science Congress at BHU, Varanasi

Meetings/seminars/conferences/workshops attended by Dr D. Sarma, Director (Acting) during 01.01.2021 to 12.05.2021:

S.No.	Purpose	Date
1.	Attended Review Meeting of Officers & Staff of DARE & ICAR under the the chairmanship of the Hon'ble Agriculture and Farmers Welfare Minister.	01.01.2021
2.	Meeting for Discussions on EFC/SFCunder the chairmanship of DDG (F.S).	04.01.2021
3.	Meeting of Growel Fish Feed, AP	15.01.2021
4.	International Webinar on Fish Reproduction of the subject Germ Cells in Fish: Basic to Application.	22.01.2021
5.	Monthly Meeting of Fisheries SMDunder the chairmanship of DDG (F.S).	25.01.2021
6.	IACUC Meeting.	25.01.2021
7.	Webinar on Recirculatory Aquaculture System (RAS) for intensive farming of Rainbow Trout organized by ICAR-DCFR Bhimtal. DDG (FS)	29.01.2021
8.	Ph.D) Thesis submission meetingof Sh. Kishor Kunal, Scientist at CIFE, Mumbai	29.01.2021
9.	Webinar on IInd meeting of Network Programme on Mahseer (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)	30.01.2021
10.	Meeting with skritting feeds, Norway	03.02.2021
11.	Sh. Kishor Kunal, Scientist (Ph.D) Thesis meeting.	04.02.2021
12.	SMD Monthly Meeting under the chairmanship of DDG (F.S).	10.02.2021
13.	Meeting with NHPC on Tripartite MoA for implementation of Fisheries Management Plan at Subansiri Lower Project.	10.02.2021
14.	Meeting with Agrinnovate India Ltd., Delhi.	17.02.2021
15.	Assessment Committee Meeting of Scientist in the field of Fish Health.	22.02.2021
16.	National Workshop on "Recent Advances in Coldwater Fish Farming Technologies" on virtual mode under PMMSY programme.	24.02.2021
17.	Foundation Stone Laying Ceremony of Administration-cum-Laboratory Building of ICAR-VPKAS.	26.02.2021
18.	Twenty Sixth Meeting of the National Committee on Introduction of Exotics Aquatic Species into India under the Chairmanship of Sh. Sagar Mehra, Joint Secretary (Inland Fisheries).	02.03.2021
19.	Meeting on Budget Utilization under the chairmanship of Secretary DARE and DG ICAR.	05.03.2021
20.	Monthly Meeting of Directors and Fisheries SMD under the chairmanship of DDG (F.S).	10.03.2021
21.	India UK Aquaculture partnerships-aquaculture monitoring Strategies &systems and also on Sustainable and SMART aquaculture management.	10.03.2021
22.	Webinar on Biology, Breeding and Seed Production of Snow Trout.	25.03.2021
23.	Ph.D Viva-voce meeting at Aligarh Muslim University.	25.03.2021
24.	RAC Meeting of DCFR.	26.03.2021
25.	Webinar on BOS meeting at Kumaun University, Nainital.	03.04.2021
26.	Monthly Meeting of the Directors of Fisheries Institutes & SMD under the chairmanship of DDG (F.S).	07.04.2021

27.	Mid-Term Review Meeting of the 24th Regional Committee Meeting (RCM) Zone-III under the chairmanship of Dr S.K. Chaudhary, DDG, Natural Resources Management Division of ICAR, New Delhi organized by Director ,ICAR RC-NEH, Umiam (Barapani), Meghalaya.	10.04.2021
28.	XXV Meeting of ICAR Regional Committee No. II organized by Director (A), ICAR-National Rice Research Institute Cuttack, Odisha.	12.04.2021
29.	Mid Term Review Meeting of Regional Committee-I organized by Mr. Brajesh Singh, IN-CHARGE, PME CELL & COORDINATOR, ICAR Regional Committee Meeting (Region-I), ICAR-Central Potato Research Institute, Shimlaunder the Chairmanship of Dr AK Singh, Deputy Director General (Horticulture Science), ICAR& Nodal Officer of Regional Committee-I.	12.04.2021
30.	Meeting with DDG (FS) with all the fisheries institute Directors	16.04.2021

17.2 Participation in meetings /seminars/ conferences/ workshops

- A.K. Giri attended a Regional Eastern Africa e-Conference on Aquaculture, organized by Aquaculture Africa Magazine (AAM) and World Aquaculture Society African Chapter (WASAC) during 27-29th August, 2021.
- A.K. Giri attended an international webinar on 'Biofloc aquaculture- for fish farmers or wizards?' organized by Aquaculture Africa Magazine (AAM) on 23rd September, 2021.
- A.K. Giri attended in National Stakeholder Consultation on 'Indian Ornamental Fisheries 2.0- The Way Forward', organized by ICAR-CIFA, Bhubaneswar in collaboration with Dept. of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India, New Delhi and NFDB, Hyderabad during 22-24th April, 2021.
- A.K. Giri attended in the webinars on 'Implementation and use of Agricultural Research Management System (ARMS)' organized by ICAR-IASRI, New Delhi on 25th November, 2021, 2nd December, 2021, 9th December, 2021 and 16th December, 2021.
- A.K. Giri participated in Kisan Goshti cum Awareness and Demonstration program on Balanced Use of Fertilizer in Aquaculture, organized by ICAR-DCFR, Bhimtal on 18th June, 2021.
- A.K. Giri participated in the 'UK-India Aquaculture Partnerships for Research and Innovation' international event virtually during 08-11th March, 2021 and interacted with the experts working on precision fish farming for future collaborative work.
- A.K. Giri participated in the celebration of 7th International Yoga Day at home isolation with the theme, 'Be with yoga, Be at home' on 21st June, 2021.
- A.K. Giri participated in the celebration of World Soil Day at ICAR-DCFR, Bhimtal with special talk by Dr Anjuli Agrawal on 4th December, 2021.
- A.K. Giri participated in the international webinar on 'Fish Reproduction', organized by ICAR-DCFR, Bhimtal on 22nd January, 2021.
- A.K. Giri participated in the virtual training program on Expert talk: Innovation and Technology in Fisheries Sector, organized by Agrinnovate India on 22nd February, 2021.
- A.K. Giri participated in the webinar on 'Start-ups in Hydroponics' hosted by MANAGE-CIA, Hyderabad on 29th May, 2021.
- A.K. Giri participated in the webinar on Processing Patents and Trademark Filing for Start-ups, organized by MANAGE AC&ABC Incubation Centre, Hyderabad on 12th June, 2021.
- A.K. Giri participatedin an international webinar on 'Design, feeding and management for Aquaculture hatcheries' organized by Aquaculture Africa Magazine (AAM) and World Aquaculture Society African Chapter (WASAC) on 29th July, 2021.
- Amit Pande attended the webinar on "Agricultural transformation for nutritional security" organized by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 7th August, 2021.
- Amit Pande attended "Azadi Ka Amrut Mahotsav" Seminar on Farmer's Day on 10th July 2021 Invited Lecture- Prof. Ajay Rawat, Retd. Professor, Kumaun University.
- Amit Pande attended a seminar on Nutricereals Multi-stakeholders Mega convention, and PoshanVatika and Tree plantation Campaign event for International Year of Millets 2023.
- Amit Pande attended an expert talk on "Strategies for doubling farmers income in the hill region: Technological options" organized by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 3rd July, 2021.
- Amit Pande attended special talk by Dr Anjuli Agrawal (Professor GB Pant University of Ag & Tech, Nainital, Uttarakhand, India on World Soil Day on 4th December, 2021.
- Amit Pande attended the webinar on Coldwater Fisheries the untapped resources organized by the Ministry of Fisheries, Animal Husbandry and Dairying on 22nd December, 2021.
- Amit Pande attended the webinar on "Diversification in aquaculture" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 1st September, 2021.

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- Amit Pande attended the webinar on "Food and nutrition for farmers" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 26th August, 2021.
- Amit Pande coordinated and attended a webinar on the occasion of Rastriya Ekta Diwas on "Sardar Bhai Patel: An Architect of United India" on 31st October, 2021.
- Amit Pande participated in the online valedictory programme "Pre-vibrant Gujarat Summit 2021" 16 Dec 2021 addressed by Hon'ble PM of India. Participated in Regional Committee Meeting on 11th December, 2021
- B.S. Kamalam attended the international webinar on Recent advances in coldwater fish farming technologies, jointly organised by the Ministry of Fisheries, Animal Husbandry & Dairying, National Fisheries Development Boardand ICAR-DCFR, on 24 February 2021, and delivered a theme presentation on 'Nutrition and feed management in rainbow trout farming'.
- B.S. Kamalam participated in the brainstorming session on 'Fish microbiome and immunome research' organised by ICAR-CMFRI Dr E.G. Silas Centre of Excellence and Innovations, on 20 December 2021, and delivered a brief presentation on the technical and biological challenges in fish microbiome studies.
- B.S. Kamalam participated in the UK-India Aquaculture Partnerships for Research and Innovation virtual conference, organised by UK Science and Innovation Network, British High Commission, New Delhi, during 8-11 March 2021, and delivered a theme presentation on 'Coldwater aquaculture research in India'.
- B.S. Kamalam, Rajesh, M., Prakash Sharma and Debajit Sarma attended a virtual meeting with Mr. P.S. Narendra (Executive Director), Dr Arul Victor Suresh (Technical Director) and Mr. Grace Angel (Dy. Manager) of Growel Feeds Pvt. Ltd., on 15January 2021 to discuss the progress of research collaboration on rainbow trout feed development. B.S. Kamalam gave a brief presentation on the experimentations and research activities.
- B.S. Kamalam, Rajesh, M., Prakash Sharma, Ciji, A. and Debajit Sarma attended a virtual meeting with executive representatives of Skretting(Nutrecofeed company, Norway) on 11 February 2021 for discussing potential research collaboration on rainbow trout feed evaluation in India.
- B.S. Kamalam, Rajesh, M., Prakash Sharma, M.S. Akhtar, Ciji, A. and Debajit Sarma attended a virtual meeting with executive representatives of Aker BioMarine (Norway) on 24 March 2021 for discussing potential research collaboration on krill meal evaluation trials. B.S. Kamalam gave a brief presentation on rainbow trout feeds R&D in India.
- Ciji Alexander attended an expert talk on "Strategies for doubling farmers income in the hill region: Technological options" organized by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 3rd July, 2021.
- Ciji Alexander attended India-UK aquaculture partnership programme during 8-11th March, 2021 organized by ICAR, New Delhi.
- Ciji Alexander attended international webinar on "Fish reproduction" organized by ICAR-DCFR, Bhimtal on 22nd January, 2021.
- Ciji Alexander attended the webinar on "Agricultural transformation for nutritional security" organized by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 7th August, 2021.
- Ciji Alexander attended the webinar on "Diversification in aquaculture" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 1st September, 2021.
- Ciji Alexander attended the webinar on "Food and nutrition for farmers" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 26th August, 2021.
- Ciji Alexander attended webinar on "Recent advances in coldwater fish farming technologies" organized by ICAR-DCFR, Bhimtal on 24th February, 2021.
- D. Thakuria participated in International Webinar on "Covid-19 Pandemic: Concerns and Perspectives" on 23rd January 2021 of Animal Biotechnology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India
- D. Thakuria Participated in the online workshop on "Site specific Molecular Docking studies (Auto Dock Vina)" held on 31st July, 2021 organized by FINOSEQ.
- Debajit Sarma participated and delivered talk in DISTF Agriculture and Technology Conclave, 2021 at Regional Science Centre, Dehradun on 28th November, 2021 on "Diversification of aquaculture: Way Forward for Blue Revolution in Hilly Region"
- Kh. Victoria Chanu attended National Fish Farmers' Day on 10th July 2021 organized at ICAR-DCFR, Bhimtal.
- Kh. Victoria Chanu attended the webinar on "Food and nutrition for farmers" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 26th August, 2021.
- Kh. Victoria Chanu attended virtual talk on "Agricultural transformation for nutritional security" on 7th August, 2021 organized by ICAR-DCFR under Azadi ka Amrut Mahotsav.
- Kh. Victoria Chanu attended virtual talk on "Diversification in Aquaculture" on 1st September, 2021 by Dr A. P. Sharma.
- Kh. Victoria Chanu Participated in International Webinar on "Covid-19 Pandemic: Concerns and Perspectives" on 23rd January

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2021 of Animal Biotechnology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India.

- Kh. Victoria Chanu participated in the celebration of World Soil Day at ICAR-DCFR, Bhimtal with special talk by Dr Anjuli Agrawal on 4th December, 2021.
- Kh. Victoria Chanu Participated in the online workshop on "Site specific Molecular Docking studies (Auto Dock Vina)" held on 31.07.2021 organized by FINOSEQ.
- Kishor Kunal attended as "Guest of Honour" in Indo-Bangladesh International Webinar on Aquaculture and Fisheries celebrating Fish Farmers Day on 10th July, 2021 organised by The Neotia University, Kolkata.
- Kishor Kunal attended one day seminar cum training programme organised by District Fisheries Department, Champawat at Pati Block and gave lecture on the topic construction and management of carp ponds in mid hills on 5th February, 2021.
- M.S. Akhtar attended an expert talk on "Strategies for doubling farmers income in the hill region: Technological options" organized by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 3rd July, 2021.
- M.S. Akhtar attended India-UK aquaculture partnership programme during 8-11th March, 2021 organized by ICAR, New Delhi.
- M.S. Akhtar attended international webinar on "Fish reproduction" organized by ICAR-DCFR, Bhimtal on 22nd January, 2021.
- M.S. Akhtar attended the webinar on "Agricultural transformation for nutritional security" organized by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 7th August, 2021.
- M.S. Akhtar attended the webinar on "Diversification in aquaculture" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 1st September, 2021.
- M.S. Akhtar attended the webinar on "Food and nutrition for farmers" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 26th August, 2021.
- M.S. Akhtar attended webinar on "Recent advances in coldwater fish farming technologies" organized by ICAR-DCFR, Bhimtal on 24th February, 2021.
- N.N. Pandey as co-coordinator organized the technical session, theme 6: Harnessing Energy Efficiency in Fisheries sector during XV Agricultural Science Congress on 16th November, 2021 at Institute of Agricultural Sciences, Banaras Hindu University, Varanasi.
- N.N. Pandey attended 25th Regional Committee Meeting for Zone- on 11th December, 2021
- N.N. Pandey attended 27th Meeting of National Committee on Introduction of Exotic Aquatic species into Indian waters held on 16th June, 2021.
- N.N. Pandey attended 28th Meeting of National Committee on Introduction of Exotic Aquatic species into Indian waters held on 23rd July, 2021.
- N.N. Pandey attended 29th Meeting of National Committee on Introduction of Exotic Aquatic species into Indian waters held on 19th August, 2021.
- N.N. Pandey attended 30th Meeting of National Committee on Introduction of Exotic Aquatic species into Indian waters held on 23rd September, 2021.
- N.N. Pandey attended 31st Meeting of National Committee on Introduction of Exotic Aquatic species into Indian waters held on 2nd November, 2021.
- N.N. Pandey attended Hill Consortium meeting on 10th November, 2021.
- N.N. Pandey attended Review meeting on special campaign and pending matters, which was held on 27th October, 2021 under the Chairmanship of Hon'ble MoS.
- N.N. Pandey attended XV Agricultural Science Congress & ASC Expo' organized by National Academy of Agricultural Sciences and Banaras Hindu University at Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during November 13-16, 2021 and presented a paper on Comparative growth of three species of snow trout and their aquaculture prospects.
- Neetu Shahi and Sumanta Kumar Mallik attended FAO virtual terminal workshop on topic "Support mitigation of AMR risk associated with aquaculture in Asia" on 23 to 24 November, 2021.This workshop was organised in collaboration with Nitte University & Infofish.
- Neetu Shahi and Sumanta Kumar Mallik attended virtual "International Technical Seminar on understanding AMR and Bio security in aquaculture" from 20-21st December, 2021. This seminar was organised by FAO candidate reference centres on AMR & Aquaculture Biosecurity
- Neetu Shahi attended "Coldwater Fisheries Society of India" general body meeting on 08th November, 2021 via virtual mode.
- Neetu Shahi attended "Interactive meeting of ICAR scientists and Secretary DARE and DG ICAR" by virtual mode of zoom on 27th October, 2021.
- Neetu Shahi attended expert talk on "Strategies for doubling farmers income in the hill region: Technological options" under Azadi Ka Amrut Mahotsava on 03rd July, 2021 at ICAR-DCFR via zoom platform.
- Neetu Shahi attended virtual 5th webinar on "Implementation and use of ARMS" for ICAR scientist on 9th December, 2021. This webinar was conducted by ICAR-IASRI, via zoom platform.

- Neetu Shahi attended virtual international webinar on "Fish Reproduction" on 22nd Janurary, 2021 organized by ICAR- Directorate of Coldwater Fisheries Research, Bhimtal, India.
- Neetu Shahi attended virtual meeting on "AQUAPRENEURSHIP" Institute Industry Interface organised by Agrinnovate+ICAR on 25th February, 2021. The purpose of this meeting was to conduct a branding and marketing exercise to spread awareness about aquaculture and fisheries technology developed by fishery based ICAR institutes.
- Neetu Shahi attended virtual talk on "Diversification in Aquaculture" on 1st September, 2021 by Dr A.P. Sharma.
- Neetu Shahi attended zoom meeting on topic "Talent search for manning agriculture tree (Teaching, Research and Extension Education)" by Dr C.D. Mayee, Former Chairman, ASRB, India.
- P.A. Ganie Attended the National webinar on "Casting into the future of Fisheries and Aquaculture" Organized by School of Fisheries, Centurion University of Technology and Management (CUTM), Odisha on 22-23 June, 2021
- Pragyan Dash attended virtual talk on "Agricultural transformation for nutritional security" on 7th August, 2021 organized by ICAR-DCFR under Azadi ka Amrut Mahotsav.
- Pragyan Dash attended virtual talk on "Food and nutrition for farmers" on 26.08.2021 organized by ICAR-DCFR under Azadi ka Amrut Mahotsav
- Pragyan Dash attended virtual talk on "Increasing Coldwater Fish Production and enhancing farmer's income" on 10th July 2020 on National Fish Farmers Day organized by ICAR-DCFR under Azadi ka Amrut Mahotsav.
- Pragyan Dash attended virtual talk on Diversification in Aquaculture on 01.09.2021 organized by ICAR-DCFR under Azadi ka Amrut Mahotsav
- Pragyan Dash attended virtual training on use of histological tool in aquaculture and fisheries research on 15th Dec., 2021 organized by ICAR-DCFR
- Prakash Sharma participated in webinar series: UK-India partnerships to further innovation in the aquaculture sector organised by UK Science & Innovation Network during 8-11th March, 2021.
- R.S. Patiyal participated on webinar "Patenting in India and Overseas: Pathways & Barriers", IKP Webinar Series 2021 organized by IKP PRIME (IKP Platform for Regional IP Management Ecosystem) on on 11th June, 2021.
- R.S. Patiyal Participated in webinar Aquaprenurship "Institute Industry Interface through virtual mode" program 2021 organised by Agri innovate India on dated 25th February, 2021.
- R.S. Patiyal participated in webinar on "Filling a Patent application, prosecution and grant patent in India, Organised by National Agriculture Higher Education Project (NAHEP) on dated 23rd January, 2021.
- R.S. Patiyal participated as expert in meeting for Progress report evaluation, chaired by commissioner Kumoan on "Ecological and fisheries profile of Kumoan lakes by Collage of Fisheries, Pantnagar on 23rd January, 2021.
- R.S. Patiyal participated in DPC for assessment for promotion under career advancement scheme of scientist of ICAR-NBFGR Lucknow, on 26th March, 2021.
- R.S. Patiyal participated in Webinar "Review and Sensitization Workshop organized by ZTMU ICAR-CIFT Cochin on dated 8th October, 2021
- R.S. Patiyal participated Prime ministers scheme for mentoring Young Authors on Aazadi ka Amrit mahotsav - Man ki baat, on 31st January, 2021.
- R.S. Patiyal participated in online training on ´ Recirculatary Aquaculture System for Intensive Farming of Rainbow Trout" organized by ICAR-DCFR Bhimtal on 17th September, 2021
- R.S. Patiyal participated in DPC meeting of ICAR- DCFR staff on 15th January, 2021.
- R.S. Patiyal participated in online meeting with DG ICAR Azaadi ka Amrit Mahotsav.
- R.S. Patiyal participated in Prime Minister Farmers Interaction on dated 28th September, 2021and given lecture on ornamental fish culture.
- R.S. Patiyal participated in Virtual training on "Frequently asked question (FAQS) on rainbow trout Nutrition and feeding organized by ICAR-DCFR on dated 4th December, 2021
- R.S. Patiyal participated in Webinar Emerging opportunity and Challenges for the Himalayan Agriculture on date 9th September, 2021 organized by ICAR-VPKAS,Almora
- R.S. Patiyal participated in webinar on ´Coldwater Fisheries: Untapped Resources´ organised by Department of Fisheries, Ministry of fisheries, Animal Husbandry & Dairying Govt. of India.On the occasion of Bharat ki Azaadi ka Amrit Mahotsav on 23rd December, 2021.
- R.S. Patiyal participated in webinar series No.-6 "Mahseer of Cauvery River" under theme conservation of freshwater fauna for pure water organized by Karnataka forest department on 23rd December, 2021.
- R.S. Patiyal participated in webinar lecture on "Diversification in Aquaculture" by Dr A.P. Sharma, during Azadi ka Amrit Mahotsav Program on dated 1st September, 2021

- R.S. Patiyal participated in webinar on the theme of "Identifying Right Startup Incubator for Technology & Market Connect" on 9th September 2021 organized by BIRAC BIG Team, a-IDEA (Technology Business Incubator of ICAR-NAARM).
- R.S. Patiyal attended talk on Agricultural Transformation for Nutritional Security BY Padam bhushan, Dr R.B. Singh during Azadi ka Amrit Mahotsav program Organised by ICAR-DCFR Bhimtal on dated 7th August, 2021.
- R.S. Tandel attended attended 12th Batch Generic Online Training Course in Cyber Security dated 29th April 2021 by Ministry of Electronics and Information Technology (MeitY), Government of India.
- R.S. Tandel attended International webinar on Aquatic Animal Health Part 3: Diseases and Treatment by Aquaculture Africa Magazine on 23rd April, 2021.
- R.S. Tandel attended the National Webinar: Disease and Health Management in Aquaculture & Culture of Marine Fish Seabass organised by Marsco Aqua Clinics - Aqua One Centre on 05-July-2021.
- R.S. Haldar attended International webinar on Fish Reproduction on 22nd January, 2021.
- R.S. Haldar participated in network programme on mahseer on 30th January 2021.
- R.S. Haldar participated in NFDB meeting on 10th June 2021.
- R.S. Haldar participated in webinar on strategies for doubling farmer's income in the NE region: Technology option-3rd July, 2021.
- R.S. Haldar participated in webinar on consultation on breeding of snow trout on 8th September, 2021.
- Raja Adil H. Bhatt attended International webinar on Aquatic Animal Health Part 3: Diseases and Treatment by Aquaculture Africa Magazine on 23rd April, 2021
- Raja Adil H. Bhatt attended the National Webinar: Disease and Health Management in Aquaculture & Culture of Marine Fish Seabass organised by Marsco Aqua Clinics - Aqua One Centre on 05-July-2021.
- Rajesh, M. participated in "Re-circulating Aquaculture Systems (RAS) - Can it work for Africa?" webinar organised by Africa Aquaculture Magazine on 19th March 2021.
- Rajesh, M. participated in Aquaculture Innovation Webinar III: Exploring the Frontiers of Aquaculture Systems webinar organised byInnovation Partner for Impact (IPI), Singapore on 27th May, 2021.
- Rajesh, M. participated in webinar on "Re-circulating aquaculture: Overview and Discussion "Ohio Aquaculture Association, Ohio State University Extension, and the North Central Regional Aquaculture Centre on February 20, 2021.
- Rajesh, M. participated in webinar series: UK – India partnerships to further innovation in the aquaculture sector organised by UK Science & Innovation Network during 8-11th March, 2021.
- S. Ali attended a seminar on Nutricereals Multi-stakeholders Mega convention, and Poshan Vatika and Tree plantation Campaign event for International Year of Millets 2023.
- S. Ali attended a webinar on the occasion of Rastriya Ekta Diwas on "Sardar Bhai Patel: An Architect of United India" on 31st October, 2021.
- S. Ali attended CFSI meeting held on 8th November, 2021.
- S. Ali attended expert talk on "Strategies for doubling farmers income in the hill region: Technological options" under Azadi Ka Amrut Mahotsava on 03rd July, 2021 at ICAR-DCFR via zoom platform.
- S. Ali attended National Fish Farmers' Day on 10th July 2021 organized at ICAR-DCFR, Bhimtal
- S. Ali attended the webinar on "Food and nutrition for farmers" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 26th August, 2021.
- S. Ali attended virtual international webinar on "Fish Reproduction" on 22nd Janurary, 2021 organized by ICAR- Directorate of Coldwater Fisheries Research, Bhimtal, India.
- S. Ali attended Virtual meeting with DG, ICAR on 28th October, 2021.
- S. Ali attended virtual talk on "Agricultural transformation for nutritional security" on 7th August, 2021 organized by ICAR-DCFR under Azadi ka Amrut Mahotsav.
- S. Ali attended virtual talk on "Diversification in Aquaculture" on 1st September, 2021 by Dr A.P. Sharma.
- S. Ali participated in the celebration of World Soil Day at ICAR-DCFR, Bhimtal with special talk by Dr Anjuli Agrawal on 4th December, 2021.
- S.K. Mallik attended AMR and the environment on 19th November, 2021.
- S.K. Mallik attended Fish Vaccination: Theory, Innovations and Application. 4th August, 2021.
- S.K. Mallik attended International Technical Seminar on understanding AMR and Bio-security in Aquaculture. December 20-21, 2021
- S.K. Mallik attended National Fish Farmers' Day on 10th July 2021 organized at ICAR-DCFR, Bhimtal.
- S.K. Mallik attended National Webinar on Antimicrobial Resistance (AMR). 18th November, 2021.
- S.K. Mallik attended TCP/RAS/3702 project: Support mitigation of Antimicrobial Resistance risk associated with Aquaculture in Asia. 24th November, 2021.
- S.K. Mallik attended Technical Seminar on

Aquaculture Biosecurity: Understanding Antimicrobial Resistance (AMR) in Aquaculture". 13-14th April, 2021

- S.K. Mallik attended the webinar on "Food and nutrition for farmers" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 26th August, 2021.
- S.K. Mallik attended virtual talk on "Agricultural transformation for nutritional security" on 7th August, 2021 organized by ICAR-DCFR under Azadi ka Amrut Mahotsav.
- S.K. Mallik attended virtual talk on "Diversification in Aquaculture" on 1st September, 2021 by Dr A.P. Sharma.
- S.K. Mallik attended World Antimicrobial Awareness Week Event (Tripartite+UNEP): AMR Storytellers from the Asia-Pacific. 24th November, 2021.
- S.K. Mallik participated in the celebration of World Soil Day at ICAR-DCFR, Bhimtal with special talk by Dr Anjuli Agrawal on 4th December, 2021.
- Siva, C attended virtual talk on "Agricultural transformation for nutritional security" on 7th August, 2021 organized by ICAR-DCFR under Azadi ka Amrut Mahotsav.
- Siva, C participated in the International launch event "Genomics at Edinburgh" organized by the University of Edinburgh during 16th September 2021.
- Siva, C participated in the online Workshop on 'R for Biologists' organized by the ICAR-Indian Institute of Spices Research, Kozhikode from 6-8 October 2021.
- Siva, C. attended expert talk on "Strategies for doubling farmers income in the hill region: Technological options" under Azadi Ka Amrut Mahotsava on 03rd July, 2021 at ICAR-DCFR via zoom platform.
- Siva, C. attended National Fish Farmers' Day on 10th July 2021 organized at ICAR-DCFR, Bhimtal.
- Siva, C. attended the webinar on "Food and nutrition for farmers" hosted by ICAR-DCFR under Azadi Ka Amrit Mahotsav on 26th August, 2021.
- Siva, C. attended virtual talk on "Diversification in Aquaculture" on 1st September, 2021 by Dr A. P. Sharma.
- Siva, C. participated in the celebration of World Soil Day at ICAR-DCFR, Bhimtal with special talk by Dr Anjuli Agrawal on 4th December, 2021.

17.3 Participation in training

- A.K. Giri attended international training on Practical Aquaculture Feed Management, organized by Aquaculture Africa Magazine (AAM) on 29th April, 2021.
- A.K. Giri attended international training on Practical Understanding of Aquafeed Formulation, organized by Aquaculture Africa Magazine (AAM) on 03rd June, 2021.
- Amit Pande attended training on Advance Course on Disciplinary Proceedings from 22/07/2021-23/07/2021" conducted by National Productivity Council, Government of India.
- Amit Pande attended training on Design Thinking for Research Project Formulation and Implementation from 24-28 August, 2021 conducted by NAARM, Hyderabad.
- Ciji Alexander attended 5 days training programme on "Climate Change: Challenges and Response" organized by Centre for Disaster Management, LBSNAA, Mussoorie during 9-13th August, 2021.
- D. Thakuria participated in DBT -funded 21 days days e-training course on "Skill Development on Advanced Bioinformatics in Genome Analysis of Livestock and Pets" organized by the College of Animal Biotechnology and DBT -CRCN project Monitoring Unit of Guru Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, from from 5th to 25th March 2021.
- D. Thakuria participated in online training programme on "Protein structure modelling and dynamics" organised by Centre for Agricultural Bioinformatics (CABin), ICAR-IASRI, New Delhi from 27th to 29th October 2021.
- Garima attended orientation training program at ICAR-DCFR from 1st March 20 to 31st March 2021.
- Garima attended Professional attachment training at ICAR-CIFE, Mumbai from 16th August, 2021 to 1st December, 2021 on the topic "Impact of Microplastic on the environment and effects on the organisms."
- Kh. Victoria Chanu participated in DBT -funded 21 days dayse-training course on "Skill Development on Advanced Bioinformatics in Genome Analysis of Livestock and Pets" organized by the College of Animal Biotechnology and DBT-CRCN project Monitoring Unit of Guru Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, from 5 to 25th March, 2021.
- M.S. Akhtar attended and delivered a presentation on "Captive maturation and multiple breeding technology of golden mahseer" during Aquapreneurship: Institute-Industry Interface Program' organized by ICAR-Agrinnovate, New Delhi on 25th February, 2021.
- N.N. Pandey attended Management Development Programme on Leadership Development (a Pre – RMP programme during 13-24th December, 2021, organized by at ICAR – NAARM, Hyderabad.
- Neetu Shahi attended HRD training programme on topic "Improve drafting, editing and presentation skill" at ICAR-DCFR, Bhimtal

from 31st August 2021to 2nd Sept 2021, at ICAR-DCFR. The training was conducted by Ms. Radha Shankar Narayan of SMART SERIES India, Bangalore.

- Neetu Shahi attended online training cum workshop via Google meet on the topic "J-Gate CeRA training" on 23rd July, 2021 at ICAR-DCFR, Bhimtal.
- Neetu Shahi attended online virtual training on "Recirculatory Aquaculture System for Intensive farming of rainbow trout" on 17th September, 2021 at ICAR-DCFR, Bhimtal.
- Neetu Shahi attended the "Basic coding skill in R" for beginner's course for biologists from 29th June to 27th July, 2021, conducted by AFS talks and rainbow analytics, Australia via zoom.
- Neetu Shahi attended virtual training on "Recirculatory Aquaculture System for Intensive Farming of Rainbow trout" on 20th January, 2021 organized by ICAR- Directorate of Coldwater Fisheries Research, Bhimtal, India.
- Neetu Shahi attended virtual training on "Use of histological tool in aquaculture and fisheries research" on 15th December, 2021. This training was conducted by ICAR-DCFR, Bhimtal.
- P.A. Ganie attended five days online training programme, "Strategies for climate risk management and resilient farming" during 20-24 September, 2021 organised jointly by ICAR- Central Research Institute of Dryland Agriculture, Hyderabad, Telangana and National Institute of Agricultural Extension Management, Hyderabad, Telangana.
- P.A. Ganie participated in the online course on "Geospatial inputs for enabling master plan formulation for AMRUT sub scheme" during 11.10.2021 to 15.10.2021 organised by Indian Institute of Remote Sensing, Department of Space, Dehradun.
- P.A. Ganie participated in the online course on "Geospatial Modelling for Watershed Management" during 02-08-2021 to 06-08-2021 organised by Indian Institute of Remote Sensing, Department of Space, Dehradun.
- P.A. Ganie participated in the online course on "RS and GIS applications in Natural Resource Management" during 08.11.2021 to 26.11.2021 organised by Indian Institute of Remote Sensing, Department of Space, Dehradun.
- Pragyan Dash attended Virtual Training on frequently asked questions (FAQs) in rainbow trout nutrition and feeding on 4th Dec 2021 organized by ICAR-DCFR
- R.S. Haldar attended virtual training on Recirculating Aquaculture System for rainbow trout farming 29th January 2021.
- Raja Adil H. Bhatt attended 10 days training on "Recent Advances in Aquatic Animal Health & Environment Management for Sustainable Aquaculture" organised by College of Fisheries, Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana, Punjab, India, from 31st August to 10th September 2021.
- Raja Adil H. Bhatt attended 12th Batch Generic Online Training Course in Cyber Security dated 29th April 2021 by Ministry of Electronics and Information Technology (MeitY), Government of India
- Rajesh M. completed an International virtual training course on Recirculating Aquaculture System (RAS) taught by Graduate Professor Michael Ben Timmons, Cornell University, Ithaca, NY, USA, from 30th October-20th November, 2021 (20 hrs) conducted by AQUAFIN, India.
- Rajesh M. completed 10 days e-training on "Recent Advances in Aquatic Animal Health & Environment Management for Sustainable Aquaculture" organized by College of Fisheries, Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana, Punjab, India, from 31st August to 10th September 2021 under ICAR-NFDB project "National Surveillance Programme for Aquatic Animal Diseases (NSPAAD)", funded by DOF, MoFAHD, Govt. of India.
- S. Ali attended online Training on "Transcriptomic Data Analysis" organized by CABin, ICAR-IASRI, New Delhi during 28-30 September, 2021.
- S.K. Mallik attended 5 days training programme on "Surveillance and Monitoring of Antimicrobial Resistance in Aquaculture" from 26-30th July, 2021
- S.K. Mallik attended Baclink WHONET training for INFAAR members, on 23rd February 2021.
- Siva, C. participated in the training on "Recirculating Aquaculture System for Intensive Farming of Rainbow Trout" organized by the Directorate of Coldwater Fisheries Research during 17th September, 2021.
- Siva, C. participated in the training program on "Statistical Designs and Analytical Methods for Multifactor Experiments" organized by ICAR-Central Marine Fisheries Research Institute, Kochi under the LBS YS award project of ICAR during 08-17 December 2021
- Siva, C. attended online Training on "Transcriptomic Data Analysis" organized by CABin, ICAR-IASRI, New Delhi during 28-30 September, 2021.

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 latest information in the field of fisheries and allied subjects. During the year (January-December) 2021, the library section has not procured any journals and books due to lack of funds. The current holdings of the library includes~ 7116 books, ~1700 volumes of foreign journals, ~550 volumes of Indian journals and more than 9000 other publications. The library provides services to the scientists and other staff members of the institute apart from scholars, researchers, students and other stakeholders from local organizations interested in scientific literature on coldwater fisheries and allied subjects. Directorate providing access to the ICAR CeRA journals through J-gate platform.

18.2 Library automation

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

18.3 Information services

The library also provides platform to access free online downloads of publications and articles of many international and national journals through www.cera.jece.in. The library is further continuing by its efforts in collection, 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 deliver service of J-gate plus under CeRA of ICAR.

18.4 Exchanges services

The library maintained exchange relationship with various research organizations and institute of national and international repute, The annual reports, newsletters, special publications and technical bulletins published from time to time have been mailed to more than 100 organizations, institutions, Fisheries Directors, Deans, and fishery agencies, and other stakeholders.

18.5 Documentation section

The documentation section of the library is entrusted with responsibility of publishing in-house publications such as scientific bulletins, brochures, pamphlets, annual reports, newsletters, monographs etc. During the year, this section published one annual report of 2020, three leaflets, one Hindi magazine (Himjyoti) and two newsletters of the Directorate.

ICAR-DCFR's in-house publications during the year 2020

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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 Haryana, Chandigarh, Haryana	Member
Dr I.J. Singh, Dean, CFSc., GBPU&T, Pantnagar US Nagar(UK)	Member
Dr K.D. Joshi, Pr. Scientist, ICAR-NBFGR, Dilkusha, Lucknow-226002 (UP)	Member
Dr S.K. Das, Head ICAR Research Complex, Barapani, Meghalaya -793103	Member
Dr Mukunda Goswami, Principal Scientist, ICAR-CIFE, Mumbai, Punch Marg, off Yari Road, Versova, Andheri (West) 400061.	Member
Shri Kunal Kalia, F&AO, ICAR, Krishi Bhawan, New Delhi-110001	Member
Mr. Vivek Sah, P/o Naini Cottage, Cantt. Tallital Nainital	Member
Mr. Pushkar Joshi, Bharoment, Jeolikote, Post-Jeolikote-27 Distt-Nainital	Member
Smt. Khilawati Rawat, Administrative Officer, ICAR-DCFR	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, Scientist (SS)	Member
Sh. Amit Kumar Saxena, Technical Officer	Technical support
Smt. Susheela Tewari, Private Secretary	Secretarial assistance

19.4 Members of Prioritization Monitoring & Evaluation Committee

Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal	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, ICAR-DCFR, Bhimtal	Chairman
Dr Veena Pande, Head, Dept. of Biotechnology, Kumaon, University, Bhimtal Campus	External Member
Dr N.N. Pandey, Principal Scientist	Member
Dr Neetu Shahi, Sr. Scientist	Member
Dr M.S. Akhtar, Sr. Scientist	Member
Dr Biju Sam Kamalam, Scientist (SS)	Member
Mr. 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

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

19.8 ARMS

Dr N.N. Pandey, Principal Scientist	In-charge
Sh. A.K. Saxena, Technical Officer	Technical support

19.9 Library Advisory Committee

Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal	Chairman
Dr N.N. Pandey, Principal Scientist	Member
Dr Shahnawaz Ali, Sr. Scientist	Member
Dr M.S. Akhtar, Sr. Scientist	Member
Smt. Khilawati Rawat, Administrative Officer	Member
Sh. Sayed Mohsin Ali, Asst. Fin. & Acc. Officer	Member
Sh. Baldev Singh, Senior Technical Officer & I/c Library	Member Secretary

19.10 Institute Joint Staff Council

Official side	
Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal	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, Sr. Technical Assistant	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 Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal	Chairman
Dr M.A. Ramakrishnan, Acting Head & Pr. Scientist Division of Virology, IVRI, Mukteshwar	DBT Nominee
Dr A.B. Pandey, Principal Scientist & Head, Division of Virology, ICAR-IVRI, Mukteshwar	Outside Expert
Dr D. Muthuchelvan, Pr. Scientist, Division of Virology, IVRI, Mukteshwar	Outside Expert
Col. (Dr.) C. S. Rawat, MBBS, DPH, FRIPHH	Biosafety Officer
Dr Suresh Chandra, Pr. Scientist, ICAR-DCFR, Bhimtal.	Internal Expert
Dr Kh. Victoria Chanu, Scientist (SS), ICAR-DCFR, Bhimtal.	Internal Expert
Dr Amit Pande, Pr. Scientist, ICAR-DCFR, Bhimtal.	Member Secretary

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, Scientist (SS)	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, Scientist (SS)	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, Technical Officer	Nodal Officer

19.15 Women Cell Committee

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

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20. Staff News

20.1 Joining

- Dr Pramod Kumar Pandey joined as Director, ICAR-DCFR, Bhimtal on 13th May, 2021.
- Sh. D.C. Sati joined as Finance & Accounts Officer, ICAR-DCFR, Bhimtal on 10th November, 2021.

20.2 Promotions

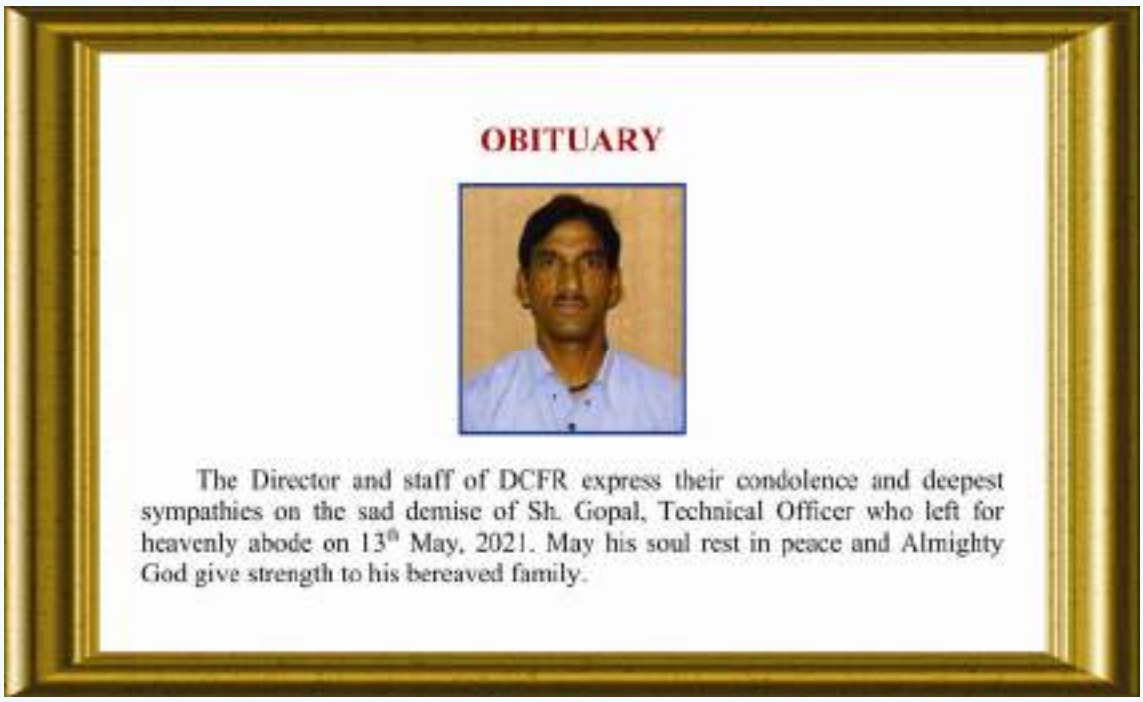
- Dr Shahnawaz Ali promoted from Scientist to Sr. Scientist with effect from 26th February, 2017.
- Dr Neetu Shahi promoted from Scientist to Sr. Scientist with effect from 21st April, 2018.
- Dr M.S. Akhtar promoted from Scientist to Sr. Scientist with effect from 15th December, 2018.

20.3 Transfer

- Dr Deepjyoti Baruah, Sr. Scientist transferred from ICAR-DCFR, Bhimtal to ICAR-IARI Regional Centre, Dhemaji, Assam on 04th February, 2021.

20.4 Resignation

- Dr Arul S., Scientist was relieved from this Directorate on 25th September, 2021.



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21. Personnel

Staff list as on 31.12.2021

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	Sr. Scientist (Aquaculture)
7.	Sh. Sumanta Kumar Mallik	Scientist (Selection Scale)(Aquaculture)
8.	Dr Neetu Shahi	Sr. Scientist (Biotechnology-Animal Science)
9.	Dr Md. Shahbaz Akhtar	Sr. Scientist (Fish & Fishery Science)
10.	Dr Dimpal Thakuria	Scientist (SS)(Biochemistry-Animal science)
11.	Dr Kh. Victoria Chanu	Scientist (SS)(Biochemistry-Animal science)
12.	Dr Ciji Alexander	Scientist (SS)(Fish Nutrition)
13.	Dr Biju Sam Kamalam J.	Scientist (SS)(Fish Nutrition)
14.	Dr Rajesh M	Scientist (SS) (Fish Nutrition)
15	Dr Tandel Ritesh Kumar Shantilal	Scientist (SS) (Fish Health)
16.	Sh. Abhay Kumar Giri	Scientist (SS) (Aquaculture)
17.	Smt. Pragyan Dash	Scientist (SS) (Aquaculture)
18.	Dr Prakash Sharma	Scientist (SS) (Fish Nutrition)
19.	Sh. Siva, C.	Scientist (Fish Genetics & Breeding)
20.	Sh. Kishor Kunal	Scientist (Fisheries Resource Management)
21.	Sh. Parvaiz Ahmad Ganie	Scientist (Fisheries Resource Management)
22.	Sh. Raja Aadil Hussain Bhat	Scientist (Fish Health)
23.	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	Sr. Technical Officer
4.	Sh. Santosh Kumar	Sr. Technical Officer
5.	Sh. Ravinder Kumar	Technical Officer
6.	Sh. Amit Kumar Saxena	Technical Officer
7.	Sh. Hansa Dutt	Technical Officer
8.	Sh. T.M. Sharma	Technical Officer
9.	Sh. R.K. Arya	Technical Officer
10.	Sh. Partha Das	Technical Assistant
11.	Sh. Manoj Kumar Yadav	Driver (Technical Assistant)
12.	Sh. Sunder Lal	Technician

21.4 Administrative Staff		
1.	Smt. Khilawati Rawat	Administrative Officer
2.	Sh. D.C. Sati	Finance & Accounts Officer
3.	Sh. Sayed Mohsin Ali	Asstt. Fin. & Accounts Officer
4.	Sh. Ankesh Kumar Sinha	Asstt. Admn. Officer
5.	Sh. P.C. Tewari	Asstt. Admn. Officer
6.	Smt. Susheela Tewari	Private Secretary
7.	Sh. J.C. Bhandari	Assistant
8.	Sh. Pratap Singh Bisht	Assistant
9.	Smt. Munni Bhakt	UDC
10.	Sh. Hansa Singh Bhandari	UDC
11.	Sh. Mangla Prasad	LDC
12.	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

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भा.कृ.अनु.प.-शीतजल मात्स्यिकी अनुसंधान निदेशालय
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Website: www.dcfr.res.in