ICAR-DCFR

ANNUAL REPORT

2020

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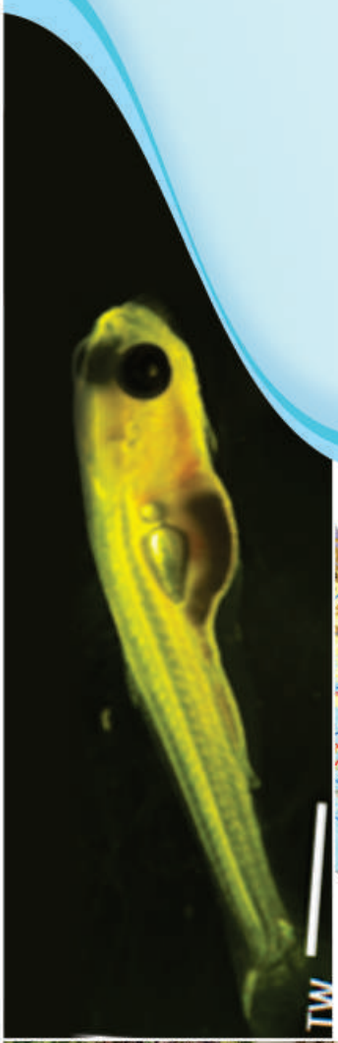

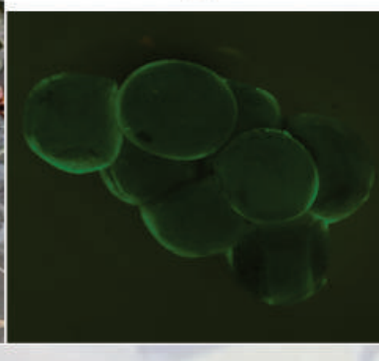

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ICAR-DIRECTORATE OF COLDWATER FISHERIES RESEARCH

Bhimtal-263 136, Nainital, Uttarakhand, India

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January - December

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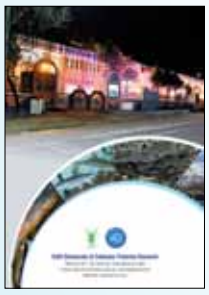

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प्रस्तावना

भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय स्थानीय शीतजल की मत्स्य प्रजातियों की उत्पादकता व उनके संरक्षण, विविधता एवं संसाधनों के मूल्यांकन की दिशा में निरंतर कार्य कर रहा है। हमने रेन्बो ट्राउट की वृद्धि के लिए स्टार्टर एवं ग्रोआउट आहार तैयार किया है, जिसको देश के चार हिमालयी राज्यों के आठ अलग–अलग स्थानों में प्रायोगिक मूल्यांकन के बाद व्यावसायिकरण किया है। परिणामों की सफलता ने मौजूदा आहार को भोजन रूपांतरण अनुपात (एफसीआर), विकास एवं उत्तरजीविता के मानक पर श्रेष्ठ पाया। ये आहार नर्सरी पालन की अवधि को कम करने मे दक्ष है। रेन्बो ट्राउट फीड का अब ग्रोवेल प्राइवेट लिमिटेड, आन्ध्र प्रदेश के साथ व्यावसायिकरण कर लिया गया है। शीतजल मात्स्यिकी अनुसंधान निदेशालय पुर्नसंचरण जल संवर्द्धन प्रणाली (आर.ए.एस.) में भी रेन्बो ट्राउट का सफलतापूर्वक प्रदर्शन कर रहा है। आशा है कि पुर्नसंचरण जल संवर्द्धन प्रणाली (आर.ए.एस.) की तकनीकी शीतजल के मत्स्य पालकों, उद्यमियों एवं अन्य हितधारकों तक पहुंच जाएगी। हिमाचल प्रदेश के अधिकारियों को पहले चरण का प्रशिक्षण पूर्व में ही दिया जा चुका है। इस संस्थान की एक और सफलता फोटो थर्मल और सब्स्टेट्म मैनिपुलेशन तकनीक के साथ सुनहरी और चॉकलेट महासीर का तालाबों में प्रजनन एवं बीज उत्पादन है। यह तकीनकी हमारे देश के हिमालयी जल में लुप्तप्राय महासीर के संरक्षण और पुर्नवासन के मुद्दों को हल करने में सहायक होगी।

भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय के वैज्ञानिक मत्स्य स्वास्थ्य प्रबंधन की समस्याओं के समाधान हेतु व प्रारम्भिक चरण में शीतजल मत्स्य प्रजातियों के लिंग निर्धारण के लिए आणविक दृष्टिकोण तथा सैप्रोलेग्निआ प्रजाति की पहचान एवं सिंथेटिक पेप्टाइड के विकास की जांच तकनीकियों के विकास के मुद्दों को हल करने के लिए प्रयोगशालाओं में बहुत प्रयास कर रहे हैं। शीतजल मात्स्यिकी अनुसंधान निदेशालय देश के विभिन्न हिमालयी राज्यों में उनकी आजीविका सुरक्षा में सुधार के लिए प्रशिक्षण, कौशल विकास कार्यक्रम प्रदान करते हुए किसानों को प्रत्यक्ष लाभ देते हुए एस.सी.एस.पी., टी.एस.पी., मेरा गांव मेरा गौरव और एन.ई.एच. गतिविधियों जैसे विभिन्न कार्यक्रमों के माध्यम से किसानों तक पहुंच रहा है।

भारत मे शीतजल मत्स्य उत्पादन 46,381 टन तथा रेन्बो ट्राउट का उत्पादन 1600 टन (एनएसी, 2020) है। रेन्बो ट्राउट के कुल ओवा का उत्पादन 17.35 मिलियिन है। शेष मत्स्य उत्पादन कॉमन कार्प, ग्रास कार्प, सिल्वर कार्प, माइनर कार्प आदि से प्राप्त होता है। कैप्चर फ़िशरीज़ में अधिकांशतः स्नो ट्राउट, महासीर, लोचेज, माइनर कार्प्स, सेमिप्लोटस, बारिल्स, मिननो एवं अन्य पर्वतीय धाराओं की स्वदेशी मछलियां होती हैं। भारत में शीतजल की मात्स्यिकी और जलीय कृषि विकास के प्रमुख क्षेत्र एवं चुनौतियां हैं –प्रजातियों का विविधीकरण और लचीली जलवायु वाली जलकृषि; जल संसाधन मूल्यांकन; जैव विविधता व पुर्नवासन; प्रणाली विविधीकरण; मत्स्य स्वास्थ्य प्रबन्धन के लिए रोग निगरानी एव नियंत्रण; रेन्बो ट्राउट का पोषण और आहार का विकास; शीतजल मात्स्यिकी पर जीनोमिक दृष्टिकोण; राष्ट्रीय संस्थानों/संबन्धित विभागों के साथ अनुसंधान संबन्धों को मजबूत करना और अर्न्तराष्ट्रीय स्तर पर नए शोध–सहयोग को बढ़ावा देना; नाजुक पारिस्थितिकी तंत्र वाले हिमालयी क्षेत्र में सर्वोत्तम प्रबन्धन प्रथाओं व नित–नवीन प्रोद्योगिकियों का प्रदर्शन; विपणन एवं दोहन के

बाद की सुविधाओं का विकास। इसके साथ ही इस क्षेत्र को आधुनिक बुनियादी ढांचे, उच्च प्रारंभिक निवेश, निविष्टियों की निरंतर आपूर्ति, पर्याप्त संस्थागत समर्थन और गहन प्रशिक्षण की आवश्यकता है ताकि कृषकों की आय दोगुनी करने के लक्ष्य को पूरा करने के लिए उत्पादन और उत्पादकता दोनों को बढ़ाने के लिए इस उद्यम में शामिल होने के लिए उद्यमिता को प्रोत्साहित किया जा सके। 2024–25 तक 10,000 टन रेन्बो ट्राउट सहित 1 लाख टन अण्डे शीतजल मत्स्य उत्पादन के लक्ष्य को प्राप्त करने तथा हिमालयी राज्यों में शीतजल मत्स्य पालन के सतत् विकास के लिए निर्दिष्ट क्षेत्रों को प्राथमिकता दी जानी है और शीतजल मत्स्य पालन के क्षेत्र में सतत् और समावेशी विकास को अवसरों में बदलने के लिए चुनौतियों का समाधान किया जाना है। मुझे यह बताते हुए खुशी हो रही है कि हमने आदरणीय उप महानिदेशक 'मत्स्य विज्ञान विभाग भा.कृ.अनु.परि. नई दिल्ली के मार्गदर्शन मे अपने वैज्ञानिक परिणामों के आधार पर इस अवधी के दौरान 2 पेटेंट दायर किए हैं, तीन अर्न्तराष्ट्रीय वेबिनार आयोजित किए हैं और 'पूर्वी व पश्चिमी हिमालयी क्षेत्र में महासीर की प्रजाति और भण्डार सत्यापन' पर एक नवीन नेटवर्क परियोजना आरम्भ की।

भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय के वैज्ञानिकों, कर्मचारियों एवं शोधार्थियों ने उत्तराखण्ड राज्य में कोविड–19 महामारी के खिलाफ़ लड़ने के लिए निरंतर सात महिनों से भी अधिक समय तक VRDL, हल्द्वानी और IVRI मुक्तेश्वर में कोविड–19 नमूना परीक्षण के लिए सराहनीय व निडर सेवाएं दी हैं। इस निदेशालय के कर्मचारियो ने भी संस्थान के आस पास के स्थानीय लोगों के बीच जरूरतमंदों को भोजन वितरित करने में सहयोग किया। महामारी के दौरान निदेशालय ने विभिन्न पर्वतीय राज्यों के कृषकों के लाभ के लिए सात स्थानीय भाषाओं में 15 एडवाइजरी तैयार की है ताकि उचित स्वच्छता के साथ लाइव स्टॉक बनाए रखा जा सके।

वार्षिक पत्रिका 2020, के इस अंक को जो कि वैज्ञानिकों, शिक्षाविदों, शोधार्थियों, किसानों और उद्यमियों के लिए अत्यन्त लाभाकारी सिद्ध होगी को प्रकाशित करने के लिए मैं संपादकों को बधाई देता हूँ। मै वार्षिक पत्रिका के इस अंक को संपादित करने के लिए इसके मुख्यालय भीमताल एवं चम्पावत स्थित प्रक्षेत्र के सभी वैज्ञानिकों को वैज्ञानिक उपलब्धियों और गतिविधियों को प्रस्तुत करने हेतु उनकी कड़ी मेहनत के प्रति कृतज्ञता ज्ञापित करता हूँ।

मै कामना करता हूँ कि डी.सी.एफ.आर. और आगे बढ़े तथा इसकी ख्याति फैले।

(देबाजीत सर्मा)
निदेशक (कार्यवाहक)

PREFACE

ICAR-DCFR has been incessantly functioning for the enrichment of productivity in coldwater fish farming, evaluation of the cold-water aquatic resources and ichthyofaunal diversity and conservation of endemic cold-water species. We have formulated, validated and commercialized rainbow trout starter and grow out feed of which validation has been carried out in eight different places of four Himalayan states of the country. The success of the results has outperformed the existing feed having better feed conversion ratio (FCR), maximizing the growth and survival, enhancing the feed efficiency resulting in reducing the crop duration of rainbow trout during the nursery rearing period. The rainbow trout feed has been now commercialized with Growel Pvt. Ltd., Andhra Pradesh. DCFR also has been successfully demonstrating rainbow trout production in Recirculatory Aquaculture System (RAS). The RAS technology is expected to disseminate to the coldwater fish farmers, entrepreneurs and other stakeholders within a short span of time. The first phase of training has already been given to the officers of Himachal Pradesh. Another breakthrough of this institute is captive breeding and seed production of Golden and Chocolate mahseer with photo thermal and substratum manipulation technique. This technology will be helpful in solving conservation and rehabilitation issues of endangered mahseer in our Indian Himalayan waters.

The scientists of DCFR have been putting a lot of efforts in the laboratories to address the issue on health management, molecular approach for sex determination of cold-water species at early stage, development of rapid assay techniques for identification of *Saprolegnia* species and development of synthetic peptides etc. DCFR is reaching to the farmers through various developmental programs like SCSP, TSP, Mera Gaon Mera Gaurav and NEH activities giving direct benefit to the farmers while providing training, skill development programs for the improvement of their livelihood security in various Himalayan states of the country.

Coldwater fish production in India is 46,381 tonnes and rainbow trout production is 1600 tonnes (NAC, 2020). Total ova production of rainbow trout is 17.35 million. Rest of fish production comes from aquaculture of common carp, grass carp, silver carps, minor carps etc. The capture fisheries mostly dominated by snow trout, mahseer, loaches, minor carps, semiplotus, barills, minnows and other indigenous hill stream fishes. The major thrust areas and challenges of coldwater fisheries and aquaculture development in India are species diversification and climate resilient aquaculture; aquatic resource assessment, biodiversity and rehabilitation; system diversification to overcome resource limitation; disease surveillance and control for fish health management; rainbow trout nutrition and feed development; genomic approaches on coldwater fisheries; strengthening research linkages with national institutions/line departments and fostering new research collaboration in international level; demonstration of best management practices and innovative new technologies in Himalayan region having fragile eco-system; development of marketing and post harvesting facilities etc. Also the sector need modern infrastructures, high initial investments, continuous supply of inputs, adequate institutional support and intensive training to encourage entrepreneurship to join in this venture for enhancement of production and productivity to meet out the targets of doubling farmers income. In order to achieve the target of 1 lakh tonne coldwater fish production including 10,000 tonne

of rainbow trout by 2024-25 and sustainable development of coldwater fisheries in Himalayan states, the specified thrust areas are to be given priority and challenges to be addressed to convert it to the opportunities for sustainable and inclusive development of coldwater fisheries sector. I am also happy to inform that we have filed 2 patents during this period based on our scientific results, organized 3 international webinar with large participation and started a new network project on "Species and stock validation of mahseer in eastern and western Himalayan region" under the guidance of respected DDG (Fishery Science), ICAR, New Delhi.

DCFR scientists, staff and research scholars have given admirable and fearless services for the COVID-19 sample testing at VRDL, Haldowani and IVRI, Mukteshwar for more than a period of seven months continuously to fight against the COVID-19 pandemic in the state of Uttarakhand. The staff of this Directorate also led from the front by distributing food to the needy among the local people surrounding the institute. During the pandemic, the Directorate has prepared 15 advisories in seven local languages for the benefit of the farmers of different hill states to maintain the live stocks with proper sanitation.

I congratulate the editors for bringing out this issue of Annual Report, 2020 which will be highly beneficial for scientists, academicians, students, research scholars, farmers and entrepreneurs. I also complement them for their hard work to edit this issue of Annual Report in a much comprehensive manner presenting all the scientific achievements and activities undertaken at its headquarter Bhimtal and Champawat field centre.

I wish DCFR will progress further and bring many laurels to the Directorate.

(Debajit Sarma)
Director (Acting)

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कार्यकारी सारांश

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हाल के वर्षों में शीतजल मात्स्यिकी एक सम्भावित मात्स्यिकी क्षेत्र के रूप में उभरा है, जो न केवल आजीविका के अवसर प्रदान करता है बल्कि अधिक से अधिक पोषणिक सुरक्षा का आश्वासन भी देता है। भारतीय कृषि अनुसंधान परिषद के तत्वाधान में शीतजल मात्स्यिकी अनुसंधान एवं विकास हेतु एक केन्द्रीय (नोडल) संस्थान के रूप में भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने हिमालयी राज्यों के मत्स्य पालकों के वास्तविक लाभ हेतु पिछले तीन दशकों से अथक प्रयास किया है। बुनियादी, रणनीतिक और अनुप्रयुक्त अनुसंधान, विस्तार गतिविधियों, पर्वतीय जल कृषि एवं संसाधन मूल्यांकन के द्वारा भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय की सराहनीय उलब्धियां हैं, जिससे सभी हितधारकों को लाभ पहुॅचा हे। निदेशालय ने भू–सूचना विज्ञान का उपयोग करते हुए जल संसाधनों का विस्तृत मानचित्रण किया है तथा हिमालयी राज्यों में जल कृषि के विकास के लिए उपयुक्त मानचित्र तैयार किए हैं। उत्पाद एवं उत्पादकता में वृद्धि के लिए प्रजाति विविधीकरण एक महत्वपूर्ण विषय बना हुआ है और इसलिए विभिन्न शीतजल की मत्स्य प्रजातियों का तालाबों में प्रजनन एवं पालन पोषण किया गया है। संस्थान ने मत्स्य पालन विशेष रूप से महासीर के माध्यम से प्राकृतिक मत्स्य भण्डार में वृद्धि करने का भी कार्य किया है साथ ही कुछ कार्यक्रम संरक्षण बिन्दु व सजावटी उदद्श्यों से महत्वपूर्ण मत्स्य प्रजातियों पर भी केन्द्रित हैं। निदेशालय ने अधिक आय प्राप्त करने के लिए वैज्ञानिक नवीन कृषि पद्धतियों को लागू करने के लिए पर्वतीय राज्यों के कई किसानों को तकनीकी सहायता प्रदान की है। मानव संसाधन विकास के क्षेत्र के लिए कुशल कार्यबल पैदा करने के लिए यह एक महत्वपूर्ण क्षेत्र है इसलिए डीसीएफआर ने अनेक कौशल विकास प्रशिक्षण कार्यक्रम का आयोजित किए हैं। वर्ष 2020 को हमेशा कोविड–19 महामारी के लिए याद किया जाएगा जिसने मानव जाति के लिए सबसे बड़ी चुनौति पैदा की। लॉकडाउन की अवधी में निदेशालय उपलब्ध सभी संचार माध्यमों से कार्य करता रहा और चुनौतियों का साहस के साथ सामना किया। निदेशालय ने कोविड–19 परीक्षण कार्य में भाग लिया तथा किसानों को परामर्श देने के साथ–साथ सभी हिमालयी राज्यों के मत्स्य पालकों तक पहुॅचने का प्रयत्न किया। निदेशालय ने परा–स्नातक स्तर पर एवं पी.एच.डी. में छात्रों के अकादमिक और सहयोगी अनुसंधान के लिए विश्वविद्यालयों, राज्य मत्स्य विभागों एवं अन्य संस्थानों के साथ एमओयू के माध्यम से संबन्ध बनाए हैं। वर्ष 2020 में संस्थान की उपलब्धियों को संक्षेप में प्रस्तुत किया गया है:

संसाधन मूल्यांकन एवं प्रबन्धन

- अरूणाचल प्रदेश की कामेंग जल प्रणाली में प्रजातियां की संरचना का विश्लेषण यह दिखाता है कि इसमें व्यावसायिक रूप से अत्यधिक महत्वपूर्ण प्रजातियों के तीन समूहों नामतः महासीर, स्नो ट्राउट एवं विदेशी ट्राउट का अस्तित्व है। भविष्य में, बदलती जलवायु और जल प्रणालियों में बढ़ती हुयी मानवजनित गतिविधियॉ, स्थानीय स्नो ट्राउट की आबादी के लिए खतरा हो सकता है।
- अरूणाचल प्रदेश के पांच जिलों पूर्वी कामेंग, कुरूंग कुमे, पक्के केसांग, पापुम पारे तथा कारा दादी काह अध्ययन किया गया तथा जल संसाधन, जल निकासी नेटवर्क, भूमि उपयोग, भू आवरण, डिजिटल ऐलिवेशन व ढालानों का ArcGIS v 10.8 उपकरण के द्वारा सैटेलाइट डेटा, जियो रेक्टिफाइड SOI टोपोशीट व गैर स्थानिक डेटा का विकास करके उनका मानचित्र बनाया गया।
- उत्तराखण्ड के मध्य हिमालयी की सरयू और लधिया नदियों की जैव विविधता और स्वास्थ्य मूल्यांकन का आंकलन करने के लिए अध्ययन किया गया। लधिया नदी से दर्ज किए गऐ मत्स्य जैव समूहों में शाइजोथोरैक्स रिचार्डसोनी, बेरिलियस बेंडेलिसिज़, गारा गोट्चला, ग्लैप्टोथोरैक्स एवं टौर प्युटिटोरा की प्रधानता थी।
- कुमायूॅ क्षेत्र में ईको–टूरिज्म और संरक्षण के लिए महासीर के आखेट का आंकलन करने का कार्य आरम्भ किया गया है। कुमायूॅ क्षेत्र में महासीर के वास स्थलों एवं आखेट स्थलों का जी.आई.एस. के आधार पर मानचित्र तैयार किया गया है।
- भारत के मध्य और पूर्वी हिमालयी क्षेत्र से महासीर की प्रजातियों (टौर और नियोलिसोचिलस) का और

उनके भण्डार के सत्यापन हेतु एक नेटवर्क कार्यक्रम आरम्भ हुआ। विभिन्न जल प्रणालियों व झीलों से एकत्रित प्रजातियों का मॉर्फोमेट्रिक एवं मेरिस्टिक पैरामीटर, उनकी बारकोडिंग व डी.एन.ए.का अलगाव किया गया।

- उत्तराखण्ड के विभिन्न स्थानों से एकत्र किए गए टौर प्रजाति के वाउचर नमूनों का एक भण्डार भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल संग्रहालय में रखा गया है। वर्तमान में संग्रहालय में विशिष्ट आई.डी. के साथ 12 टौर प्रजातियां मौजूद हैं।

जलीय कृषि के अनुकूल अनुसंधान एवं विकास

- तालाबों में महासीर के प्रबन्धन के तहत, चौकलेट महासीर के स्पॉनिंग हेतु आधार स्थल (सब्स्ट्रेट) की वरीयता का परीक्षण किया गया। हैचरी में कुल 15000 जीरा को पाला गया तथा 23000 अण्डों का उत्पादन किया गया।
- फोटो–थर्मल कौशल के साथ तालाबों में महासीर के प्रजनन व स्पॉनिंग प्रदर्शन को कंकड़–पत्थर के आधार स्थल पर देखा गया। वर्ष 2020 की अवधी में जनवरी को छोड़कर प्रत्येक महीने में सुनहरी महासीर में बहु–प्रजनन देखा गया तथा 18 मादाओं से 1,22520 अण्डों का संदोहन किया गया, जिनमें से > 72 प्रतिशत प्रतिक्रिया देने वाली मादा मछलियां थीं।
- एस. प्रोजेस्टस और एस. प्लेजियास्टोमस की वृद्धि क्षमता और प्रजनन प्रदर्शन से पता चला कि एस. प्लेजियास्टोमस एस. रिचार्डसोनी की तुलना में 11.8 प्रतिशत बेहतर वृद्धि हुयी, जबकि एस. प्रोजेस्टस नेएस. रिचार्डसोनी की तुलना में 7.9 प्रतिशत बेहतर वृद्धि दिखायी।
- सकर हेड गारा गोट्यला का तालाब में सफलतापूर्वक प्रजनन किया गया और 25 ग्राम आकार तक की अंगुलिकाओं में उत्तरजीविता दर 98 प्रतिशत दर्ज की गयी। विभिन्न पांच प्रजनन कार्यों में लगभग 2000 सकर हैड का उत्पादन किया गया।
- सजावटी मत्स्य प्रजनन कार्यक्रम के अर्न्तगत नर एवं मादा बेरिलियस वाग्रा के जी.आई एस. को मापा गया। पोस्ट ओवुलेटरी फॉलिकल्स और रिक्त ट्यूबलर लुमेन की उपस्थिति ने जुलाई के अंत से स्पॉनिंग की शुरूआत का संकेत दिया जो कि सितम्बर के मध्य तक जारी रहा।
- 1–3 घनमीटर व 7 घनमीटर जल धारण क्षमता वाले एक छोटे व कम लागत वाले एवं सरलतापूर्व कार्यान्वयन हेतु एक पुर्नजल संचरण प्रणाली (आर.ए.एस सिस्टम) का मॉडल डिजायन किया गया। इस विशेष पुर्नजल संचरण प्रणाली (आर.ए.एस सिस्टम) में 30 किग्रा. प्रति मी^{3} के भण्डारण की क्षमता के साथ मत्स्य पालन किए जाने की संभावना है।
- प्रयोग के तौर पर डी.सी.एफ.आर. भीमताल के परिसर में मछली के साथ सब्जी उत्पादन हेतु एक प्रोटो टाइप एक्वापोनिक्स ईकाई की स्थापना की गयी है।

मत्स्य पोषण एवं चारा विकास

- रेन्बो ट्राउट के चारे में प्राकृतिक गैस से उगाए गए मेथनोट्रोफिक जीवणु भोजन का उपयोग करके मत्स्य भोजन को आंशिक रूप से या पूर्ण रूप से परिवर्तित करने हेतु विकास परीक्षण किए गए।
- उत्पादन से सम्बन्धित फ़ेनोटाइप (विकास, फीड का उपयोग व उत्तरजीविता) का मूल्यांकन करके, फीडिंग परीक्षणों की एक श्रृंखला के माध्यम से एक उच्च–प्रदर्शन करने के लिए ट्राउट स्टार्टर फ़ीड विकसित किया; मोर्फोमिट्रिक, उतक व ट्रांसक्रिप्सनल मार्कर व आटे की गोलियों के भौतिक गुण तथा इसके अतिरिक्त वास्तविक क्षेत्र की स्थितियों में इस स्टार्टर फ़ीड के प्रदर्शन को दिखाने के लिए क्षेत्र का सत्यापन किया गया। सभी परीक्षण स्थलों में उत्तरजीविता 90 प्रतिशत से अधिक थी। भोजन रूपांतरण अनुपात भी काफी कम 0.8 से 1.2 मध्य था।
- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने रेन्बो ट्राउट के चारे की पूरी श्रंखला के विकास और सत्यापन पर एक सहयोगी अनुसंधान कार्यक्रम के लिए आन्ध्र पदेश के कृष्णा जिले में स्थित एक प्रमुख भारतीय एक्वाफीड निर्माता ग्रोवेल फीड्स प्राइवेट लिमिटेड के साथ आधिकारिक तौर पर एक समझौता ज्ञापन पर हस्ताक्षण किए।
- सुनहरी महासीर (टौर प्युटिटोरा) के प्रजनन की क्षमात और लार्वा गुणवत्ता लक्षणों में सुधार करने के लिए प्राकृतिक जल स्रोतों एवं तालाबों में पालित प्रजनकों प्रजनकों के बीच प्रजनन प्रदर्शन में अंतर की जांच हेतु परीक्षण किए गए और यह पाया गया कि निषेचन और अण्डे सेने की सफलता प्राकृतिक जल स्रोतों की तुलना तालाबों के प्रजनकों में अपेक्षाकृत कम है (6.10%)। प्रजनन प्रदर्शन और लार्वा गुणवत्ता

का मूल्यांकन करने के लिए मौजूदा प्रजनक भण्डार के चारे में कुछ पोषक तत्वों को शामिल करके एक बेहतर चारे को तैयार किया गया।

- रेन्बो ट्राउट प्रजनकों के लिए एक प्रयोगिक चारा तैयार किया गया तथा भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, चम्पावत केन्द्र में तीन महिने के लिए चारा परीक्षण किया गया। परीक्षण के बाद मछलियों की प्रजाति, चारे की क्रियाशीलता और प्रजनन के लक्षणों का लेखा दर्ज किया गया।

आणविक आनुवंशिकी एवं जैव प्रोद्योगिकी

- इल्युमिना हिसेक 2500 प्रणाली का उपयोग करते हुए दोनों लिगों के गोनाड और मस्तिष्क को अनुक्रमित करके टौर प्युटिटोरा के लिए व्यापक ट्रांसक्रिप्टोमिक डेटा सेट का निर्माण किया गया। इन ट्रांसक्रिप्टों (प्रतिलेख) से, लगभग 92.5 प्रतिशत को कार्यात्मक रूप से एनोटेट किया गया, जिससे कई उम्मीदवार तीनों की पहचान की जा सकती है जोकि विकास प्रक्रियाओं, यौन प्रजनन, युग्मक निर्माण, अर्धसूत्री विभाजन, लिंग भेदभाव, शुक्राणु गतिशीलता, नर का प्रेमालाप व्यवहार तथा निषेचन में केन्द्रीय भूमिका निभा सकते हैं।
- अगली पीढ़ी के अनुक्रमण का उपयोग करते हुए डे नोवो ट्रांसक्रिप्टोम विश्लेषण का उददेश्य तापीय दबाव के लिए सुनहरी महासीर के विशिष्ट लिंगीय प्रतिक्रिया का अध्ययन करना था। कुल 24 युग्मित आर.एन.ए.–स्वीक्वेंसिंग (श्रृंखलाओं) का निर्माण किया गया। युग्मित आर.एन.ए.–स्वीक्वेंसिंग (श्रृंखलाओं) को 2X150 बी.पी. अनुक्रमण रीडिंग उत्पन्न करने के लिए Hi-Seq 2000 (इलुमिना, सैन डिएगो, यू.एस.ए.) पर अनुक्रमित किया गया।
- जेब्रा फिश, डैनियो रेरियो और कॉमन कार्प , साइपिनस कार्पिओ के एकल कोशिका चरण में आर. एन.पी. को माइक्रोइंजेक्ट करने के लिए तथा MSTN और dnd जीन को बाहर करने के लिए एक प्रविधि को विकसित एवं मानकीकृत किया गया।
- रेन्बो ट्राउट के विभिन्न अंगों से कोशिका रेखा को विकसित करने का कार्य आरम्भ किया गया।

रोग निगरानी एवं स्वास्थ्य प्रबंधन

- सेप्रोलिग्निआ से जीनोमिक डी.एन.ए. के आसान अलगाव के लिए एक निष्कर्षण बफ़र विकसित किया गया। विकसित प्रोटोकॉल अन्य कवक प्रजातियों से जीनोमिक डी.एन.ए. अलगाव के लिए भी उपयुक्त है।
- सेप्रोलिग्निआ पैरासाइटिका की पहचान के लिए थियोल संशोधित जांच के साथ यूनिवर्सल प्राइमर ITS1 और ITS4 का उपयोग करके ITS क्षेत्र को लक्षित करने वाला एक सरल प्रोटोकॉल अनुकूलित किया गया है। दो प्राइमरों के बीच इसकी बाध्यकारी साइट के साथ जांच सेप्रोलिग्निआ पैरासाइटिका के लिए विशिष्ट है।
- सेप्रोलिग्निस पैरासाइटिका के प्रति इसकी एंटी ओमाइसीट गतिविधि के लिए बहुलक आधारित फॉर्मूलेशन का परीक्षण किया। सेप्रोलिग्निआ पैरासाइटिका को नियंत्रित करने के लिए सूत्रीकरण में संभावित प्रयोग हो सकता है।
- सोने के सूक्ष्म कणों को सेप्रोलिग्निस पैरासाइटिक के विशिष्ट थियोल संशोधित ओलिगोन्यूक्लोटाइड जांच के साथ संयुग्मन द्वारा क्रियाशील किया गया। सेप्रोलिग्निस पैरासाइटिक एवं सेप्रोलिग्निस ऑस्ट्रेलिस की पहचान करने हेतु एक प्रविधि का विकास किया गया।
- फार्म में पालित रेन्बो ट्राउट में ओमाइसीट्स संक्रमण के विरूद्ध एंटी फंगल एजेंटों के रूप में जोस्पोर्स व हाइप के प्रति न्यूनतम बाध्यकारी संकेद्रण के लिए चुनिंदा योगिकों की जांच की गयी। इन सबके बीच करक्युमिन (CUR), सिनामाल्डिहाइड (CIN) एवं यूजेनॉल (EUG) ज़ोस्पोर उत्पादन को पूर्ण रूप से रोक सकते हैं तथा सेप्रोलिग्निस पैरासाइटिक एवं सेप्रोलिग्निस ऑस्ट्रेलिस के विरूद्ध हाइपल की वृद्धि को प्रभावकारी रूप से बाधित कर सकते हैं।
- अध्ययन में एक सम्भावित लक्षित प्रोटीन और उसके अवरोधकों की पहचान करने हेतु एवं एक आम सहमति का कम्प्यूटूशनल ढांचा विकसित करने का प्रयास किया गया। ऑटोडॉक वीना सॉफ्टवेयर द्व ारा एरोमोनस हाइड्रोफिला के ऐरोलिसिन के साथ पचास रोगक ऐंजेंटो/लिगेंडस के आणविक डॉकिंग का प्रयास किया गया। सभी 50 रोगक एजेंटों में मोरिन, स्टिग्मास्टरोल, ट्राक्लोसन, मायरिकेटिन और क्लोरैमाइन T ने लक्षित प्रोटीन के साथ अच्छा संबन्ध प्रदर्शन किया।
- ट्राउट फार्मों मे बीज उत्पादन की अवधी में मृत्यु से जुड़े सामान्य स्वास्थ्य विकार संबन्धी विश्लेषण किया गया। ट्राउट फार्म और हैचरी के भौतिक–रासायनिक मापदण्डों के साथ–साथ उत्तराखण्ड के विभिन्न

फार्मों से महामारी विज्ञान संबन्धी जानकारी एकत्र की गयी।

- मछलियों मे प्रतिसूक्ष्म जीव निवारक क्षमता (AMR) पर एक केन्द्रीय कार्यक्रम के अर्न्तगत ऐरोनोमाज़ एस.पी.पी., ई.कोलाई एवं स्टैफिलोकोकस एस.पी.पी. के विरूद्ध विभिन्न एंटीबायोटिक दवाओं का प्रदर्शन किया गया।
- जलीय जीवों के रोग निगरानी हेतु शीजल मत्स्य रोग के लिए राष्ट्रीय निगरानी कार्यक्रम के अन्तर्गत (NSPAAD), उत्तराखण्ड के चमोली एवं नैनीताल जिलों के 20 ट्राउट व कार्प फार्मों एवं हैचरियों में सक्रिय व निष्क्रिय रोगों की निगरानी की गयी।
- मत्स्य स्वास्थ्य पर अखिल भारतीय नेटवर्क परियोजना के अर्न्तगत फ्लोरफेनिकॉल (F1427-500 MG; सिग्मा, यूएसए) की न्यूनतम निरोधात्मक सांद्रता (MIC) 6 जीवाणु रोगकों एरोमोनस हाइड्रोफिला आटीएस 02, एरोमोनस वेरोनी जीसीएएफबीएलसी 229, लैक्टोकोकस गार्विए एलआई फ्लेवोबेक्ओरियम कॉलम बीआरटीएजीआइएलएफसी 01 ए, विब्रियो एंगुइलारम एमएचजेएल 248 तथा एरोमोनस साल्मोनिसिडा एसपी के विरूद्ध निर्धारित की गयी।
- निक्रा परियोजना के अर्न्तगत, निदेशालय ने रेन्बो ट्राउट की खेती के लिए जलवायु के अनुकूल ठण्डे पानी के पुर्नसंचरण जलीय कृषि प्रणालियों को विकसित करने और उसको बढ़ावा देने का बीड़ा उठाया है। भीमताल में रेन्बो ट्राउट ग्रो–आउट कल्चर के लिए कए बड़े पैमाने पर पुर्नजल संरचरण प्रणाली को डिजायन कर स्थापित किया गया है। वर्तमान में इसमें प्रति घन मीटर 35–40 किग्रा. मत्स्य उत्पादकता प्राप्त की गयी है, जो कि पारम्परिक फलो–थ्रो रेसवे प्रणाली में औसत उत्पादकता से 2–3 गुना अधिक है।
- रेन्बो ट्राउट में बेहतर तापीय अनुकूलन क्षमता को समझने के लिए तापीय टॉलरेंस फ़ेनोटाइप में महत्वपूर्ण समय –गतिकी परिवर्तनों की जांच की गयी।
- रेन्बो ट्राउट में तापीय तनाव को कम करने के लिए रेन्बो ट्राउट में पोषक तत्वों की खुराक के मूल्यांकन हेतु तथा उसकी तापीय सहनशीलता क्षमता में सुधार करने के लिए विशिष्ट तत्वों की खुराक अर्थात् एंटी आक्सीडेंट व इम्युनोस्टिमुलेंट की क्षमता का मूल्यांकन करने के लिए दो आहार परीक्षण किए गए।
- धीमी गति से बढ़ने वाली स्थानिक हिमालयन स्नो ट्राउट, शाइजोथोरैक्स रिचार्डसोनी में आहार ग्रहण करने के नियमन के बारे में हमारी समझ में सुधार करने के लिए पूर्ण या आंशिक न्यूक्लिक एसिड, पेप्टाइड्स और प्रोटीन को विनियमित करने वाले चयनित आहार सेवन की एक विशेषता है।

बाह्य परियोजनाऐं

- डीबीटी प्रायोजित परियोजना के अन्तर्गत उप परिवार बारबिना से सम्बन्धित असमिया किंगफिश (साइप्रिनियन सेमीप्लोटम) का पूरा माइटोजेनोम अनुक्रमित किया गया और एनजीएस डेटा का प्रयोग करके उसको वर्गीकृत किया गया। AT-rich नियंत्रण क्षेत्र की 3' परिधि में एक विशिष्ट 90 bp सम्मिलन पाया गया। यह आबादी स्तर पर प्रजातियों की पहचान के लिए एक उपकरण हो सकता है।
- देश में पहली बार डीबीटी प्रायोजित परियोजना के अर्न्तगत ट्रिपलोइड रेन्बो ट्राउट का कुशलतापूर्वक उत्पादन करने के लिए एक व्यवहार्य पद्धति को पोस्ट –निषेचित ट्राउट अण्डे के लिए उपचार प्रोटोकॉल द्वारा मानकीकृत किया गया। ये निष्कर्ष बढ़ी हुयी वृद्धि के साथ ट्रिपलोआइड रेन्बो ट्राउट के उत्पादन के लिए उपयोगी है।
- डीबीटी प्रायोजित परियोजना के अन्तर्गत तालाबों में सुनहरी महासीर के प्रजनक भण्डार का इम्यूनो मॉडयूलेशन किया गया तथा चार लक्षित प्रतिरक्षा जीन (IFNγ, TNFα, C3, और IL10) की पूर्ण लम्बाई को RACE PCR के द्वारा वर्णित किया गया और उसकी क्लोनिंग की गयी। भ्रूण और प्रारम्भिक लार्वा चरणों के दौरान टौर प्युटिटोरा में प्रतिरक्षा जीन के जीन अभिव्यक्ति पैटर्न की जांच की गयी।
- डीबीटी प्रायोजित परियोजना के अन्तर्गत दो जैव इंजीनियर एएमपीज़ अर्थात् आर वाई 12 डब्लू वाई तथा केके16 का मूल्यांकन एंटीबायोटिक प्रतिरोधी बैक्टीरिया सहित विभिन्न जीवाणु रोगजनकों के विरूद्ध उनकी रोगाणुरोधी गतिविधियों के लिए किया गया। इन पेप्टाइड्स ने ए सोबरिया, ए. हाइड्रोफिला, ई. टार्डा, एस. ऑरियस, वी.पैराहामोलिटिकस, पी. एरूगिनोसा, ई. काली एवं ए. साल्मोनिसिडा के प्रति रोधगाणुरोधी गतिविधियों को दिखाया गया।
- डीएसटी परियोजना अर्न्तगत एक राष्ट्रीय मिशन के तहत हिमालयी पारिस्थितिकी तंत्र को बनाए रखने के लिए मध्य पर्वतीय क्षेत्र में माइनर कार्प के पॉलीकल्चर

हेतु एक मॉडल बनाकर उसमें लचीली जलवायु का परीक्षण किया गया। कम घनत्व वाले पौली ईथीलीन (एलडीपीई) फिल्म लाइन वाले तालाब में माइनर कार्प (लेबियो डायोचिलस, बेंगाना डेरो) आधारित पौलिकल्चर का एक मॉडल मध्य हिमालयी क्षेत्रों में 0.7किग्रा/मी^{3} के सामान्य मत्स्य उत्पादन के साथ मानकीकृत किया गया।

बौद्धिक सम्पदा सृजन

- 2020 की अवधी में भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय ने दो पेटेंट आवेदन और चार ट्रेडमार्क हेतु आवेदन दायर किए।
- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय प्रोफाइल और इसकी भूमिका पर वृत्तचित्र फिल्म के लिए एक कॉपीराइट दायर किया गया।
- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय ने आई.सी.ए.आर. डेयर एग्रीइनोवेट इंडिया लिमिटेड के माध्यम से तीन प्रौद्योगिकियों का विज्ञापन किया।
- वर्ष 2020 की अवधी में भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय ने विभिन्न गैर सरकारी संगठनों और विश्वद्यिलयों के साथ समझौता ज्ञापन (एम.ओ.यू.) पर भी हस्ताक्षर किए।

महत्वपूर्ण घटनाएं, विस्तार गतिविधियां, प्रशिक्षण एवं अन्य विकास कार्य

- 26 जनवरी, 2020 को निदेशालय परिसर में गणतंत्र दिवस के अवसर पर ध्वजारोहण किया गया जिसमें निदेशालय के सभी वैज्ञानिकों/कर्मचारियों आदि ने भाग लिया।
- दिनांक 27 से 29 फरवरी, 2020 तक भा.कृ.अनु. परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय के चम्पावत स्थित प्रयोगिक केन्द्र ने गोरलचौड़, चम्पावत में 'चम्पावत महोत्सव' में भाग लिया।
- दिनांक 29 फरवरी, 2020 को एनईएच गतिविधि के अर्न्तगत मत्स्य पालन विभाग, भारत सरकार के सहयोग से ईटानगर, अरूणाचल प्रदेश में आयोजित अरूणाचल प्रदेश में शीतजल मत्स्य विकास' पर आयोजित राष्ट्रीय परामर्श आयोजित किया गया।
- दिनंक 7 मार्च, 2020 को भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय की प्रोद्योगिकी प्रबंधन ईकाई ने 'शीतजल मत्स्य पालन में आईपीआर आयाम' विषय पर एक दिवसीय कार्यशाला का आयोजन किया।
- दिनांक 20 अप्रैल, 2020 की अवधी में उपमहानिदेशक (वित्त) की अध्यक्षता में सभी वैज्ञानिकों की उपस्थिति में ऑनलाइन वर्चुअल बैठक आयोजित की गयी।
- दिनांक 21–22 मई, 2020 कों डा. डब्लू. एस. लाकड़ा, भूतपूर्व निदेशक एवं कुलपति भा.कृ.अनु.परि.–केन्द्रीय मत्स्य शिक्षा अनुसंधान मुम्बई की अध्यक्षता में आर.ए. सी की ऑनलाइन बैठक आयोजित की गयी।
- दिनांक 8–9 जून, 2020 को भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल में निदेशक (कार्यवाहक) की अध्यक्षता में संस्थान की आई.आर. सी. बैठक आयोजित की गयी।
- दिनांक 11 जून, 2020 को भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल की एनईएच गतिविधियों के अर्न्तगत निदेशालय द्वारा भीमताल में मत्स्य पालन विभाग, मेधालय सरकार (अटारी, बारापानी एवं मात्स्यिकी प्रभाग, आई.सी.ए. आर. रिसर्च कॉम्पलेक्स, बारापानी के सहयोग से 'मेघालय में महासीर मत्स्य पालनः संरक्षण और प्रसार के लिए रणनीतियां' शीर्षक पर एक राष्ट्रीय वेबिनार आयोजित किया गया।
- दिनांक 28 जुलाई, 2020 को भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल द्वारा 'प्रजाति और भारत के पश्चिमी व पूर्वी हिमालयी क्षेत्र से महासीर की टौर एवं नियोलिसोचिलस प्रजातियों के सत्यापन' पर एक कार्यशाला का अयोजन किया गया।
- दिनांक 15 अगस्त, 2020 को भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल के परिसर में 74वां स्वतंत्रता दिवस समारोह के अवसर पर ध्वजारोहण किया गया। इस अवसर पर निदेशालय के सभी वैज्ञानिकों एवं कर्मचारियों ने भाग लिय।
- दिनांक 24 अगस्त, 2020 को भा.कृ.अनु.परि. –शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने मत्स्य पालन निदेशालय, सिक्किम सरकार के साथ ऑनलाइन मंच के माध्यम से ''रेन्बो ट्राउट की उन्नत नस्ल के आयात के संबन्ध में तकनीकी मार्गदर्शन प्रदान करना; डेनमार्क से आयातित आइड ओवा के जैव–सुरक्षा उपाय और सर्वोत्तम प्रबन्धन प्रथाएं'' पर एक तकनीकी/वेबिनार का आयोजन किया।
- दिनांक 14–20 सितम्बर, 2020 को भा.कृ.अनु.परि.

–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल में हिन्दी सप्ताह समारोह का आयोजन किया गया। इस अवसर पर विभिन्न हिन्दी प्रतियोगिएं आयोजित की गयी तथा विजित प्रतिभागियों को पुरस्कृत किया गया।

- दिनांक 24 सितम्बर, 2020 को निदेशालय द्वारा कोल्डवाटर फिशरीज़ सोसायटी ऑफ इण्डिया के सहयोग से अपना 33 वॉ स्थापना दिवस मनाया। इस अवसर पर एक वर्चुअल इंटरएक्टिव मीट का भी आयोजन किया गया।
- दिनांक 2 अक्टूबर, 2020 को भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल में तथा इसके चम्पावत स्थित केन्द्र में गांधी जयंती मनायी गयी।
- दिनांक 15 अक्टूबर, 2020 को भा.कृ.अनु.परि. –शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल में महिला किसान दिवस का आयोजन किया गया।
- दिनांक 27 अक्टूबर से 2 नवम्बर, 2020 को भा.कृ. अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल में तथा इसके चम्पावत स्थित केन्द्र में 'सतर्क भारत–समृद्ध भारत' विषय पर सर्तकता जागरूकता सप्ताह मनाया गया।
- दिनांक 16–31 दिसम्बर, 2020 को भा.कृ.अनु.परि. –शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल में स्वच्छता पखवाड़ा का आयोजन किया गया। इस अवसर पर निदेशालय परिसर में आस पास के क्षेत्रों की साफ–सफाई के साथ व्याख्यान, छात्रों के मध्य निबन्ध प्रतियोगिता आदि का भी आयोजन किया गया।
- दिनांक 21 नवम्बर, 2020 को निदेशालय में ''कैन एक्वाकल्चर बिकम द ब्लू बायोटैक्नोलॉजी ऑफ द फ्यूचर'' शीर्षक पर एक वेबिनार का आयोजन किया गया।
- दिनांक 16 दिसम्बर, 2020 को निदेशालय में महासीर पर एक अर्न्तराष्ट्रीय वेबिनार आयोजित किया गया।
- दिनांक 17 दिसम्बर, 2020 को निदेशालय में संस्थान की बायोसेफ्टी समिति की बैठक का आयोजन किया गया।
- दिनांक 23 दिसम्बर, 2020 को निदेशालय में आई. एम.सी. की बैठक आयोजित की गयी। बैठक में विभिन्न प्रशासनिक एवं वित्तिय मुद्दों पर चर्चा की गयी और मंजूरी प्रदान की गयी।
- दिनांक 29 दिसम्बर, 2020 को निदेशालय में, 'ब्रीडिंग एण्ड सीड प्रोडक्शन ऑफ रेन्बो ट्राउट एण्ड इट्स बैस्ट मेनेजमैंट प्रैक्टिसेज़' शीर्षक पर एक वर्चुअल प्रशिक्षण कार्यक्रम आयोजित किया गया।
- कोविड–19 लॉकडाउन की अवधी में सजावटी मत्स्य पालन एवं एक्वा बागवानी की अवधारणा के माध्यम से आजीविका बढ़ाने के लिए एक कार्यक्रम आयोजित किया गया।
- कोविड–19 लॉकडाउन की अवधी में नैनीताल जिले के सलड़ी ग्राम के 16 किसानों को तालाबों में भण्डारण के लिए तकनीकी सहायता और मत्स्य बीज आदि को प्रदान किया गया।
- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल द्वारा कुमायूं की झीलों में लुप्तप्राय सुनहरी महासीर टौर प्युटिटोरा के संरक्षण एवं पुर्नवासन के लिए पहल करते हुए भीमताल, सातताल व नॉकुचियताल के लिए पालन पोषण कार्यक्रम आयोजित किया।
- उत्तराखण्ड के नैनीताल और अल्मोड़ा जिलों के विभिन्न ग्रामों में पर्वतीय मत्स्य पालकों की ग्रामीण आजीविका सुरक्षा के उत्थान के लिए भा.कृ.अनु.परि. –शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने पीपीपी मोड में आईसीआईसीआई फाउण्डेशन के साथ सहयोगात्मक कार्य किया।
- कोविड–19 लॉकडाउन की अवधी के बाद भा.कृ. अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल और प्रयोगिक मत्स्य प्रक्षेत्र चम्पावत के विभिन्न वैज्ञानिकों द्वारा किसानों के लिए विभिन्न भाषाओं परामर्श तैयार कर उनको उपलब्ध करायी।
- प्रयोगिक मत्स्य प्रक्षेत्र चम्पावत द्वारा केन्द्र में विभिन्न जागरूता और प्रदर्शन कार्यक्रम जैसे कार्प मछली के भोजन, उसकी आदतें, मध्य पर्वतीय क्षेत्रों कार्प का पॉली कल्चर, कार्प के तालाबों में पानी की गुणवत्ता मानकों का आंकलन तथा स्थानीय रूप से उपलब्ध सामग्री का उपयोग करके कार्प के आहार का निर्माण करना आदि आयोजित किए।
- दिनांक 17–19 फरवरी, 2020 को बाद भा.कृ.अनु. परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने पंतनगर में गो.ब.प.कृ.एवं प्रोद्योगिकी विश्वविद्यालय, पंतनगर, ए.ई.एच.एम.एस व पी.एफ. जी.एफ. के सहयोग से एक अर्न्तराष्ट्रीय सम्मेलन का

आयोजन कराया तथा इस अवसर पर एक प्रदर्शनी भी लगायी।

- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने उत्तराखण्ड जल विद्युत निगम द्वारा प्रयोजित बायोडाइवर्सिटी ऑफ महासीर एण्ड अदर इंडीजीनस स्पेसीज़ फॉर डिवलपिंग कंजरवेसन स्ट्रेटिजीज इन द व्यास हाइड्रोइलैक्ट्रिक प्रोजेक्ट ऑन रिवर यमुना, उत्तराखण्ड पर परामर्श सेवाएं प्रदान की।
- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल ने कानन देवन हिल्स प्लांटेशन प्राइवेट लिमिटेड कंपनी, मुन्नार, केरला को राजमलाया चाय बागान में रेन्बो ट्राउट हैचरी के संचालन एवं उसमें सुधार के लिए वैज्ञानिक एवं तकनीकी मार्गदर्शन एवं परामर्श प्रदान किया।
- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय, भीमताल हिमाचल प्रदेश, सिक्किम, जम्मू एव कश्मीर, नागालैण्ड व उत्तराखण्ड के ट्राउट पालकों और राज्य मत्स्य पालन विभागों को सक्रिय रूप से फीड सलाह एवं वैज्ञानिक मार्गदर्शन प्रदान कर रहा है।
- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय ने भीमताल तथा अपने चम्पावत स्थित प्रयोगिक प्रक्षेत्र में शीतजल की विभिन्न खाद्य मत्स्य प्रजातियों जैसे– टोर प्युटिटोरा, नियोलिसोचिलस हैक्सागोनोलिपिज़, एस. प्रोजेस्टस, परिष्कृत कामन कार्प, विदेशी कार्प, रेन्बो ट्राउट एवं सजावटी मत्स्य प्रजातियों जेसे– कोइ कार्प, गोल्ड फिश एवं गारा गोट्यला का बीज उत्पादन किया।
- भा.कृ.अनु.परि.–शीतजल मात्स्यिकी अनुसंधान निदेशालय ने टीएसपी, एससीएसपी एवं एनईएच कार्यक्रमों के अर्न्तगत किसानों और समुदायों के लाभ के लिए विभिन्न विस्तार एवं प्रशिक्षण कार्यक्रम आयोजित किए साथ ही निदेशालय के वेज्ञानिकों, तकनीकि कर्मचारियों एवं शोधार्थियों ने मेडिकल कॉलेज हल्द्वानी एवं आई.वी.आर.आई, मुक्तेश्वर में सरकार के किविड–19 परीक्षण में योगदान दिया।

Executive Summary

1

In recent years, coldwater fisheries have emerged as one of the potential fisheries sector that not only provides opportunities for livelihood but also assures nutritional security at greater extent. ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, a nodal institute for coldwater fisheries research and development under the aegis of Indian Council of Agricultural Research (ICAR) has worked tirelessly since last three decades to bring tangible benefits to the fish farmers of Himalayan states. Through basic, strategic and applied research, extension activities, hill aquaculture and resource assessment, ICAR-DCFR has commendable achievements, which benefitted all stakeholders. The Directorate has carried out detailed aquatic resource mapping using geoinformatics and prepared site suitability maps for aquaculture development in the Himalayan states. Species diversification remained a crucial area for production and productivity enhancement and therefore has developed captive breeding and rearing of different coldwater fish species. The institute has also worked for enhancement of natural fish stocks through ranching particularly mahseer with while some of the program focussed on fish species important for conservation and ornamental purposes. The Directorate has provided technical support to many farmers of hill states to implement scientific/ innovative farming practices to realise higher income/profit. Human resource development is an important area for generating skilled work force for the sector and therefore, DCFR has conducted many skill development training programmes. The year 2020 will always be remembered for COVID-19 pandemic that posed the greatest challenge for humankind. During lockdown, the Directorate kept working through all available communication means and showed courage to face the inescapable challenges. It participated in COVID-19 testing and prepared advisories to 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 2020 are summarized as follows:

Resource assessment and management

- Analysis of the species composition in the Kameng drainage of Arunachal Pradesh showed the existence of three group of commercially important fish species *viz*., mahseer, snow trout and. In future, changing climate and increasing anthropogenic activities, in the drainage, could pose a threat to the endemic snow trout population.
- Five districts of Arunachal Pradesh viz., East Kameng, Kuruang Kumey, Pakke Kesang, Papum Pare and Kaara Daadi were investigated and the aquatic resources, drainage network, land use land cover, digital elevation model and slope map 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
- Studies have been undertaken to assess the ichthyofaunal diversity and health assessment of central Himalayan River Saryu and Ladhiya, Uttarakhand. The ichthyofauna recorded from river Ladhiya were *Schizothorax richardsonii, Barilius bendelesis, Garra gotyla, Glyptothorax sp.* and *Tor putitora.*
- Work has been initiated to assess the angling status of mahseer in Kumaun region for eco-tourism and conservation. A GIS based map of mahseer habitat and angling points in Kumaun region was prepared.
- A network programme started on species and stock validation of mahseer species (*Tor*

and *Neolissochilus*) from central and eastern Himalayan region of India. Morphometric and meristic parameters were collected and DNA isolation was done for barcoding of the species collected from different drainages and lakes.

- A repository of voucher specimens of *Tor* spp. collected from various geographical locations of Uttarakhand was deposited at ICAR-DCFR, Bhimtal museum. Currently there are 12 *Tor* species present in the museum each having a unique ID present in the museum.

Aquaculture oriented research and development

- Under captive management of mahseer, substrates preference for spawning of chocolate mahseer was tested. A total of 23,000 eggs were produced and around 15,000 fry were reared in the hatchery.
- Optimizing reproductive and spawning was performance of golden mahseer in captivity was achieved through gravel bed breeding substratum with photo-thermal manipulations. During the year 2020, except January, multiple breeding of golden mahseer in every month was observed and 1,22,520 eggs were stripped from 18 females with > 72 % of responding females.
- Growth potential and breeding performance of *S. progastus* and *S. plagiostomus* revealed that *S. plagiostomus* has 11.8% better growth in comparison to *S. richardsonii,* while *S. progastus* showed 7.9% better growth than *S. richardsonii*.
- Sucker Head, *Garra gotyla* was successfully bred in captivity and the survival rate from fingerling up to 25gm size was recorded as 98%. Approximately 2000 sucker head produced in five different breeding operations.
- Under ornamental fish breeding programme GSI of male and female *Barilius vagra* were measured. The presence of post-ovulatory follicles and empty tubular lumen, indicated beginning of spawning from late July that continued till mid-September.
- A low-cost model of 1-3 m^3 and 7m^3 water holding capacity mini-RAS system was designed for easy operation with reduced mechanical parts. There is a potential for this particular RAS design to culture fishes at stocking of 30 kg per m^3.
- A prototype of an experimental aquaponics unit has been set up at the ICAR-DCFR, Bhimtal campus for the pilot scale fish-vegetable production.

Fish nutrition and feed development

- Growth trials were conducted to partially or completely replace fish meal using natural gas grown methanotrophic bacterial meal in rainbow trout feeds.
- Developed a high-performance trout starter feed through a series of feeding trials, by evaluating production related phenotypes (growth, feed use and survival); morphometric, tissue and transcriptional markers; and pellet physical properties. Furthermore, field validation was made to demonstrate the performance of this starter feed at real-field conditions. Survival was greater than 90% in all the test sites. The feed conversion ratio ranged from 0.8 to 1.2, with substantially less feed wastage.
- ICAR-DCFR officially signed a memorandum of understanding with Growel Feeds Private Limited, a prominent Indian aquafeed manufacturer situated in the Krishna district, Andhra Pradesh, for a collaborative research programme on the development and validation of complete range of rainbow trout feeds.
- To improve the reproductive competence and larval quality traits of golden mahseer, *Tor putitora,* in captivity, trials were made to investigate the differences in breeding performance between wild and captive brooders and found that the fertilization and hatching success is relatively lesser (6-10%) in captive brooders as compared to the wild ones. An improved brood stock diet formulated by incorporating some nutrients/additives to the existing brood stock diet to evaluate the reproductive performance and larval quality.
- An experimental rainbow trout brooder diet was prepared, and feeding trial conducted for three months at the Experimental Field Centre, ICAR-DCFR, Champawat. Following the trial, fishes bred, and diet-responsive reproductive traits were recorded.

Molecular genetics and biotechnology

- A comprehensive transcriptomic dataset was generated for *Tor putitora* by sequencing the gonads and brain of both sexes using the Illumina Hiseq 2500 system. From these transcripts, approximately 92.5% were functionally annotated allowing the identification of several candidate genes that are likely to play a central role in developmental processes, sexual reproduction, gamete generation, meiosis, sex differentiation, sperm motility, male courtship behaviour and fertilization.
- *de novo* transcriptome analysis using next generation sequencing was aimed to study the sex specific response of golden mahseer for thermal stress. A total of 24 paired-end RNA-Seq libraries were constructed. The paired-end RNA-Seq libraries sequenced on Hi-Seq 2000 (Illumina, San Diego, USA) for generating 2 × 150 bp sequencing reads.
- 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.
- Work has been initiated for developing cell lines from rainbow trout.

Disease surveillance and health management

- An extraction buffer was developed for easy isolation of genomic DNA from Saprolegnia. The developed protocol is also suitable for isolation of genomic DNA from other fungal species.
- A simple PCR protocol targeting ITS region using universal primers ITS1 and ITS4 along with thiol modified probe for the identification of *Saprolegnia parasitica* has been optimised. The probe is specific for *S. parasitica* with its binding site in between the two primers.
- Functional gold nano-particles were developed by conjugation with thiol modified *S. parasitica* specific oligonucleotide probes. An assay was developed to indentify *S. parasitica* and *S. australis*.
- A polymer based formulation was tested for its anti-oomycete activity against *Saprolegnia parasitica*. The formulation may have possible application in controlling saprolegniasis.
- As anti-fungal agents against oomycetes infection in farmed rainbow trout, selective compounds were screened for the minimum inhibitory concentration against zoospores and hyphae. Among all, Curcumin (CUR), Cinnamaldehyde (CIN) and Eugenol (EUG) could completely inhibit zoospore production and significantly inhibit hyphal growth against *S. parasitica* and *S. australis*.
- A Study is designed to develop a consensus computational framework for the identification of potential target proteins and their inhibitors. Molecular docking of the fifty antimicrobial agents/ligands with aerolysin of *Aeromonas hydrophila* by AutoDock Vina software was attempted. Among all the 50 antimicrobial agents, morin, *stigmasterol*, triclosan, myricetin and chloramine T have shown good affinity with the target protein.
- Investigations related to common health disorders associated with mortality in trout farms during seed production was targeted. Physicochemical parameters of the trout farm and hatcheries along with epidemiological information collected from different farms of Uttarakhand.

National Network programmes

- Under the Network programme on antimicrobial resistance (AMR) in fishes, the antimicrobial resistance of *Aeromonas* spp, *E. coli*, and *Staphylococcus* spp. was performed against different antibiotics.
- Under the National surveillance programme for aquatic animal disease-Surveillance of coldwater fish diseases (NSPAAD), active and passive disease surveillance in 20 trout and carp farms as well as hatcheries was carried out in Chamoli and Nainital districts of Uttarakhand.
- Under the All India network project on fish health the minimum inhibitory concentration (MIC) of florfenicol (F1427-500 MG; Sigma, USA) was determined against six bacterial pathogens; *Aeromonas hydrophila* RTS 02, *Aeromonas veronii* GCAFBLC 229, *Lactococcus*

garvieae LI10, *Flavobacterium columnare* BRTAGILLFC 01, *Vibrio anguillarum* MHJL 248 and *Aeromonas salmonicida* sub sp.

- Under the NICRA project, the Directorate has taken a lead to develop, validate and promote climate resilient Coldwater re-circulating aquaculture systems for rainbow trout farming. A pilot scale RAS facility was designed and established for rainbow trout grow-out culture at Bhimtal. At present, we have achieved a unit productivity of 35-40 kg of fish per cubic metre, which is 2-3 times higher than the average productivity in conventional flow-through raceway system.
- For better understanding of thermal adaptation in rainbow trout, the time-kinetic changes in the critical thermal tolerance phenotype and transcript abundance of selected stress biomarkers after high temperature exposure was investigated.
- For the evaluation of nutritional supplements and mitigation of thermal stress in rainbow trout, two feeding trials were conducted to evaluate the ability of specific nutritional supplements (i.e., antioxidants and immunostimulants) to improve the thermal tolerance capacity.
- Characterized the complete or partial nucleic acid sequence of selected feed intake regulating peptides and proteins, to improve our understanding of the regulation of food intake in the slow growing endemic Himalayan snow trout, *Schizothorax richardsonii.*

Externally funded projects

- Under DBT sponsored project - Complete mitigenomc of Assamese kingfish (*Cyprinion semiplotum*) belonging to the subfamily *Barbinae* was sequenced and characterized using NGS data. A distinctive 90 bp insertion was found in 3′ periphery of the AT-rich control region. This can be a tool for identification of the species at the population level.
- For the first time in the country, a viable methodology to efficiently produce triploid rainbow trout has been standardised by mechanical treatment protocol for the post-fertilized trout eggs under a DBT sponsored project. These findings are useful for the production of triploid rainbow trout with enhanced growth.
- Under another DBT sponsored project, immunomodulation in golden mahseer (*Tor putitora*) broodstock under captive conditions full length characterization of four target immune genes (IFNγ, TNFα, C3, and IL10) was achieved through RACE PCR and cloning. Gene expression patterns of immune genes in *Tor putitora* during embryonic and early larval stages were examined.
- Under DBT sponsored project, two bio-engineered AMPs viz. RY12WY and KK16 were evaluated for their antimicrobial activities against various bacterial pathogens including antibiotic resistant bacteria. These peptides showed antimicrobial activities against *A. sobria, A. hydrophila, E. tarda, S. aureus, V. parahaemolyticus, P. aeruginosa, E.coli* and *A. salmonicida*.
- Under DST sponsored project, National Mission for sustaining the Himalayan ecosystems, a model on Climate resilience of minor carp for polyculture in mid hill region was tested. A model of minor carps *(Labeo dyocheilus, Bengana dero)* based polyculture in low density poly ethylene (LDPE) film lined pond has been standardized in mid Himalayan region with an average fish production of 0.7 kg/m^3.

Intellectual property generation

- The ICAR-DCFR during 2020 has filed two patent applications and four trademark applications.
- A copyright for documentary film on "ICAR - Directorate of Coldwater Fisheries Research profile and its role" has been filed.
- The ICAR-DCFR has advertised three technologies through ICAR-DARE Agrinnovate India Ltd.
- The ICAR-DCFR has also signed Memorandum of Understanding (MoU) with various NGOs, Organizations and Universities during the year 2020.

Important events, extension activities, trainings and other developments

- The Republic Day of our nation was celebrated with flag hoisting ceremony on 26 January 2020, in which all the scientists and staff of the Directorate participated.
- The Experimental Field Centre, ICAR-DCFR, Champawat participated in "Champawat Mahotsav" at Goral Chaur Field, Champawat from 27th to 29th February, 2020.
- National Consultation on "Coldwater Fisheries Development in Arunachal Pradesh" was organized under NEH activity in collaboration with the Department of Fisheries, Govt. of Arunachal Pradesh on 29th February, 2020 at Itanagar (Arunachal Pradesh)
- The Institute Technology Management Unit of ICAR-DCFR organised a one-day workshop themed 'IPR dimensions in Coldwater Fisheries' on 7th March, 2020 at Bhimtal. Dr. Shashank Mauria (Former Asst. Director General. IP & TM, ICAR) and Dr. Kajal Chakraborty (Senior Scientist, ICAR-CMFRI) were the invited subject matter experts.
- Online virtual meeting was held under the Chairmanship of DDG (Fy) during 20th April, 2020 in the presence of all the Scientists.
- The institues RAC was held online on 21st - 22th May 2020 under the chairmanship of Dr. W.S. Lakra, Former Director and Vice-Chancellor ICAR-CIFE, Mumbai.
- The Institute IRC meeting was held on 8th - 9th June 2020 at ICAR-DCFR, Bhimtal under the Chairmanship of Dr. D. Sarma, Director (Acting).
- A National Webinar on "Mahseer Fisheries in Meghalaya: Strategies for Conservation and Propagation" was organized by ICAR-DCFR on 11th June, 2020 under the NEH activity of the Directorate at ICAR-DCFR, Bhimtal in collaboration with the Department of Fisheries, Government of Meghalaya; ATARI, Barapani and Division of Fisheries, ICAR Research Complex for NEH Region, Barapani.
- The ICAR-DCFR celebrated National Fish Farmer's Day on 10th July, 2020 and organized a webinar through virtual mode. The programme was graced by the Chief guest Hon'ble State Minister of Women's Welfare & Child Development, Animal Husbandry, Sheep & Goat Rearing, Fodder & Pastoral Development, Fishery Development, Smt. Rekha Arya ji.
- Mahseer network project launching workshop on "Species and stock validation of mahseer species of genus *Tor* and *Neolissochilus* from western and eastern Himalayan region of India for its propagation and conservation" was conducted online on 28th July, 2020 by ICAR-DCFR
- The 74th Independence Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate
- ICAR-DCFR, Bhimtal convened a technical meeting/webinar through online platform on 24th August, 2020 with Directorate of Fisheries, Govt. of Sikkim to provide technical guidance regarding import of improved strain of rainbow trout; bio-safety measures and best management practices of imported eyed ova from Denmark.
- Hindi Saptah was organized ICAR-DCFR, Bhimtal from 14th to 19th September, 2020. A quiz competition was organized for the staffs of this Directorate.
- The ICAR-DCFR celebrated its 33rd Foundation day in collaboration with Coldwater Fisheries Society of India on 24th September, 2020. A virtual interactive meet was organized and Dr. J.K. Jena, Deputy Director General (Fisheries) graced the occasion as the Chief Guest.
- Gandhi Jayanti on 2nd October, 2020 was celebrated at ICAR-DCFR Bhimtal and Experimental Field Centre, Champawat.
- Mahila Kisan Divas" was organized at ICAR-DCFR Bhimtal on October 15, 2020.
- ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat celebrated Vigilance Awareness Week during 27th October to 2nd November, 2020 on the theme "Vigilant India – Prosperous India".
- ICAR-DCFR organized Swachhata Pakhwara during 16-31 December 2020. During the pakhwara various programmes such as cleaning of premises and adjoining areas, awareness

campaign for cleanliness and hygiene, lecture, student's essay competition were organized. A mega event was organized on the occasion of closing ceremony of the Swachhata Pakhwara on December 30, 2020.

- ICAR-DCFR IMC meeting was held on 23rd December, 2020 at Bhimtal. Various administrative and financial issues were discussed and approved during the meeting.
- World Fisheries Day was celebrated and Webinar on "Can aquaculture become the blue biotechnology of the future" was organized on 21st November 2020.
- International webinar on mahseer was held on 16th December, 2020. Dr. Adrian Pinder, Associate Director, Bournemouth University, United Kingdom presented a talk on mahseer conservation and rehabilitation.
- Institute Biosafety Committee Meeting was held on 17th December 2020. The meeting was chaired by Dr. D. Sarma, Director (Acting), ICAR-DCFR as Chairman.
- Virtual Training on "Breeding and seed production of rainbow trout and its best management practices" was organized on 29th December 2020.
- Programme on enhancement of livelihood through ornamental fish culture and concept of aqua-gardening was promoted during COVID lockdown period.
- During COVID-19 lockdown, 16 farmers at Saladi, Nainital district (Uttarkhand) were provided with technical help and critical inputs like fish seed for stocking in the ponds.
- ICAR-DCFR took initiative for conservation and rehabilitation of endangered golden mahseer (*Tor putitora*) in Kumaon lakes and organized ranching programme for Bhimtal, Sattal, and Naukuchiatal.
- 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.
- A numbers of advisory in different languages were prepared and provided to the farmers during the COVID-19 lockdown and after the unlocking period by different scientists of the ICAR-DCFR, Bhimtal and EFC, Champawat.
- Different awareness and demonstration programmes were organized by the Experimental Field Centre, Champawat such as Food and Feeding habits of Carps, Poly-culture of carps in mid hills, Estimation of water quality parameters of carps ponds Preparation of Carp Feed using locally available ingredients etc.
- The ICAR-DCFR participated in the exhibition during the International Conference organized by ICAR-CIFRI in association with GBPUAT, AEHMS and PFGF during February 17-19, 2020 at GBPUAT, Pantnagar
- The ICAR-DCFR provided consultancy services to UJVN sponsored study on biodiversity of mahseer and other indigenous species for developing conservation strategies in the Vyasi Hydroelectric project on river Yamuna, Uttarakhand.
- The 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.
- The 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.
- The ICAR-DCFR produced seeds for different coldwater food and ornamental fishes such as *Tor putitora, N. hexagonolepis*, *S. progastus*, improved common carp, exotic carps, rainbow trout, ornamental fish such as Koi carp, gold fish, and *Garra gotyla* at Bhimtal and its Experimental Field Centre, Champawat.
- The ICAR-DCFR has conducted various extension and training programmes for the benefits of farmers and communities under TSP, SCSP and NEH programme.
- The ICAR-DCFR Scientists, technical staff and research scholars contributed in COVID-19 RT-PCR testing at Govt. Medical College Haldwani and IVRI Regional Station, Mukteshwar.

Introduction

2

2.1 Brief history

Coldwater fisheries has a great 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 involvement of Indian Council of Agricultural Research in this sector started during late sixties that subsequently culminated in the creation of National Research Centre on Coldwater Fisheries as an independent Research Centre on 24 September 1987 during the VII Five Year Plan. Considering the greater potential of Coldwater fisheries in different Himalayan states and the ever expanding activities of NRCCWF, the institute was upgraded to Directorate of Coldwater Fisheries Research (DCFR) during the eleventh five year plan. This is the only national facility in the country to take up the research investigation on capture and culture aspects with a focus on exotic and indigenous Coldwater fish species.

At present, the Directorate is ISO certified (ISO 9001:2015) nodal research centre focussed on endemic as well as exotic Coldwater fishes. In the last 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 among a long list of activities undertaken by the Directorate. The Directorate has also contributed in human resource development and skill development programme for creating trained manpower for the overall development of the sector. The ICAR-DCFR is on its glorious path of virtually actualizing its vision by imparting boon of quality research in sustainable Coldwater fisheries production, management and conservation.

2.2 Location

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

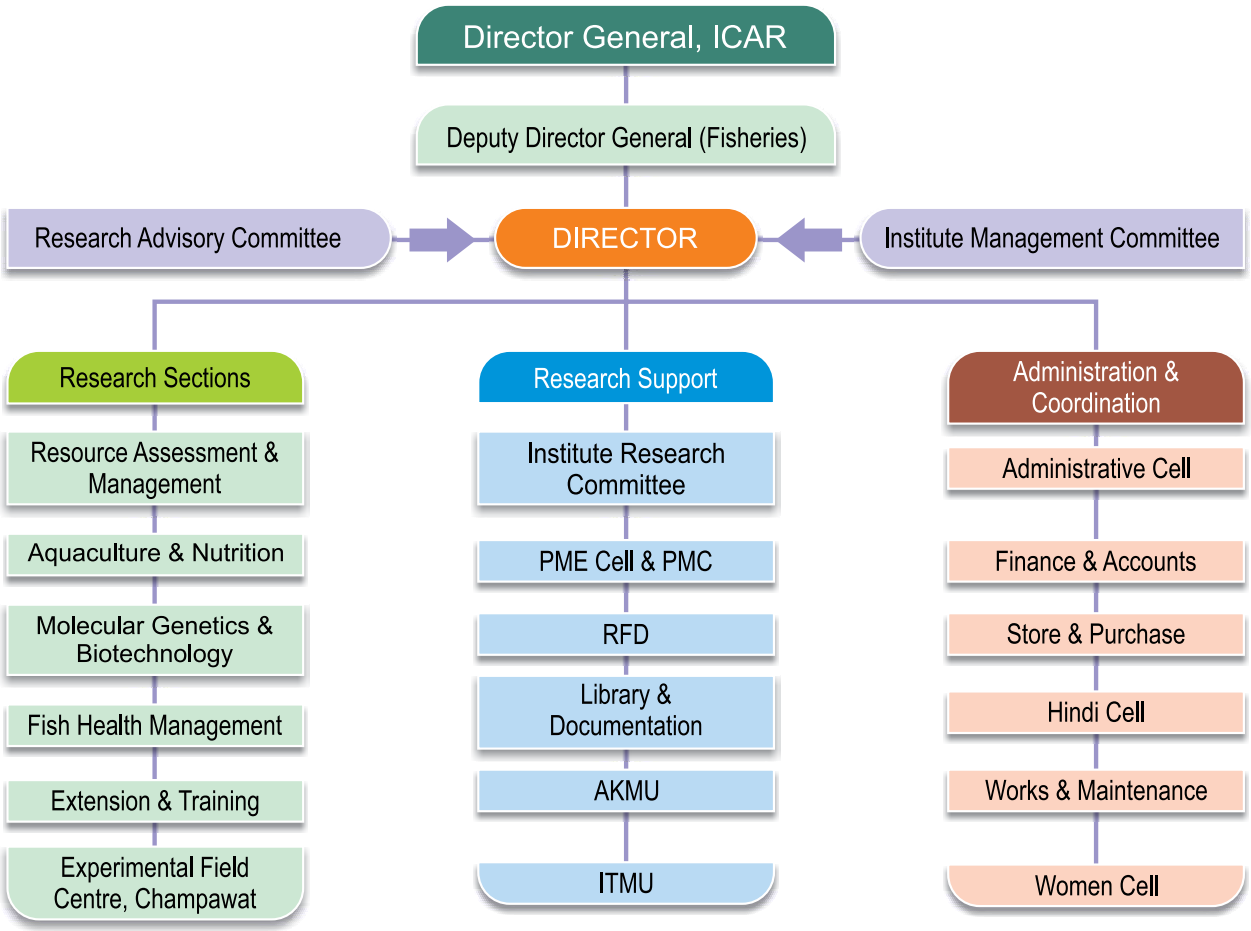
2.4 Mission

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 suggests research programmes based on national and global context in the thrust areas within the mandate of the institute. The RAC also guides in development of skills for presentation and efficient writing of reports, highlighting outputs and impact, commercialization, and innovative approaches for handling IPR and biosafety issues. Similarly, the Institute Management Committee (IMC) monitors the various administrative and financial aspects of the Directorate, under the chairmanship of the Director. A number of other internal committees such as Institute Research Committee (IRC), Project Monitoring and Evaluation Committee (PME) and Institute Joint Staff Council (IJSC) are also in place for smooth functioning and proper management of the institute.

2.8 Infrastructure

Building

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 seedproduction unit is also available at a different site in Bhimtal. The Directorate has an Experimental Field Centre at Chhirapani, Champawat, Uttarakhand. The field centre has trout hatchery, cemented nursery and grow-out raceways with water recirculation

Main office building of ICAR-DCFR, Bhimtal

ICAR-DCFR Outdoor experimental facility

Coldwater Fishery Museum at ICAR-DCFR, Bhimtal

system, ponds, tanks for conducting experiments, laboratories, check dam, reservoir, meeting hall, guest houseand staff quarters.

Guest House of ICAR-DCFR, Bhimtal

Experimental Fish farm 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, diagnostic virology, bacteriology and mycology. There is also wet laboratory facilities available in this institute that are well maintained used 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 cellof the institute monitors the implementation and progress of research projects. The PME cell is responsible for maintaining the records of project reports through RPP system and for dealing with all the associated technical matters. The cell also keeps a record of publications, deputation and participation of scientists in seminars, symposia, workshop and conferences, training programmes attended as well as conducted. This 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 the facilities for scanning and printing and internet access (BSNL) to all scientists and other staff members. It also serves as network administrator and monitors LAN connectivity of around 50 computers at this Directorate. In the AKMU cell, desktop computer and internet facilities are also available for research scholars and students working under various project/programmes. Internet facilities at the experimental field centre, Champawat is provided through BSNL. Electronic mail and messaging solutions (mail server) are also maintained at this Directorate for secure communication via webmail.

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

Library and Documentation Unit

AKMU unit of ICAR-DCFR, Bhimtal

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

Library and Documentation unit at ICAR-DCFR, Bhimtal

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 for 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 of intellectual property rights.

Staff strength (as on 31.12.2020)

Category	Sanctioned	Filled	Vacant
Director (RMP)	1	-	1
Scientific	30	23	7
Technical	14	12	2
Administrative	13	10	3
Supporting	12	9	3
Total	**70**	**54**	**16**

2.11 Financial statement for the year 2020-21

S. No.	Head	Expenditure 2019-20	RE 2020-21	Expenditure up to 31.12.2020
CAPITAL				
1.	Works			
A.	Land	-		
B.	Office Building	32.25	6.39	
C.	Residential Building			
2.	Equipments	94.61	20.58	0.10
3.	Information Technology	13.64	2.03	
4.	Library Books & Journals	14.23	0.16	0.06
5.	Vehicle & Vessels	6.14		
6.	Furniture & Fixtures	1.00	3.04	
	Total Capital	**161.87**	**32.20**	**0.16**
Grants in Aid- Salaries (Revenue)				
	Establishment Expenses			
	Salaries	675.67	699.44	564.38
Grants in Aid- General (Revenue)				
1.	Pension & other Retirement Benefit	2.00	0.00	0.00
2.	**Travelling Allowance**			
	Domestic TA/Transfer TA	34.79	5.00	2.95
3.	**Research & Operation Expenses**			
	A. Research Expenses	92.16	210.50	54.03
	B. Operational Expenses	90.57	98.50	57.61
	Total- Research & Operation Expenses	**182.73**	**309.00**	**111.64**
4.	Administrative Expenses			
A.	Infrastructure	95.71	89.00	63.38
B.	Communication	0.87	0.80	0.53
C.	Repair & Maintenance			
i)	Equipments, Vehicle & Others	6.21	5.95	2.23
ii)	Office Building	16.73	29.20	16.18
iii)	Residential Building			0.00
iv)	Minor Works	3.03	10.10	1.20
D.	Other (excluding TA) (instt.)	107.40	74.30	41.57
	Total AdministrativeExpenses	**229.95**	**209.35**	**125.09**

S. No.	Head	Expenditure 2019-20	RE 2020-21	Expenditure up to 31.12.2020
5.	**Miscellaneous Expenses**			
A.	HRD within India	3.14	0.75	0.26
	HRD (Abroad)	-		
B.	Other Items (Fellowship)	-		
C.	Publicity & Exhibition	3.06	0.55	
D.	Guest House Maint.	2.00	0.75	0.23
E.	Other Miscellaneous	6.78	4.60	2.61
	Total Misc. Expenses	**14.98**	**6.65**	**3.10**
	NEH (Capital)	8.00	2.80	0.00
	NEH (Revenue)	8.00	40.00	15.96
	Total NEH	**16.00**	**42.80**	**15.96**
	TSP (Capital)	10.00	20.00	0.00
	TSP (Revenue)	17.26	33.00	0.14
	Total TSP	**27.26**	**53.00**	**0.14**
	SCSP (Capital)	9.27	1.63	0.00
	SCSP (Revenue)	50.78	67.00	13.37
	Total SCSP	**60.05**	**68.63**	**13.37**
	Total Revenue (Grants in Aid-Salaries + Grants in Aid- General)	**1216.16**	**1369.44**	**836.63**
	Total Revenue + Capital	**1405.30**	**1426.07**	**836.79**

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 4:	**Assessment of population status, species diversity and habitat ecology of snow trout *Schizothorax* species in selected streams of Indian Himalayan region**
Period:	**April 2016 – March 2020**
Personnel:	**D. Baruah (PI), D. Sarma, P. Sharma, K. Kunal, P.A. Ganie**
Funding Support:	**Institutional, ICAR-DCFR**

The study was conducted in Kameng drainage, which is a major tributary of Brahmaputra river and one of the important drainages among five drainages of Arunachal Pradesh with the aim to understand the habitat ecology of snow trouts, taxonomically evaluate them using classical and molecular approaches and understand their reproductive and feeding biology in order to comprehend the life processes of snow trout in the drainage. Sampling was carried out at six selected stations, i.e., Shergaon, Dirang, Sangti, Rupa, Munna Camp and Tenga, located at an altitude of 1217 to 1979 m on a seasonal basis. The four seasons were classified as Premonsoon (March to May), Monsoon (June-September), Postmonsoon (October- early November), and Winter (late November- February).

Kameng drainage was identified as "collecting type" of stream subsystem and a coldwater snow or glacier fed stream. The streams of the drainage were found to be of fourth or fifth order at the sampling sites, which itself is an indicator of high biological productivity of the system. Different physicochemical and biological parameters were studied in order to assess the habitat conditions in the drainage. All the physicochemical variable of water quality were in the range well suited for snow trouts and other aquatic flora and fauna.A total of 52 phytoplankton species belonging to 37 genera, 30 families, 21 orders and 9 classes were identified and their density was found in the range of 142-1348 cell/litre. A total of 19 periphyton genera belonging to 16 families, 13 orders and 6 classes were identified with density of 133-1365 individual /cm^2. Density of the plankton and periphyton, at different sampling stations, showed negative correlation with water or stream velocity. A total of 8 zooplankton genera belonging to 5 families, 4 orders and 3 classes were identified with the density of 68-286 individual/

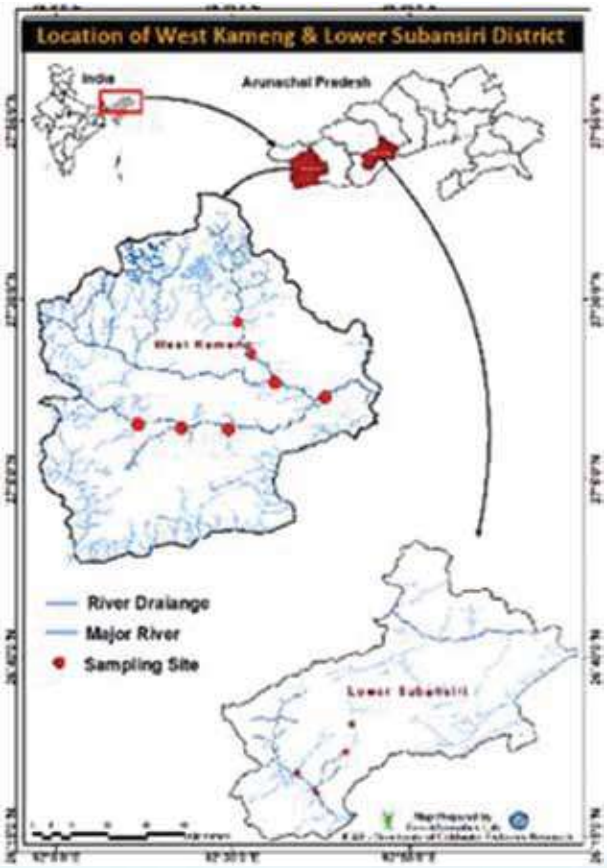


Fig.: Location map of the study area

liter.Total 23 species of fishes, including 5 species of snow trouts, were collected from selected stretch of Kameng drainage and to our knowledge, this is the first report of S. molesworthi from Kameng river. Based on the present study, it can be concluded that snow trout species prefer a particular type of habitat and thus, their abundance and distribution was restricted to upper stretch of river. Kameng drainage provides ideal habitat for snow trouts with no pollution or minimal anthropogenic effect. The morphometric and meristic characters of snow trout species are often overlapping and ambiguous and hence need a thorough revision of the species of genus *Schizothorax*. Biology of the species indicates moderate fecundity and hence, planned management and conservation measures are required for maintaining the sustainability of population over a longer time period. In future, changing climate and increasing anthropogenic activities, in the drainage, can pose a threat to the endemic snow trout population.

Fig.: Sampling for Phytoplankton in one of the sampling stations of Kameng drainage

Fig.: Sampling for snow trouts in one of the sampling stations of the Kameng drainage

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 2021**
Personnel:	**Dr. D. Baruah (PI), Mr. Parvaiz Ahmad Ganie, Mr. Kishor Kunal**
Funding Support:	**Institutional, ICAR-DCFR**

Five districts of Arunachal Pradesh viz., East Kameng, Kuruang Kumey, Pakke Kesang, Papum Pare and Kaara Daadi were investigated and the aquatic resources, drainage network, land use land cover, digital elevation model and slope map 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

Digitised mapping of aquatic resources and stream order delineation: Aquatic resources in the form of major river drainages, their connecting channels and streams, upland lakes, wetlands were digitized and mapped. The combined length of river network and wetland area are reflected in Table 1. The majority of the upland lakes accounting 46% and 61% of the total, are situated at an altitude ranging between 4000-5000m MSL in districts East Kameng and Kuruang Kumey respectively, whereas no upland lakes were found in other three districts. Papum pare has maximum number of rivers and river network length followed by Kuruang kumey, Pakkekesang, East Kameng and KaaraDaadi.

Table 1: Details of river network and upland lakes of the selected districts

Resources	Districts				
	East Kameng	Kuruang Kumey	Pakke Kesang	Papum Pare	KaaraDaadi
River network in length (No./km)	2901/3140.53	5508/3306.11	4447/3010.41	8538/5265.93	2818/1638.345
Wetland area (No./ha)	81/664.83	41/246.54	NA	NA	NA

The stream order ranking was carried out based on the method proposed by Strahler because of its simplicity. The stream orders are classified up to six orders in districts East Kameng and Pakke Kesang while inKuruang Kumey, Papum Pare and Kaara Daadi it can be slight higher. The details of stream order of the selected districts are as shown in the Table 2. The maximum stream order frequency is witnessed in case of first-order streams and then for second order. Hence, it is perceived that there is a decrease in stream frequency as the stream order increases and vice versa.

Table 2: Details of stream order: number and length of the selected districts

Stream order	Districts									
	East Kameng (No's/ length in km		Kuruang Kumey (No's/ length in km)		Pakke Kesang (No's/ length in km)		Papum Pare (No's/ length in km		KaaraDaadi (No's/ length in km)	
1st	1632	1588.97	3363	1660.31	1632	1588.97	5317	2723.06	1742	819.94
2nd	1123	805.65	1822	829.12	1123	805.65	2451	1310.55	965	425.62
3rd	125	360.1	300	463.92	125	360.1	702	676.38	102	230.42
4th	18	222.02	17	169.15	18	222.02	55	295.98	7	83.135
5th	2	103.97	4	152.02	2	103.97	11	188.05	2	79.23
6th	1	59.82	2	31.59	1	59.82	2	71.91	-	-

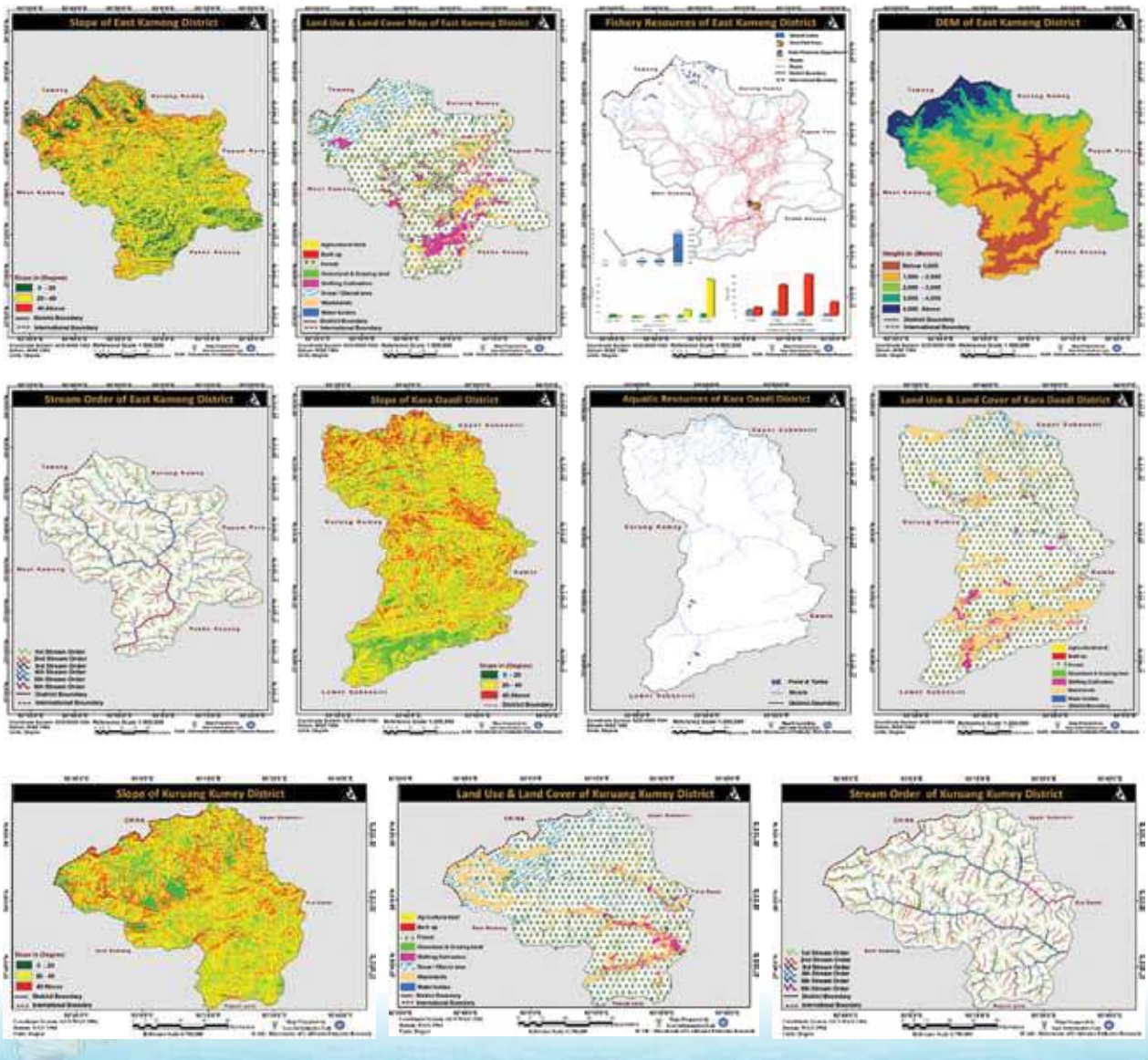
Development of Land Use Land Cover (LULC) maps: Eight categories of LULC were classified for the five districts and the area of coverage in each category is mentioned in Table 3. Forest covers the maximum land cover accounting 71.08%, 72.42%, 87.51%, 84.39% and 81.62%of the total area in the districts of East Kameng, Kuruang Kumey, Pakke Kesang, Papum Pare and KaaraDaadi respectively. Snow area is occupied only in East Kameng, Kuruang Kumey, Pakke Kesang districts occupying 11.35%, 11.00% and 0.23% of the total area respectively. Shifting cultivation is a prominant feature in Arunachal Pradesh and is practised in all the five districts.Wasteland and agricultural land occupy a sufficient portion of the land cover thus offering the opportunity for fisheries development in all the five districts.

Table 3: Confusion matrix of the LULC classes

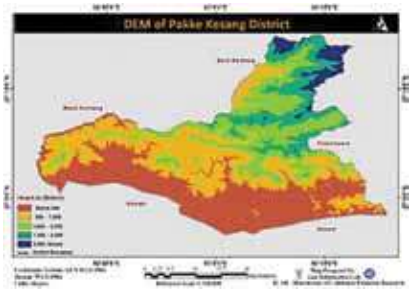
SI. No.	LULC classes	Districts (Area in sq.km)				
		East Kameng	Kuruang Kumey	Pakke Kesang	Papum Pare	Kaara Daadi
1.	Agricultural land	86.17	4.3	21.38	63.33	4.036
2.	Built up	15.19	5.02	4.26	16.44	2.96
3.	Forest	2968.66	3144.95	1620.62	2750.4	1844.14
4.	Grassland & Grazing land	1.06	7.04	8.76	8.99	2.1

SI. No.	LULC classes	Districts (Area in sq.km)				
		East Kameng	Kuruang Kumey	Pakke Kesang	Papum Pare	Kaara Daadi
5.	Wastelands	338.82	600.96	133.09	337.54	352.46
6.	Water bodies	43.63	23.12	24.71	20.49	9.42
7.	Shifting Cultivation	248.82	79.79	34.82	61.9	44.23
8.	Snow / Glacier area	474.21	477.67	4.24	-	

Digital Elevation Model (DEM) and Slope: The DEM examination of the selected districts infers that the districts East Kameng, Kuruang Kumey and Kara daadi have elevation range of below 1000m to above 4000 masl with 81.39%, 67.44 %, and 96.89% of total geographic area in the elevation range of below 1000 to 3000 m encompassing an area of 3398.86 ha, 2929.36 ha and 2200.27 ha respectively whereas the districts Pakkekesang and Papum pare have elevation range of above 3500m and 2000 m respectively. Furthermore, the slope class 0-20 degree in green colour comprising 24.38%, 21.42% and 45.56% 42.23% and 18.92 % of the total geographic area of the above five districts have better probability in considering potential sites for undertaking fisheries developmental activities as compared to slope class 20-30 degree and above.

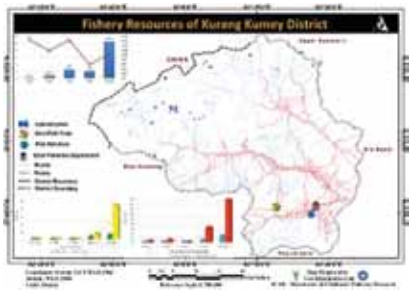



Fishery Resources of Pakke Kesang District


DEM of Pakke Kesang District

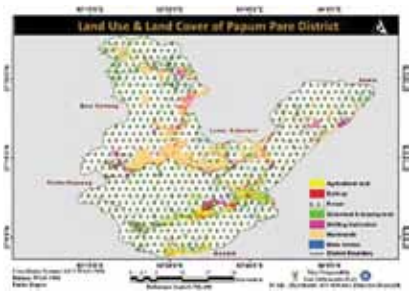

Stream Order of Pakke Kesang District

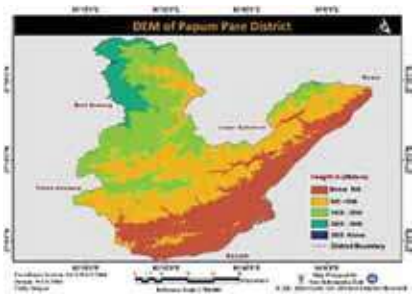

DEM of Kurung Kumey District


Fishery Resources of Kurung Kumey District

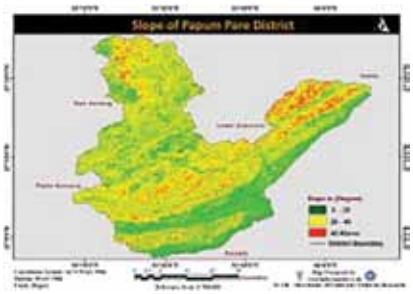

Slope of Pakke Kesang District


Aquatic Resources of Papum Pare District


Land Use & Land Cover of Papum Pare District


DEM of Papum Pare District


Stream Order of Papum Pare District


Slope of Papum Pare District


DEM of Kara Daadi District


Stream Order of Kara Daadi District

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), D. Baruah, P.A. Ganie, Ms. Garima**
Funding Support:	**Institutional, ICAR-DCFR**

Freshwater fishes are one of the most threatened taxonomic groups because of their high sensitivity to the quantitative and qualitative alteration of lotic ecosystems, the rivers and their adjoining streams of the Indian Himalayan Region in particular. Off late, these ecosystems and fisheries are subjected to intense pressure from a wide range of anthropogenic activities, the main ones being impacts from modifications to river flow regimes, altered land use, riparian and physical habitat loss, exotic species invasions, water pollution and intensive exploitation of fish stocks. As a consequence, they are often used as bio-indicator for the assessment of water quality, river network connectivity or flow regime and overall health of the aquatic ecosystem. Thus the current study was envisaged to assess the ichthyodiversity and Health Assessment of Central Himalayan River Saryu, Uttarakhand. In this study it is expected to assess the drivers governing the spatio temporal variation in ichthyodiversity. Besides this, the habitat characteristics of the basin along with the catchment and riparian vegetation influences on the water quality and fish distribution of the river will also be studied. In addition to this the length weight relationship, Gondasomatic index and reproductive biology of some of the commercially important fish species will also be taken care of so as to formulate a comprehensive management strategy for exploitation of the riverine resources.

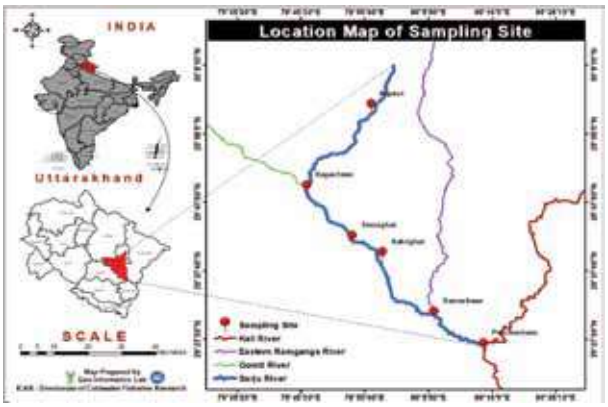


Fig.: Location map of study area

Field sampling was carried out at six different locations of the river Saryu (viz. Kapkot, Bageshwar, Seraghat, Panar, Ghat and Rameshwar) during the month of November, 2020 and January 2021 for recording and collection of piscine and hydrobiological data. The physic-chemical parameters recorded were water velocity (0.2-1.8 m/s) water temperature (16.91-17.76^{0}C); pH (8.6 -8.8); Dissolved oxygen (8.78 -10.82 mg/l); TDS (134-151 mg/l), Nitrite (0.50-1.4 mg/l); Nitrate (2-6 mg/l); Phosphate (0.01-0.06mg/l); Iron (0.1-1.59 mg/l); Magnesium (16.2 -22.3 mg/l); Hardness (140-210 mg/l); Alkalinity (90-130 mg/l); Calcium (38-64 mg/l). The Ichthyofauna recorded were *Schizothorax richardsoni* and *Nazirito rcheyloinides* from commercial catches only.

Fig.: Sampling at River Saryu, Uttarakhand

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), D. Baruah, K. Kunal, Ms. Garima**
Funding Support:	**Institutional, ICAR-DCFR**

Freshwater systems are under pervasive stress from human induced modification of habitats and changing climate. Alteration of freshwater habitats has occurred at multiple spatial and temporal scales and influenced the abundance and distribution of native species worldwide. Changes in the timing, magnitude, frequency, rate, and duration of seasonal water discharges may obsolesce evolved life history strategies of some freshwater species maladapted to contemporary habitat conditions and favour others. Immediate and future changes in climate may exacerbate changes in both habitat availability and connectivity in riverine systems. For instance, increased water temperatures at local spatial scales in conjunction with limited connectivity to possible refuge habitats may result in a tipping point after which species declines may occur without intervention indirect management to expand the geographic range of the species (i.e., translocation). The story of Himalayan Rivers is no different and that is why the present investigation was planned to assess the health status and influence of hydro-biological variations on fish assemblage patterns in river Ladhiya Central Himalayas, Uttarakhand. In the current study it is envisaged to study the basin and drainage structure, catchment influences on river health, factors governing the fish species assemblages, besides identifying critical areas for conservation. In the present investigation, the protocol of David *et al.* 2010 was followed for reach scale fish diversity as the fish species relative abundance and richness is influenced by the number of unit samples and the corresponding fishing effort.

Field sampling was carried out at six different locations of the River Ladhiya (Sunnegoan, Sunnkot, Reetha sahib,Bael kheth, Chalthi and Chukka) during the month of December 2020 for recording and collection of species and hydrobiological data. The ichthyofauna recorded were *Schizothorax richardsonii, Barilius bendelesis, Garra gotyla, Glyptothorax sp. and Tor putitora.* The physic-chemical parameters recorded were water velocity (0.1-1.4 m/s) water temperature (10.93-20.940C);pH (7.53 -8.76);dissolved oxygen (7.34 -8.81 mg/L); TDS (20-96 mg/L), nitrite (0.0.5 mg/L); nitrate (0.5-1.4 mg/L); phosphate (0.4-0.6mg/L); iron (0.1-0.3mg/L); magnesium (2.8-8.0mg/L); chloride (1.0-4.0 mg/L) etc. Besides this, the basin and drainage structure of the river was assessed using the spatial analyst tool of ArcGIS 10.8 following the Strahlers method of stream order delineation. For this purpose the data from digital globe quick bird, India wris ISRO and ASTER satellites were used. The basin assessment revealed River Ladhiya to be 5thorder basin with dendritic drainage pattern. Moreover, the DEM and slope assessment of the catchment inferred that the river falls in the elevation regime of below 500m to above 2000 masl with 95% and 57 % of land cover in the elevation range of 500 to 2000 masl and above 20 degree slope. However, more number of sampling and corresponding analyses will be carried out to get a clearer picture of the river.

Fig.: Map of River Ladhiya showing different sampling stations

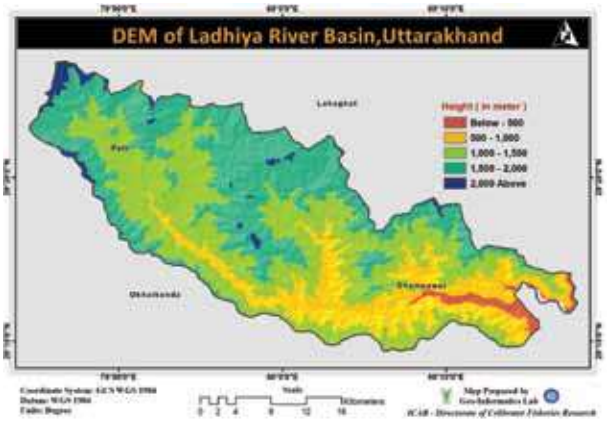


Fig.: Map of Ladhiya River basin showing the elevation gradients

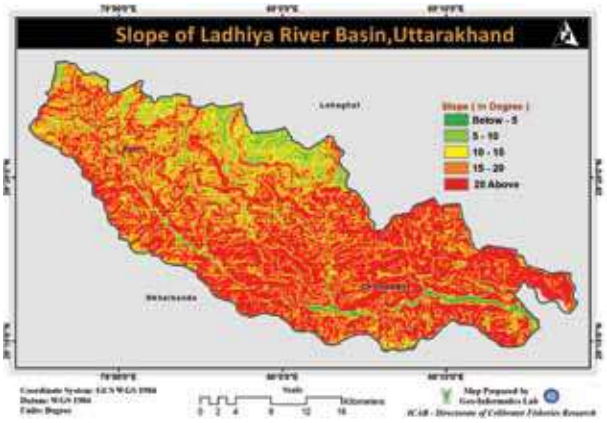
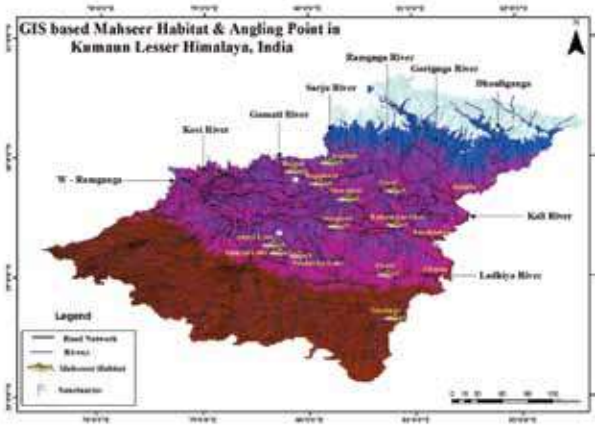


Fig.: Map of Ladhiya River basin showing the slope gradients

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**

Recreational fishing for mahseer was introduced by the British during 1873. It has been estimated that there are over a million anglers both subsistence and recreational. Anglers are also spread across India, even in the remote villages and involved in sport / recreational fishery. Generally, a detailed record of catches is maintained by the anglers and this information requires evaluation for the purpose of conservation. The anglers have a deep inclination towards saving fish, especially golden mahseer in nature. The caught fish is released back into its environment thus practicing "Catch and Release". It has been observed that recreational fishing induces social bonding, provides livelihood opportunity among local population besides promoting awareness for the importance of conservation and ecotourism.

An investigation reflecting the concern of anglers about fish conservation was initiated, as some anglers even spend their own money for the conservation of fish at different sites in the rivers. Anglers are actively involved in conservation of sport fish and their fishing sites. Moreover, they also create awareness among local population so that



destructive and unlawful methods of fishing are prohibited. Therefore, a participatory approach is required for the generation of data on angling status to develop a viable strategy for conservation and ecotourism. In this project, a review of literature and field data were collected during the reporting period. GIS based mapping was employed to record the habitat of mahseer and its angling sites. In this direction, a questionnaire has also been developed to obtain important information from anglers and locals for further study.

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), D. Baruah, R.S. Haldar**
Funding Support:	**Institutional, ICAR-DCFR**

Exploratory survey and field visit was carried out for collection of germplasm of mahseer from Bhimtal Lake, Sattal Lake, Suyal stream, Kosi river and Gomati river. The documentation of fish fauna was carried out and available mahseer samples were collected for the identification using DNA barcoding. In addition, approximately 80 adult *Tor* spp. collected from Bhimtal Lake, Kosi River and Gomati River are maintained as live genebank or genetic stock of golden mahseer in outdoor cement raceways of ICAR-DCFR, Bhimtal for the purpose of conservation. Altogether 80 specimens of live or freshly dead mahseer were sampled from Bhimtal Lake, Sattal Lake, Suyal stream, Gomati River and Kosi River. Morphometric and meristic parameters was collected and fin samples were stored in absolute ethanol for DNA isolation for DNA barcoding and for determination of genetic distance. Mahseer of various body shapes and differential pattern in head and mouth were collected during this study.

A repository of voucher specimen with unique ID for twelve *Tor* spp. collected from various lakes, streams and rivers of Uttarakhand was deposited at the Museum of ICAR-Directorate of Coldwater Fisheries Research, Bhimtal. These specimens will be used for reference in future studies and each voucher specimen has been given unique identification ID.

Fig.: Specimens of mahseer collected under the project

Fig.: Voucher specimens with unique ID in ICAR-DCFR museum

DNA barcoding for identification of *Tor* spp up to the genus level was carried out. A set of primers (F-5'TCA ACC AAC CAC AAA GAC ATT GGC AC 3' & R-5'TAG ACT TCT GGG TGG CCA AAG AAT CA3') was used to amplify the COX gene of size 660 bp. These amplicons were gel purified and Sanger sequenced. The sequences were BLAST searched for similarity. Altogether 60 samples were sequenced for DNA barcoding. NCBI GenBank accession number for *Tortor* collected from Bhimtal lake is MW280354- *Tortor.*

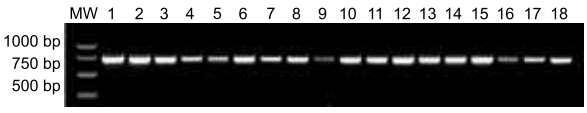


Fig.: PCR amplification of COX gene from fin samples of collected mahseer for DNA barcoding

Moreover, 27 samples were sequenced for genetic structure determination using primers (F-5′- GACTTGAAAAACCACCGT TG-3 and R-5'-CTCGGATCTCCGGATTACAAG AC 3').

Habitat mapping of mahseer at Bhimtal Lake and Kosi River, Ramnagar was also carried out under this project using GIS tool. In addition to this, protocol for eDNA was standardized for further study.

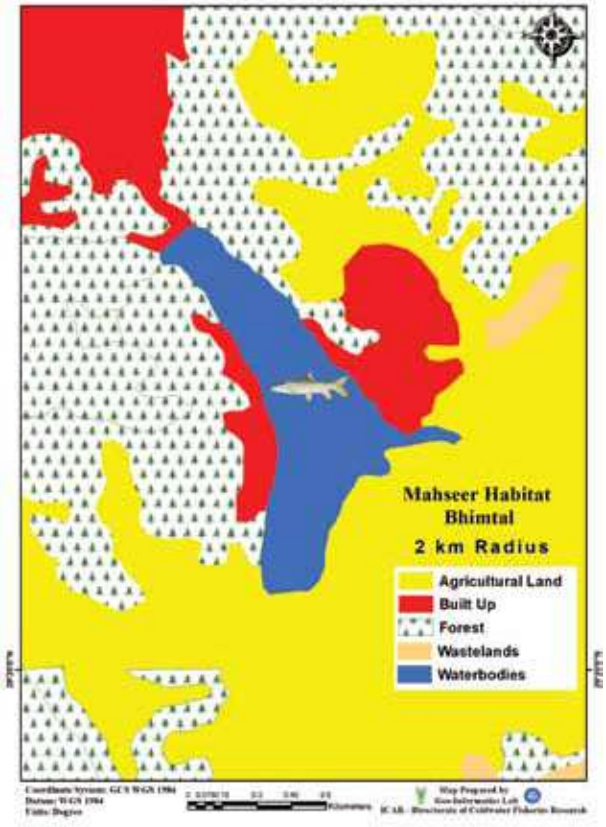


Fig.: Habitat mapping of mahseer at Bhimtal Lake, Uttarakhand

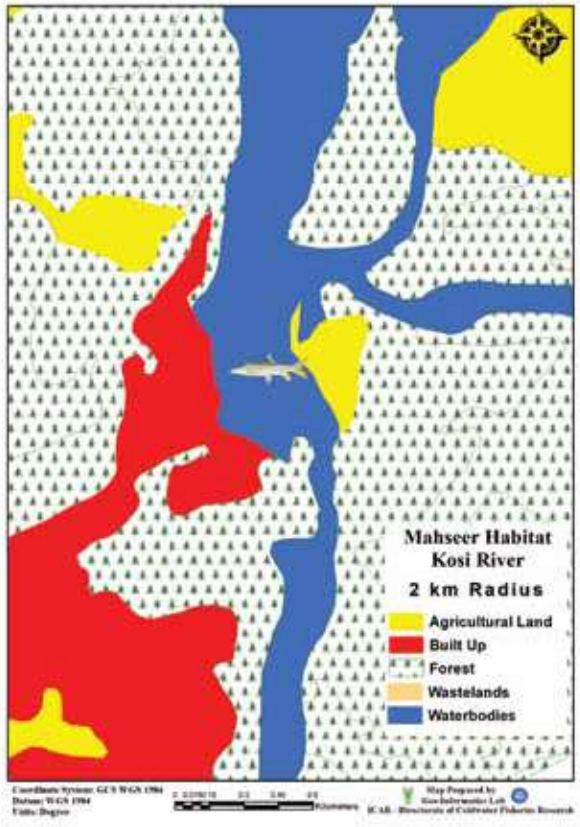
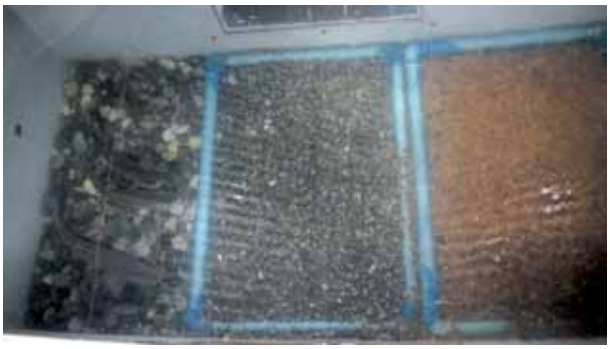


Fig.: Habitat mapping of mahseer at Kosi river, Uttarakhand

3.2 Aquaculture Oriented Research and Development

Project: AQ-16	**Captive management of golden mahseer in perspective to aquaculture and conservation**
Sub project 4:	**Scaling up the seed production of chocolate mahseer in captivity (Renamed as: Standardization of seed production protocol of chocolate mahseer through optimization of environmental condition)**
Period:	**April 2018 – March 2021**
Personnel:	**Pragyan Dash (PI), D. Sarma, R.S. Tandel**
Funding Support:	**Institutional, ICAR-DCFR**

Spawning substrates preference of chocolate mahseer was tested in five flow-through rectangular tanks. The fishes were given choice for the three spawning substrates gravel, small cobble and coarse sand. The percentage retrieval of fertilized eggs were evaluated from the substrate with respect to siphoning time. Further trial included the optimization of substrate area for which three treatments viz. (1) gravel covering 100% of tank bottom (2) a gravel tray covering 1/3rd part of tank bottom area (3) control without substrate were arranged. The females were tagged through caudal fin clipping for their identification. To maximize the percentage fertilized egg retrieval from gravel, tray stripping was carried out as soon as fish showed spawning behaviour. Continuous seed production was achieved from the month of July-Nov, 2020. A total of 23000 eggs were produced and around 15000 fry were reared in the hatchery.



(A)

(B)

Fig.: (A) Trial on preference of spawning substrate in tank (B) Gravel tray as spawning substrate in flow-through tank

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 2021**
Personnel:	**M.S. Akhtar (PI), Ciji,A., Rajesh, M., D. Thakuria**
Funding Support:	**Institutional, ICAR-DCFR**

For optimizing reproductive and spawning performance of golden mahseer in captivity, adult golden mahseer reared in pond conditions were collected and further raised in round FRP tanks installed with gravel bed breeding substratum with photo-thermal manipulations. The water temperature was maintained using 1000W thermostatic water heaters. Fishes were fed *ad libitum* with regular broodstock diet twice daily. Water quality parameters such as temperature, DO, pH, nitrite, ammonia, free CO_2, hardness etc. were monitored regularly. The protocol of sex segregation has been standardized for stripping higher number of eggs. Captive maturation and multiple/repeated breeding of golden mahseer through photo-thermal manipulation has taken the shape of a novel technology. During the year 2020, except January, we observed multiple breeding of golden mahseer in every month and 1,22,520 eggs were stripped from 18 females with > 72 % of responding females. The average annual egg stripping of each female was evidenced as 2.77 times and annual average relative fecundity of 9680±811 eggs/kg body weight of responded females was obtained. The fertilization rate was in the range of 79-87 %, hatching rate in the range of 77-88 % and with a survival of the fry in the range of 75 – 90% until 75 dph.

(A)

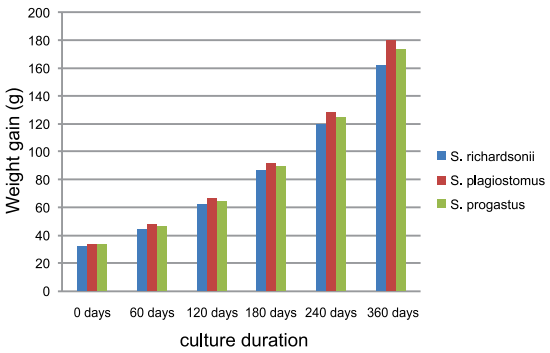
(B)

Fig.: (A) Stripping of captive matured brooders (B) Golden mahseer fry produced from captive matured brooders

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 2021**
Personnel:	**N.N. Pandey (PI), R.S. Patiyal, S. Ali**
Funding Support:	**Institutional, ICAR-DCFR**

Comparative growth performance of three species of snow trout in field conditions

A field experiment of 360 days was conducted in FRP tanks (n=6) of 1200 L capacity. Each tank (water volume 1m^3) was stocked with yearlings (n=40) of *S. richardsonii*, *S. plagiostomus* and *S. progastus* and fed with feed of 35% protein at the feeding rate of 3-5% of their body weight twice a day. Initial and final data were recorded for growth indices and survival rate with regular monitoring of water quality parameters. The net weight gain in one year culture duration was observed as 129.82 g, 145.21 g and 140.04 g for *S. richardsonii*, *S. plagiostomus* and *S. progastus,* respectively. Field study reveals that *S. plagiostomus* has 11.8% better growth in comparison to *S. richardsonii,* while *S. progastus* showed 7.9% better growth than the *S. richardsonii*. Survival in the range of 80-85% was observed with permissible limits of water quality parameters. Study also reflected 4.380-4.470kg/ m^3 production of snow trout with a water flow of 6-10 LPM. Considering the market price as Rs. 300/kg, the approximate operation cost was Rs. 912/ m^3 with a net profit of Rs. 429/ m^{3}per year. The study reflects the feasibility of snow trout culture in flow through system by stocking yearlings.



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, *Garra gotyla***
Period:	**April 2018 – March 2021**
Personnel:	**R.S. Patiyal(PI), N.N. Pandey**
Funding Support:	**Institutional, ICAR-DCFR**

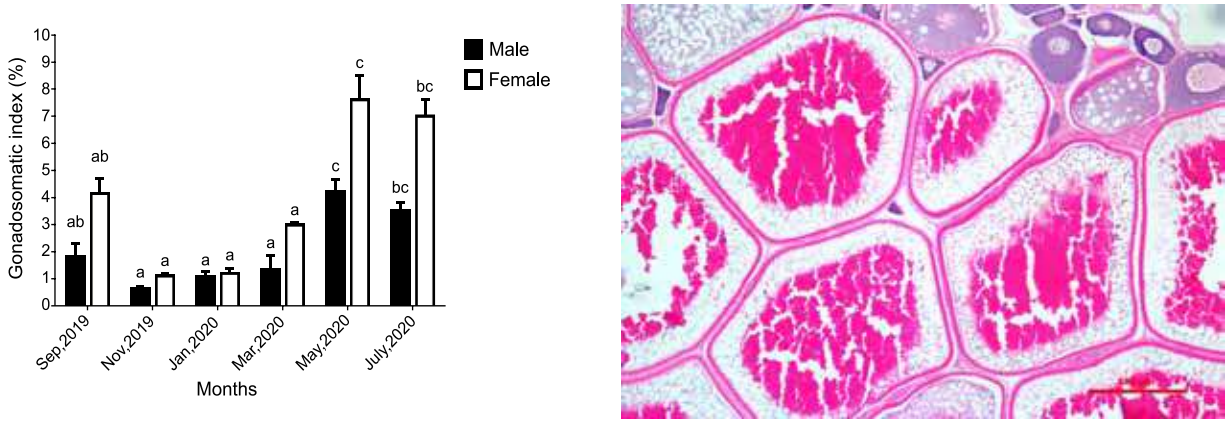
Seed production of Sucker Head, *Garra gotyla* in captivity

Brooders were maintained at 22-24 ^{0}C water temperature. Captive reared fish were regularly monitored for maturity confirmation by slight pressing at the abdomen and other biological traits. The hatching rate was 90-95% and survival rate from fry to fingerling was more than 90%.The survival rate from fingerling up to 25gm size was 98%. The

larvae were allowed to grow in rearing tanks as well as in glass aquarium for validation of ornamental potential of the fish. Approximately 2000 *Garra* were produced in different five breeding operations.

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**

Sampling of *Barilius vagra* was carried out twice a month from Sep-2019 to July-2020 from Ladhia River, Chalthi, Champawat. The maximum GSI in males (4.06±0.39) and females (7.57±1.2) were reported in May and July. In September, both sexes were reported with a fall in GSI value. The presence of post ovulatory follicles and empty tubular lumen, indicated beginning of spawning from late July that continued till mid-September. The overall, the gonadal histology and percentage of oocyte stages in females indicated that *B. vagra* exhibit asynchronous pattern of oocyte development.



(A) (B)

Fig.: (A) Seasonal variations in gonadal maturation of *Barilius vagra* (B) Gonadal histomicrography 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), R.S. Patiyal, B.S. Kamalam**
Funding Support:	**Institutional, ICAR-DCFR**

A low-cost model of 1-3 m^3 and 7 m^3 water holding capacity mini-RAS system was designed with simple design for easy operation with reduced mechanical parts, except for pumps and aeration devices. The system consisted of dual drain tanks with swirl separators or settling tanks which removed 50% of solid generated and the remaining 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 15 grams were stocked in rearing tanks. Growth curve was obserevd in these mini RAS (Fig). There is a potential for this particular RAS design to culture fishes at stocking of 30 kg per m^3. However, when stocking density crosses 35 kg per m^3a significant decrease in dissolved oxygen and an increase in

turbidity of water is recorded which required an additional refining of the system. This system also requires regular cleaning to ensure lower water turbidity to aid vsisibility. During the rearing period, water quality parameters like DO, pH temperature, TAN, NO_2 NO_3, CO_2 and alkalinity were monitored daily. Initially pH and alkalinity dropped regularly below 7 which affected nitrification and later this was ameliorated through regular addition of sodium bicarbonate at the rate of 150 g per kg of feed fed which stabilised pH and alkalinity. During the backwash procedure of gravel filters, 15-20 % of water is exchanged which also reduces nitrate level. Further studies were carried out to understand the microbial diversity of nitrifying bacteria in biological filter using 16S RNA phylotyping. DNA extracted from different biofilters maintained under different experimental conditions such as different temepratures (12°C and 20°C), adddition of organic carbon source (20 YE) as well as practical biofilters (EXPBF and PRBF) were used in the study. The study revealed a diverse bacterial profile harboured in fixed gravel biofilter (Figure 2). The major genus that observed across the treatment was *Nitrospira*, the abundance of which decreased with reducing temperature and addition of organic matter (69.2 to 11.7%). Other known nitrifying bacteria belonging to the family*Nitrosomonadacea*unclassified, were also present inlow abundance particularly in practical RAS biofilters. It seems that *Nitrospira* is a major nitrifying organism found in Coldwater RAS biofilter, while the abundance of*Nitrosomonas* is very less in actual biofiliter. Considering the dominance of the *Nitrospira*, it may be possible that some *Nitrospira* may be comammox as there are sufficient evidences for presence of comammox *Nitrospira* in RAS biofilter. Overall, the result suggests that the enrichment of *Nitrospira* is possible which can be used for speeding up the biofilter startups. However, functional annotation and gene study (i.e. AmoA and Nxr) is required to identify some novel nitrifying microorganisms.

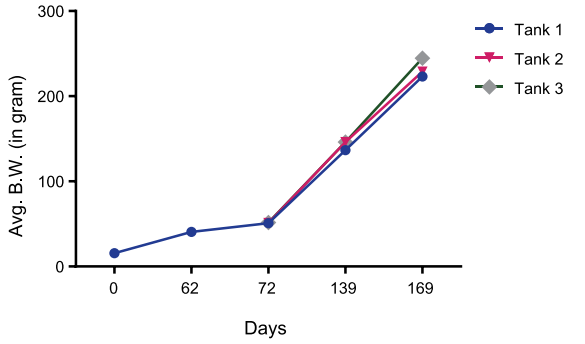


Fig.: Growth curve of rainbow trout in mini backyard RAS

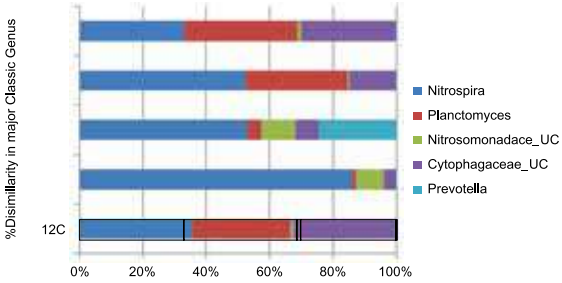


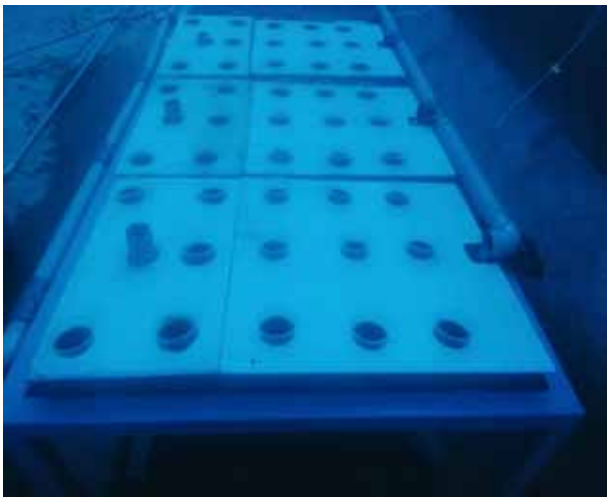
Fig.: Percentage variation in major genera found in biofilter under different conditions

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**

Aquaponics is a self-sustained integrated/ hybrid food production system. It has a potential to produce two diversified groups of crops such as fish and plants in a limited space or area for human consumption and/or use. Hence, it is also known as 'Integrated Agri-Aquaculture Farming' (IAAF). A prototype of an experimental aquaponics unit has been set up at the ICAR-DCFR, Bhimtal campus for the pilot scale fish-vegetable production. The technical design of the system with installation of fish rearing tanks, hydroponic cum biofiltration unit, aeration system and swirl separator has been

completed. Plastic drum barrels were innovatively used for the removal of solids. Beds for the cultivation of plants were used besides egg trays, to germinate vegetable seeds for the reducing the cost and to make the system economically viable. Two types of media beds such as crusher stones and natural riverbed stones were used for the performance evaluation on plant growth. For deep water culture (DWC) aquaponics, broken unused false ceilings and disposal glasses, to solve the purpose of rafts and net pots for plant growth respectively, are used in innovative way for their recycling and to reduce the capital cost of the unit. Research trials have been initiated to test the feasibility and economic viability of the system so that the said model can be demonstrated and disseminated to the farmers, entrepreneurs etc. after repeated assessment and refinement of the technology.

(A)



(B)

Fig.: (A) Design and set up of the experimental aquaponics unit (B) Design of Deep Water Culture (DWC) aquaponics

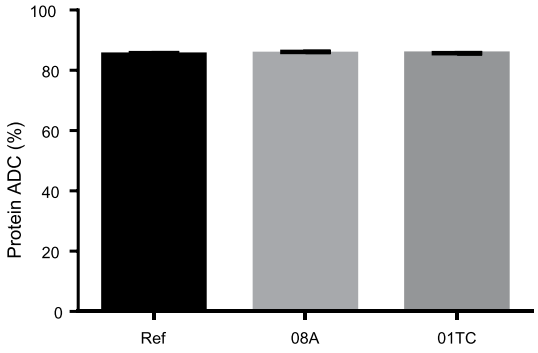
3.3 Fish Nutrition and Feed Development

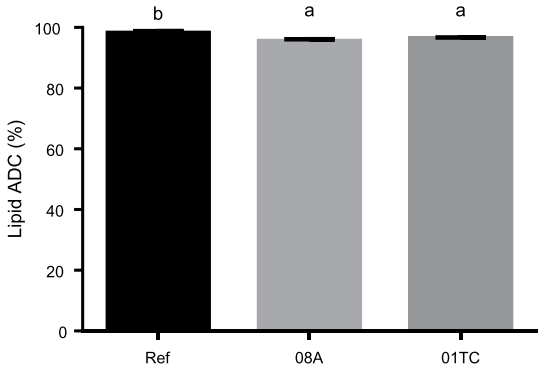
Project: AQ-21	**Coldwater fish nutrition and feed development**
Sub project 1:	**Development and validation of novel feed formulations for rainbow trout (*Oncorhynchus mykiss*) based on commercial-scale industrial by-products**
Period:	**April 2018 – March 2021**
Personnel:	**B.S. Kamalam (PI), Rajesh,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

Methanotrophic bacterial meal digestibility study

A growth trial was conducted to evaluate the potential of natural gas grown methanotrophic bacterial meal (String Bio, Bengaluru) to partially or completely replace fish meal in rainbow trout feeds. It was observed that the growth and feed utilisation response was fairly high (*i.e.*, thermal growth coefficient was 2.55 and feed efficiency was 1.23) even in the group where fish meal was completely replaced with the bacterial protein. Nevertheless, measurement of apparent digestibility coefficients (ADC) of different diets showed that digestibility of dry matter and protein was significantly reduced at the 100% FM substitution level while lipid digestibility and leucine aminopeptidase activity decreased beyond 25% FM replacement. Therefore, in a subsequent ingredient digestibility study, we estimated 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 two ingredient variants showed high protein digestibility (90-93%), but low lipid digestibility (60-67%). Moreover, there were significant differences in essential amino acid digestibility between the two variants, indicating that the production of the bacterial meal may influence digestible nutrient content.





Field validation and demonstration of rainbow trout starter feed

In the critical first feeding and nursery rearing stages of rainbow trout, the performance efficacy of the starter feed is a critical determinant for the production of rainbow trout seed both in terms of quantity and quality. In this context, we had developed a high-performance trout

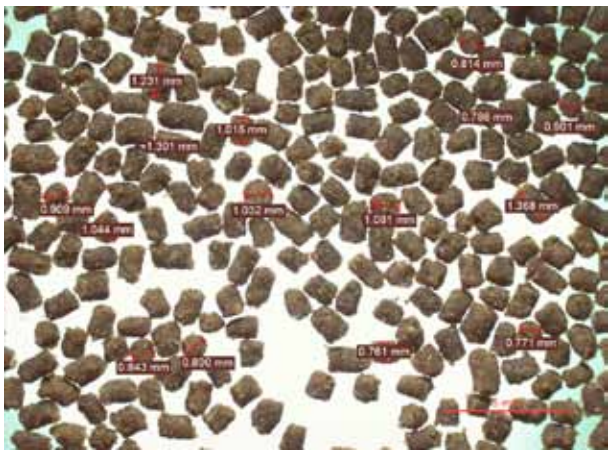
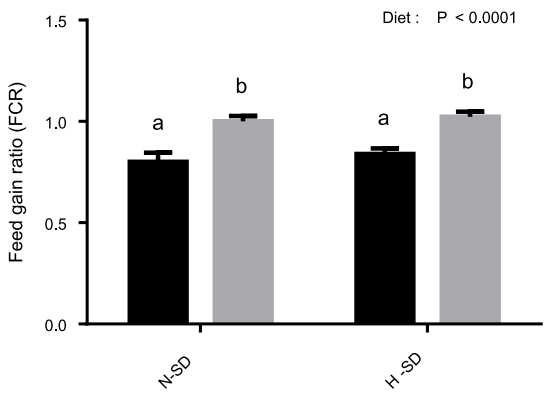


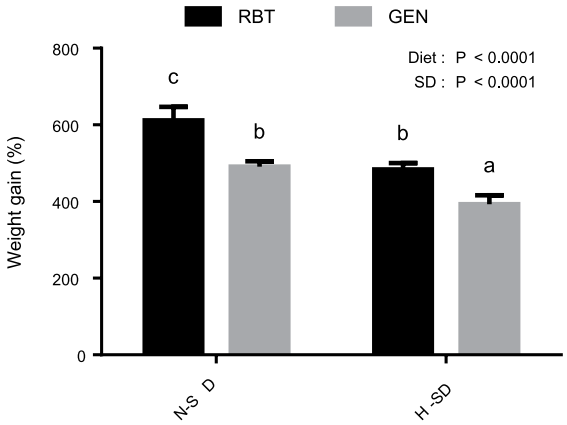
Fig.: Clockwise, from top left: ICAR-DCFR starter feed produced by M/s Growel Feeds; Healthy rainbow trout advanced fry produced in Bairangana trout farm, Uttarakhand; on-farm demonstration in Sikkim; on-farm demonstration in Himachal Pradesh.

starter feed through a series of feeding trials, by evaluating production related phenotypes (growth, feed use and survival); morphometric, tissue and transcriptional markers; and the pellet physical properties. Subsequently, to validate and demonstrate the performance of this starter feed at real-field conditions, we conducted on-farm feeding trials at eight public and private trout farms in Himachal Pradesh, Jammu & Kashmir, Uttarakhand and Sikkim, from January to May 2020. For this, we collabotrated with Growel Feeds Pvt. Ltd., Andhra Pradesh to produce 2500 kg of nutritionally and physically superior extruded starter 1 (0.4-0.6 mm crumble) and starter 2 (0.8 mm slow sinking pellet) feeds having 50% crude protein and 15% crude fat. In all the test sites, under different environmental conditions, the performance of DCFR's starter feed was found to be consistent and very good in terms of feed acceptance, use, growth, survival and size homogeneity. Specifically, on a comparative scale, this feed outperformed the existing trout starter feeds by a difference of 50-90% in weight gain. Survival was greater than 90% in all the test sites. The feed conversion ratio ranged from 0.8 to 1.2, with substantially less feed wastage. Importantly, the duration of nursery rearing (from first feeding to 2 g size) was reduced from 75-90 days to 45-60 days. Based on conservative estimates, ICAR-DCFR has contributed to the production of more than 0.5 million healthy trout fingerlings across the country, using this starter feed.

Rainbow trout feed R&D collaboration between ICAR-DCFR and Growel Feeds Pvt. Ltd.

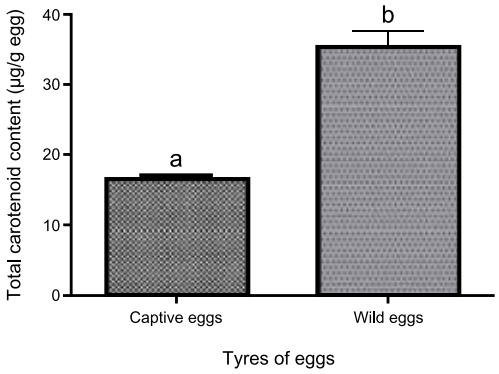
On 16th July 2020, ICAR-DCFR officially signed a memorandum of understanding with Growel Feeds Private Limited, a prominent Indian aquafeed manufacturer situated in the Krishna district, Andhra Pradesh, for a collaborative research programme on the development and validation of complete range of rainbow trout feeds. Under this partnership, initially, 3.5 tonnes of experimental feed were manufactured and supplied by Growel Feeds, for a series of grower feed evaluation trials. The first on-farm trial is being carried out in outdoor flow through raceways at Experimental Field Centre, Champawat, with two different rainbow trout families. The second set of feed evaluation trials is being carried out in different scales of experimental RAS loops. Thirdly, a comparative performance evaluation of rainbow trout and generic carnivorous feeds is being carried out at Bhimtal, under different stocking density. Mid-term measurements showed that the FCR of the DCFR-Growel rainbow trout feeds ranged between 0.8 to 1.1, across the different trials and production systems. When comparing the performance of the rainbow trout (RBT) and generic carnivorous (GEN) fish feeds under different stocking densities, it is evident that growth rate and feed conversion efficiency is significantly enhanced with the use of high energy rainbow trout specific feeds.





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.**
Funding Support:	**Institutional, ICAR-DCFR**

Endangered golden mahseer, a flagship species in Coldwater fisheries of India needs rehabilitation and conservation measures for its sustainability. For this, mass scale seed production using captive brood stock is imperative. Recently ICAR-DCFR succeeded in inducing maturity and spawning of golden mahseer under captivity. However, the reproductive competence of captive raised golden mahseer brooders is relatively less, in comparison to wild collected brooders, which may be linked to brood stock nutrition as reported in several other species. In this milieu, we investigated the differences in breeding performance between wild and captive brooders and found that the fertilization and hatching success is relatively lesser (6-10%) in captive brooders as compared to the wild ones. Moreover, the total carotenoids were found to be significantly lower in eggs produced from captive brooders. They were pale whitish in colour in contrast to golden yellow coloured eggs obtained from wild brooders. Additionally, the incubation period and hatching window (time taken to complete 100% hatching) is relatively longer in case of eggs produced from captive brooders. Considering these differences in breeding performance, an improved brood stock diet has been formulated by incorporating some nutrients/additives to the existing brood stock diet to evaluate the reproductive performance and larval quality.



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

Rainbow trout farming in India is considerably quite old, and it is growing progressively and rapidly. Rainbow trout is majorly cultured in Himachal Pradesh, Kashmir, Sikkim and Uttarakhand. One of the major challenges for further propagating trout farming in the country is the non-availability of quality seed. Until now, no specific brooder feed for rainbow trout is available in our country, and farmers are rearing the broods on grow-out feed with some supplementation and fortification. Due to the unavailability of proper brood stock feed, trout hatchery runners face spawning failures due to improper or asynchronous gonadal maturation. There are reports of poor fecundity and gamete quality, weak larvae at hatching and developmental abnormalities. A good brooder feed may help us to overcome all these challenges. 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, an experimental (control and test) rainbow trout brooder diet was prepared,

keeping the same protein and energy levels. The feeding trial was conducted for three months at the Experimental Field Centre, ICAR-DCFR, Champawat. Following the trial, fishes were bred, and diet-responsive reproductive traits were recorded.

Fig.: Activities (brooder selection) at the initiation of rainbow trout brooder feed trial (top), and the gonadal status (bottom) at the beginning of the experiment.

Fig.: Rainbow trout starter feed trial, Sribadam, Sikkim; January-February, 2020

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 a preferred game fish, is a regional table delicacy and considered as India's national heritage. In the last decade, skewed sex ratios have been reported in various populations of golden mahseer. However, the molecular mechanisms governing this process remain a mystery. In order to study the molecular mechanisms underlying sex determination and to unravel the molecular differences between male and female fishes, we generated a comprehensive transcriptomic dataset for *Tor putitora* by sequencing the gonads and brain of both sexes using the Illumina Hiseq 2500 system. RNA-seq yielded 1497.3 million clean reads, which were mapped,assembled,and used to characterize differential gene expression. Through a *de novo* assembly approach we obtained 316,548 transcripts of which 78306 transcripts had significant alignments (e-value ≤ 1e – 05) to known proteins in public databases. From these transcripts, approximately 92.5% were functionally annotated allowing the identification of several candidate genes that are likely to play a central role in developmental processes, sexual reproduction, gamete generation, meiosis, sex differentiation, sperm motility, male courtship behaviour and fertilization.

Additionally, comparisons of ovaries and testes revealed several conserved orthologous genes known to be involved in sex differentiation, gonadal development and gametogenesis. In addition, we have also identified several important pathways enriched in male and female gonads. The highly reliable transcriptome assembly developed in our study will be useful for future genomic and genetic studies on golden mahseer and related species. In addition, the present study also provides an important archive for further studies on sex differentiation and gonadal maturation mechanisms in golden mahseer.

Project: AQ18C	**Gender specific transcriptomics response to environmental stress in golden mahseer (*Tor putitora*)**
Period:	**April 2018 – March 2021**
Personnel:	**S. Ali (PI), Siva, C., P. Sharma**
Funding Support:	**Institutional, ICAR-DCFR**

Global climate change poses many threats to biodiversity, altering the physical, chemical, and biological characteristics of freshwater habitats that affect freshwater and diadromous fishes. It is widely accepted that phenotypic plasticity is characteristic of most living organisms and it can aid population persistence during periods of rapid environmental change. The skewed sex ratio in mahseer may be a response to the environmental warming. In the present investigation, *de novo* transcriptome analysis using next generation sequencing was aimed to study the sex specific response of golden mahseer for thermal stress. A thermal challenge study was conducted and in the first phase of transcriptome profiling, gonads and brain tissues were selected. Histological examination of gonads was carried out for the confirmation of mature stages of specimen samples. Total RNA was isolated and assessed both qualitatively and quantitatively. A total of 24 paired-end RNA-Seq libraries (12 each for gonad and brain) were constructed. The paired-end RNA-Seq libraries were sequenced on Hi-Seq 2000 (Illumina, San Diego, USA) for generating 2 × 150 bp sequencing reads. The NGS data is being processed for different downstream analyses.

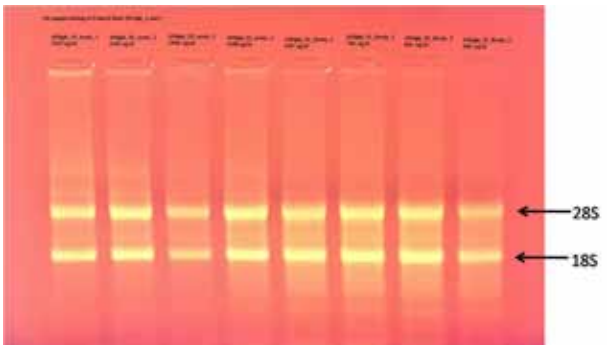


Fig.: Total RNA isolation from different tissue samples

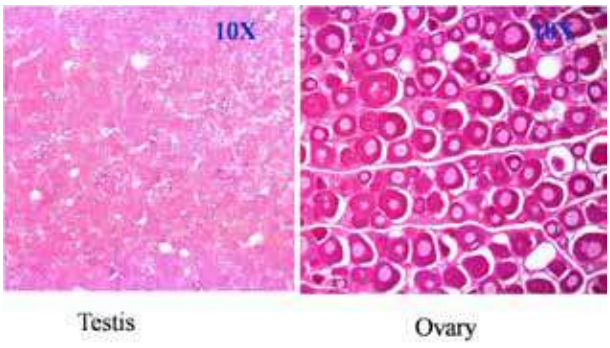


Fig.: Histological examination of gonads of sampled golden mahseer

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

Myostatin (MSTN) is a negative regulator of skeletal muscle development and growth in vertebrates, including teleosts. Common carp (*Cyprinus carpio*) is an economically important food fish, increasing its skeletal muscle mass and improving growth without introducing exogenous DNA is highly desirable. In this project, sgRNA/Cas9 ribonucleoprotein (RNP) was used to knockout the MSTN gene in common carp, and subsequent hatchability, survivability and growth performance was evaluated in mutated common carp. Five male and five female common carp brooders were maintained for production of eggs, required for microinjection of RNPs. Eggs and milt were stripped after injecting the common carp brooder with ovatide. A method for pulling out the glass capillary with fine tip for microinjection, and procedure for microinjection was standardized. All the initial procedures of microinjection and volume optimization were standardized in wild zebra fish eggs. Wild type (22 numbers) and hybrid (6 numbers) brooders of zebra fish, *Danio rerio* are maintained as live genetic stock under the project. Process for breeding the zebra fish under aquarium unit for collection of eggs is standardized as well.

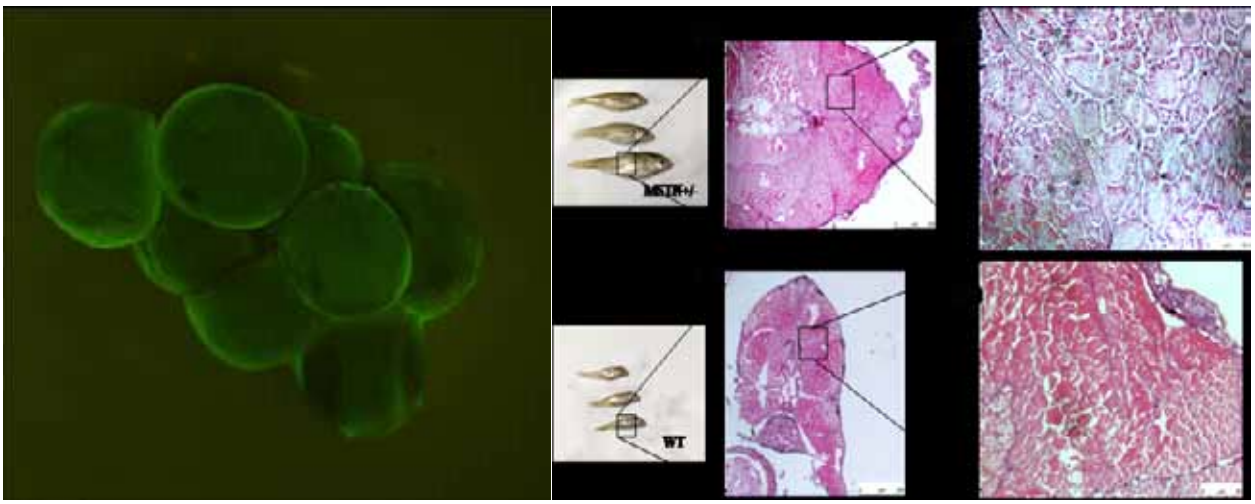


Fig.: Detection of fluorescence in common carp embryo at 48 hpf and histology section of skeletal muscle of MSTN +/- common carp at 90 dph. H&E staining.

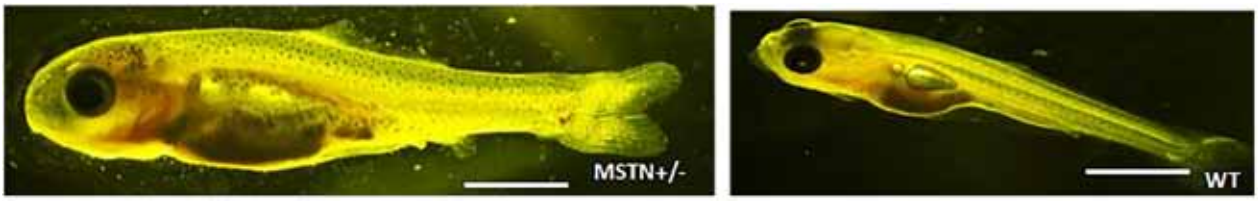


Fig.: MSTN +/- and wildtype common carp, *cyprinus carpio* on 30 dph.

MSTN knockout F0 common carp (MSTN $^{+/-}$) was produced with small insertion-deletion (Indel) mutation of 1-11bp in first exon of MSTN gene. Total body length and total body weight of MSTN $^{+/-}$F0 common carp were significantly (p<0.001) higher than the WT common carp, which confirms the double muscle phenotype.

Dead end nuclease gene (dnd gene) was PCR amplified from fin and muscle tissue of common carp, *Cyprinus carpio* using high fidelity polymerase, and Sanger sequenced. The GenBank accession numbers for nucleotide sequence of dnd gene of common carp are MW280352 and MW280353 respectively. Methodology/ process for evaluating the *invitro* cleavage efficiency of dnd transcripts and cas9 protein (RNPs) was standardized and evaluated, before microinjection.

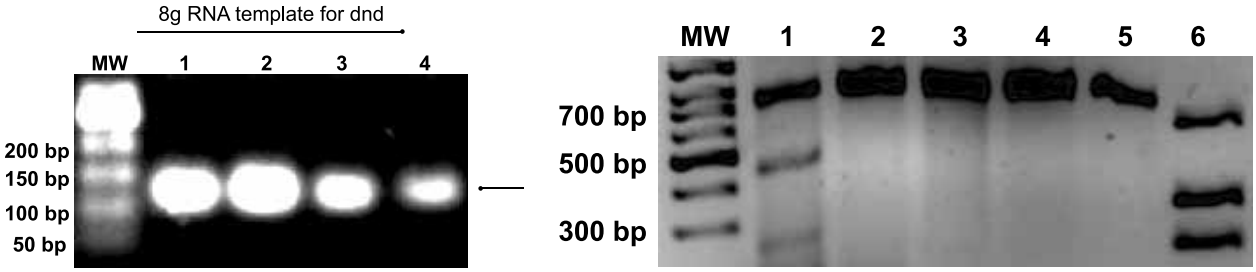
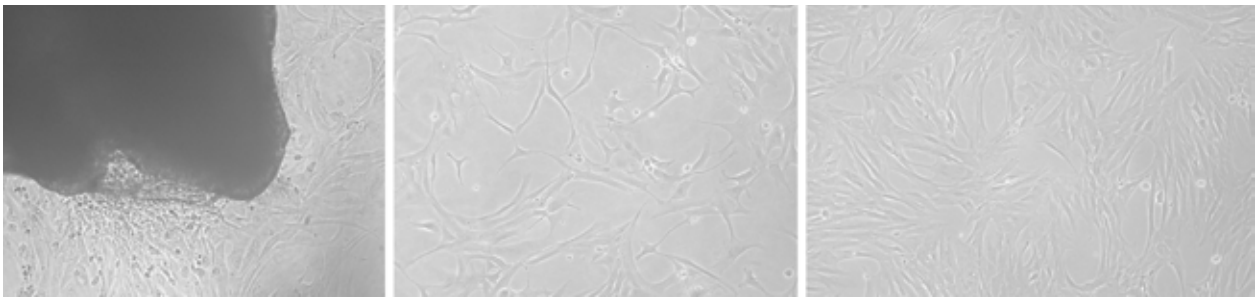


Fig. sg RNA template of dndFig. *Invitro* cleavage assay of dnd gene of common carp

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**

Explants were prepared from different tissues of rainbow trout namely, gills, brain, eye stalk, caudal fin, liver, spleen, head kidney and heart. The explants from diferent tissues were placed in different 25cc tissue culture flasks. Cells could be obtained by supplementing them with Earle's minimal essential medium and 40% fetal calf serum (FCS). After 18-24 hours, cells from gills, brain, eye stalk, caudal fin, liver, spleen, head kidney and heart could be seen radiataing. However, the cells obtained from the explants of gills, eye stalk, caudal fin, liver, spleen, caudal fin and brain degenerated and were lost after few sub-cultures. Cells obtained from heart explants were sub-cultured upto 20th passage are being propagated and maintained in the laboratory. However, a problem encountered was slow growth and degeneration of cells even in enriched medium containing 40% serum. Therefore, to overcome this problem, a new growth medium was formulated and cells cultured in this medium demonstrated better growth. Using this medium, RBT-H cells could be cultured *in vitro* till the 16th passage. The cells were treated with β-MCyclin (BMC-1 and BMC-2) for removal of mycoplasma as a precautionary measure. RBT-H cells at passage levels P10, P12 and P14 were cryopreserved in liquid nitrogen for future use. RBT-H cells so far cultured in MEM, have now been adapted in Leibovitz's L-15 medium, as L-15does not require CO_2 for buffering and is easier to work with.



Cell radiating from heart explant | Heart cells after sixth passage | Heart cells with almost complete monolayer

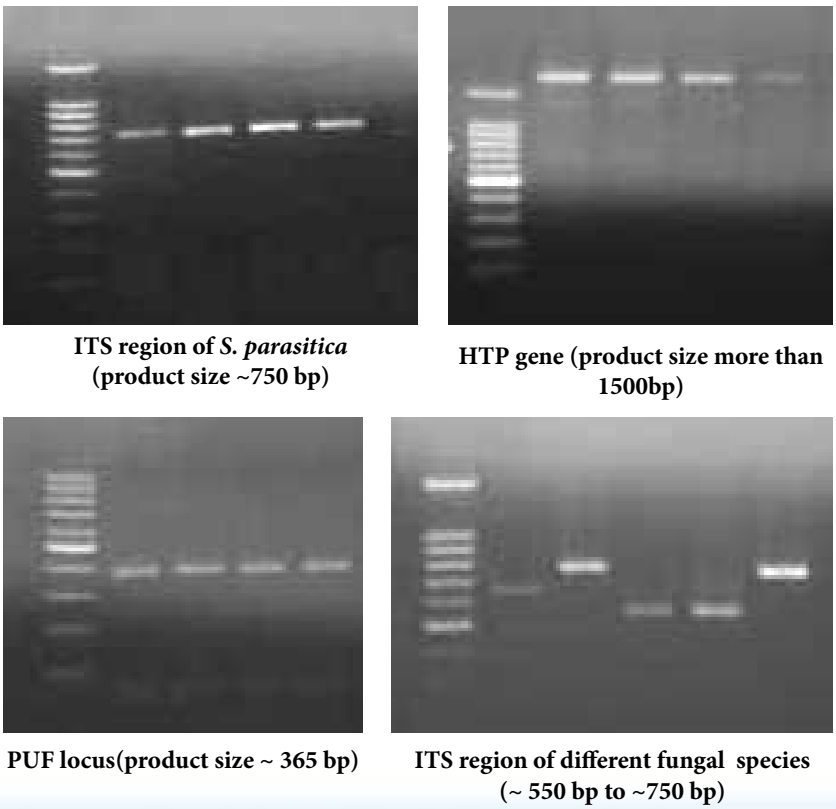
Fig.: Stages of cultured cells from rainbow trout heart, explant, cells sub-cultured from explant and cells nearing formation of monolayer

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**

Rapid protocol for isolation of genomic DNA from *Saprolegnia* for PCR analysis

An extraction buffer was developed for easy isolation of genomic DNA from *Saprolegnia*. The protocol consists of simply chopping the mycelium with a pair of scissors in a buffer till the solution turns into slurry followed by centrifugation. The supernatant thus collected is suitable for direct PCR amplification as confirmed by using three sets of primers. The A260/A280 ratio of the isolated DNA was above 1.7. The developed protocol is also suitable for isolation of genomic DNA from other fungal species.



ITS region of *S. parasitica* (product size ~750 bp)

HTP gene (product size more than 1500bp)

PUF locus(product size ~ 365 bp)

ITS region of different fungal species (~ 550 bp to ~750 bp)

Fig.: PCR amplified product using genomic DNA isolated by the rapid protocol

Use of DNA probe in simple PCR for identification of *Saprolegnia parasitica*

A simple PCR protocol targeting ITS region using universal primers ITS1 and ITS4 along with thiol modified probe for identification of *Saprolegnia parasitica* has been optimised. The probe is specific for *S. parasitica* with its binding site in between the two primers. Normally, the universal primers result in amplified product of around 750 bp in case of *Saprolegnia*. In the presence of specific region, as in case of *S. parasitica*, the probe binds and acts as reverse primer resulting in a PCR product of 600 bp approximately. Whereas, in case of other species such as *S. australis*, the size of the PCR product of 750 bp remains unchanged, indicating the specificity of the probe.

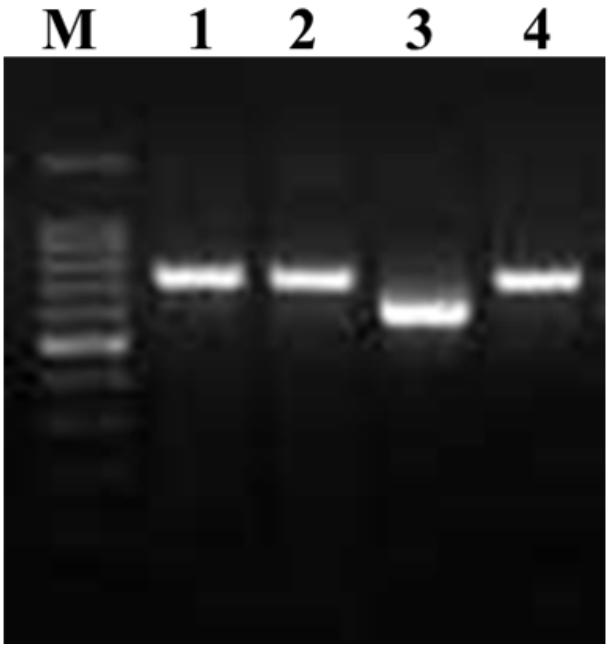


Fig.: Gel electrophoresis of PCR product. M-100 bp ladder, 1&2-*S. australis* with and without DNA probe, 3&4- *S. parasitica*with and without DNA probe

DNA probe conjugated gold nanoparticle for visual assay to detect *Saprolegnia parasitica*

Gold nanoparticles (GNPs) were functionalized by conjugation with thiol modified *S. parasitica* specific oligonucleotide probes. The probe conjugated GNP had a red shift in absorbance as compared to naked GNP. In stability test using 0.75 to 2.5 M of NaCl, GNP-probe was found to be more stable as indicated by little or gradual change in the color of solution unlike naked GNP which turns blue instantly even at 0.75 M NaCl. In gel electrophoresis using 1% agarose, AuNP-probe move out of the well and can be seen as a red band whereas naked GNP turns blue as soon as it was loaded in the well and showed no movement. In visual assay, using PCR product of ITS region from *S. parasitica* and *S. australis*, the colour of the solution in the tube containing PCR product of *S. parasitica* remains unchanged. This indicates the presence of specific nucleotide sequence of *S. parasitica* where as the tube containing conjugated GNP and PCR product of *S. australis* turns purple thereby differentiating the two species.

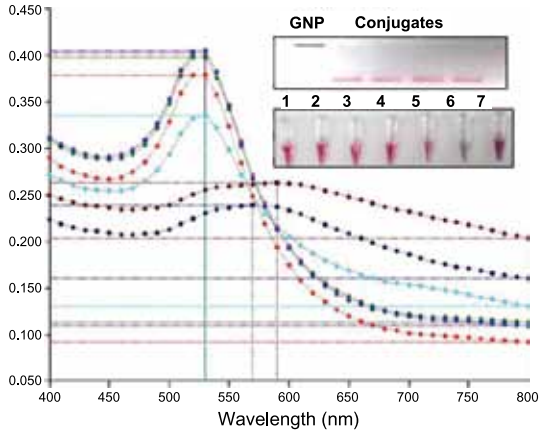


Fig.: Gel electrophoresis and stability test of GNP-probe conjugated at different concentrations of NaCl

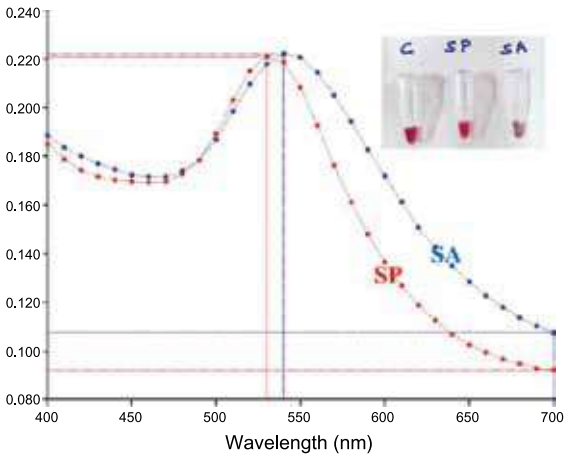


Fig.: Tube based visual assay using GNP and DNA probe for detection of *S. parasitica*

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*. Minimum inhibitory concentration (MIC) of the formulation on zoospores was determined following standard protocol using resazurin dye. The concentration of the formulation at which no colour change occurs was taken as MIC value. As shown in the picture, the purple colour of resazurin remains unchanged indicating that zoospores are killed. But in the wells containing viable zoospores changed the colour of the dye to pink. Based on this colour changes, the MIC was determined and it was found to be 50 ppm against zoospores. The formulation also inhibited hyphal growth and prevented colonization and germination of spores. Therefore, the formulation may have possible application for controlling saprolegniasis.

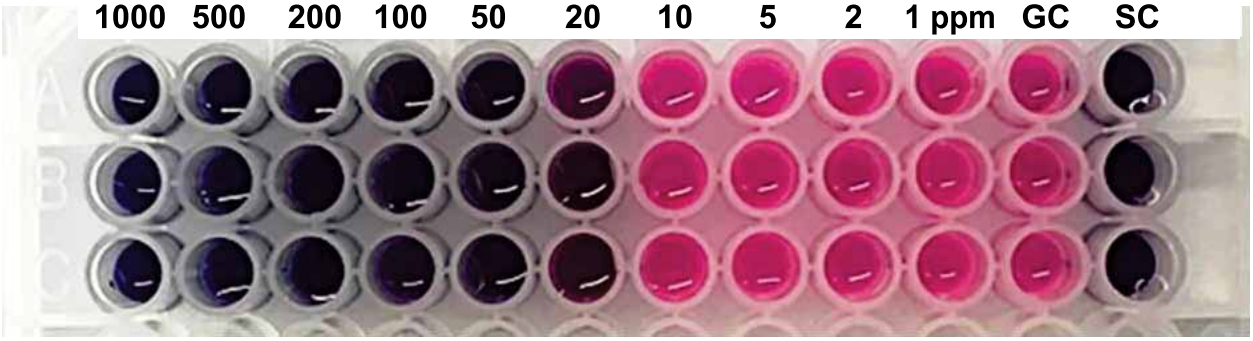


Fig.: Minimum Inhibitory concentration against *Saprolegnia parasitica* spores in GY broth containing different concentrations of polymer based formulation after 24h of incubation. GC: Growth control; SC: Sterile control

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**

Oomycetes cause most devastating fish diseases resulting in significant economic losses both early and advance development stages of fish. Most effective compound malachite green dye, earlier used for the control of saprolegniasis was banned due to carcinogenic properties. Other teratogenic agent used for control of saprolegniasis such as formalin, hydrogen peroxide and acetic acid can be toxic when used in pond/raceways.

One of the substitutions of these synthetic compounds is the use of purified compounds from the plants, which are locally available, abundant, low cost, with low residual effects and could be used in large aquaculture ponds. During the period, 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. The protocol for immuno-stimulatory potential activity was 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 anti-oomycetes activity. Molecular docking results were consistent with *in vitro* studies, possibly due to binding of vital proteins of *S. parasitica*. CUR and CIN showed increased nitrite oxide production and higher peroxidase activity. Moreover, studies were also conducted on acute toxicity, hemato-biochemical and behaviour changes in golden mahseer, *Tor putitora* with most effective *Thymus linearis* leaf extract having antio-omycetes activity.

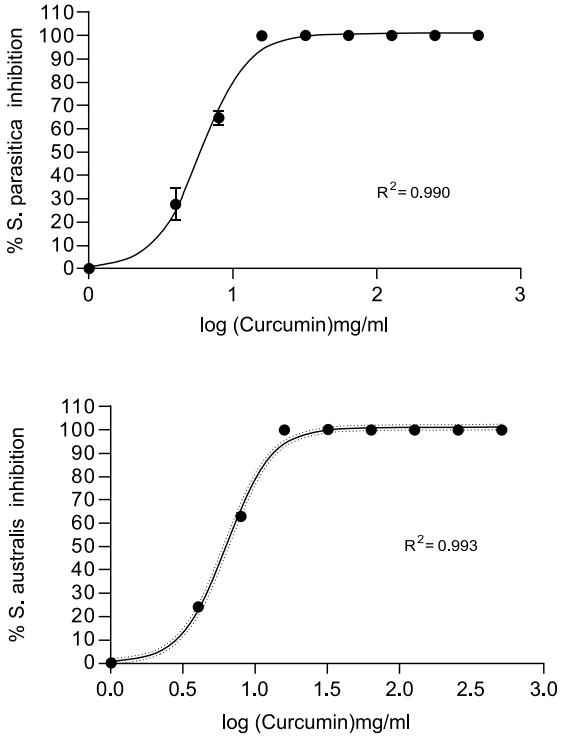


Fig.: Growth inhibition of Curcumin against *S.parasitica* and *S. australis*

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

The present study is designed to develop a consensus computational framework for the identification of potential target proteins and their inhibitors and subsequent experimental validation of selected compounds by *in vitro* approach. The DrugBank database was exploited to select the antimicrobial ligands and their binding affinity with their respective protein target (aerolysin) and confirmed by computational modelling. We attempted molecular docking of the fifty antimicrobial agents/ligands with aerolysin of *Aeromonas hydrophila* by AutoDock Vina software. Among all the 50 antimicrobial agents, morin, *stigmasterol*, triclosan, myricetin and chloramine T have shown good affinity with the target protein. Furthermore, these compounds showed significantly higher binding energy towards their target protein, ranging from - 6.9 to -7.7 kcal/mol^{-1}. We reported three hydrogen bonds between morin and aerolysin with the binding energy of -7.7 kcal/mol^{-1}. In addition, eight amino acid residues of aerolysin are involved in hydrophobic interactions. The antimicrobial activity of these antimicrobial agents also needs to be evaluated *in vitro*.

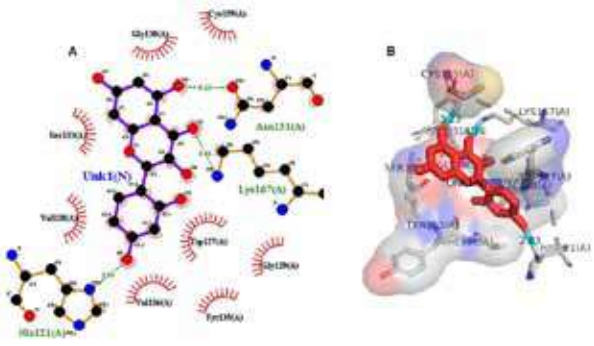


Fig.: Molecular docking of aerolysin amino acids with morin depicted in 2D (A) and 3D (B).

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

With a view to investigate common health disorders associated with mortality in trout farms during seed production, rainbow trout farms in Bairgana, Koteshwar and Talwadi of Chamoli and Ramgarh of Nainital district were visited. Physicochemical parameters of the trout farm and hatcheries along with epidemiological information were collected. The water quality parameters of the hatcheries were found within the normal range. Samples were collected from trout brooders, fertilized eggs, eyed ova and trout larvae. *Saprolegnia parasitica* was the most common fungal infection during egg incubation and in trout brooders. Loss from fertilized eggs to hatchlings stage was about 25-45% in sampled trout hatcheries during November, December depending on the water temperature and incubation. Higher day and night water temperature fluctuations in between 8-12.5°C during egg incubation resulted in higher incidences of fungal infestation in eggs. It was observed that in trout hatcheries where water temperature was <10°C, with minor fluctuations in day and night temperature, fungal infection in eggs was comparatively lower. Loss due to chocking of eggs by sediments was not reported during the sampling period due to low precipitation. Moreover, whiting of tail and mouth in about 35-40% population of trout brooders was also observed. The intensity of which was more in old brooders.

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**

Aeromonas spp

The antimicrobial resistance of *Aeromonas* spp. (n=62) isolated from 67 gill tissues of 67 fish samples; rainbow trout (29), common carp (32), rohu (1), catla (2), mrigal (2) and grass carp (1) from 67 fish farms in district Bilaspur and Kullu-Mandi in Himachal Pradesh was performed against 14 antibiotics by disk diffusion method as per CLSI guidelines. The results recorded that highest antimicrobial resistance was observed against cephalothin (58.1%), followed by ampicillin/sulbactam (51.6%), cefoxitin (41.9%), cefotaxime (21%) and trimethoprim/sulfamethoxazole (21%). Low antibiotic resistance among *Aeromonas* spp was recorded against ceftazidime, ceftriaxone, cefepime, tetracycline, and chloramphenicol, whereas percentage of isolates showing intermediate resistance to cefotaxime, cefepime and ampicillin/sulbactam were 27.4, 19.4 and 16.1 respectively. 98.4% of the isolates were susceptible to amoxicillin/clavulanic acid, followed by ceftazidime (93.5%) and ciprofloxacin (93.5%).

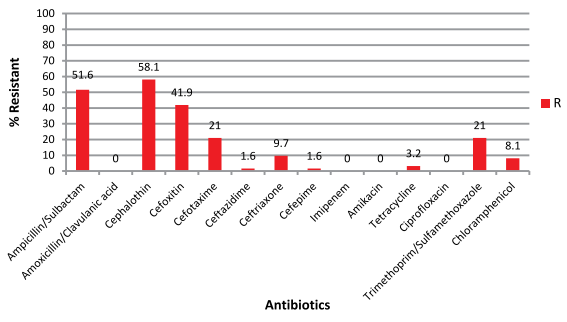


Fig.: Showing antibiotic resistance pattern of *Aeromonas* spp. (n=62) isolated from Bilaspur and Kullu-Mandi in Himachal Pradesh

Escherichia coli

Intestine tissues from 67 fish samples; rainbow trout (29), common carp (32), rohu (1), catla (2), mrigal (2) and grass carp (1)) were collected from 67 fish farms in district Bilaspur and Kullu- Mandi in Himachal Pradesh and processed aseptically

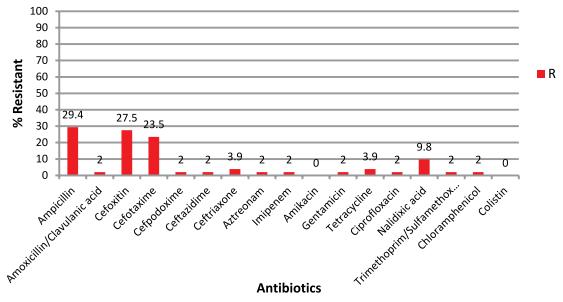


Fig.: Showing antibiotic resistance pattern of *E. coli* (n=51) isolated from (Bilaspur and Kullu-Mandi in Himachal Pradesh

for isolation and purification of *Escherichia coli*. Antimicrobial resistance pattern among isolates of *E. coli* (n=51) was determined against 17 antibiotics by disk diffusion method as per CLSI guidelines. The results recorded that highest antimicrobial resistance was observed against ampicillin (29.4%), followed by cefoxitin (27.5%) and cefotaxime (23.5%). Low antibiotic resistance in *E. coli* isolates was recorded against amoxicillin/clavulanic acid, cefpodoxime, ceftazidime, ceftriaxone, aztreonam, imipenem, gentamicin, tetracycline, ciprofloxacin, nalidixic acid, trimethoprim- sulfamethoxazole and chloramphenicol, whereas 31.4% of isolates had shown intermediate response to cefotaxime, followed by ampicillin (21.6%) and ceftazidime (17.6%). All the isolates of *Escherichia coli* were susceptible to colistin (100%), followed by aztreonam (98%), gentamicin (98%), trimethoprim-sulfamethoxazole (98%), and amoxicillin/clavulanic acid (96.1%).

Staphylococcus spp

Gill tissues from 67 fish samples; rainbow trout (29), common carp (32), rohu (1), catla (2), mrigal (2) and grass carp (1)) were collected from 67 fish farms in district Bilaspur and Kullu- Mandi in Himachal Pradesh and processed aseptically for isolation and purification of *Staphylococcus* spp. (n=48). Antimicrobial resistance pattern among the isolates of *Staphylococcus* spp. (n=48) was determined against 10 antibiotics by disk diffusion method as per CLSI guidelines. The results showed that the highest antimicrobial resistance was observed against penicillin G (56.2%), followed by cefoxitin (39.6%) and oxacillin (39.6%), erythromycin (22.9%) and trimethoprim-sulfamethoxazole (20.8%) (Figure 3). Low antibiotic resistance among *Staphylococcus* spp. was recorded against tetracycline (12.5%), ciprofloxacin (4.2%), chloramphenicol (4.2%) and linezolid (6.2%). The percentages of isolates showing intermediate resistance to the antibiotics were ciprofloxacin (16.7%), oxacillin (12.5%) and erythromycin (12.5%). The percentages of isolates showing susceptibility to the antibiotics were gentamicin (95.8%), chloramphenicol (93.8%) and linezolid (93.8%).

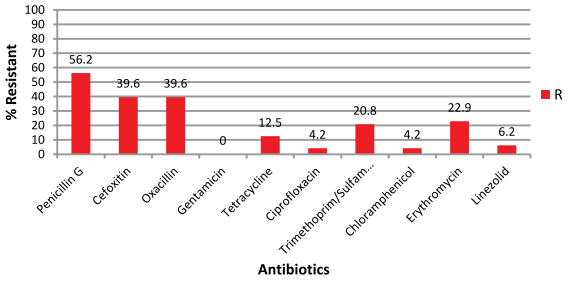


Fig.: Showing antibiotic resistance pattern of *Staphylococcus* spp. (n=48) isolated from Bilaspur and Kullu-Mandi in Himachal Pradesh

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**

Active and passive disease surveillance in 20 trout and carp farms and hatcheries was carried out in Chamoli and Nainital distrcts of Uttarakhand. Samples were collected from fertilised eggs, larvae, grow out and brooders rainbow trout. 66 pooled fish tissue samples of skin, gills kidney, liver, spleen and intestine were collected from the selected sites following standard protocol. Tissue samples were transported to the laboratory maintaining cold chain. The collected samples were screened for VHSV, IPNV, and IHNV, bacterial, fungal and parasitic infections. RT-PCR conducted using the gene specific primer of VHSV (Viral hemorrhagic septicemia virus), IPNV (infectious pancreatic necrosis) and IHNV (infectious hematopoietic necrosis virus). All the screened samples were negative for IPN, VHSV and IPNV. Mass mortality of cage reared grass carp fry was observed to be nearly 20% with typical signs of tail and fin rot besides darkening of skin pigmentation. Bacteria were isolated from the morbid fish samples demonstrating the said signs. Further, 16sRNA was used for the identification and molecular characterization of bacterial isolates. *Aeromons veronii* was identified as the primary causative pathogen.From the infected fish and eggs, *Saprolegnia* sp. was identified by means of PCR using ITS-1 and ITS-4 primers. It was observed that there was an increased fungal infection in troutf arms during the sampling period. Moreover, severe argulosis infestation was observed in cage reared *Schizothorax* spp. at a temperature range of 19.5- 24.4°C. In order to make the fish farmers aware about fish diseases and their mitigation, three awareness cum interaction meets and two virtual meetings were conducted in Chamoli and Nainital districts involving 240 trout and carp farmers.

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**

Determination of minimum inhibitory concentration (MIC) of florfenicol by broth micro-dilution assay against laboratory bacterial pathogens

The minimum inhibitory concentration (MIC) of florfenicol (F1427-500 MG; Sigma, USA) was determined against six bacterial pathogens; *Aeromonas hydrophila* RTS 02, *Aeromonas veronii* GCAFBLC 229, *Lactococcus garvieae* LI10, *Flavobacterium columnare* BRTAGILLFC 01, *Vibrio anguillarum* MHJL 248 and *Aeromonas salmonicida* subsp. Masoucida MHJM 250, isolated from Coldwater aquaculture practices by broth micro-dilution assay (Wiegand et al., 2008) using microtiter format. The viable cells of bacteria if present, react with the resazurin dye and turn the bluedye to pink, signifying bacterial growth in the culture at that particular antibiotic concentration. In the study, the wells of 96-well micro-titre plate with antibiotic solution and bacterial culture turning blue to pink colour are considered as positive for the bacterial growth (Figure 1). The results demonstrated that the MICs of florfenicol are ranged in between 0.5 to 16**µg mL**$^{-1}$against the test bacterial pathogens. The lowest MIC of 0.5**µg mL**$^{-1}$ was recorded against *Vibrio anguillarum* MHJL 248.

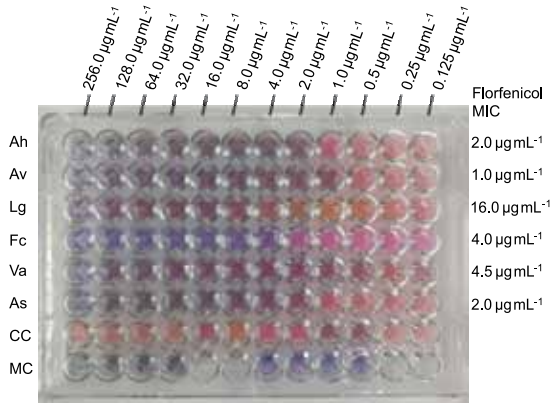


Fig.: Resazurin based micro-dilution assay for MICs determination of florfenicol against six bacterial pathogens. The wells in 96-well microtitre plate turning blue to pink colour considered as positive for bacterial growth. Ah: *Aeromonas hydrophila*; Av:*Aeromonas veronii*; Lg: *Lactococcus garvieae*; Fc:*Flavobacterium columnare*; Va:*Vibrio anguillarum*and As: *Aeromonas salmonicida*; CC: culture control; MC: media control.

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, D. Baruah, 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**

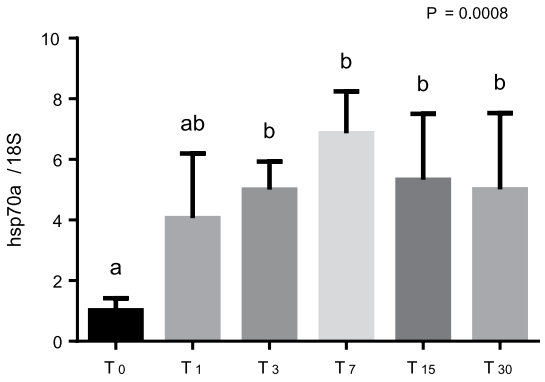
Rainbow trout production trials in re-circulating aquaculture facility

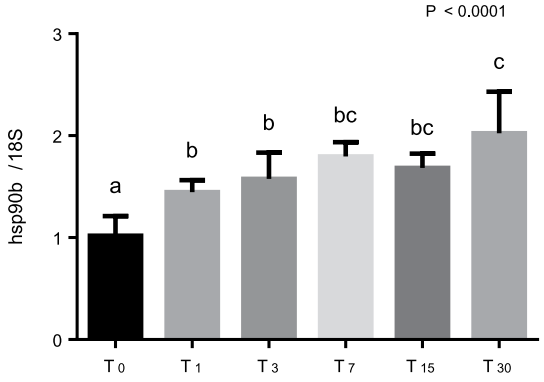
Conventionally, rainbow trout is cultured in flow-through raceway systems in India, where approximately 200,000 litres of water is used to produce one kilogram of fish. However, with the threat of climate change and everincreasing competition for the available freshwater resources, greater emphasis has been laid on efficient utilisation of water in aquaculture production systems. Under the NICRA project, the Directorate has taken a lead to develop, validate and promote climate resilient Coldwater re-circulating aquaculture systems for rainbow trout farming. A pilot scale RAS facility was designed and established for rainbow trout grow-out culture at Bhimtal, during September 2019. This facility has large grow-out tanks, 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 35-40 kg of fish per cubic metre, which is 2-3 times higher than the average 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. Optimization of rearing conditions for higher unit productivity is still in progress.

Fig.: Rainbow trout production in recirculating aquaculture facility at Bhimtal

Elucidation of the post-thermal challenge stress response kinetics in rainbow trout

For better understanding of thermal adaptation in rainbow trout, we investigated the time-kinetic changes in the critical thermal tolerance phenotype and transcript abundance of selected stress biomarkers after high temperature exposure. While the upper thermal tolerance limit peaked at 3 days post-challenge, the lower thermal tolerance limit increased linearly and peaked at 30 days post-challenge. The mRNA levels of several members of the heat shock family proteins (*hsp70*, *hsp90*, *hspa5*, *stip1*, *serpinh1*) remained elevated in the kidney throughout the post-challenge duration (1 to 30 days). Whereas in liver, an acute transcriptional response of stress markers was evident, that was not persistent after 7 days. This understanding of the whole animal and tissue-specific thermal stress response kinetics could support targeted mitigation strategies in rainbow trout farming.





Evaluation of nutritional supplements for mitigation of thermal stress in rainbow trout

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 two feeding trials to evaluate the ability of specific nutritional supplements (i.e., antioxidants and immunostimulants) to improve the thermal tolerance capacity of rainbow trout. 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. However, the critical thermal scope was enhanced by more than 4°C. On the other hand, the tested immunostimulant did not cause any remarkable change in the thermal tolerance phenotype. Further analysis of biochemical and physiological indices is in progress.

Characterization of feed intake regulatory peptides and proteins in snow trout

In order to improve our understanding of the regulation of food intake in the slow growing endemic Himalayan snow trout, *Schizothorax richardsonii*, we characterized the complete or partial nucleic acid sequence of selected feed intake regulating peptides and proteins such as agouti-related protein, apelin, cocaine and amphetamine regulated transcript isoform 1 and 2, cholecystokinin, corticotropin releasing hormone, galanin/GMAP prepropeptide isoforms 1A and 1B, growth hormone secretagogue receptor type 1, leptin, leptin receptor, melanin concentrating hormone, neuropeptide Y, nucleobindin 2, proopiomelanocortin and peptide transporter 1. The characterized *S. richardsonii* mRNA sequences showed maximum homology with the reports available from other cyprinid fishes and they were added to NCBI GenBank (MW086922-MW086937). This is the first step towards deciphering the appetite regulatory pathways which may underlie the slow growth recorded in *S. richardsonii*.

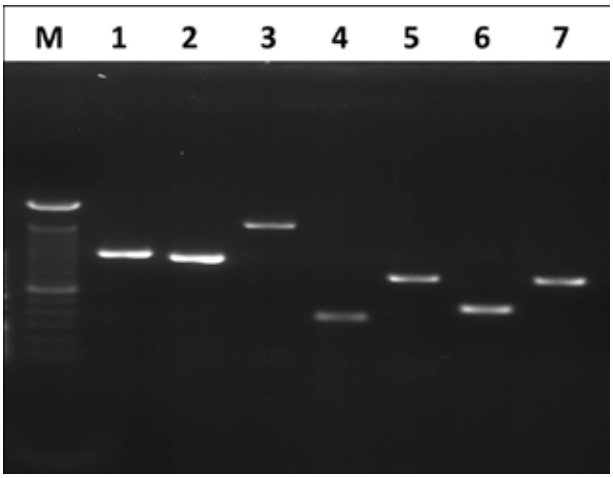


Fig.: From left to right: 100bp ladder, NUCB, PEPT-1, LEPR, MCH, NPY, APLN, CRH

Project: DBT-6	**Molecular and genetic characterization of selected important ornamental fishes of North-East India**
Period:	**January 2017-July 2020**
Personnel:	**Siva, C. (PI)**
Funding Support:	**DBT, New Delhi**

Assamese kingfish (*Cyprinion semiplotum*) belonging to the subfamily *Barbinae* is an important food as well as aquarium fish having identified pharmacological benefits. The species has a complex taxonomic history and its phylogenetic position remains uncertain. Molecular data employed in earlier phylogenetic studies was inadequate for its phylogenetic placement. Therefore, we characterized 16,671 bp long complete mitogenome of *C. semiplotum* using next-generation sequencing. The mitogenome encodes a typical set of 13 protein-coding genes, 22 transfer RNA genes, two ribosomal

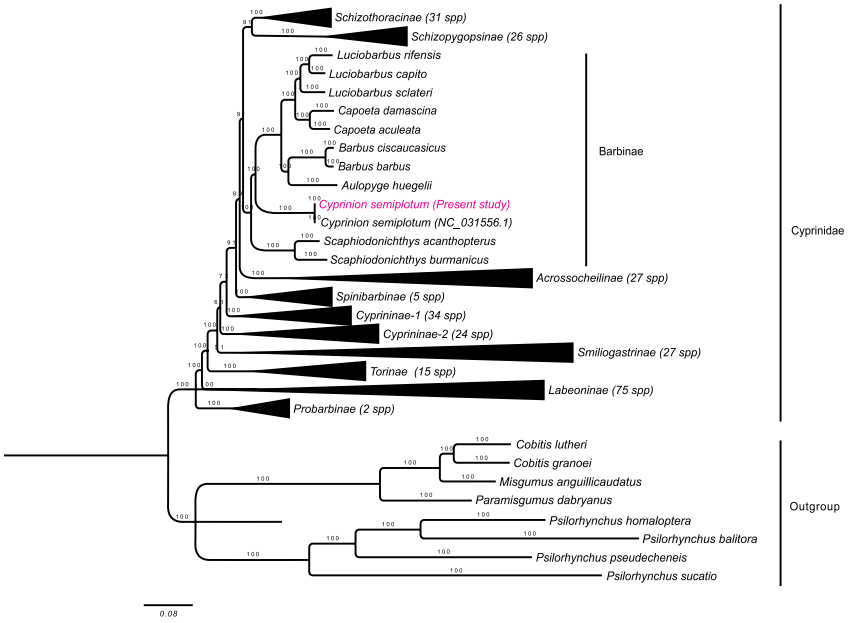


Fig.: Phylogenetic tree inferred from nucleotide sequences of 13 PCGs of the mitogenome using ML analysis. The numbers along branches indicate bootstrap support values.

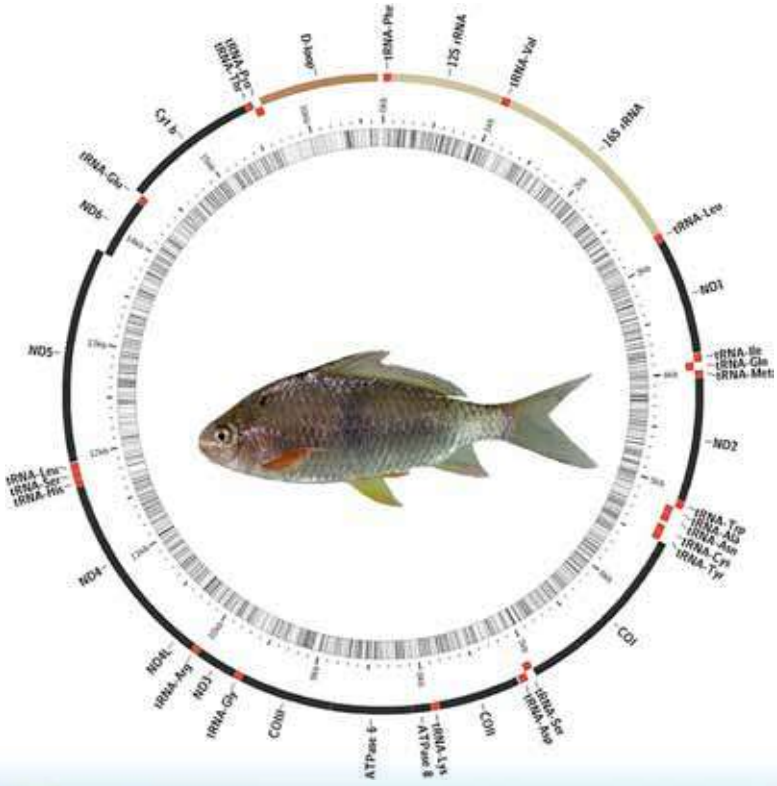


Fig.: The organization of the mitochondrial genome of *C. semiplotum*

RNA genes and two non-coding regions. Its gene organization, distribution pattern, nucleotide composition, tRNA secondary structure and codon usage was similar to other Cyprinid mitogenomes. However, a distinctive 90 bp insertion was found in 3' periphery of the AT-rich control region. This can be a tool for identification of the species at the population level. Further, we reconstructed the most comprehensive phylogenetic trees of *Cyprinidae* based on complete mitogenome. In the resulting phylogenetic trees, *C. semiplotum* clustered tightly with other *Barbinae* species and exhibited a sister relationship with the species of the genera *Aulopye, Barbus, Luciobarbus* and *Capoeta*. The results presented herein will support future investigations on molecular taxonomy, population genetics, evolution and molecular phylogeny of *C. semiplotum* and its relatives.

Project: DBT-7	**Triploid rainbow trout (*Oncorhynchus mykiss*) production for aquaculture enhancement and ecological risk management**
Period:	**December2017-December2020**
Personnel:	**N.N. Pandey (PI), B.S. Kamalam, R. Singh**
Funding Support:	**DBT, New Delhi**

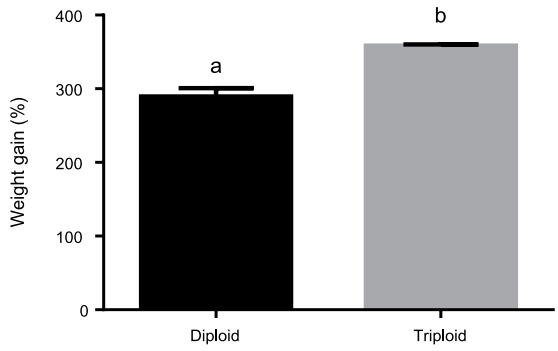
Triploid rainbow trout (*Oncorhynchus mykiss*) production for aquaculture enhancement in hills

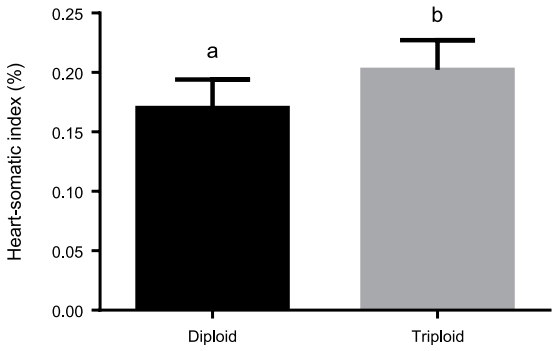
For first time in the country, a viable methodology to produce triploid rainbow trout efficiently has been standardised by mechanical treatment protocol for the post-fertilized trout eggs. Triploids remain more heterozygous due to extra genetic material, and result in better growth. Experiments were conducted at three sites at different altitudes viz. Jogindernagar in Himachal Pradesh (1220m), State trout farm Uttarey, Sikkim (2012m) and Experimental Fish Farm, Champawat, Uttarakhand (1610m). The 'time window' (a frame of zygote age, heat shock regime and shock duration) period was found to be very narrow. TRC Aqua Pressure Vessel was used for the induction of triploidy in fish. Breeding operation was conducted for the induction of triploidy at 9500 psi for 5 min exposure time during December to March. Spawning was conducted at 9 to 14°C. Eggs were incubated and larvae were reared in ova house. Water quality parameters were recorded during entire experimental operation. About 98-100% triploidy was induced and achieved with appropriate pressure shock and accurate zygote age. In triploids, three sets of chromosomes (N=90) were observed in chromosome plates. Erythrocytes measurement (µm) reflects comparatively larger cell size and larger nucleus in triploids over the diploids. During incubation of eggs, the hatching rate of 68% was comparatively less than the diploids (76%). Results of the pressure shock were comparatively better than the heat shock and other methods. Karyotyping and measurement of erythrocytes are direct methods for conforming induction of triploidy. However, silver staining or AgNOR method was standardised for indirect conformity without sacrificing the specimen fish. This method is easily applicable, cost effective and fast. Small pieces of fin/ skin tissue are obtained and sheared on a pre-cleaned slide with few drops of 50% acetic acid. They are allowed to dry in air at room temperature. Alternatively, blood smears may be prepared by taking blood from caudal peduncle. Liver tissue may also be used in case of dead specimen. The slide is treated with silver nitrate at fixed temperature in dark to obtain golden staining of cells and dark dots of nuclear material. Diploids show only one and two dots in cells, while triploids show three dots in 15-45% cells along with cells having one and two dots. These findings are useful for the production of triploid rainbow trout with enhanced growth.

Performance evaluation of triploid rainbow trout

The performance traits of diploid rainbow trout was evaluated during six weeks growth trial using juveniles of 4-5 g. During the trial, triplicate groups of 60 fishes, both diploid (control) and triploid (induced by pressure-temperature shock) were fed an experimental diet containing 50% protein and 15% lipid, twice a day, till visual satiation. The

experiment was conducted in 100 L glass aquaria, connected to a recirculating water loop, at 20±2°C. Important water quality parameters such as dissolved oxygen concentration/saturation, temperature, pH, conductivity, alkalinity, total dissolved solids, total ammonia, nitrogen and nitrite concentrations were regularly monitored and recorded. At the end of the trial, 30% higher growth in the triploid group was observed as compared to the diploids (weight gain 290 *vs.* 358%), with correspondingly lower feed conversion ratio (1.1 *vs.* 1.3). Survival (97-98%) and body condition factor (1.3) was high in both groups, with no significant difference. The triploid fish had a significantly higher heart and lower liver to somatic index. Blood haemoglobin content was marginally lower in the triploid fishes, but there was no significant difference in the critical thermal tolerance limits (measured as a fitness trait). Further, comparative evaluation of transcriptional differences in growth, metabolism and well-being related molecular biomarkers for example, AMP kinase is being investigated. Under field conditions, comparative study on growth was carried out in triploid and diploid rainbow trout in flow through system (raceways) at West district Sikkim and Mandi district, Himachal Pradesh. Growth trials in raceways/ RAS resulted in 19% better growth in triploids. This technology would be helpful for achieving a better growth of the rainbow trout and to promote trout farming in hill states.





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**

Under this project, full length characterization of four target immune genes was achieved through RACE PCR and cloning. The full-length mRNA sequence of IFNγ, TNFα, C3, and IL10 was 927, 1409, 5125 and 1177 bp with an ORF of 558, 765, 4938, and 540 bp, encoding a putative protein of 185, 254, 1645, and 179 amino acid residues, respectively. *In-silico* analysis of all the target immune genes has also been completed. The deduced amino acid sequences of these genes shared highly conserved structures with those from other cyprinids. To investigate the gene expression patterns of immune genes in *Tor putitora* during embryonic and early larval stages, different developmental stages were sampled including unfertilised egg, fertilized egg, morula stage, blastula stage, gastrula, organogenesis, just hatched, pre-metamorphosis, post-metamorphosis to early and advanced fry stage. Ontogenic real-time qPCR results indicated that expression of IFNγ and TNFα was lower until the morula stage that increased from blastula stage to a maximum at organogenesis. Expression of the C3 gene was lower until the gastrula stage followed by a linear increase from organogenesis to the pre-metamorphosis stage.

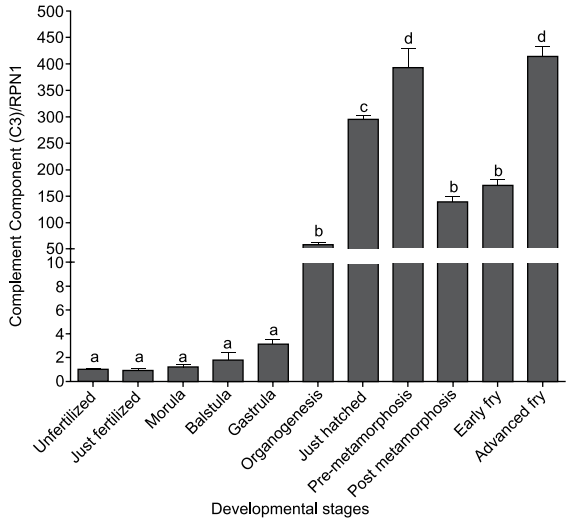


Fig. Relative expression of complement component 3 (C3) mRNA of golden mahseer during embryonic and larval development stages. Expression values are normalized by ribophorin 1 (RPN1) expressed transcripts. Data expressed as expressed as mean ± standard error, n = 6. Mean values bearing different superscripts (a, b, c, d) above the bars are significantly different from each other ($p < 0.05$).

The level of IL1β was observed to be maximum in unfertilized eggs and remained elevated till the morula stage. The expression of TLR4 was lower during initial developmental stages but maximum at organogenesis. The expression level of defensin1 was substantially low until organogenesis, while hepcidin1 was found to be considerably high until the blastula stage that remained significantly low during later stages of development. The expression of some non-specific immune genes in unfertilized eggs suggested their maternal transfer.

In order to elucidate the immuno-modulatory potential of β-glucan on golden mahseer broodstock under captive conditions, an experimental trial was carried out with four treatment groups (control, 0.5% β-glucan, 1.0% β-glucan, 1.5% β-glucan). After the experiment was over, tissue and plasma were sampled. The expression of different immune genes in response to different dietary β-glucan levels are presently being studied.

Fig. Experimental set-up

Fig. Tissue sampling

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**

Two bio-engineered AMPs viz. RY12WY and KK16 were evaluated for their antimicrobial activities against various bacterial pathogens including antibiotic resistant bacteria. These peptides showed antimicrobial activities against *A. sobria, A. hydrophila, E. tarda, S. aureus, V. parahaemolyticus, P. aeruginosa, E.coli* and *A. salmonicida*. The peptides retained antimicrobial activities at higher temperatures and demonstrated their activities in the presence of physiological salts and serum. The peptides were least haemolytic and able to bind with the genetic material of bacteria thus, may inhibit its replication as indicated by DNA binding assays. The bacterial live-dead assays

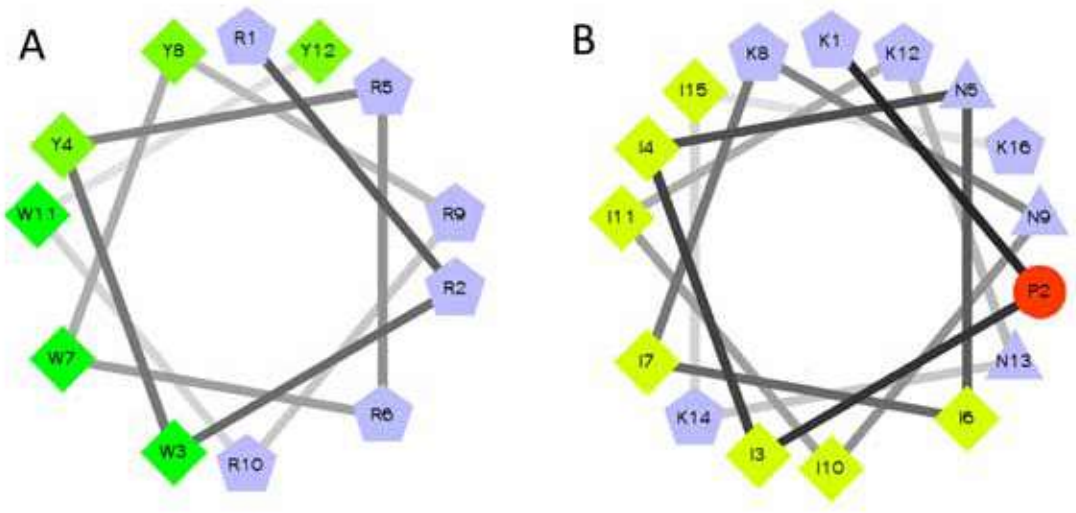


Fig. Helical wheel structures of RY12WY (A) and KK16 (B) peptides

Project: NMSHE	**National Mission for sustaining the Himalayan ecosystems (NMHSE-Taskforce 6 for Himalayan Agriculture)**
Period:	**April 2015 - March 2020**
Personnel:	**N.N. Pandey (PI)/ D.Sarma (PI), S. Ali , R.S. Patiyal, Rajesh, M., B.S. Kamalam, A.K.Giri**
Funding Support:	**DST, New Delhi (Nodal Agency- ICAR-IISWC, Dehradun)**

revealed that the peptides interfered with bacterial membrane integrity. The molecular docking study demonstrated that peptides have strong affinity towards two protein targets of *A. sobria*, aerolysin and outer membrane protein (OMP).

Climate resilience of minor carp for polyculture in mid hill region

Mountains are early indicators of climate change with the continuous shift of snow line towards higher altitudes besides having major changes in the form of increasing temperature, draught and erratic precipitation pattern. This climatic transforming situation affects hill aquaculture for shifting of species and growth pattern. Increasing temperature, diurnal fluctuation in temperature, water scarcity, algal growth and draught like situation are the challenges for hill aquaculture, which have been addressed in a field study at Almora, Uttarakhand (79°29'604" E, 29°48'5"N), a draught prone area, that lies in the drainage of river Kosi at 3000 masl. A model of algae phagus minor carps *(Labeo dyocheilus, Bengana dero)* polyculture in low density poly ethylene (LDPE) film lined pond has been standardized in mid Himalayan region with an average fish production of 0.7 kg/m^3.Poly-lined rainwater harvesting tanks are suitable for climate resilient practices in hills, where scarcity and low water temperature are bottlenecks in crop production. The overflow of the water was used for irrigating horticultural crops. Minor carp is also helpful to keep the pond clean due to its feeding habit of browsing and mainly feed on periphyton. A small farm pond in the form of poly-tank and practice of fish farming coupled with horticulture could be a climate resilient approach in the Indian Himalayan region.

4 Technology Development

4.1 Liquid anaesthetic formulation for fish -DCFR Aqua FSD

A fish anesthesia was developed by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal. This anesthesia is named as DCFR Aqua FSD and is suitable for freshwater fishes of all age and size. MS-222 is the most commonly used fish anesthesia globally. However, MS-222 is relatively expensive, not easily dissolved in hard water. It has to be used in exact quantity to avoid the possibility of euthanasia to fishes as the safety margin is less. In additions MS-222 is less potent in warm water with high calcium content (as in hills). Often it is also not feasible to use MS222 anesthesia under field conditions due to unavailability of high precision weighing balance with farmers. Moreover, the use of MS222 is expensive for farmers. Therefore, to overcome some of the constraints with MS222, ICAR-DCFR, Bhimtal has developed a safe and effective liquid anesthetic formulation for fish, which is very much cost effective than MS-222 and has long shelf life of 2.5 years when stored at 4°C. It is very handy to use as any ordinary dropper can be used for its application. It has no known toxicity in fishes. In addition, this formulation is equally potent in warm water with high hardness. This anesthesia was developed by Dr. Neetu Shahi, Mr. Sumanta K Mallik, Mr. Abhay Giri and Dr. D. Sarma and a MoU is signed with Agrinnovate India, Govt of India, Department of Agricultural Research and Education, New Delhi for commercialization.

DCFR Aqua FSD

Fig.: Trademark logo for DCFR Aqua FSD

4.2 A diagnostic kit for rapid and specific identification of bacterial pathogen *Lactococcus garvieae* - DCFR Lg Kit

A diagnostic kit for rapid and specific identification of bacterial pathogen *Lactococcus garvieae* was developed by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal. The invention is filed for complete Indian patent with application number 202011057122 dated 30-12-2020. The inventor of this kit is Dr. Neetu Shahi, Mr. Sumanta K Mallik, Mr. Krishna Kala and Dr. Debajit Sarma. This kit can detect the *L. garvieae* from fish samples precisely and result can be interpreted by naked eye. The potential end users of this kit can be fish farmers, processing laboratories, fish disease diagnostic laboratories and fishery colleges.

DCFR Lg Kit

Fig.: Trademark logo for ICAR-DCFR Lactococcus garvieae detection kit

4.3 Triploid rainbow trout (*Oncorhynchus mykiss*) production for aquaculture enhancement and ecological risk management

A viable protocol has been developed for the mass scale triploidy induction in rainbow trout by pressure shock treatment using aqua pressure vessel and heat shock treatment. Karyotyping and erythrocytes measurement are direct methods for conformity of the triploidy induction. However, Ag NOR technique was standardized as an applicable indirect method for triploidy detection. This technique is applicable for increasing 19-20% growth in rainbow trout in farm condition and potential increase in trout production in the country. Sterile triploids are also helpful for reducing environmental risk in wild condition. Though, triploidy induction has been successfully achieved in leading trout producing countries, this technology is the first attempt in India to standardise a systematic triploid trout production technology and assess its performance in an applied perspective. Technology has been validated in the field and demonstrated to the state fisheries departments. Dr. N.N. Pandey and his team have introduced this technology for triploid seed production.

Fig.: Triploid rainbow trout with rudimentary gonads

4.4 Bio-engineering approach for development of short antimicrobial peptides

Antibiotic resistance occurs when bacteria change over time but the process is accelerated by the indiscriminate and extensive use of antibiotics, as well as poor infection prevention and control. Antibiotic resistance is rising to dangerously high levels threatening global health, food security, and development today. Considering this ever escalating problem, it has become essential to look for another strategy to combat the infections. As a result, many researches are focussed on the development of new classes of antibiotics with novel targets and modes of action. One of the potential alternatives to antibiotic is antimicrobial peptides (AMPs), a component of innate immune system of most multicellular organisms. However, therapeutic applications of AMPs have been limited by problems such as toxicity and low stability in serum or plasma. Apart from these, naturally occurring AMPs are generally long and compositionally complex leading to higher cost of production and longer time consumption in synthesis. Therefore, development of short and compositionally simple peptides with desired activities that can be produced economically is the need of the hour. Thus considering the properties of AMPs, few short compositionally simple peptides were designed using critical basic positively charged residues (lysine and arginine) and hydrophobic residues (leucine, isoleucine, tryptophan and phenylalanine) through bio-engineering approach. The peptides were designed in such a way that the hydrophilic amino acids remain at one side and hydrophobic amino acids at opposite side in helical wheel projection. The peptides were synthesized using Fmoc-chemistry and characterized by various

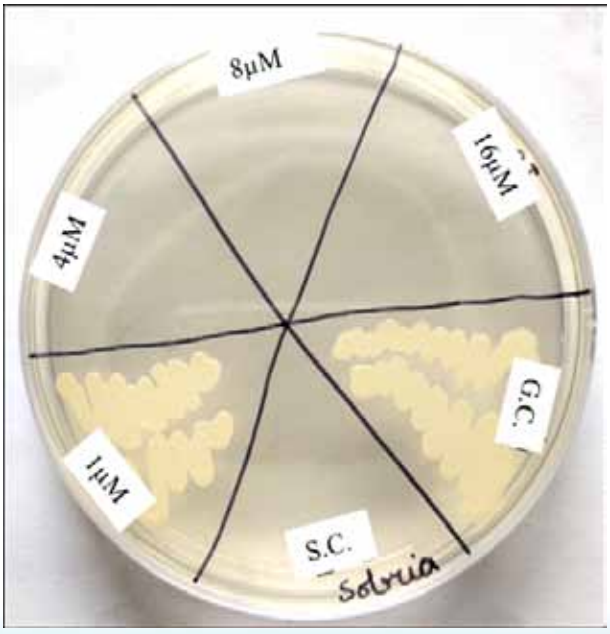


Fig.: MBC of bio-engineered RY12WY peptide against *A. sobria*

in-silico tools. The peptides showed promising antimicrobial activities against various bacterial and fungus-like pathogens, including antibiotic resistant bacteria with minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) in micromolar range. The peptides retained their antimicrobial property in the presence of physiological salts and serum and even at higher temperatures. The peptides were less hemolytic even at higher concentration indicating its least toxicity to host cells. The peptides were found to interfere with bacterial membrane integrity, which is a very attractive property of AMPs. Ability to disrupt bacterial membrane may prevent microbes from developing resistance against AMPs as multiple mutations will be required to change membrane morphology. These findings confirmed that the designing strategy for generation of short AMPs through bio-engineering approach was successful and can be adopted to generate more potent AMPs in future. Dr. D. Thakuria, Dr. Kh. Victoria Chanu, Dr. A. Pande, Mr. Raja-Aadil H Bhatt, Mr. R.S. Tandel and Ms. Vinita Pant have designed and developed bio-engineered AMPs.

List of Research Projects 5

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	**D. Sarma** (Coordinator)		
	Sub-project 4: Assessment of population status, species diversity and habitat ecology of snow trout *Schizothorax* species in selected streams of Indian Himalayan region	**D. Baruah** D. Sarma P. Sharma K. Kunal P.A. Ganie	2016	2020
	Sub-project 5: GIS based digital data base on coldwater fishery resources of Arunachal Pradesh in North East Himalaya region	**D. Baruah** K. Kunal P.A. Ganie	2018	2021
	Sub project 6: Ichthyofaunal diversity and health assessment of Central Himalayan River Saryu, Uttarakhand	**Mr. Kishor Kunal** D. Baruah 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** D. Baruah 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** D. Baruah R.S. Haldar	2020	2023
B. Aquaculture oriented research and development				
AQ-16	Captive management of Golden mahseer in perspective to aquaculture and conservation	**D. Sarma** (Coordinator)		
	Sub-project 4: Scaling up the seed production of chocolate mahseer in captivity (Renamed as: Standardisation of seed production protocol of chocolate mahseer through optimization of environmental condition)	**P. Dash** D. Sarma R.S. Tandel	2018	2021

Project Code	Project Title	Investigators	Year of Start	Year of Completion
	Sub-project 5: Optimizing reproductive and spawning performance of golden mahseer for upscaling its seed production in captivity	**M.S. Akhtar** D. Sarma D. Thakuria Ciji, A. Rajesh, M.	2018	2021
AQ-19	Domestication, biology and breeding of selected species for species diversification in mid-hill aquaculture	**N.N. Pandey** (Coordinator)		
	Sub-project 4: Growth potential and breeding performance of *S. progastus* and *S. plagiostomus*	**N.N. Pandey** R.S. Patiyal S. Ali	2018	2021
	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. 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
D. 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
E. Molecular genetics and biotechnology				
AQ-18B	Transcriptome based sex specific marker discovery in golden mahseer (*Tor putitora*)	**Siva, C.** S. Ali P. Sharma Rajesh, M.	2017	2021

Project Code	Project Title	Investigators	Year of Start	Year of Completion
AQ-18C	Gender specific transcriptomics response to environmental stress in golden mahseer (*Tor putitora*)	**S. Ali** Siva, C. P. Sharma	2018	2021
AQ-18D	Genome editing in common carp, *Cyprinuscarpio* using CRISPR/Cas system	**Neetu Shahi** D. Sarma S.K. Mallik	2019	2022
AQ18 E	Development of cell lines from different organs of rainbow trout	**Amit Pande** D. Thakuria	2019	2021
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
AMR	Network programme on antimicrobial resistance (AMR) in fishes under INFAAR	**S.K. Mallik** N. Shahi	2018	2021

5.2 Externally funded projects

Project Code	Project Title	Investigators	Year of Start	Year of Completion
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

Project Code	Project Title	Investigators	Year of Start	Year of Completion
NICRA	Development of climate resilient rainbow trout and innovative trout farming strategies to mitigate climatic stressors	**D. Sarma** R.S. Patiyal D. Baruah 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-6	Molecular and Genetic Characterization of selected important ornamental Fishes of North East India	Siva, C.	2017	2020
DBT-7	Triploid rainbow trout (*Oncorhynchusmykiss*) production for aquaculture enhancement and ecological risk management	**N.N. Pandey** B.S. Kamalam R. Singh	2017	2020
DBT-8	Immunomodulation in golden mahseer (*Tor putitora*) brood stock 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
NMSHE	National Mission for sustaining the Himalayan ecosystems (NMHSE-Taskforce 6 for Himalayan Agriculture)	**N.N. Pandey/ D. Sarma** S. Ali R.S. Patiyal Rajesh, M. B.S. Kamalam A.K. Giri	2015	2020
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

Institute Technology Management Unit (ITMU)

6

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

- Facilitated the engagement of ICAR empanelled law firm M/s L.S. Davar& Co., as the officially authorized attorney to deal with all intellectual property rights protection related matters of the ICAR-DCFR. Moreover, ITMU facilitate liaison between the Scientists and attorney.
- 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.
- Conducted IPR workshop and prepared technical briefs on intellectual property protection.
- Documented and processed all intellectual property protection applications through the ITMC.
- Submission of 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. Debajit Sarma.
- Application no.202111004283, entitled "System for year-round repeated breeding and higher robust fry production of Golden Mahseer"; developed by Dr. M.S. Akhtar, Dr. Rajesh, M., Dr. Ciji Alexander and Dr.Debajit Sarma.

6.3 Trademark applications registered

- Application no. 4820881, "ICAR - Directorate of Coldwater Fisheries Research (DCFR)" logo under Class 44.
- Application no. 4855227, "Captive maturation and multiple breeding of Golden Mahseer - an ICAR-DCFR technology" logo under Class 44.
- Application no. 4868952, "DCFR Lg (*Lactococcus garvieae*) kit" logo under Class 5.
- Application no. 4868953, "DCFR Aqua FSD fish anaesthetic" logo under Class 5.

6.4 Copyright application filed

- Cinematographic copyright diary no. 2614/2020-CO/CF, for documentary film on "ICAR - Directorate of Coldwater Fisheries Research profile and its role".

6.5 Technologies advertised through Agrinnovate India Limited

- DCFR Aqua FSD, a novel anaesthetic formulation for fishes, developed by Dr. Neetu Shahi, Mr. S.K. Mallik, Mr. Abhay Kumar Giri and Dr. Debajit Sarma.

- DCFR Lg Kit, a diagnostic kit for the detection of *Lactococcusgarvieae*, developed by Dr. Neetu Shahi, Mr. S.K. Mallik,Mr. Krishna Kala and Dr. Debajit Sarma.
- ICAR-DCFR Captive maturation and multiple breeding of Golden Mahseer technology, developed by Dr. M.S. Akhtar, Dr. Rajesh, M., Dr. Ciji Alexander and Dr. Debajit Sarma.

6.6 Memorandum of Understanding (MoU) signed

- MoU with Growel Feeds Private Limited, Andhra Pradesh for collaborative research programme on the "Development and validation of complete range of rainbow trout feeds" was signed on July 2020. It includes a commitment of 15 tonnes of R&D feed worth approximately Rs. 20 lakh. This three year research collaboration is supervised by Dr. Biju Sam Kamalam (Principal Investigator), Dr. Rajesh, M., Dr. Prakash Sharma, Dr. Ciji Alexander, Dr. M.S. Akhtar, Dr. N.N. Pandey and Dr. Debajit Sarma.
- MoU with Uttarakhand Jal Vidyut Nigam Limited, Dehradun for consultancy project "Study on habitat ecology and biodiversity of mahseer and other indigenous fish species for developing conservation strategies in Vyasi hydro-electric project site on River Yamuna, Uttarakhand" was signed in July 2020.The total cost of the three year project is Rs. 61.9 lakh. This project is supervised by Dr. Debajit Sarma (Principal Investigator), Dr. R.S. Patiyal and Dr. M.S. Akhtar.
- MoU with S.P.Y. Agro Industries Limited, Andhra Pradesh for research collaboration on "Evaluation of rice distillers dried grains as an alternative protein source in rainbow trout grow-out feeds" was signed in September 2018 and is on-going. This three year research collaboration is supervised by Dr. Biju Sam Kamalam (Principal Investigator), Dr. Rajesh, M., Dr. Prakash Sharma, Dr. Ciji Alexander, Dr. M.S. Akhtar, Dr. N.N. Pandey and Dr. Debajit Sarma.
- MoU with String Bio Private Limited, Bengaluru, Karnataka for research collaboration on "Evaluation of single cell protein by-product of methane conversion as an alternative protein source in rainbow trout grow-out feeds" was signed in November 2018 and is on-going. This three year research collaboration is supervised by Dr. Biju Sam Kamalam (Principal Investigator), Dr. Rajesh, M., Dr. Prakash Sharma, Dr. Ciji Alexander, Dr. M.S. Akhtar, Dr. N.N. Pandey and Dr. Debajit Sarma.
- MoU with Kanan Devan Hill Plantations Company Private Limited, Keralafor "Scientific and technical guidance to improve and up-scale the rainbow trout hatchery and farm operations at Rajamallay, Munnar, Kerala" was signed in May 2018 and is on-going. This three year scientific advisory is supervised by Dr. Biju Sam Kamalam (nodal officer), Dr. Rajesh, M., Mr. Abhay Kumar Giri, Mr. Siva, C. and Dr. Debajit Sarma.

Extension Activities, Consultancy and Services

7

7.1 Extension Activities

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

Two awareness programme were organized in the month of July and August 2020 at Manan village of Almora district (Uttarakhand) by observing all health protocols. The first progamme was organized on 15th July 2020 in which 26 fish farmers were participated from the nearby village i.e. Kalet, Manan, Bhatgar, Kakrar, Padolia, Thapnia etc. The farmers were made aware about MGMG programme being carried out by ICAR-DCFR. The farmers were also briefed about different farmer's developmental programme of the ICAR especially for the coldwater region of the country. After the meeting visit of the local fish farmer's pond was carried out and advisories were given for the better management practices.

Second programme was organized on 10th August 2020 at Almora district. Under MGMG, visit of made to the site of fish farming developed by Sri Jaipal Singh Nayal in the village Lolager, Mr.Jaipal has two ponds for fish farming and is involved in production of vegetables integrated with fish farming using spent water from the fish ponds. Visited Sri Balam Singh's and Sri Mahesh Chandra's fish farm across the river Kosi in Manan who was also earning rich dividends from fish culture. Visited Kalet village where two migrant SC labours, who lost their jobs in Delhi due to COVID pandemic, had put up their physical effort in digging two separate ponds with perennial water supply. Fish farming has provided livelihood opportunities to the farmers in these areas. Dr. R. S. Haldar, Nodal Officer, MGMG and Dr. Amit Pande, Principal Scientist coordinated the programme.

Fig.: Visit to farmers pond for providing advisories and support

7.1.2 Aqua-gardening in mid hill region during COVID-19 lockdown

Small land holdings, slow growth of fish due to low temperatures and water scarcity are serious limitations for aquaculture in hilly regions. Therefore, enhancement of livelihood through ornamental fish culture and concept of aqua-gardening was promoted during COVID lockdown period. Location-specific aqua-gardening was demonstrated using low cost materials like UV resistant Silpauline sheets. Moreover, an economically viable package of practices including fish breeding was validated for backyard gardening. Since the ornamental fish culture in mid hill region is a new approach, this initiative can provide a source of income for small and marginal farmers. Culture of ornamental fish can be carried out in limited land holdings and water resources besides low-cost of establishment and daily maintenance. During lockdown, 20 women from nearby village were motivated to adopt aqua-gardening of ornamental fish in their backyard. Farmers were trained and provided with ornamental fish seed produced at ICAR-DCFR, Bhimtal. In the month of May a demonstration of aqua-gardening was conducted in the backyard of Deepali Bist, Nisola Bhimtal. The demonstration was highly appreciated by national media and highlighted as option of livelihood security opportunity for mid hill region. The programme was coordinated by Dr. R.S. Patiyal.

Fig.: Adoption of aqua-gardening by women in the hilly region of Bhimtal

Lockdown Special: Showcase on-Aqua-gardening with Ornamental fish (MAY 2020) – Media Coverage by TV18

7.1.3 Seed stocking in farmers' pond

Due to COVID pandemic, many fish farmers of the area could not able to get the desired quality of seed. The most favourable growth period for carp species in hills is from March -April to September-October months. With an initiative to provide technical help and critical inputs like fish seed; 16 fish famers' ponds of Saladi (Bhimtal) area were stocked with cage reared one year old stunted fingerlings of grass carp, common carp and silver carp in the month of May, 2020. Dr S. Chandra, coordinated the distribution program.

Fig.: ICAR-DCFR initiative to provide critical inputs (carp seed) during COVID-19 to farmers of Bhimtal

7.1.4 ICAR-Directorate of Coldwater Fisheries Research takes initiative for conservation and rehabilitation of endangered golden mahseer (*Tor putitora*) in Kumaon lakes

Mahseer is a cultural icon of diverse economic, recreational and conservational value in rivers and lakes of eleven Asian nations (FAO) and has been declared as 'State Fish' of seven states of India. Despite their abundance at one time in Kumaun rivers, mahseer population has been declining in natural water bodies. In this context, ICAR-Directorate of Coldwater Fisheries Research (DFCR), Bhimtal successfully organized a seed ranching programme of golden mahseer in three prime lakes of Kumaon region viz. Bhimtal lake, Naukuchiatal lake and Sattal Lake on 4th November, 2020 as an attempt to save and increase the population of golden mahseer in the respective lakes. Sh. Deepak Chanotiya, Chairman, Bhimtal Nagar Panchayat and Sh. Surendra Surya, Gram Pradhan, Sattal graced the occasion and emphasized upon the need of people's participation in the conservation of mahseer. They also felt that necessary measures to be taken to save the fish by protecting its breeding grounds.

Dr. Debajit Sarma, Director (Acting), DCFR, Bhimtal expressed his concern to save golden mahseer in the natural water bodies of Kumaun region. The Directorate has taken up several steps for seed production of golden mahseer in the hatchery complex and release of the seed in the different streams/rivers/lakes of Kumaun region to increase the population of this fish in the natural habitat and also to conserve the germplasm. On this occasion, thirty thousand fingerlings (10 thousand fingerlings in each lake), which were produced from the captive matured brooders in the DCFR's Mahseer hatchery, were ranched/stocked in all the three Kumaon lakes. More than 30 participants including scientists such

Fig.: Releasing golden mahseer fingerlings into Naukuchiatal lake

as Dr. Suresh Chandra, Principal Scientist; Dr. Siva C., Scientist; Dr. M. S. Akhtar, Scientist, and staffs of DCFR, staffs from the Fisheries Department, Bhimtal and local people participated in the event. The programme was coordinated by Dr. M. S. Akhtar.

Fig.: Releasing golden mahseer fingerlings into Bhimtal lake

Fig.: Golden mahseer fingerlings for ranching in river Kosi, Almora during 17th July 2020

7.1.5 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 two days training was organized to the selected farmers to know-how of the scientific fish farming. In collaboration with the ICICI Foundation polythene lining, fish seed, fish feed etc. were also provided to the selected farmers.

Two day training workshop on "Development of Hill Fish Farming for upliftment of Rural Economy in Uttarakhand was organized among the selected fish farmers of Ramnagar Block (Nainital District) and Molekhal Block (Almora District) of Uttarakhand during 27-28 November, 2020 in collaboration with the ICICI Foundation for Better Growth. First day 15 selected fish farmers were present from Jassa Ganja, Madaiya, Thari, Puchhdi, Kandla, Narayanpur Muliya, Lachhampur Theree etc. villages of Ramnagar Block (Nainital District). The training was organized at National Rural Livelihood Mission (NRLM) Meeting Hall at Ramnagar on 27th November 2020 for upliftment of livelihood to the poor peoples of the area. Mr. N. D. Bhatt, Incharge, Block Development Officer (BDO) of Ramnagar Block graced the occasion as Chief Guest and Dr. Shiv Kumar Srivastava, Block Mission Manager (BMM) as Guest of Honour and Mr. Rahul Saxena, Development Officer, ICICI Foundation was also present during the training programme.

Second day the training was organized at Govt. Senior Secondary School, Painsia, Salt, Molekhal (Almora). Mr. Ram Avatar Tewari, Principal Incharge, Govt. Senior Secondary School, Painsia, Salt graced the occasion as Chief Guest. Some of the senior faculty members of the Institute were also present during the training programme. Another 20 selected fish farmers from Jhimar, Kupi, Simli Heet, Bhitakote, Masaniya Banj etc. villages of Molekhal Block were participated in the training on 28th November 2020. 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, required 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, CTO of this Directorate.

7.2 Exploratory survey, field visit, farm advisories

- **Visit to Barot, Hamni, Patlikuhl and Bathar trout farm and hatcheries**

In reference to the letter of the Director cum Warden of Fisheries, Himachal Pradesh letter No FSH-F(3)-132/99-D-IV-640 dated 31st January. 2020 regarding "non fertility in rainbow trout eggs at departmental trout farms", a team of Scientists comprised of Dr Suresh Chandra, Principal Scientist (Fish Pathology) and Sri R.A.H. Bhat, Scientist (Fish Health), ICAR-Directorate of Coldwater Fisheries Research, Bhimtal visited Barot, Hamani, Patlikuhl and Bathar and 11 trout growers raceways during 6-12 February, 2020. During the period, sampling of the rainbow trout brooders, stripped eggs and trout larvae were made and other relevant farm details were also collected. Tissue samples were collected for further investigation. Discussion with farm staff members, officers and local fish farmers was also made. Based on the observations made at different trout farms, the lower brooder performance is seems to be a cumulative effect of primarily nutritional disorder with impaired water quality followed by infections. However, further periodic investigation of full culture cycle is desirable to identify the primary causative factor/conditions for inducing the non-fertility in rainbow trout eggs at Himachal State Departmental Trout Farms. A detail report was submitted to Himachal State Fisheries department with suitable remedial measures to minimize the loss were also suggested.

Swollen genital opening of a old trout brooder

Immature eggs

- **Visit to investigate the mass mortality in River Suyal at Vishwanath Ghat**

A team of Scientists from the Directorate along with Shri Ritesh Chand, ADF, DOF, Uttarakhand visited the affected Suyal River site in Almora district on 24th December, 2020 to assist State Fisheries Dept. in finding out the reason for mass mortality. The news about the sudden and unexpected death of thousands of golden mahseer and Mastacembelus spp and other fish species in a short period of time in River Suyal at Vishwanath Ghat in Almora district caused havoc in the area. As per the onsite information collected from the department officials and local residents, the sudden and heavy mortality of fishes started at 5:30 PM on 23rd of December, 2020 and the fishes were seen upside down in moribund stage and were gulping the air at the water surface for want of dissolved oxygen. Onsite thorough examination of dead and moribund specimen showed that the colour of the body and gills had turned pinkish- white with broken lamellae. Wet mount preparation of gill showed lamellar fusion with disorganised secondary lamellae. Further, complete erosion of the lamellar capillary was observed under microscope. Some fishes showed haemorrhage in the distal portion of the anal fin. In total, five specimens of golden mahseer were dissected and haemorrhages in alimentary canal and internal organs was reported. The vital organs such as gills, intestine, kidney and liver were subsequently preserved in neutral buffered formalin until further use. The visit was undertaken by Dr. S. Chandra, Mr. S. K. Mallik and Mr. Raja Adil H. Bhat.

विश्वनाथ घाट के पास नदी में सैकड़ों मछलियां मिलीं

जांच की मांग

अल्मोड़ा | हमारे संवाददाता

नगर से लगे विश्वनाथ घाट के पास नदी में सैकड़ों मछलियां मृत मिली हैं। क्षेत्र के लोग इससे हैरत में है। सूचना मिलने पर मत्स्य विभाग के अधिकारी और पुलिस कर्मी मौके पर पहुंचे। मत्स्य विभाग की टीम ने मृत मछलियों के सैंपल लेकर जांच को भेज दिए। पूर्व राज्य मंत्री बिट्टू कनाटिक ने भी मामले की जांच की मांग की।

गौरतलब है कि बीते 20 सालों से अधिक समय से विश्वनाथ घाट में शिव मंदिर के समीप बने तालाब में विभिन्न प्रजाति की मछलियां पाली जा रही हैं। यहां मत्स्य विभाग बीच उपलब्ध कराता है। जिसे स्थानीय लोग समेत अंतिम संस्कार को पहुंचने वाले लोग दाना भी डालते हैं। लेकिन बुधवार की देर शाम ग्रामीणों को नदी में मछलियां मृत दिखाई दी। जिसके बाद ग्रामीणों ने तालाब के पास जाकर देखा तो वहां तालाब में दूर-दूर तक सैकड़ों की संख्या में मछलियां मृत मिली। जिससे वहां हड़कंप मच गया। स्थानीय लोगों की सूचना पर मौके पर पुलिस और मत्स्य

विश्वनाथ घाट के पास मरी हुई मछलियां।

अनुसंधान संस्थान भीमताल नैनीताल से पहुंची टीम सैंपल लेकर गई है। रिपोर्ट आने के बाद ही मामले का पूरी तरह पता चल सकेगा। मछली और पानी दोनों के सैंपल लिए गए है।
–रितेश चंद, सहायक निदेशक मत्स्य।

विभाग की टीम पहुंची। मत्स्य विभाग की टीम ने मरी हुई मछलियों के सैंपल लिए। अनुसंधान संस्थान भीमताल नैनीताल से पहुंची टीम ने पानी और मरी मछलियों के सैंपल ले लिए है। विभागीय अधिकारियों ने बताया कि सीजन के समय अब विभाग गांव वालों की बीच उलब्ध कराएगा। फिर से यहां मछलियों को संरक्षित किया जाएगा।

Fig.: River Suyal

Fig.: A view of mass mortality of fishes

Fig.: Dead golden mahseer at the site

Fig.: Gill of the dead specimen

- A team of scientists Dr. B.S. Kamalam, Dr. Rajesh and Mr. A.K. Giri organized a field day at HEAL FARM (Himalayan Eco Alternative Lifestyle For Agriculture Recreation and Meditation), Trichakhet, Bhowali and analysed water quality parameters of various water sources such as ground water, rainwater harvest tank and the fish tank filled with surface runoff to test the feasibility of setting up of an aquaponics system.
- Dr Neetu Shahi visited Bairangana trout farm of Uttarakhand, India from 29-30 November 2020 in connection with microbial sampling under fish health management programme of ICAR-DCFR, Bhimtal for the recently imported rainbow trout stock from Denmark.
- Dr. Neetu Shahi visited trout and fish farms of Chamoli district, Uttarakhand, India from 1-2 December 2020 for collection of microbial samples and for exploratory survey in connection to various projects of ICAR-DCFR, Bhimtal.
- Dr. Neetu shahi also participated in distribution of DCFR made fish feed and seed to various SC farmers of the Kumaun and Chamoli region under SCSP programme during 29th Nov.-2nd Dec. 2020.
- Dr. Neetu shahi has carried out field visit and exploratory survey for establishing the *Tor* spp. germplasm repository from 1-21st December 2020 at Kalsi stream, Chafi of Nainital district of Uttarakhand, India. Tor spp. germplasm was collected by cast net, documented and maintained live in aquarium units.
- R.S. Tandel, Biju Sam Kamalam, Raja Aadil Hussain, Prakash Sharma and N.N. Pandey provided advisories and technical support of rainbow trout farmers of Uttarakhand, Himachal Pradesh, Sikkim though WhatsApp group during February 2020 to December 2020.
- A.K. Giri conducted on-field trials to develop methodology for the degumming of fertilized eggs of common carp to remove stickiness and to test the feasibility of various degumming agents such as skimmed milk, urea and sodium carbamide solution with the record of the agent possessing better proficiency so that the technology can be released for the farmers.
- A.K. Giri conducted on-field analysis of water quality parameters of rainbow trout and carp farms of Kerala, Himachal Pradesh and Uttarakhand.
- Field adaptation trial was conducted for farming of rainbow trout at Ramgarh, Uttarakhand and regular farm advisory and inputs were given to farmer Mr. Jagath Singh by Rajesh M., Biju Sam Kamalam, and R.S. Haldar.

- S K Mallik visited trout and carp farms at Bilaspur and Mandi to collected microbial samples under the project NP-AMR from 26-31st January 2020.
- S K Mallik visited trout farm of Mr. Jagath Singh at Ramgarh, Uttarakhand to collect diseased trout samples for detection of pathogenic microbes during November 2020.
- S K Mallik visited state rainbow trout farm at Bairangna, Chamoli, Uttarakhand, India from 29-30th November, 2020 to collect microbial samples under NP-AMR and AINP-FH.
- S K Mallik visited state rainbow trout farms of Chamoli district, Uttarakhand, India from 1-2 December 2020 for collection of microbial samples and fish health monitoring under institute programme of ICAR-DCFR, Bhimtal.
- S K Mallik visited Kalsi Stream, Chaffi, Nainital, Uttarakhand to collect *Tor* spp. germplasm on 21st December 2020.

7.3 Farm advisories and field days at Experimental Field Centre, ICAR-DCFR, Champawat

- A Farm advisory on "Health management of carps in mid hills" was conducted on 20th July 2020 at Village Shaktipur Bunga, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Miss Garima, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the programme.
- A Farm advisory on "Weed Management of Fish Ponds" was conducted on 30th July 2020 at Village Chaikuni, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Miss Garima,Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the programme.
- A Farm advisory on "Health management of carps in mid hills" was conducted on 16th November, 2020 at Village Shaktipur Bunga and Doodhpokhara, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie,Miss Garima,Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the programme.
- A Farm advisory on "Water Quality Management of Carps Ponds" was conducted on 26th December, 2020 at Village Banlekh, Champawat Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Miss Garima, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the programme.
- A Farm advisory on "Poly Culture of Carps in Mid Hills" was conducted on 31st December, 2020 at Village Mudiyani, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie,Miss Garima, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the programme.
- Dr. R.S. Patiyal created aqua two gardening ponds, for Deepali Bisht, at Nisola Bhimtal, and stocked with 500 advance fry of gold and koi carp.
- Dr. R.S. Patiyal provided Ofs seed to Sh. Ganga Bhatt, village-Son gaun, Bhimtal, (trainee ASCI), 200 no. advance fry of gold and koi stocked in pond during lock down period.
- Dr. R.S. Patiyal provided Ofs seed to Sh. Brijmohan, village- Pande gaon, Bhimtal, (trainee ASCI), 200 nos advance fry of gold and koi stocked in pond during lock down period.
- Dr. R.S. Patiyal distributed ornamental fish seed (200 no.) to Capt. Harsh Dangwal, a Skill India Farmer.
- Dr. R.S. Patiyal provided fishes (mahaseer/ grass/ common/Schizothorax/ gold fish and koi) to St. Josef school for education and awareness programme.

7.4 Awareness programmes

- One day awareness programme on "Food and Feeding habits of Carps" was conducted on 28th July 2020 at Village Shaktipur bunga, Champawat, Mr. K. Kunal, Mr. P. A. Ganie, Miss Garima, Mr. Ravinder Kumar, and Mr. Hansa Datt conducted and coordinated the programme.
- One day awareness programme on "Poly-culture of carps in mid hills" was conducted on 17th July 2020 at Village Mudiyani, Champawat.

Dr. Raghvendra Singh, Mr. K.Kunal, Mr. P. A. Ganie, Miss Garima, Mr. Ravinder Kumar, and Mr. Hansa Datt conducted and coordinated the programme.

- One day awareness programme on "Estimation of water quality parameters of carps ponds" was conducted on 25th July 2020 at Village Doodhpokhara, Champawat Mr. K. Kunal, Mr. P.A. Ganie, Miss Garima, Mr. Ravinder Kumar, and Mr. Hansa Datt conducted and coordinated the programme.
- One day awareness cum Demonstration programme on "Preparation of Carp Feed using locally available ingredients" was conducted on 01st August, 2020 at Village Chaikuni bora, Champawat Mr. K. Kunal, Mr. P. A. Ganie, Miss Garima, Mr. Ravinder Kumar, and Mr. Hansa Datt conducted and coordinated the programme.
- One day awareness cum Demonstration programme on "Estimation of water quality parameters of carps ponds" was conducted on 11th November, 2020 at Village Dudhpokhara and Shaktipur bunga, Champawat Mr. K. Kunal, Mr. P. A. Ganie, Miss Garima, and Mr. Hansa Datt conducted and coordinated the programme
- One day awareness cum Demonstration programme on "Estimation of water and soil quality parameters of carps ponds" was conducted on 12th November, 2020 at Village Mudiyani and Chaikuni Bora, Champawat Mr. K. Kunal, Mr. P. A. Ganie, Miss Garima, and Mr. Hansa Datt conducted and coordinated the programme
- One day awareness cum Demonstration programme on "Estimation of water Quality and soil parameters of carp ponds" was conducted on 13th November, 2020 at Village Kathar and Kaflang, Champawat. Mr. K.Kunal, Mr. P. A. Ganie, Miss Garima, and Mr. Hansa Datt conducted and coordinated the programme
- One day awareness cum Demonstration programme on "Preparation of Carps Feed using Locally available ingredients" was conducted on 28th December, 2020 at Village Chaikuni Bora, Champawat. Mr. K. Kunal, Mr. P.A. Ganie, Miss Garima, and Mr. Hansa Datt conducted and coordinated the programme
- One day Demonstration programme on "Health Management of Carps in Mid Hills " was conducted on 30th December, 2020 at Village Chaikuni Bora, Champawat. Mr. K. Kunal, Mr. P. A. Ganie, Miss Garima, and Mr. Hansa Datt conducted and coordinated the programme

7.5 Participation in exhibition

Participation in Conference on Ecosystem Health & Fisheries of Indian Inland Waters: Multiple Stressors, Management & Conservation organized by Inland Fisheries Society of India (IFSI), Barrackpore in collaboration with College of Fisheries, GBPUAT, Pantnagar; Aquatic Ecosystem Health & Management Society, Canada; ICAR-CIFRI, Barrackpore and Professional Fisheries Graduates Forum (PFGF) during February 17-19, 2020

Fig.: Dr. J.K.Jena, Deputy Director General (Fy. Sci.), ICAR, New Delhi visited the ICAR-DCFR stall during the International Conference organized by ICAR-CIFRI in association with GBPUAT, AEHMS and PFGF during February 17-19, 2020 at GBPUAT, Pantnagar

7.6 Visitors

7.6.1 Students visit

- A group of 14 PGDIF&AM Trainees (09 males + 05 females) from ICAR-Central Institute of Fisheries Education, Salt Lake, Kolkata Centre (West Bengal) visited ICAR-DCFR, Bhimtal during February 12-17, 2020 and interacted with scientists.
- A group of 44 Third year B.Sc. (Ag) students along with two faculty members from Bhartiya

College of Agriculture (Affiliated to Indira Gandhi Agricultural University, Raipur), Pulgaon Chowk, Durg, (Chhatishgarh) visited ICAR-DCFR, Bhimtal during February 29, 2020 and interacted with scientists.

7.7 Consultancy Services

7.7.1 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 Dr. R.S. Patiyal]

The large rivers worldwide have been fragmented due to the construction of hydroelectric dams. The discontinuity created by dams in the natural structure and function of a river leads to changes in physical, chemical, and biological conditions both upstream and downstream of the dam (Ward and Stanford, 1995). This affects species composition, trophic community structure and risks to native species (Hoeinghaus et al., 2008). To understand the basic changes in biotic and abiotic parameters upstream and downstream of the dam, we investigated the case of river Yamuna near vyasi hydroelectric project site, latitude 30°52' N and longitude 77°88' E, Dakpatthar, Dehradun. The river Yamuna is a snow-fed river, originating from the Yamunotri glacier located in the lower Himalaya in Uttarakhand. In the present study, we investigated the biotic and abiotic parameters of the river from its four different sites viz: S-1, S-2 (upstream to reservoir site), and S-3, S-4 (downstream to the dam). The analyzed data has revealed significant variations among the studied sites. During the investigation period a total no of 5 fish species were reported namely *Tor putitora, Schizothorax richardsonii, Schizothorax plagiostomus, Barilius bendelisis, Gara gotyla*. Among the reported fish species Schizothorax was present in all the selected sites while, Mahseer was only present in the upstream to the dam site. The periphytonic as well as plankton community was dominated by Bacillariophyceae, followed by Chlorophyceae and Cyanophyceae. The Physico-chemical parameters of site S1 and S2 (upstream to the dam site) i.e. avg. water temperature (14.2 °C), transparency (45 cm), DO (12 mg/l), nitrate(0.4 mg/l), phosphate (0.02 mg/l) while S3 and S4 (downstream to the dam site) i.e. avg. water temperature (13.8 °C), transparency(34.5 cm), DO (10.5 mg/l), nitrate(0.3 mg/l), phosphate (0.04 mg/l) were recorded. Great variations in fish assemblages among the fragmented habitats have also been recorded. The diversity and density of Bacillariophyceae members were recorded to be abundant in the free-flowing site while smaller numbers were found in the downstream water site. However, the hydroelectric dam is still under construction and the presence of mahseer only in the upstream to the reservoir is a major concern hence, there is a need of further study for their conservation and migration pattern.

Fig.: Golden mahseer catch during sampling at the Vyasi HEP site

Fig.:Water quality sampling at the Vyasi HEP site

Table: various water quality parameters recorded at different sampling locations

S. No.	Parameter	Site1 (upstream)	Site2 (upstream)	Site3 (downstream)	Site4 (downstream)
1.	Dissolved O_2	12mg/l	12mg/l	11mg/l	10mg/l
2.	CO_2	2mg/l	2mg/l	2mg/l	2mg/l
3.	TDS	110ppm	112ppm	111ppm	110ppm
4.	pH (Systronics)	7.33	7.02	7.47	7.52
5.	Temp (air)	20.3°C	20.5°C	19.4°C	18.3°C
6.	Temp (water)	14.8°C	14.6°C	14.5°C	13.2°C
7.	Transparency	45cm	45cm	37cm	42cm
8.	Alkalinity	120mg/l	160mg/l	200mg/l	210m/l
9.	Phosphate	0.03mg/l	>0.02mg/l	0.05mg/l	0.04mg/l
10.	Ammonia	>0.01mg/l	>0.01mg/l	>0.01mg/l	>0.01mg/l
11.	Nitrate	0.33mg/l	0.52mg/l	0.35mg/l	0.30mg/l

7.7.2 Consultancy on 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 Directorate continues to provide scientific and technical guidance to improve the operation of the heritage rainbow trout hatchery at Rajamallay tea estate. Following the nutritional interventions and hands-on training provided during the previous years, the rainbow trout brooder management activity has considerably improved. However, due to unusually less rainfall and higher ambient water temperature, the health of the brooders was compromised. To address this challenge, we initiated a water quality monitoring and record keeping exercise, by providing the farm-manager and staff hands-on demonstration and training. At present, we have obtained a one year baseline data of the monthly variations in the important water quality indices like temperature, dissolved oxygen, total ammonia nitrogen, carbon dioxide, alkalinity and hardness. Also, we have suggested and made changes in the egg incubation set-up in the hatchery for ease of operation. Further, arrangements are being made to supply rainbow trout eyed ova during this breeding season to replenish the stock in Munnar. This activity is coordinated by Dr. Biju S. Kamalam, Dr. Rajesh, M and Dr. D. Sarma.

7.7.3 Rainbow trout feed advisory activities

[Dr. Biju S. Kamalam, Dr. Rajesh, M., Dr. P. Sharma, Dr. Ciji A. and Mr. P.A. Ganie]

Considering the importance of feed and feeding in enhancing the production and profit margins in rainbow trout farming, the Directorate 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. This includes support 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. Progressive rainbow trout farmers like Mr. Kushal Gupta, Mr. Rajeev Jaswal and Mr. Tot Ram (Himachal Pradesh); Mr. Samdup Bhutia (Sikkim); and Mr. Mushtaq - Teeli brothers (Jammu & Kashmir) are availing this advisory. Likewise, rainbow trout feed related information is also communicated to the fisheries departments of all the rainbow trout farming states. For states with trout feed mills, advisory is 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 trout feeds have increased substantially. This activity is coordinated by Dr. Biju S. Kamalam, Dr. Rajesh, Dr. P. Sharma, Dr. Ciji A. and Mr. P.A. Ganie.

8 Coldwater Fish Breeding and Seed Production

8.1 Captive maturation and multiple breeding of golden mahseer

Until recently, the breeding and seed production of endangered golden mahseer (*Tor putitora*) was being done using wild gravid brooders collected from natural water bodies which have been a destructive and non-sustainable practice. This dependence on wild brooders was because golden mahseer females fail to complete ovarian development and maturation in captive conditions due to endocrine dysfunctions. Therefore, to address this issue on priority basis, ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, through institutional projects AQ16a and AQ16d, embarked upon conducting series of experiments for over last seven years and finally achieved captive maturity and multiple breeding through photo-thermal manipulations. This technology of captive maturity and multiple breeding of endangered golden mahseer have resulted in producing a substantial number of fry of golden mahseer round the year on sustainable basis which otherwise has been a major bottleneck for large scale rehabilitation efforts to conserve this esteemed species.

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

Captive maturation system

Stripping of captive matured brooder

Fertilized eggs of golden mahseer matured in captivity

Golden mahseer fry produced from captive matured brooders

8.2 Seed production of chocolate mahseer

Chocolate mahseer is widely recognized as sport fish and food fish in coldwater rivers and streams of India, Bangladesh, Bhutan, Nepal and Myanmar. The population of chocolate mahseer in the natural water bodies had declined alarmingly due to the over-exploitation and habitat lost over the past years in most of its range. Breeding and seed production of chocolate mahseer is not standardized in captivity. Chocolate mahseer adults were procured from Meghalaya, India and maintained in captivity in mahseer hatchery of ICAR-Directorate of Coldwater Fisheries Research, Bhimtal. Broodstock were reared in flow-through rectangular tanks provided with the environmental conditioning. A gravel based tray constituting 1/3rd of the tank was provided in flow through tank. Fish were stripped for the seed production.

[Report by: Ms. P. Dash, Scientist, ICAR-DCFR]

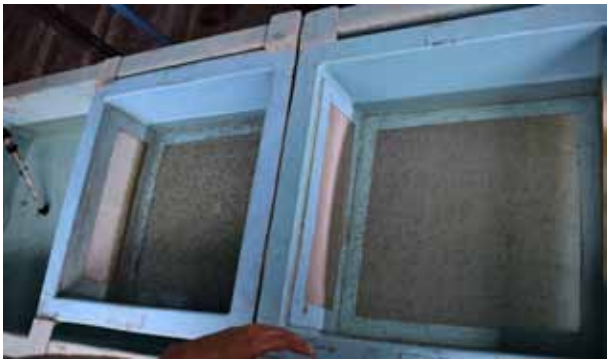


Fig.: Breeding and seed production of chocolate mahseer at ICAR-DCFR

8.3 Seed production of improved common carp

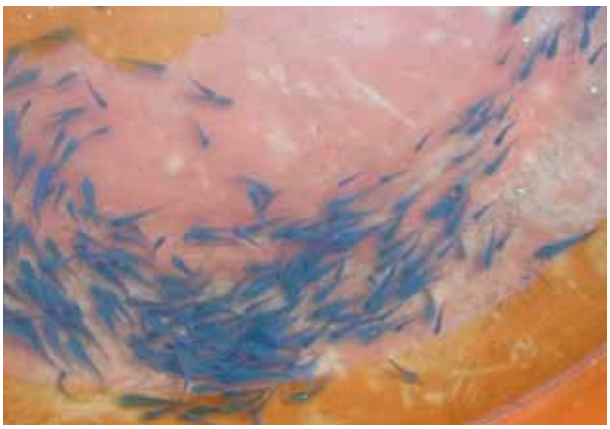
Common carp (*Cyprinus carpio*) is a very important candidate fish in mid Himalayan region. It is being cultured widely either alone or in Polyculture system in the central and lesser Himalayan region in cemented as well as earthen tanks, ponds etc owing to its growth potential and minimal maintenance. 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 in the year 2007. These species were found more suitable for hill farming due to their fast growth and wide temperature tolerance (5-32°C). The species spawn twice during a year, i.e. March-May and July-August. Breeding and seed production of improved common carp was carried out at EFF, ICAR-DCFR, Champawat following old conventional hapa breeding method without hormone administration. Eggs were collected using plastic twines extracted from unused plastic sacks. About 150-200g of twines per kg of female were used for collection of eggs. Sex ratio was kept 1.0-1.5:1.0 (Male: Female) by weight. Fertilized eggs were 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 took place after 84-112 hrs post fertilization and yolk absorption within 72-90 hrs at 18-22°C. The survival percentage of egg to spawn and spawn to fry was found 40-45% and 30-35%, respectively. A total of 5 lakh fry (15dph) were

produced from the improved Hungarian strains of common carp during April to June, 2020. A total of 140 numbers of female brooders of size range 211 g to 453g were deployed for breeding purpose. The breeding program was jointly coordinated by Mr. K. Kunal, Mr. P.A. Ganie and Mrs. Garima.

[Report by: Mr. Kishor Kunal, Scientist, ICAR-DCFR, Experimental Field Centre, Champawat]

Nursery pond preparation

Common carp brooders



Common Carp fry

8.4 Carp seed raising in cages for up-scaling of hill aquaculture

Grass carp, common carp and silver carp fry of 15-20 mg stocked in cages with a stocking density of 800-1000/sq m attain the weight gain of 7-16 g in a rearing period of 6-7 months in temperature range of 10.5- 22.4 ^{0}C. Regular cleaning, feeding with pelleted feed and health management was done during the rearing period. Water temperature, DO, pH, conductivity, iron, alkalinity, calcium, nitrate and nitrite ranged in between 10.5- 22.4^{0}C., 6.5 to 7.5 mg L^{-1}, 7.0 to 7.8, 160-178 µ/cm, 0- 0.3 mg L^{-1},

50-80 mg L^{-1}, 55-70 mg L^{-1}, 10 to 40 mg L^{-1} and 10 to 25 mg L^{-1}, respectively.

[Report by: Dr. S. Chandra, Pr. Scientist, ICAR-DCFR]

8.5 Seed production of *S. progastus*

S. progastus is one of the important snow trout species in the Indian Himalayan region. Brood stock were maintained in captivity and bred by dry stripping method during the month of September 2020. Survival in the range of 80-85% was observed with permissible limits of water quality parameters. A total of 10,000 fry of *S. progastus* and maintained in the hatchery facility of ICAR-DCFR, Bhimtal

[Report by: Dr. N.N. Pandey, Pr. Scientist, ICAR-DCFR]

8.6 Breeding and seed production of Rainbow trout

Breeding, seed production and culture of rainbow trout is an important activity at the Experimental Fish Farm, ICAR-DCFR, Champawat. At present, 1200 adult, 600 table size and 3500 yearlings with weight range of 1.5-3.2 kg, 800-1.2 kg and 220-250 g respectively are being maintained at the farm. The farm raised rainbow trout brooders were deployed for the breeding and seed production during Nov-Dec, 2020. For breeding purpose, a total of 400 numbers of female (wt. range: 1605- 2990 g) and 400 males (wt. range: 1415-2340g) were selected. Around 650,000-700,000 numbers of fertilised eggs of size 2.5.-3.7 mm with pale yellow colour were produced. Recorded fertilization rate was about 80-85% and the eggs are currently being incubated in the flow through hatchery system of the farm. The activities of seed production and rearing of rainbow trout were coordinated by Mr. Parvaiz Ahmad Ganie, Mr. Kishor Kunal and Ms Garima

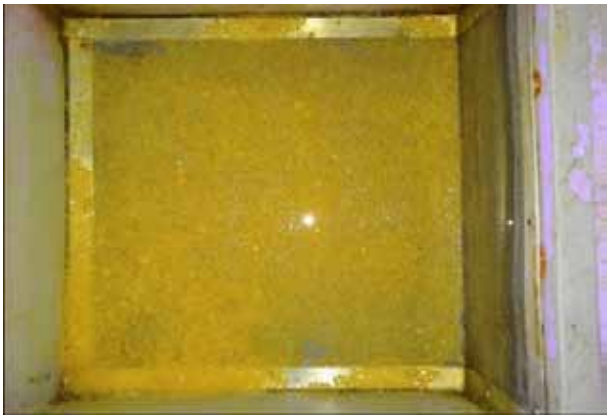
[Report by: Mr. Kishor Kunal, Scientist, ICAR-DCFR, Experimental Field Centre, Champawat]

Selection of brooders

Male trout

Female trout

Strippping of brooders



Incubation of fertilized eggs

8.7 Breeding and seed production of ornamental fishes

Seed production of popular ornamental fish species viz. koi carp and gold fish was carried out at the farm during the month of July- August. For the purpose, 7 females and 10 males each of gold fish and koi carp were deployed in separate breeding hapas. The weight of koi carp ranged from 47-70g and that of gold fish from 35-50g. About 1500 nos. of fry (15 dph) were produced from koi carp while gold fish produced about 700 nos. of fry (15 dph). The activities of seed production and rearing were coordinated by Mr. Kishor Kunal, Mr. P. A. Ganie and Ms. Garima with the help of technical staff of the farm.

Distribution of fish feed and seed

Fish seed and feed distribution to the different stakeholders is an important activity of the farm. A total of 10000 numbers of carp fry and fingerlings, 2000 rainbow trout fingerlings and 50 fingerlings of gold and koi carp raised at the farm were distributed to the farmers of Champawat. In addition to this 200 kg of grow out rainbow trout feed and 2500 kg of carp feed was also distributed to the farmers and other stakeholders of the Champawat and adjoining villages under different outreach and extension programmes of the directorate. The farm also generated the revenue of Rs. 130000.00 (Rupees one lakh and thirty thousand rupees only) through the sale of different size stocks of rainbow trout and common carp.

[Report by: Mr. Kishor Kunal, Scientist, ICAR-DCFR, Experimental Field Centre, Champawat]

8.8. Rainbow trout farming in re-circulating aquaculture system

ICAR-DCFR initiated research programme on rainbow trout farming in recirculating aquaculture system with an aim to reduce water and land footprints. In northern Hill states of India, generally, rainbow trout farming is done in flow through raceways (FTR). Culture of rainbow trout in FTR requires nearly 200 m^3 of water per kg fish production and growth period is nearly 14-16 months. RAS can reduce water requirement to less than 1m^3 per kg of trout produced and culture duration to 5-6 months. Research work related to production and technological feasibility and commercial variability of this farming methods are being studied in a pilot scale RAS unit at the Directorate. Initial production trial suggested that

Captive maturation system

Stripping of captive matured brooder

Fertilized eggs of golden mahseer matured in captivity

Golden mahseer fry produced from captive matured brooders

a 1 kg of rainbow trout can be achieved by rearing for 5-6 months. This system provides opportunity to sustainably farm rainbow trout in places with limited water and land availability.

[Report by: Dr. Rajesh, M. & Dr. Biju S. Kamalam, Scientist, ICAR-DCFR]

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 HRD Programme and input distribution in Mizoram

HRD Programme on Hill Fisheries Development in the state of Mizoram for the upliftment of Tribal Fish Farmers of Mamit District has been organized in collaboration with the KVK Mamit, Mizoram on 29th May, 2020 at Darlak Village, Mamit District. A training programme was conducted on Pond management, water quality management, fish stocking density, acclimatization of fish seeds and composite fish culture. During the occasion, essential farm inputs like drag nets, cast nets, fish feeds and fish seeds were distributed to the selected 26 Tribal farmers. Dr. H. Saithantluanga, Director of Agriculture, Research and Extension, Govt. of Mizoram graced the occasion as Chairman and thanked ICAR-Directorate of Coldwater Fisheries Research, Bhimtal for their generous contribution

Organization of HRD programme and distribution of inputs

in helping the poor tribal farmers in their time of need and request the farmers to find this generosity as an inspiration to work harder. The programme was coordinated by Dr. R.S. Haldar, ACTO.

9.2 HRD Programme and input distribution in Nagaland

Aquaculture inputs distribution and awareness programme organized in collaboration with the Department of Fisheries and Aquatic Resources, Govt. of Nagaland under the project entitled 'Socio Economic Development through Scientific Fish Farming under Tribal Sub Plan' for upliftment of Tribal Fishermen of Kohima village under Kohima District on 3rd July 2020. During the occasion critical fisheries inputs such as fish seeds, fish feeds and enclosure nets, chemicals etc. were distributed to the selected 30 Tribal fish farmers of the area. The Nodal Officer of the Program highlighted on the importance of the project and the significance of scientific culture of fish farming practices. He stated that sustainable, productive fisheries and aquaculture improve food and nutrition security, increase income and improve livelihoods, promote economic growth and protect our environment and natural resources. He also urged the farmers and entrepreneurs of the State to take up scientific system

Organization of inputs distribution programme

of fish culture to uplift our economy and reduce our dependency on low quality fishes imported from other States. A wide discussion was also made on the management practices of fish culture and the importance of provision of good quality fish seed and feed for a successful fish farming business enterprise. Shri Aselie Kire, a fish farming enthusiast, thanked ICAR-Directorate of Coldwater Fisheries Research, Bhimtal for the project and assured on behalf of the beneficiaries that they will endeavour for the success of the project which will also encourage others to take up such venture. The programme was coordinated by Dr. R.S. Haldar, ACTO.

Harvesting from the paddy cum fish culture ponds by the TSP beneficiaries

Harvesting production of the paddy cum fish culture ponds by TSP beneficiaries

9.3 Training cum input distribution programme at Meghalaya

One day Training cum input distribution was organized by ICAR-DCFR, Bhimtal in collaboration with KVK, Ri Bhoi on the eve of 20th National Fish Farmer's Dayon 10th July 2020 at village Madan Nonglakhiat, Ri-Bhoi, Meghalaya during the COVID-19 pandemic lockdown and shutdown period with the follow of Standard Operating Procedures (SOPs) issued by the district administration. The fish farmers of that area including the headman, Mr. Cleverson Rymbai were enthusiastically participated in the event. The farmers were made aware about various scientific approaches in modern fish farming with species as well as system diversification and upgradation to boost farm productivity in many folds within the limited area and space and urged the farmers to become self-sufficient in everything. A case study and house to house survey of the ponds were undertaken by Mr. A.K. Giri and Dr. R.S. Haldar during 2018 regarding the feasibility of fish farming in the village and are being noticed that, most of the farmers practicing fish culture in integrated approach i.e. with pig, duck, poultry, rabbit and also with varieties of horticultural crops. Various farm inputs such as feed, lime, nets and 13000 fingerlings of Amur carps were distributed to 26 beneficiaries of the village. The entire program and various activities were coordinated by Mr. A.K. Giri, Dr. R.S. Haldar, Mr. B.K. Mukhim and Dr. R.S. Patiyal.

Fig.: Training cum input distribution programme at Madan Nonglakhiat, Ri-Bhoi

9.4 Workshop on "Development prospectus of remote tribal areas in the village Pangu, District Pithoragarh

A workshop on "Development prospectus of remote tribal areas in the village Pangu, District Pithoragarh was organized by district administration during November 29, 2020.

ICAR-DCFR participated in the said workshop and created awareness about prospectus of fish farming in remote tribal area or livelihood and nutritional security. During workshop an exhibition on aquaculture in Himalayan region was also dsplayed. Workshop was participated by about 250 participants including farmers, gram pradhan and sarpanch and state fisheries officers. Invited guest lecture on "Prospectus of fisheries in tribal areas of district Pithoragarh was given by Dr R.S.Patiyal principal scientist and Nodal officer TSP. Exhibition was inaugurated jointly by Commissioner kumoan Shri Arvind Hyanki and Dr Jogdande District magistrate, Pithoragarh. During the workshop, 2,000 carp seeds and ornamental fingerlings and 1155 Kg of feed were also distributed to tribal farmers.

Fig.: Organization of inputs distribution

9.5 Demonstration and promotion of ornamental fish farming in Pithoragarh, Uttarakhand

A small aqua-garden pond was established in village Nainee Saine,Pithoragarh under TSP for the demonstration and promotion of ornamental fish farming in that area. This was the first initiatives on the culture and demonstration of ornamental fish in Pithoragarh district. A total of 60 numbers of ornamental koi carp and gold fish were stocked in the aqua-garden pond on 27.10.2020. The aqua-gardening work was initiated in a farmer pond with the help and motivation of Social worker cum Environmentalist, Mr Sanjay Chauhan.

Stocking of 4500 nos. of rainbow trout fry in the raceways with the distribution of rainbow trout feed to two farmers of village-Sarmoli, Munshyari, Pithoragarh. Along with these, a total of 100 nos. of ornamental fish seeds were also distributed to two farmers of the area for their livelihood security and income generation.

Fig.: Stocking of ornamental seeds in aqua-garden pond

9.6 Training cum capacity building program at Nanakmatta, U.S. Nagar, Uttarakhand

A Training cum capacity building program was organized under TSP during the month of March 2020 at Nanakmatta, U.S. Nagar, where 15 fish farmers of that area were participated. During this program, an exposure visit was also arranged at Pantnagar for 10 interested farmers. In this occasion, 2000 nos. of carp seeds and 200 nos. ornamental seeds were distributed to 5 farmers and 1 farmer of villages Tharutisor and Amrupur, Nanakmatta, U.S. Nagar respectively.

North East Hill (NEH) Activities 10

Research and development activities have been carried out in the northeast region for promotion of fish production through adoption of scientific methods and species diversification programme. Training and skill development programmes were also conducted for transfer of technical know-how to farmers and different stakeholders under NEH programme. The details of the programmes are enlisted hereunder.

10.1 Development and promotion of trout farming in Arunachal Pradesh

Successful breeding of Brown and Rainbow trout has been done at Shergaon Govt. trout farm in Arunachal Pradesh during the month of January and February, 2020 and about 8000 brown trout fry and 4000 rainbow trout fry were produced. Technical and financial support has been provided to the Department of Fisheries, Govt. of Arunachal Pradesh for maintenance of their Shergaon trout hatchery facilities. Renovation of Shergaon trout hatchery has also been done for production of quality seed of rainbow and brown trout in relation to expansion of trout farming in the state in a scientific manner. Dr. R.S.Haldar, Nodal Officer, NEH activity coordinated the programme.

Egg collection

stripping

Haul of rainbow trout

ICAR-DCFR financed trout hatchery being renovated in Shergaon Trout farm, Arunachal Pradesh

10.2 Establishment and promotion of rainbow trout farming in Nagaland

To initiate the Rainbow trout farming in the Nagaland state one hatchery and three trout raceways were established to rear quality brooders of Rainbow trout at village Dzuleke, Kohima district with necessary technical and financial support from this Directorate in collaboration with the Department of Fisheries & Aquatic Resources, Govt. of Nagaland. About 3000 numbers of rainbow trout advanced fry were stocked in the raceways, which were produced in the trout hatchery established for the purpose at Dzuleke for further rearing as brooder. After 10 months of rearing the rainbow trout attains a growth about 250-300 mm in size and 350-500 g in weight. The trout raceways are of the first kind established in the state. In continuation to it, three trout raceways are under construction with

necessary technical and financial support from this Directorate for rearing of rainbow Trout at Dzuleke, Kohima district, Nagaland. Demonstration of Rainbow trout farming has been done among the Fisheries officers and fish farmers at Village Dzuluke, Nagaland. The programme was coordinated by Dr. R.S. Haldar, ACTO.

10.3 Distribution of ICAR-DCFR developed trout feed

ICAR-DCFR prepared starter feed of rainbow trout, which was provided to Shergaon (Arunachal Pradesh) Govt. trout farm for better growth, and survival of the species. In addition 200 kg grow-out feed of rainbow trout has been provided to the Department of Fisheries & Aquatic Resources, Government of Nagaland for rainbow trout stocks being reared in raceways at Dzuleke, Kohima district for better growth and survival of the species.

10.4 Fish Diversity studies in Northeast region

For exploration & study of important coldwater fish species Mahseer from the selected Himalayan drainages in North-east, a collaborative project on "Taxonomic identification and genetic characterization of Mahseer population in North-eastern region of India" is under taken under NEH activity of this Directorate with the Department of Aquatic Environment Management, College of Fisheries, Assam Agriculture University, Raha, Nagaon district (Assam).

Scheduled Caste Sub Plan (SCSP)

11

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

11.1 Socioeconomic upliftment of Scheduled Caste community through adoption of scientific fish farming and fish-based ecotourism intervention

A collaborative programme was undertaken by ICAR-DCFR with College of Fisheries, AAU, Raha, Assam on the title "Socioeconomic upliftment of Scheduled Caste community of Thekeraguri Village, Nagaon and Morigaon district, Assam through adoption of scientific fish farming and fish-based ecotourism intervention" at Thekeraguri Village, Nagaon district, Assam. Altogether 900 SC fish farmers belonging to 160 households were benefited.

Socioeconomic Upliftment of Scheduled Caste Community of Thekeraguri Village, Nagaon & Morigaon District, Assam on 02.03.2020

The programme witnessed the following outcomes: (i) 2 Community fish ponds of 0.27 and 1 ha size, 3.78 ha of individual fish ponds and 1 *beel* of 30 ha size were stocked with advanced sized fish seeds at Thekeraguri village, Assam. (ii) 160 villagers will be trained batch-wise @ 40 persons in one batch. (iii) Other farm inputs in the form of fish feeds, fish nets, prophylactic chemicals etc were distributed free of cost to the beneficiaries.

11.2 Awareness programme on Sustainable Ornamental Fisheries Development

A joint collaborative programme on "Sustainable ornamental fisheries development for scheduled caste women households in lower Brahmaputra valley of Assam for livelihood security and income generation" has been undertaken by ICAR-DCFR, Bhimtal with Livestock Research Station, Assam Agricultural University, Hekera, Rural Kamrup district, Assam, with an objective to undertake the occupation of ornamental fish farming in their backyards for income generation and socioeconomic development. An Awareness progamme was organized on 27th February 2020 at Livestock Research Station, Assam Agricultural University Hekera, Rural Kamrup district, Assam for 30 women SC farmers of Kamrup and Goalpara districts of Assam under the project. Glass aquariums, ornamental fish seeds, feeds were distributed to the farmers. Backyard concrete tanks were also constructed by the farmers at their own houses for breeding and raising local ornamental fishes. Dr. D. Sarma, Director (Acting) and Dr. Deepjyoti Baruah, Sr. Scientist of ICAR-DCFR participated in the programme along with the Chief Scientist and Scientists of LRS, AAU, Hekera. Dr. Jyotismita Thakuria, Scientist of LRS, AAU, Hekera coordinated the programme. Field visit was also conducted on the day to the 30 SC women farmers to witness the progress of the work.

Awareness programme on Sustainable Ornamental Fisheries Development in
Lower Brahmaputra Valley Zone of Assam through the involvement of Scheduled Caste Population

11.3 Fish Farm Input (Feed & Seed) distribution programme

ICAR-DCFR, Bhimtal organized fish farm input distribution programme in five districts of Uttarakhand namely Tehri, Rudraprayag, Nainital, Champawat and Pithoragarh during the month of November-December, 2020 under Scheduled Caste Sub Plan (SCSP). Altogether, 10,000 kg of quality fish feeds were procured by this Directorate were transported to the above districts from ICAR-DCFR, Bhimtal and were distributed among the SC fish farmers @ 70-105 kg per farmer based on their requirement. More than 100 SC fish farmers of the state benefitted under the programme. Dr. Deepjyoti Baruah, Sr. Scientist and Dr. R. S. Haldar, Chief Technical Officer coordinated the programme for the Tehri, Rudraprayag, Champawat and Pithoragarh districts; Dr. Kishor Kunal, Scientist coordinated the programme for the Champawat district and Dr. Suresh Chandra coordinated the programme for the Nainital district and visited the selected areas of the respective districts in collaboration with the District administration and officials of Department of Fisheries, Govt. of Uttarakhand.

Fish Farm Input (Feed & Seed) distribution programme organized at district Tehri, Rudraprayag, Nainital, Champawat and Pithoragarh under Scheduled Caste Sub Plan (SCSP)

11.4 First Angling Competition cum Interactive Workshop on Mahseer organized by ICAR-DCFR held at Vyasghat, Pauri Garhwal (Uttarakhand)

A three days angling competition cum Interactive workshop was successfully conducted by ICAR-Directorate of Coldwater Fisheries Research in collaboration with Department of Fisheries, Govt. of Uttarakhand at Vyasghat of Pauri Garhwal district (Uttarakhand) during 20-22 November, 2020. The angling competition was participated by 21 avid anglers from Marchula, Almora, Pancheswar, Pauri, Dehradun of Uttarakhand and other neighbouring states and witnessed by 50 personnel representing scientists, departmental officials, district administration and farmers. During the competition, the anglers could hook golden mahseer *Tor putitora* (Hamilton, 1822) and Indian hill trout *Raiamas bola* (Hamilton 1822) as the major catch in rivers Nayar and Ganga. The largest catch weighed 13 pounds in the hooks of Mr. Satpal from Himachal Pradesh, followed with a 10 pounds mahseer in the hooks of Mohd. Ali Khan and 5 pounds by Mr. Tegbir Mann from Dehradun (Uttarakhand). The maximum numbers of fishes were caught by Mr. Sanjeev Paroriya from Marchula (Uttarakhand) followed by Mr. Mohd. Ali Ghazi from Rampur (Uttar Pradesh) and Mr. Shyam Gurung from Marchula (Uttarakhand). The outcomes of the programme are: Recognition of Vyasghat as a major mahseer angling destination for the tourist on the world map; Promotion of the SC village (Baggi) to earn revenue through mahseer based recreational fisheries and eco-tourism; Conservation of mahseer in the river systems through mahseer angling and eco-tourism. Dr. Deepjyoti Baruah, Ex. Sr. Scientist; Dr. R. S. Haldar, Chief Technical Officer coordinated the programme.

Fig.: Big catch of Golden mahseer by Mr. Satpal from Himachal Pradesh

Fig.: Prize distribution by the Hon'ble MLA, Pouri

11.5 Socioeconomic upliftment of Scheduled Caste population of Chamoli district, Uttarakhand through Rainbow trout farming intervention

A collaborative programme was undertaken by ICAR-DCFR with Department of Fisheries, Chamoli district, Govt. of Uttarakhand on the title "Socioeconomic upliftment of Scheduled Caste population of Chamoli district through Rainbow trout farming intervention under SCSP project, 2019-20" at Chamoli district, Uttarakhand. Altogether 18 SC fish growers were benefited. The programme witnessed the following outcomes: (i) Completed repairing and renovation of concrete raceways for trout culture in Chamoli district. (ii) Advanced sized trout fingerlings were stocked in the raceways. (iii) High quality trout feeds were given to the 18 beneficiaries. (iv) Fish nets and fish disinfectants were distributed

11.6 Virtual interactive meet

A Virtual interactive meet was conducted by ICAR-DCFR on 18th September 2020 (1100-1500 hrs) on the title "Production and Productivity Enhancement among Scheduled Caste Fish Farmers through Scientific Hill Fish Farming". The programme was chaired as Chief Guest by Dr. Pravin P., ADG (Marine Fisheries), ICAR New Delhi and other dignitaries Dr. Prem Kumar, Principal Scientist, ICAR New Delhi; Dr. (Mrs.) Yasmeen Basade, Principal Scientist and Nodal Officer (SCSP), ICAR New Delhi; Dr. Hare Krishna Purohit, Joint Director, Department of Fisheries, Govt. of Uttarakhand; Dr. Krishna Kanta Tamuli, Dean, College of Fisheries, AAU, Raha as Guest of Honour. Altogether, 40 farmers of Assam and Uttarakhand were interacted. The Principal Investigators from the implementing institutes presented on the progress of work done in their respective places on four (4) thematic areas: trout fisheries (Chamoli), ornamental fish farming by women farmers (Kamrup), fish based eco-tourism in wetlands (Nagaon) & mahseer angling (Pauri). Dr. Deepjyoti Baruah, Ex. Sr. Scientist and Dr. R.S. Haldar, Chief Technical Officer coordinated the programme.

11.7 Other activities under SCSP

- Fingerlings size carp fish seed (16,250 nos) distributed to 65 fish farmers of the area and technical assistance given through 12 nos, field visits and demonstrations.
- Technical guidance and critical inputs provided to 46 SC farmers of Nainital, Almora and Chamoli District of Uttarakhand through periodic field visit and demonstrations to their tanks.
- Organized one day training cum demonstration programe on Livelihood uplifment of hilly fish farmers through value addition of fish products on 9th December, 2020 at village Berijala, Bhimtal. The trainings were given hands on training on preparation of fish pickles. Hill fish farming practices were also discussed. Total 130 farmers attended the meet.

Technical assistance given to a SC fish farmer. View of newly developed carp tank in village Simili, Manila(Almora)

Technical assistance given to a SC fish farmer. View of newly developed carp tank in village Simili, Manila (Almora)

Critical input distribution to the SC fish farmers of Harinagar village.

SC fish farmers attending training cum seed distribution programe

Training and Capacity Building

12

12.1 Training cum exposure visit for the students of Assam Agricultural University

Training cum exposure visit for the fifteen B.F.Sc. students on Coldwater Fisheries, selected under NAHEP program of the Directorate of Post Graduates studies, Assam Agricultural University, College of Fisheries, Raha was organized at ICAR-Directorate of Coldwater Fisheries Research, Bhimtal and its field centre, Champawat during 18th to 29th January, 2020. In the inaugural session of the program, Dr. Debajit Sarma, Director (Acting), urged students to make best use of this opportunity and try to enrich their theoretical as well practical knowledge on coldwater fisheries through interactions with scientists. During the program, students visited trout Re-circulatory Aquaculture System (RAS) established at Bhimtal, mahseer hatchery, ornamental farm facilities to be familiar with coldwater aquaculture activities. Classroom lectures were also arranged for the students on various topics viz., strategies for sustainable development of coldwater fisheries, backyard ornamental fish farming for livelihood generation, GIS, advances in trout and carp farming, applications of biotechnological tools in coldwater fisheries, fish health management and large-scale rainbow trout production. During the training students also visited Champawat Experimental Field Centre, where they practically exposed to trout breeding and larval rearing techniques and hatchery management techniques. Visits to local Lakes and hill stream rivers were also arranged to gather firsthand knowledge on coldwater natural aquatic resources. In the valedictory function, student gave presentation. Dr. Debajit Sarma distributed participation certificates and conveyed his best wishes for student's bright future. Dr. Suresh Chandra, Principal Scientist of the Directorate coordinated the program.

Exposure Visit for the Students of Assam Agricultural University

12.2 Training programme for 'Freshwater Aquaculture Farmer' under Pradhan Mantri Kaushal Vikas Yojana (PMKVY)

Under Pradhan Mantri Kaushal Vikas Yojana (PMKVY) -a flagship scheme of the Ministry of Skill Development & Entrepreneurship (MSDE) implemented by National Skill Development Corporation. The training programme on "Freshwater Aquaculture Farmer" in collaboration with Agricultural Skill Council of India was conducted from 28th Feb. to 18th March, 2020 at ICAR-DCFR Experimental Field Centre, Champawat. A total of 20 participants of the various villages of district Champawat attended the training programme. A number of lecture, practical and demonstration sessions on rainbow trout, common

Fig.: Interaction with the participants

Participants of value added training programme

carp, grass carp, silver carp etc pond management, nutrition and feed management, health management and seed production were arranged for the participants. The training programme was conducted and coordinated by Mr. Kishor Kunal, Scientist, Mr. Parvaiz Ahmad Ganie, Scientist, Ms. Garima, Scientist, ICAR-DCFR, Champawat.

12.3 Training programme on Value added fishery products under Rural Livelihood Mission

ICAR-DCFR Experimental Field Centre, Champawat in collaboration with State Fisheries Department, Champawat and District Rural Development Authority, Champawat organized one day training programme on Value Added Fishery Products under Rural Livelihood Mission, GOI on 4th June, 2020. Women from two self-help groups namely, Maa Purnagiri SHG and Jai Gaja Baba SHG, Champawat participated in the training programme. Participants were given hands-on-training on different fish value added products viz. fish pickle, fish tikka and fish cutlet for generating their livelihood through self-employment. The training programme was organized by Mr. Sanjeev Kumar, DFO, Champawat, Ms. Vimi Joshi, APD, DRDA, Champawat and conducted & coordinated by Mr. Kishor Kunal, Scientist, Mr. Parvaiz Ahmad Ganie, Scientist, Ms. Garima, Scientist, Dr. Raghvendra Singh, Scientist, ICAR-DCFR, Champawat.

12.4 Training cum Interaction meet at Harinagar, Uttarakhand

In collaboration with Uttarakhand State Fisheries Department under the Lake Development Program, one day meeting cum training was organized for the fish farmers of Harinagar, Bhimtal on 23rd September, 2020. Importance of good quality feed and other health management measures discussed. Dr Vishal Datta, Incharge, Bhimtal DOF,

Value added products

Seed distribution to SC farmers of Harinagar

Preparation of a fish pond in Harinagar through community participation

Uttarakhand also spoke about the fish farming techniques. With a view to assist farmers during Covid pandemic, fingerlings of carp species were distributed and stocked in farmers' pond. During the period, unemployed village youth prepared pond through Sharmdan (community participation). The program coordinated by Dr S. Chandra, principal Scientist, ICAR-DCFR.

12.5 Training programme on 'Scientific Methods of Integrated Hill Fish Farming'

Under outreach cum extension training programme of this Directorate, one day training cum awareness programme on "Scientific Methods of Integrated Hill Fish Farming" was organised at ICAR-DCFR Experimental Field Centre (EFC), Champawat on 15th December, 2020. A total of 116 participants including the active fish farmers, entrepreneurs, students, fisheries department officials and media personnel were present. The participants were from the villages, Mudyani, Banlekh, Chhataar, Doodhpokhra, Narsing danda, Kaflang and Pati, of the district Champawat. During the programme an overview on scope, methods, prospectus and challenges of integrated fish farming was discussed with the participants. The lectures were delivered on various aspects of integrated fish farming by Mr. P.A. Ganie, and Mr. K. Kunal, Scientists at EFC, Champawat. Dr. D. Sarma, Director (Acting), ICAR-DCFR, Bhimtal, briefed the gathering about the PMMSY. He assured that the Directorate will provide all support to the farmers of the region. He further said that farming inputs such as fish seed and feed will be given to the active fish farmers of the region and technical assistance in the form of trainings to those who wish to start the fish farming will be provided. Mr. Abhinendra, Senior fisheries inspector, Department of Fisheries, Uttarakhand gave detailed information about the terms and conditions of PMMSY along with other fisheries schemes. On the occasion, a feed and seed distribution session was also arranged for the participants. A total of 2400 kg carp feed and

Interaction with the Participants

Participants of the Training

2500 carp seed were distributed to the farmers. The programme concluded with a vote of thanks by Mrs. Garima, Scientist. The programme was coordinated and conducted by Mr Parvaiz Ahmad Ganie, Scientist, Mr. Kishor Kunal, Scientist, Mrs. Garima, Scientist of EFC, ICAR-DCFR, Champawat. Dr. Deepjyoti Baruah, Senior Scientist, Dr. R. S. Haldar, Senior technical officer along with all the technical, supporting and contractual staff of the EFC, ICAR-DCFR, Champawat were also present in the programme.

12.6 Other trainings/Webinars conducted

- Organized one day training cum demonstration programme on livelihood upliftment of hilly fish farmers through value addition of fish products on 9th December, 2020 at village Berijala, Bhimtal. The hands on trainings were given on preparation of fish pickles. Hill fish farming practices were also discussed. A total 130 farmers attended the programme.
- A. K. Giri conducted National webinar on "Mahseer Fisheries in Meghalaya: Strategies for Conservation and Propagation" on 11th June, 2020 by ICAR-DCFR, Bhimtal in collaboration with Dept. of Fisheries, Govt. of Meghalaya; ICAR-ATARI, Barapani, Meghalaya; Division of Fisheries, ICAR Research Complex for NEH Region, Barapani, Meghalaya.
- R. S. Tandel and Suresh Chandra conducted National Webinar on "Increasing coldwater Fish production and enhancing farmers income" on the occasion of National Fish Farmers Day 2020, ICAR DCFR on 10th July 2020
- R. S. Tandel, Abhay Giri and R. S. Haldar conducted National Webinar on "Coldwater Fisheries for Nutritional Security and Livelihood of The Hill Population" on 20th Jul 2020.
- N. N. Pandey coordinated a webinar on "Bio-safety measures and quarantine of imported improved strain of rainbow trout" for departmental personnel of Directorate of fisheries, Sikkim state and NFDB, Hyderabad on 24th August, 2020.
- Debajit Sarma, N. N. Pandey and R. S. Tandel conducted webinar on "Can aquaculture become the blue biotechnology of the future" by ICAR-DCFR, Bhimtal on 21st November, 2020.
- M. S. Akhtar coordinated an online training programme on "Hatchery management of golden mahseer and chocolate mahseer" for West Bengal farmers and state fisheries department officials on 25th November, 2020.
- N. N. Pandey coordinated a Virtual Programme for Students of Fisheries College and Research Institute, Toothukudi and presented an overview of Coldwater Fisheries on 14th December, 2020.
- Parvaiz Ahmad Ganie coordinated and conducted one day training cum awareness programme on "Scientific Methods of Integrated Hill Fish Farming" at Experimental Fish Farm, ICAR-DCFR, Champawat on 15th December, 2020.
- Debajit Sarma, M. S. Akhtar and R. S. Tandel conducted international webinar on mahseer on 16th December, 2020
- N. N. Pandey, S. Ali and R. S. Tandel conducted virtual training on "Breeding & Seed Production of Rainbow trout and it's best management practices" on 29th December, 2020.
- N. N. Pandey coordinated closing ceremony of Swachhata Pakhwada and awareness workshop for PMMSY scheme on 30th December, 2020.

12.7 Lectures/Talks delivered

- A. K. Giri delivered lectures on "Breeding and hatchery management of minor carps", "Food and feeding habits of minor carps" and "Rainbow trout breeding and hatchery management" during a 5 days training program for the PGDIF&AM in-service candidates of ICAR-CIFE, Kolkata during 13-17th February, 2020 at ICAR-DCFR, Bhimtal.
- B. S. Kamalam delivered an online lecture on "Coldwater aquaculture practices in India" for B.F.Sc. students of College of Fisheries, CAU, Tripura on 27th April, 2020.
- B. S. Kamalam delivered three online lectures

on "Nutritional diseases in fish: diagnosis and prevention", "Climate resilient aquaculture strategies" and "Basics of nutritional and respiratory physiology of fishes" for B.F.Sc. students of Dr. M.G.R. Fisheries College and Research Institute, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Chennai during April-May, 2020.

- B.S. Kamalam delivered a lecture on 'Advances in trout and carp feeding techniques in coldwater aquaculture' for B.F.Sc. students of College of Fisheries, AAU, Assam, during "Twelve days training cum exposure program" from 18-29th January, 2020.
- B.S. Kamalam delivered a lecture on "Coldwater fish nutrition" for PGDIF&AM in-service trainees of ICAR-CIFE Kolkata centre, as part of their exposure visit and training programme at Bhimtal during 13-17th February, 2020.
- B.S. Kamalam delivered an online lecture on "Coldwater aquaculture practices in India" for B.F.Sc. students of Annamalai University, Tamil Nadu on 27th November, 2020.
- B.S. Kamalam delivered an online lecture on "Coldwater aquaculture and nutrition in India" for B.F.Sc. students of Fisheries College and Research Institute, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Thoothukudi on 14th December, 2020.
- D. Thakuria delivered lecture on "Basics of Proteins" for the B.F.Sc students of College of Fisheries, AAU, Raha, Assam during "Twelve days training cum exposure program" from 18-29th January, 2020.
- K. Kunal delivered a lecture on "Coldwater fishes of India" to the students of GIC, Dyartoli, Champawat on 15th February, 2020.
- K. Kunal delivered a lecture on "Common carp: nutrition and feed management" to the students of *Rajkiya ucchattar madhyamik vidhyalaya*, Fungar, Champawat on 14th February, 2020.
- K. Kunal delivered a lecture on "Culture practices of common carp in mid hills" to the students of *Rajkiya ucchattar madhyamik vidhyalaya*, Salli, Champawat on 5th February, 2020.
- K. Kunal delivered a lecture on "Nutrition and Feed management of common carp" to the students of GIC, Manch, Champawat on 18th February, 2020.
- K. Kunal delivered a lecture on "Rainbow trout culture" to the students of GIC, Chaumel, Lohaghaton 17th February, 2020.
- Kh. Victoria Chanu conducted practical class on "Polymerase Chain Reaction (PCR)" and "Gel electrophoresis" for the B.F.Sc students of College of Fisheries, AAU, Raha, Assam during "Twelve days training cum exposure program" from 18-29th January, 2020.
- Kh. Victoria Chanu delivered lecture on "Solutions and reagent preparation" for the B.F.Sc students of College of Fisheries, AAU, Raha, Assam during "Twelve days training cum exposure program" from 18-29th January, 2020.
- M. S. Akhtar delivered a lecture on "Captive maturity and breeding of golden mahseer through photothermal manipulations-methodology perspectives" in online training programme on "Hatchery management of golden mahseer and chocolate mahseer" for West Bengal farmers and state fisheries department officials on 25th November, 2020.
- N. N. Pandey delivered a lecture in National webinar on "Coldwater fisheries for nutritional security and livelihood of the hill population" on 12th July, 2020 organized by ICAR-DCFR.
- N. N. Pandey delivered a lecture in the National webinar on "Increasing Coldwater Fish Production and Enhancing Farmers Income" organized by ICAR-DCFR, Bhimtal on the eve of 20th National Fish Farmers Day on 10th July, 2020.
- N. N. Pandey delivered a lecture in the virtual interactive meet on "Fish production and productivity enhancement among scheduled caste fish farmers through scientific hill fish farming" organized by ICAR-DCFR, Bhimtal on 18th September, 2020.
- N. N. Pandey delivered a lecture in the virtual

interactive meet, organized on the eve of 33rd Foundation Day by ICAR-DCFR on 24th September, 2020, Bhimtal in collaboration with Coldwater Fisheries Society of India.

- N. N. Pandey delivered a lecture in training programme on "Value addition in fish" at village Verijala, district Nainital under PMMSY scheme on date 9th December, 2020.
- N. N. Pandey delivered an invited lecture in International Web Conference on "Perspective on Agricultural and Applied Sciences in COVID-19 Scenario (PAAS-2020)", organized by Agricultural & Environmental Technology Development Society (AETDS), Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh; Shobhit Institute of Engineering & Technology, Meerut, India; Soils, Water and Environmental Res. Inst, (SWERI), Agriculture Research Center, (ARC) Giza, Egypt, Rajiv Gandhi Central University, Itanagar, and Corteva agriscience during 4-6th October, 2020.
- Neetu Shahi delivered a lecture on "Application of biotechnological tools & techniques in coldwater fisheries" for B.F.Sc. students of College of Fisheries, AAU, Assam during "Twelve days training cum exposure program" from 18-29th January, 2020.
- P. A. Ganie delivered a lecture on "Scientific Methods of Integrated Hill Fish Farming" at Experimental Fish Farm, ICAR-DCFR, Champawat on 15th December, 2020.
- P.A. Ganie delivered a lecture on "Coldwater aquatic resources of India" to the students of GIC, Dyartoli, Champawat on 15th February, 2020.
- P.A. Ganie delivered a lecture on "Coldwater fish species of India" to the students of *Rajkiya ucchattar madhyamik vidhyalaya*, Salli, Champawat on 5th February, 2020.
- P.A. Ganie delivered a lecture on "Endemic and Exotic fishes of India" to the students of GIC, Manch, Champawat on 18th February, 2020.
- P.A. Ganie delivered a lecture on "Rainbow trout distribution in India" to the students of GIC, Chaumel, Lohaghaton 17th February, 2020.
- P.A. Ganie delivered a lecture on "Snow trout: Species and distribution in India" to the students of *Rajkiya ucchattar madhyamik vidhyalaya*, Fungar, Champawat on 14th February, 2020.
- P.A. Ganie delivered a lecture on, "Coldwater fish species of India" to the students of *Rajkiya ucchattar madhyamik vidhyalaya*, Salli, Champawat on 5th February, 2020.
- Prgyan Dash delivered a lecture on seed production of chocolate mahseer in captivity on fisherman training on "Mahseer production practices" on 25th November, 2020 conducted by ICAR-DCFR.
- R. S. Tandel delivered a talk on oomycetes and fungal diseases in fish and their management during six days national workshop on "Fish health and Disease management in Tropics" organised by college of fisheries science, NDVSU, Jabalpur, Madhya Pradesh during 9th -14th September, 2020.
- R.S Patiyal Delivered a invited lecture on "Prospectus of aquaculture in remote "tribal area of district pithoragarh towards livelihood security, on 29th November. 2020 (Invited lecture) during workshop organised by district administration Pithoragarh.
- R.S Patiyal delivered a "lecture during TOT programme for NEH Student on Ornamental fishery in Mid hill region" on 25th January 2020.
- R.S Patiyal delivered an invited lecture on "Ornamental fish culture in mid Himalayan region" during training of farmers of state fisheries department Uttarakhand, on 6th February 2020.
- Rajesh M. delivered a lecture on "Recirculating aquaculture system for rainbow trout farming" for B.F.Sc. students of College of Fisheries, AAU, Assam, during "Twelve days training cum exposure program" from 18-29th January, 2020.
- S. Ali delivered lecture on "water quality and trout health management" during Virtual Training on Breeding & Seed Production of Rainbow trout and it's best management

practices on 29th December, 2020.

- S. Chandra delivered a presentation on bio-safety measures for the import of eyed ova in the webinar organised with fisheries department of Sikkim on 24th August, 2020.
- S. Chandra delivered a talk on management and control of important fish diseases in the virtual training program organized by KVK, IVRI, Bareilly for the 62 fish farmers of Uttar Pradesh on 30th September, 2020.
- S. Chandra delivered a talk on pre-stocking management of carp ponds in the programme organised on 23rd September, 2020 at Harinagar.
- S. Chandra gave an invited talk on freshwater aquaculture techniques for doubling the carp farmers production and productivity in the virtual training program organized by KVK, IVRI, Bareilly for the 70 fish farmers of Uttar Pradesh on 29th September, 2020.

12.8 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.
- Ms. Sweta Bisht, Department of Bioscience & Biotechnology, Banasthali Vidyapith Rajasthan from worked under the guidance of Dr. Kh. Victoria Chanu for M.Sc Biotechnology on the topic entitled: "Evaluation of puflocus targeted PCR for detection and identification of Saprolegnia species".
- Ms. Sanya Sethi completed her B.Tech. (Biotechnology) project research at ICAR-DCFR under the supervision of Dr. B.S. Kamalam, on the topic 'Molecular characterization of feed intake regulating peptides and proteins in Himalayan snow trout, Schizothorax richardsonii'; registered at Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad.
- 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. Jettiboina Mahija is pursuing her PhD research at ICAR-Central Institute of Fisheries Education under the co-supervision of Dr. B.S. Kamalam on the topic 'Comparative studies on the thermal adaptation of fishes with different respiratory abilities'.
- Dr. Neetu Shahi co-guided Ms. Prerna Sarma, a student registered her Ph.D in Kumaun University, Nainital on her research topic "Investigation on prevalence, biology and pathogenesis of *Chryseobacterium* spp. isolated from coldwater fish and their environment" from 2017 onwards. She has been awarded Ph.D degree in zoology on November 2020.
- Ms. Neeti completed her M. Sc. (Microbiology) project research at ICAR-DCFR under the supervision of Dr. Rajesh M, on the topic on the topic 'Profiling nitrifying bacteria and archaebacteria in fixed bed cold-water RAS biofilter" registered at Kumaon.
- Ms. Lata Sharma awarded Ph.D (Biotechnology) from Kumaun University, Nainital, Uttarakhand for her Ph.D. thesis

work entitled "Studies on genetic variability of different wild populations of chocolate mahseer (*Neolissochilus hexagonolepis*) using molecular markers" under the supervision of Dr. S. Ali.

- Shri Krishna Kala' from Department of Biotechnology Kumoan University Nainital Uttrakhand is Perusing his Phd under the supervision of Dr. R. S. Patiyal on the topic Study on efficacy and Biosefety level of Oxytetracycline in selected coldwater fish species.
- Preeti Bhatt from Department of Zoology, P.G.Callage Pithoragarh, Kumoan University Nainital Uttrakhand is Perusing his Phd under the supervision of Dr. R. S. Patiyal on the topic Habitat study, Reproductive Biology and Captive Breeding of hill stream fish, *Garra gotyla* (Gray, 1830).

12.9 Awareness programme

- Skill development training in ornamental fishery for 20 participants from 7th February-10th March, 2020.
- One day awareness programme on "Poly culture of carps in Mid hills" was conducted on 17th July, 2020 at Mudiyani of Champawat.
- Farm advisory on "Health management of carps in mid hills " was provided at Village Shaktipur- Bunga on 20th July, 2020.
- One day awareness cum demonstration programme on" Estimation of water parameters of carps ponds" was organized on 25th July, 2020 at Village Doodhpokhra, Champawat.
- One day awareness programme on "Food and feeding habits of Carps" was conducted on 28th July, 2020 at Village Shaktipur Bunga, Champawat.
- Farm advisory on "Weed management of fish Ponds" was provided at Village Chaeukoni, Champawat on 30th July, 2020.
- One day awareness cum demonstration programme on "Preparation of carps feed using locally available ingredients" was conducted on 1st August, 2020 at Village Doodhpokhra, Champawat.
- One day awareness cum demonstration programme on "Estimation of water Quality parameters of carp ponds" was conducted on 11th November, 2020 at Village Doodhpokhra, Shaktipur Bunga.
- One day awareness cum demonstration programme on "Estimation of water and Soil quality parameters of carps ponds" was conducted on 12th November, 2020 at Village Mudiyani, Chaeukoni bora etc.

12.10 Students exposure visit conducted

- An exposure cum demonstration visit for the students of *Rajkiya ucchattar madhyamik vidhyalaya*, Salli, Champawat was arranged on 5th February, 2020. They were explained about the farm and hatchery activities, coldwater fish species and their culture practices, Mr. Kishor Kunal, Mr. Parvaiz ahmad Ganie, conducted and coordinated the visit.
- 14 PGDIF & AM Trainees (09 males + 05 females) from ICAR-Central Institute of Fisheries Education, Salt Lake, Kolkata Centre (West Bengal) visited ICAR-DCFR, Bhimtal during 12th -17th February, 2020 and interacted with scientists.
- 44 third year B.Sc. (Ag) students along with two faculty members from Bhartiya College of Agriculture (Affiliated to Indira Gandhi Agricultural University, Raipur), Pulgaon Chowk, Durg, (Chhatishgarh) visited ICAR-DCFR, Bhimtal during 29th February, 2020 and interacted with scientists.
- Exposure visit was organized at Experimental Fish Farm, Champawat for 12 students of Govt. H.S.S. Salli, 28 students of Govt. H.S.S. Funger, 57 students of Govt. Inter College Dyartoli, 113 students from Govt. Inter College, Choume, 100 students from Govt. Inter College Pulhindola, Lohaghat, 45 students from Govt. Inter College Munch, 140 students from Govt. Girls Inter College, Champawat during the month of February, 2020.
- An exposure visit for the students of Class 9th from *Rajkiya ucchattar madhyamik vidhyalaya*, Fungar, Champawat, at Experimental Fish

Farm, Champawat was arranged on 14th February, 2020. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Scientists, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the visit.

- An exposure visit for the students of class IX and XI, GIC, Dyartoli, Champawat was arranged on 15th February, 2020 at EFF, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Scientists, Mr. Ravinder Kumar, and Mr. Hansa Datt conducted and coordinated the visit.
- An exposure visit for the group of 113 students of class IX and XI GIC, Chaumel, Lohaghat was arranged on 17th February, 2020 at EFF, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Scientists, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the visit.
- An exposure visit for the group of 100 students of class IX and XI GIC, Pulhindola, Lohaghat was arranged on 17th February, 2020 at EFF, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Scientists, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the visit.
- An exposure visit for the group of 45 students of class IX and XI GIC, Manch, Champawat was arranged on 18th February, 2020 at EFF, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Scientists, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the visit.
- An exposure visit for the group of 100 students of class IX and XI GIC, Digalichaur, Champawat was arranged on 18th February, 2020 at EFF, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Scientists, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the visit.
- An exposure visit for the group of 140 students of class IX and XI GGIC, Champawat was arranged on 18th February, 2020 at EFF, Champawat. Mr. Kishor Kunal, Mr. Parvaiz Ahmad Ganie, Scientists, Mr. Ravinder Kumar and Mr. Hansa Datt conducted and coordinated the visit.

12.11 Online classes taken for different Fisheries Colleges during COVID-19 Lockdown

Name of Scientist	Dated	Topic	Name of college
Dr. N. N. Pandey	14.05.2020	Cold water fish breeding & hatchery management	WBUAFS, Kolkata
Dr. S. Chandra		Parasitic diseases of Coldwater fishes & their management	SKUAST, Srinagar
Dr. Biju S Kamalam	27.4.2020	Coldwater aquaculture practices in India	CoF, CAU, Tripura
	28.04.2020	Nutritional diseases in fish: diagnosis and prevention	FC&RI, TNJFU, Chennai
	29.04.2020	Climate resilient aquaculture: strategies and approaches	FC&RI, TNJFU, Chennai
	29.04.2020	Basics of nutritional and respiratory physiology of fishes	FC&RI, TNJFU, Chennai
	14.05.2020	Climate resilient aquaculture: strategies and approaches	FC&RI, TNJFU, Chennai
Dr. Rajesh M	30.04.2020 02.05.2020	RAS-Design and operational aspects for sustainable aquaculture" RAS-Basics, components and design	CoF, CAU, Tripura, FC&RI, TNJFU, Chennai
Mr. Raja Aadil H Bhat	22.04.2020	Non infectious diseases of fishes and inflammatory response to injury	COF, Kawardha, Chhattisgarh
	23.04.2020	Stress and its mitigation, General adaption syndrome, cellular response to injury	COF, Kawardha, Chhattisgarh
	24.04.2020	Viral pathogenesis an nutritional diseases of fishes	COF, Kawardha, Chhattisgarh
	25.04.2020	Disease development process in fishes	COF, Kawardha, Chhattisgarh
	27.04.2020	Vaccination in fishes	COF, BAU, Ranchi
	28.04.2020	Immunostimulants	COF, BAU, Ranchi
	30.04.2020	Vaccines	COF, Kawardha, Chhattisgarh
	05.05.2020	General adaption response	COF, BAU, Ranchi
	10.05.2020	Alternatives to antibiotics	COF, BAU, Ranchi
	14.05.2020	Bacterial pathogenesis	COF, BAU, Ranchi
Dr. Raghvendra Singh	06.5.2020	Carp culture, pre and post stocking management	COF, Kisanganj, BASU
Mr. Kishor Kunal	27.04.2020	Soil quality/criteria requirement for aquaculture	COF, Kishanganj, Bihar
Ms. Garima	05.05.2020	Nomenclature, types, classification and interrelationship in finfish taxonomy	CoF, Kishanganj, Bihar

Events and Meetings

13

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 (Permanent and contractual) 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 Participation in Champawat mahotsav

The Experimental Field Centre, ICAR-DCFR, Champawat participated in "Champawat Mahotsav" at Goral Chaur Field, Champawat from 27th to 29th February, 2020. The visitors were sensitized about fish culture and mid hills and were also given information about various value added products from fish on the stall.

13.3 National consultation on 'Coldwater Fisheries Development in Arunachal Pradesh'

National Consultation on "Coldwater Fisheries Development in Arunachal Pradesh" was organized under NEH activity in collaboration with the Department of Fisheries, Govt. of Arunachal Pradesh on 29th February, 2020 at Itanagar (Arunachal Pradesh). with the objective of initiating and discussing the aspects of promotion and expansion of coldwater fish farming in the state by using all possible natural resources to achieve better productivity augmenting livelihood security. Shri Pasang D. Sona, Hon'ble Speaker, Legislative Assembly, *Arunachal Pradesh* graced the occasion as Chief Guest. Altogether, about 80 participants including Mr. Belatee Pertin (IAS), Fisheries

National consultation on Coldwater Fisheries Development in Arunachal Pradesh

Addressed to the house by Shri Pasang D. Sona, Hon'ble Speaker, Legislative Assembly, Arunachal Pradesh

Addressed to the house by Mr. Belatee Pertin (IAS), Fisheries Commissioner, Govt. of Arunachal Pradesh

Commissioner, Govt. of Arunachal Pradesh; Prof. Saket Kushwaha, Vice-Chancellor, Rajiv Gandhi University, Arunachal Pradesh; Dr. Dilip Kumar, Former Vice Chancellor and Chairman Institute QRT, ICAR-DCFR, Administrator, Scientists, Officers, Farmers etc. attended the programme.

13.4 Workshop on "IPR Dimensions in Coldwater Fisheries" at ICAR-DCFR, Bhimtal

The Institute Technology Management Unit of ICAR-DCFR organised a one-day workshop themed 'IPR dimensions in Coldwater Fisheries' on 7th March, 2020 at Bhimtal. Dr. Shashank Mauria (Former Asst. Director General. IP & TM, ICAR) and Dr. Kajal Chakraborty (Senior Scientist, ICAR-CMFRI) were the invited subject matter experts. The workshop was attended by 45 scientists and research scholars of the Directorate. The key agenda of the workshop was to provide the participants an overview of intellectual property management in ICAR; the basics of patent drafting and prosecution; the challenges and opportunities in technology transfer and commercialization; the possibilities in aquaculture production system design registration / patent; the safety precautions in drafting terms and conditions for contract research; and insights on intellectual property conflict management. Addressing the above points, in his keynote talk, Dr. Shashank Mauria provided an overview of Intellectual Assets Management in ICAR and shared the various initiatives in assimilating IP management aspects in the National Agricultural Research and Education System. In the second keynote presentation, Dr. Kajal Chakraborty

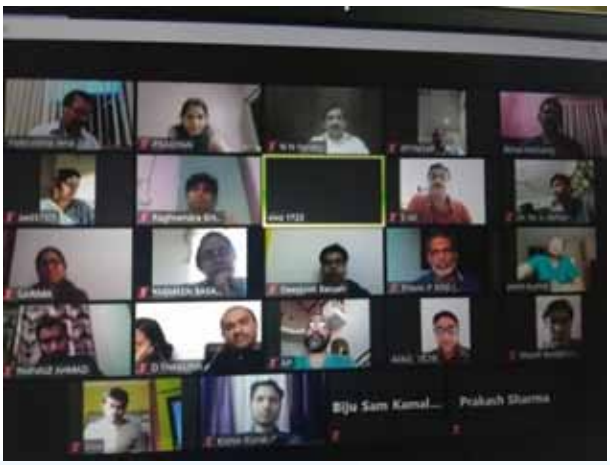
Address by Dr. S. Mauria, Former ADG (IP), ICAR, New Delhi

Release of ITMU publication by Dr. S. Mauria, Former ADG (IP), ICAR, New Delhi

comprehensively covered the basics and trends in patenting and technology management in fisheries sector in India and shared his analytical findings in this domain. In the final question and answer session, some ICAR-DCFR technologies were taken up for detailed deliberation related to IP protection and specific recommendations for IP management in DCFR was arrived at with the inputs of Dr. D. Sarma, Director (Acting) the external experts and scientists. On this occasion, an informative ITMU bulletin titled 'The Patent Guide for Fisheries Researchers' was also released. The workshop program was coordinated by Dr. R.S. Patiyal and Dr. Biju Sam Kamalam.

13.5 Online meeting with DDG (Fisheries)

Online virtual meeting was held under the Chairmanship of DDG (Fy) during 20th April, 2020 in the presence of all the Scientists. During the meeting Scientists interacted with the DDG and worked out on the possible intervention of DCFR during the lockdown for creating awareness about COVID19 among the fish farmers through digital means.



13.6 Research Advisory Committee (RAC) meeting

The institutes RAC was held online on 21st - 22th May 2020 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, ICAR-DCFR presented the progress and achievements made by the Directorate during 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 Centre of Excellence'. 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.

13.7 Institute Research Committee Meeting (IRC)

The Institute IRC meeting was held on 8th - 9th June 2020 at ICAR-DCFR, Bhimtal under the Chairmanship of Dr. D. Sarma, Director (Acting). 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 online from their respected offices and the meeting was held keeping COVID-19 guidelines.

13.8 National Webinar on "Mahseer fisheries in Meghalaya: Strategies for conservation and propagation"

A National Webinar on "Mahseer Fisheries in Meghalaya: Strategies for Conservation and Propagation" was organized by ICAR-DCFR on 11th June, 2020 under the NEH activity of the Directorate at ICAR-DCFR, Bhimtal in collaboration with the Department of Fisheries, Government of Meghalaya; ATARI, Barapani and Division of Fisheries, ICAR Research Complex for NEH Region, Barapani. The HRD programme was meant for the Fisheries Officers, Progressive Farmers, KVK Incharges and SMS Fisheries, Faculty Members of different colleges/Universities etc. of Meghalaya state. But due to request received from different NEH states and other states we accommodated all participants during the webinar. In total 120 participants were enrolled in which 71 from Meghalaya and rest from other states of the country. Dr. R.S. Haldar, Nodal Officer NEH activity coordinated the Webinar.

13.9 National Fish Famer's Day celebration

The ICAR-DCFR celebrated National Fish Farmer's Day on 10th July, 2020 and organized a webinar. The programme was organized through virtual digital platform due to COVID-19 pandemic lockdown guidelines. The programme was graced by the Chief guest Hon'ble State Minister of Women's Welfare & Child Development, Animal Husbandry, Sheep & Goat Rearing, Fodder & Pastoral Development, Fishery Development, Smt. Rekha Arya ji. In her address, she emphasized the need of fishery development through modern technologies and collaborative support of ICAR-DCFR for the upliftment of farmers and enhancement of fish production and productivity in the Uttarakhand state. The programme was attended by farmers, fishery officers and staff and scientists of ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat.

Fish Farmers day celebration at ICAR-DCFR, Bhimtal

Fish Farmers day celebration at EFC, ICAR-DCFR, Champawat

13.10 Meeting on mahseer network project

Mahseer network project launching workshop on "Species and stock validation of mahseer species of genus *Tor* and *Neolissochilus* from western and eastern Himalayan region of India for its propagation and conservation" was conducted online on 28th July, 2020 by ICAR- Directorate of Coldwater Fisheries Research, Bhimtal. Dr. Debajit Sarma, Director (Acting), Dr. Neetu Shahi, scientist, Dr. D. Baruah, senior scientist and Dr. R. S. Haldar, ACTO coordinated this meeting with four collaborating partners from northeast states- College of Fisheries, Raha, Assam; Department of zoology, Manipur university, Imphal; Dept of Fisheries and Biotechnology, St Anthony's college, Shillong and Dept of Zoology, D. M. College of Science, Imphal. ICAR-DCFR, Bhimtal is the lead institute under this project.

Review meeting on network programme on mahseer

The first online review meeting of all the partners of "Network programme on mahseer- 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" was conducted on 15th October 2020 at ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, India. Dr. Debajit Sarma, Director (Acting), Dr. N. Shahi, scientist, Dr. D. Baruah, senior scientist and Dr. R. S. Haldar ACTO coordinated this meeting with four collaborating partners- College of Fisheries, Raha, Assam; Department of zoology, Manipur university, Imphal; Dept of Fisheries and Biotechnology, St Anthony's college, Shillong and Dept of Zoology, D. M. College of science, Imphal.

13.11 Independence Day Celebration

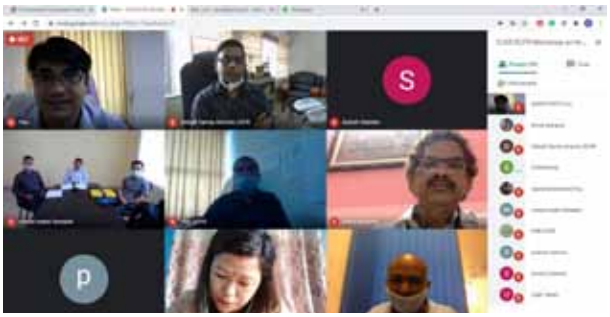
The 74th Independence Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate. The Director unfurled the national flag and saluted the patriots who fought for our freedom besides the importance of 15th August. In his address to the staff of DCFR, he laid 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.

Independence day celebration at ICAR-DCFR, Bhimtal

Independence day celebration at EFC, ICAR-DCFR, Champawat

13.12 Technical meeting with Sikkim Fisheries Department on import of rainbow trout eyed ova

ICAR-DCFR, Bhimtal convened a technical meeting/webinar through online platform on 24th August, 2020 with Directorate of Fisheries, Govt. of Sikkim to provide technical guidance regarding import of improved strain of rainbow trout; bio-safety measures and best management practices of imported eyed ova from Denmark. At the very outset Director, DCFR welcomed to DDG (FS) ICAR, ADG (I.Fy) ICAR, Executive Director NFDB, Director Fisheries Sikkim and all participants. Dr. D. Sarma, Director, DCFR briefed about the status of imported improved eyed ova of rainbow trout from Denmark to India in different hill states with approval from Govt. of India. He also highlighted the purpose to import the eyed ova and breeding programme for further propagation of improved strain. Dr. J. K. Jena, DDG (FS), ICAR address the meet and appreciated Fisheries Department, Sikkim for importing eyed ova of improved rainbow trout which reflects a strong collaboration between DCFR and Fisheries Department, Sikkim for the success of imported stock. Director, Fisheries Sikkim described in detail about the import of 5 lakh eyed ova from Denmark and its incubation facility at trout farm, Menmencho. Dr. Rathinraj, Executive Director, NFDB, Hyderabad addressed the participants and expressed his happiness for timely organising this meeting by DCFR in such an important topic and stated that DCFR should extend all necessary support to Directorate of Fisheries, Govt. of Sikkim in this regard. He also



stated that Directorate of Fisheries, Govt. of Sikkim should take necessary guidance from DCFR. Dr. Suresh Chandra presented a detail report regarding bio safety measures and quarantine practice to be followed for imported stock of rainbow trout in Sikkim. He also presented status of earlier imported strain from Denmark in Kashmir, Himachal Pradesh and Uttarakhand. It was also discussed that DCFR will provide a checklist of all record keeping points to Directorate of Sikkim related to bio safety measures and daily activities during incubation and larval rearing especially for 4-6 weeks of quarantine period. Dr. B.P. Mohanty, ADG (I.Fy) appreciated the State Fisheries Department, Sikkim for taking initiative to import eyed ova and for promotion of rainbow trout farming in the state with technical support from DCFR, Bhimtal. He also suggested to make a feasible breeding programme for propagating imported strain and to provide maximum benefits to the trout growers of the state. Dr. N. N. Pandey discussed about the isolation of imported strain and best management practice for eyed ova incubation to get good survival and healthy fingerlings. Director, DCFR nominated Dr. S. Chandra for providing all necessary guidance regarding bio safety and advisory to record keeping and Dr. N. N. Pandey for providing technical guidance for best management practices. It was decided to have periodic technical discussion and online sharing of all activities between DCFR and Fisheries Department, Sikkim regarding quarantine for a period of 4-6 weeks on priority. It was also decided to share the procedure for taking samples for further analysis of OIE listed diseases and to send the samples to DCFR for laboratory analysis. Dr. Raja Aadil Bhat and Dr. S. Chandra will look after the analysis of the samples. Meeting ended with vote of thanks to all participants.

13.13 Hindi Saptah Samaroh

Hindi Saptah was organized ICAR-DCFR, Bhimtal from 14th to 19th September, 2020. A quiz competition was organized for the staffs of this Directorate. 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, Mr. Parvaiz Ahmad Ganie, Scientist, Ms. Garima, Scientist ICAR-DCFR, Champawat. The programme ended with prize distribution to the winners.

13.14 Celebration of ICAR-DCFR 33rd Foundation Day

The ICAR-DCFR celebrated its 33rd Foundation day in collaboration with Coldwater Fisheries Society of India on 24th September, 2020. A virtual interactive meet was organized and Dr. J.K. Jena, Deputy Director General (Fisheries) graced the occasion as the Chief Guest. Other esteemed participants were Dr. M. Sinha, Former Director, ICAR-CIFRI, Dr. Dilip Kumar, Former Director, ICAR-CIFE, Mumbai, Dr. K.K. Vass, Former Director, ICAR-DCFR & ICAR-CIFRI, Dr. W.S. Lakra, Former Director, ICAR-NBFGR & ICAR-CIFE, Dr. A.K. Singh, Former Director, ICAR-DCFR. Other important dignitaries were Dr.B.P. Mohanty, ADG (I.Fy), ICAR, Dr. Pravin P. ADG (M.Fy), ICAR, Dr. C.N. Ravishankar, Director, ICAR-CIFT, Dr. S.P. Mehta, Director (Fisheries), Himachal Pradesh, Mr. Md. Amin Mir, Director (Fisheries), J&K, Mr. J. Taba, Director (Fisheries),

Hindi Saptah Samaroh at ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat

Foundation day celebration at ICAR-DCFR, Bhimtal

Foundation day celebration at EFC, ICAR-DCFR, Champawat

Arunachal Pradesh and Sh. H.K. Purohit, Jt. Director (Fisheries), Uttarakhand. Apart from these, farmers, Scientists and Staff of ICAR-DCFR Bhimtal and EEF, Champawat along with other participants from SAUs also participated. Dr. Debajit Sarma, Director (Acting), ICAR-DCFR presented the activities and achievements of the Directorate. The Chief Guest, Dr. J.K. Jena, congratulated the Directorate for its successful accomplishments and achievements and stressed upon to develop farmer friendly technologies which can be easily adopted by the farmers and also to address the concerns of different stakeholders in the coldwater sector of the country.

13.15 Celebration of Gandhi Jayanti

Gandhi Jayanti on 2nd October, 2020 was celebrated at ICAR-DCFR Bhimtal and Experimental Fish Farm, Champawat. The event was attended by all the staff (permanent and contractual) of the farm. During the programme lectures were organized on Ghandian thoughts for today's India.

13.16 Celebration of 'Mahila Kisan Divas'

The "Mahila Kisan Divas" was organized at ICAR-DCFR Bhimtal on October 15, 2020. At the outset Dr. D. Sarma, Director (Acting), inaugurated the programme and in his opening remarks he briefed about the importance of celebrating the Mahila Kisan Divas. Due to COVID-19 mass gathering was avoided in this programme to maintain social distance. An essay writing competition was organized amongst the women staff members of the Institute & NGOs on "Role of Women in Agriculture and Fisheries". In total 45 women members participated in the competition for which prizes were distributed to winners. During the valedictory programme Dr. N. N. Pandey, Principal Scientist explained about the participation of women in fishery activities in India to the gathering. Dr. R. S. Haldar, Incharge (Extension) coordinated the programme.

13.17 Vigilance Awareness Week

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal celebrated Vigilance Awareness Week during 27th October to 2nd November, 2020. Staff members, students and workers were sensitized against the corruption and dishonesty through organization of various activities on the theme "Vigilant India – Prosperous India". Program was initiated with Integrity Pledge taking ceremony for the staff members organized on 27th October, 2020. Slogan, poster, debate and interactions were organized to sensitize the staff members by following Covid-19 guidelines in the Directorate. Banners were displayed at various locations to generate mass awareness amongst people about this social evil. Participants were also informed about the Government initiatives like adopting economy measures with more focus on internal housekeeping activities, use of social media, transparency

measures in public life for eradicating this nuisance from the society. Participants expressed their views on the subject "Vigilant India – Prosperous India", where they talked about corruption and shared their views. Dr. Debajit Sarma, Director (Acting) appealed to all scientists, administrative, technical, support and contractual staff members of the Directorate to be vigilant and encouraged them for adopting e filing, maintaining honesty and transparency in their day to day activities. Dr. N.N. Pandey, Principal Scientist highlighted the need of the hour to be vigilant to fight the corruption from the society, which is weakening our social structure and country. Participants were also informed about the online portal of the vigilance department. On 2nd November, 2020 valedictory function was organized and prizes were distributed to the winners of the competitions in various categories. Dr. Suresh Chandra, Principal Scientist and Vigilance Officer of the Directorate coordinated the awareness week. The program ended with vote of thanks.

Directorate staff members taking part in different programmes

Closing ceremony of vigilance awareness week

Vigilance Awareness Week Celebrated at EFC, ICAR-DCFR, Champawat

Vigilance Awareness Week was observed from 27th October to 2nd November, 2020 at Experimental Fish Farm, Champawat. Integrity pledge, essay writing and speech competitions were organised for the staff of the centre at EFF, Champawat. The programme was coordinated and conducted by Mr. Kishor Kunal, Scientist, Mr. Parvaiz Ahmad Ganie, Scientist, Ms. Garima, Scientist ICAR-DCFR, Champawat.

Vigilance awareness week celebration at ICAR-DCFR Experimental Field Centre, Champawat

13.18 Celebration of Swachhata Pakhwara

ICAR-DCFR organized Swachhata Pakhwara during 16-31 December 2020. During the pakhwara various programmes such as cleaning of premises and adjoining areas, awareness campaign for cleanliness and hygiene, lecture, student's essay competition were organized. A mega event was organized on the occasion of closing ceremony of the Swachhata Pakhwara on December 30, 2020. On this occasion Brigadier H.M. Pant (Retd.) was invited as the Chief Guest of the programme

Swachhata Pakhwara activities at ICAR-DCFR, Bhimtal

Swachhata activities by staff of ICAR-DCFR EFC, Champawat

alongwith Sh. Vivek Sah (IMC Member) & Sh. Pushkar Joshi (IMC member), Sh. P.K. Shukla, Dy. Director of Fisheries, Government of Uttarakhand, Bhimtal; Zila Panchayat Member, Chairman Vyapar Mandal, Bhimtal. Besides, more than 70 farmers including a large group of women farmers participated in this programme. Very informative lectures on swachhata were given by the dignitaries as well the farmers were given advisories by the scientists of DCFR on different aspects.

Swachhata Pakhwada at ICAR-DCFR Experimental Field Centre, Champawat

A series of events were undertaken during 16-31 December 2020 under Swachhata Pakhwada in different villages by EFF, ICAR-DCFR, Champawat. On 18th December, 2020 a sanitation awareness programme was organised at village Dasiya, Champawat. On 20th December, 2020 stock taking of waste management and other activities including utilization of organic wastes/ generation of wealth from waste at Banlekh village were organized. On 23rd December, 2020 celebration of special day Kisan Diwas was undertaken at village Mudiyani. On 27th December, 2020 awareness on waste management and other activities including utilization of organic wastes/generation of wealth from waste was carried out. The whole programme was coordinated and conducted by Mr. Kishor Kunal, Scientist, Mr. Parvaiz Ahmad Ganie, Scientist, Ms. Garima, Scientist ICAR-DCFR, Champawat.

13.19 Institute Management Committee (IMC) meeting

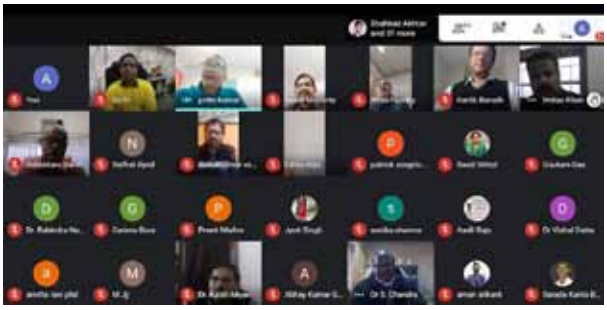
ICAR-DCFR IMC meeting was held on 23rd December, 2020 at Bhimtal. Various administrative and financial issues were discussed and approved during the meeting. The meeting was organized through digital platform in compliance to the COVID-19 guidelines. The meeting was attended by Dr. D. Sarma Director (Acting) & Chairman IMC, Dr. B.P. Mohanty, ADG (I.Fy), Dr. K.D. Joshi, Principal Scientist, ICAR-NBFGR, Dr. M. Goswami, Principal Scientist, ICAR-CIFE, Sh. Kunal Kalia, Sr. F&AO, ICAR, Sh. Vivek Sah and Sh. Pushkar Joshi. Apart from these, Sh. S. Mohsin Ali, AF&AO, ICAR-DCFR, and Smt. Khilawati Rawat, Administrative Officer and Member Secretary IMC.

13.20 Quinquennial Review Team (QRT) meeting

The Director General, Indian Council of Agricultural Research constituted a Quinquennial Review Team (QRT) vide office order No F. No. Fy/8/7/2018-IA.VI dated 22.7.2019 to examine the performance and progress of research and other work done by DCFR during the period 1.4.2013 to 31.3.2018, and to provide future guidance and recommendations for improving its performance and quality of research and other mandated activities. This team was constituted under the chairmanship of Dr. Dilip Kumar, Former Director & Vice-chancellor, ICAR-CIFE, Mumbai and Dr. S. D. Gupta, Former Principal Scientist, ICAR-CIFA, Bhubneswar, Dr. J. R. Dhanze, Former Dean, College of Fisheries, Lambuchera, Agartala, Tripura, Dr. Madan Mohan, Former ADG (Marine Fisheries), ICAR, New Delhi, Dr. Atul Borgohain, Professor, Veterinary College, Assam Agricultural University, Khanapara, Guwahati, Assam as members and Dr. N. N. Pandey. Principal Scientist, DCFR, Bhimtal as member secretary. The QRT visited different work places and facilities and held several rounds of discussions individually, in groups and collectively with the Director, scientists, technical staff and administrative personnel, farmers, fishers and other stakeholders. The team also interacted with the client departments (Departments of Fisheries of northern and northeastern upland states) and collaborating institutions / organisations to get a deeper understanding of the sector and related issues, relevance of research and extension activities undertaken by the Directorate, etc., and to comprehend contributions of the Directorate in different fields of its domain.

13.21 Other events and meetings organized

- National webinar on "Coldwater fisheries for nutritional security and livelihood of the hill population" held on 20th July 2020.



- Special Lecture on Gram Swaraj of Gandhiyan Philosophy was organized on 20th September, 2020.
- World Fisheries Day was celebrated and Webinar on "Can aquaculture become the blue biotechnology of the future" was organized on 21st November 2020.
- Fisherman training on "Mahseer production practices" was organized on 25th November 2020.
- International webinar on mahseer was held on 16th December, 2020. Dr. Adrian Pinder, Associate Director, Bournemouth University, United Kingdom presented a talk on mahseer conservation and rehabilitation.
- Institute Biosafety Committee Meeting was held on 17th December 2020. The meeting was chaired by Dr. D. Sarma, Director (Acting), ICAR-DCFR as Chairman.
- Virtual Training on "Breeding and seed production of rainbow trout and its best management practices" was organized on 29th December 2020.

Awards, Honours and Recognitions

14

- A.K. Giri Awarded 1st prize in the Hindi Quiz Competition, organized on the eve of Hindi workshop on 14th September 2020 at ICAR-DCFR, Bhimtal.
- Amit Pande received a certificate of appreciation for his significant contribution as a COVID-19 warrior for his active participation in COVID-19 RT-PCR testing at ICAR-Indian Veterinary Research Institute, Mukteshwar.
- Biju Sam Kamalam received the 'Dr. S. Ayyappan gold medal' awarded by Inland Fisheries Society of India, Barrackpore, for distinguished research contribution in fisheries science. The open house presentation and selection for this award happened during the Conference on Ecosystem Health and Fisheries of Indian Inland Waters, 17-19 February 2020, GBPUAT, Pantnagar, India.
- D. Thakuria received "First Prize" for poster presentation entitled "Development of Antimicrobial Peptide through Artificial Designing Approach" under scientific session, Emerging, re-emerging and transboundary diseases affecting livestock and control measures, in International e-conference on "New generation vaccines and animal disease control strategies: roadmap for enhancement of animal and human health" organized by Department of Veterinary Microbiology, Veterinary college and research institute, Orathanadu, Tamil Nadu and Department of Veterinary Microbiology, C.V.Sc. & A.H. Pookode, Kerala, during 02-04th December 2020.
- Kh. Victoria Chanu received "Best paper award" in International Conference on Environmental, Agriculture and Rural Development (EARD-2020) organized by International Research and Development Center for Publication (IRDCP) during October 17-18, 2020.
- Kh. Victoria Chanu received "First prize in Oral category" in Online International Conference on "Science, Technology & Environment: Current Scenario and Future Challenges (ICSTE-2020)" held at Career Point University, Himachal Pradesh, India on 27-28th November, 2020.
- N.N. Pandey, conferred Distinguished Scientist Award- 2020 by AETDS Uttarakhand.
- Neetu Shahi received Department of Biotechnology (DBT)- Conference, Travel, Exhibition and Popular Lectures (*CTEP*) travel fellowship (DBT/CTEP/02/20191150904) for attending the 2nd International mahseer conference at Chiang Mai, Thailand from 11th -15th Feb 2020.
- Raja Adil H. Bhat received appreciation letter from College of Fisheries Science, Birsa Agricultural University (BAU), Ranchi for delivering five lectures on various topics of B.F.Sc course "Microbial and parasitic diseases of fish and shellfish" through online platform during COVID-19 lockdown.
- Raja Adil H. Bhat received appreciation letter from Dean College of Fisheries, Chhattisgarh Kamdhenu Vishwavidyalaya for delivering seven lectures on various topics of B.F.Sc and M.F.Sc courses through online platform during COVID-19 Lockdown.
- Raja Adil H. Bhat received Appreciation letter from Principal Govt. Medical College, Haldwani for performing the COVID-19 testing in the Virus Research and Diagnostic Laboratory (VRDL), GMC, Haldawani from 4th September 2020 to 15th October 2020.
- Siva C. received a certificate of appreciation for his significant contribution as a COVID-19 warrior for his active participation in COVID-19 RT-PCR testing at ICAR-Indian Veterinary Research Institute, Mukteshwar.
- S. Chandra as a member participated in the online evaluation and validation of coldwater aquaculture farmer qualification pack under subsector agriculture developed by NSDA on 17th July 2020.
- S. Chandra as Agriculture Skill Council of India (ASCI) nominated assessor, assessed twenty farmers of Ornamental fish technician job role on 11th March, 2020 at Bhimtal.

15 Linkages

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

15.1 ICAR Institutes

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

15.2 Central Agencies/Departments

- National Fisheries Development Board (NFDB), Hyderabad, Telangana
- Department of Biotechnology (DBT), New Delhi
- Science and Engineering Research Board (SERB), New Delhi
- Indian Space Research Organization (ISRO), Bengaluru
- North Eastern Space Application Centre, Shillong, Meghalaya
- Uttarakhand State Council for Science and Technology, Dehradun
- Survey of India, Dehradun, Uttarakhand
- State Agricultural Management & Extension Training Institute (SAMETI), Jammu
- Ministry of Environment, Forest & Climate Change, New Delhi
- Indian Council of Forest Research and Education, 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
- Deen Dayal Upadhaya Gorakhpur University, Gorakhpur, U.P

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.

ICAR-DCFR in Media

किसानों की आय भी बढ़ाएं

चंपावत। राष्ट्रीय मत्स्य पालक दिवस पर भारतीय कृषि अनुसंधान परिषद के शीतजल मत्स्यिकीय अनुसंधान निदेशालय भीमताल की ओर से वेबीनार का आयोजन किया गया। संस्थान के निदेशक डॉ. देवाजीत शर्मा की अध्यक्षता में हुए कार्यक्रम में मुख्य अतिथि मत्स्यकीय मंत्री रेखा आर्या ने प्रदेश में मत्स्य उत्पादन बढ़ाने के साथ-साथ मत्स्य किसानों की आय बढ़ाने पर जोर दिया। संस्थान के उप महानिदेशक डॉ. जेके जेना ने नई वैज्ञानिक विधियों के विकास की जानकारी देने के साथ ही किसानों को सभी प्रकार की तकनीकी सहायता उपलब्ध कराने का भरोसा दिलाया। चंपावत संस्थान के प्रभारी डॉ. किशोर कुणाल ने किसानों के जीविकोपार्जन विकास के लिए हरसंभव सहायता का आश्वासन दिया। कार्यक्रम में रमेश कुमार पांडेय, अमित कालाकोटी, पंकज सिंह बोहरा, जगदीश चंद्र, आनंद सिंह, पूरन चंद्र पांडेय, डा.राघवेंद्र सिंह, परवेज अहमद गनई आदि ने हिस्सा लिया। संवाद

ट्राउड के अंडों की छह राज्यों में मांग

02

उत्तम किस्म के मत्स्य बीज व आहार से बढ़ेगा उत्पादन

प्रवासियों के लिए स्वरोजगार का उत्तम जरिया

चम्पावत में ठंडे पानी की रेनबो ट्राउड मछली पर शोध शुरू

जगत की मछली 1750 रुपये किलो

महंगी है रेनबो ट्राउट मछली

अमर उजाला

नीली क्रांति में मददगार होगी रेनबो ट्राउट मछली

उत्तर उजाला 6

हरिनगर, सलड़ी, बेरीजाला मत्स्य हब के रूप में विकसित होगा

हरिनगर क्षेत्र मत्स्य हब के रूप में विकसित होगा: निदेशक

मत्स्यपालकों की मदद को आगे आया निदेशालय

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16

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17 Participation in Conference, Symposia, Workshop, Meeting and Training

17.1 Participation in Conference/Symposia/Workshop/Trainings

Meetings /seminars/conferences/workshops attended by Dr. Debajit Sarma, Director (Acting) during 01.01.2020 to 31.12.2020:

S. No	Date	Place	Purpose
1.	03.01.2020 to 09.01.2020	Sikkim & Arunachal Pradesh	◆ Attended Quinquennial Review Team (QRT) of this Institute at Sikkim and Arunachal Pradesh.
2.	15.01.2020 to 16.01.2020	Ramnagar	◆ Attended meeting on Mahseer Conservation with Department of Forest, Government of Uttarakhand at Ramnagar, Uttarakhand.
3.	27.01.2020	Dehradun	◆ Attended meeting with officials of the Department of Fisheries, Govt. of Uttarakhand, Dehradun.
4.	17.02.2020	Pantnagar	◆ Participated in International Conference on "Ecosystem Health and Fisheries of Indian Inland Waters: Multiple Stressors, Management and Conservation" organized by College of Fisheries, GBPUA&T Pantnagar and Inland Fisheries Society of India, ICAR-Central Inland Fisheries Research Institute (CIFRI), Barrackpore, Aquatic Ecosystem and Health Management Society, Canada and Professional Fisheries Graduate Forum at Pantnagar.
5.	26.02.2020 to 28.02.2020	Raha, Assam Itanagar	◆ Participated in the National Workshop at College of Fisheries, Raha, Assam. ◆ Organized & Participated in One Day Workshop at Department of Fisheries, Itanagar. ◆ Attended SCSP programme at LRS, Heckera.
6.	01.03.2020 to 03.03.2020	ICAR-DCFR Bhimtal	◆ Final Quinquennial Review Team (QRT) meeting.
7.	07.03.2020	ICAR-DCFR Bhimtal	◆ Organized & Participated in IPR Workshop.
8.	03.04.2020	ICAR-DCFR Bhimtal	◆ Online Meeting with DDG (Fy.)
9.	10.04.2020	ICAR-DCFR Bhimtal	◆ Online Meeting of all Directors' of ICAR institutes and ATARI's under the chairmanship of Hon'ble Secretary DARE and DG, ICAR
10.	11.04.2020	ICAR-DCFR Bhimtal	◆ Reviewed progress of each Scientist and instructed for publication, farmers advisory and delivering online lectures.
11.	13.04.2020	ICAR-DCFR Bhimtal	◆ Online Meeting with DDG (Fy.)
12.	13.04.2020	ICAR-DCFR Bhimtal	◆ Online Meeting with Technical and administrative staff to review progress and instructed for following lockdown guidelines.
13.	19.04.2020	ICAR-DCFR Bhimtal	◆ Online meeting with Director & All Scientists under the chairmanship of DDG (Fy.).Reviewed progress of each Scientist and instructed for publication, farmers advisory and delivering online lectures during lockdown period.

S. No	Date	Place	Purpose
14.	20.4.2020	ICAR-DCFR Bhimtal	◆ Online Meeting-Director & All Scientists under the chairmanship of DDG (Fy.)
15.	21.05.2020 to 23.05.2020	ICAR-DCFR Bhimtal	◆ Online RAC Meeting (Reviewed progress of each ongoing institutional, networking and out funded project. Also reviewed work accomplished under NEH/TSP/SCSP programme) (All Scientists, Member Secretary RAC, Incharge PME, ADG (I.Fy.), RAC members under chairmanship of Dr. W.S.Lakra)
16.	27.05.2020	ICAR-DCFR Bhimtal	◆ Online SFC Meeting of ICAR-DCFR Bhimtal (Under the Chairmanship of DDG (Fy.))
17.	28.05.2020	ICAR-DCFR Bhimtal	◆ Online Fish Talk (Nutrition Day Special focus on COVID- 19)
18.	04.06.2020	ICAR-DCFR Bhimtal	◆ Webinar on "Opportunities in Fisheries Sector Post Lockdown"
19.	06.06.2020	ICAR-DCFR Bhimtal	◆ ICAR-CIFE 60TH Annual Day Celebrations
20.	08.06.2020 to 09.06.2020 & 12.06.2020	ICAR-DCFR Bhimtal	◆ IRC Meeting (Reviewed progress of each ongoing institutional, networking and out funded project. Also reviewed work accomplished under NEH/TSP/SCSP programme. Presented concept notes for new proposal).
21.	10.06.2020	ICAR-DCFR Bhimtal	◆ 1st meeting of Expert Committee on Inland Fishery Resources
22.	11.06.2020	ICAR-DCFR Bhimtal	◆ National Webinar on Mahseer Fisheries in Meghalaya: Strategies for conservation & propagation
23.	11.06.2020	ICAR-DCFR Bhimtal	◆ Webinar on Raceways Development Programme conducted by Govt. Holkar Science College in association with P.G Tech. Research Institute, Indore (Chief Guest and Keynote Speaker).
24.	12.06.2020	ICAR-DCFR Bhimtal	◆ Agrovision Foundation webinar on " Challenges, Opportunities and Future of Inland Fisheries organized by Agrovision Foundation, Agrospectrum and supported by MEDC.
25.	24.06.2020	ICAR-DCFR Bhimtal	◆ Meeting on Implementation of E-Office under the chairmanship of Sh. Sanjay Singh, Additional Secretary (DARE) & Secretary (ICAR), New Delhi.
26.	26.06.2020	ICAR-DCFR Bhimtal	◆ Discussion on some points related to ICAR By-Laws for ICAR Governing Body meeting to be held on 29.06.2020.
27.	30.06.2020	ICAR-DCFR Bhimtal	◆ XXVIth meeting of ICAR Regional Committee No 1 comprising the states of Himachal Pradesh and Uttarakhand and the Union Territories of Jammu & Kashmir & Ladakh at ICAR-CPRI, Shimla.
28.	03.07.2020	ICAR-DCFR Bhimtal	◆ Meeting regarding RCRC to COVID-19 Voices from the Field Webinar with ICAR Leadership under the chairmanship of Dr. Sanjay Kumar Singh, AS(DARE) and Secretary (ICAR).
29.	07.07.2020	ICAR-DCFR Bhimtal	◆ Webinar on HDR Programme in collaboration with Director of Fisheries, Govt. of Arunachal Pradesh, Itanagar.
30.	10.07.2020	ICAR-DCFR Bhimtal	◆ Webinar on Fish Farmers Day organized by ICAR-DCFR. Smt. Rekha Arya, Hon'ble Minister of Fisheries, Dehradun participated as Chief Guest and DDG (FS) as a guest of honour
31.	15.07.2020	ICAR-DCFR Bhimtal	◆ Meeting of the Directors of Fisheries Research Institutes and the Senior Officers of the Fisheries Science SMD under the chairmanship of DDG (FS), ICAR.

S. No	Date	Place	Purpose
32.	16.07.2020	ICAR-DCFR Bhimtal	◆ 92nd Foundation Day and Award Ceremony of the Indian Council of Agricultural Research,
33.	20.07.2020	ICAR-DCFR Bhimtal	◆ National Webinar on Coldwater Fisheries for Nutritional Security and Livelihood of the hill Population under the chairmanship of Dr. B.P. Mohanty, ADG (I.Fy), ICAR, New Delhi.
34.	22.07.2020	ICAR-DCFR Bhimtal	◆ Webinar on "Entrepreneurship Development in Fisheries" organized by Atmarnirbhar Bharat Programme, P.G Tech. Institute, Bhopal in association with Rajeev Gandhi Prodyogiki Vishwavidyalaya, Bhopal.
35.	28.07.2020	ICAR-DCFR Bhimtal	◆ Webinar on 1st meeting of Network Programme on Mahseer conducted by Dr. Neetu Shahi, Scientist ICAR-DCFR Bhimtal.
36.	10.08.2020	ICAR-DCFR Bhimtal	◆ Webinar on Blue Revolution through sustainable and responsible development of fisheries sector in India convened by Secretary, Director of Fisheries, Govt. of Uttarakhand, Dehradun under meeting of SLAMC (Pradhan Mantri Matsya Sampada Yojna PMMSY).
37.	11.08.2020	ICAR-DCFR Bhimtal	◆ Webinar on "Krishi Megh" ("NARES-Cloud Infrastructure and Services") along with "Accreditation Portal" and "Alumni Network Portal" under the chairmanship of Hon'ble Ministers of State, Agriculture and Farmers Welfare, Shri Parshottam Rupala ji, and Shri Kailash Choudhary ji, Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR, along with other senior officers of ICAR Head Quarters, University Vice-Chancellors, Directors of the ICAR Institutes conveyed by ICAR-IASRI New Delhi.
38.	11.08.2020	ICAR-DCFR Bhimtal	◆ Webinar on Meeting of the Directors of ICAR Fisheries Institutes' and Senior Officers of SMD under the chairmanship of DDG (FS), ICAR.
39.	13.08.2020	ICAR-DCFR Bhimtal	◆ Webinar on discussion of Inland Fisheries Resources under the chairmanship of Joint Secretary (Inland Fy.).
40.	18.08.2020	ICAR-DCFR Bhimtal	◆ Webinar with Danish Experts and Indian Officials and farmers on Trout Culture in India – A way Forward Conveyed by Executive Director (Tech -1), NFDB Hyderabad.
41.	20.08.2020	ICAR-DCFR Bhimtal	◆ Webinar on NICRA Review Meeting.
42.	20.08.2020	ICAR-DCFR Bhimtal	◆ Webinar on NFDB–CIFA developing perspective plan for Himalayan States.
43.	24.08.2020	ICAR-DCFR Bhimtal	◆ Webinar on import of trout eyed ova with Director of Fisheries, Government of Sikkim, Sikkim.
44.	29.08.2020	ICAR-DCFR Bhimtal	◆ Webinar on inauguration of the Administrative and Academic building of the RLB Central Agricultural University, Jhansi by Hon'ble PM _participation.
45.	03.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on 25th meeting of the National Committee on Introduction of Exotic Aquatic Species into Indian Waters under the chairmanship of Sh. Sagar Mehra, Joint Secretary, Department of Fisheries, Animal Husbandry & Dairying, New Delhi.
46.	03.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on ASRB Interview for promotion in respect of Dr. Deepjyoti Baruah, Senior Scientist, ICAR-DCFR Bhimtal to the post of Principal Scientist.

S. No	Date	Place	Purpose
47.	04.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on DPC committee for merit promotion of Technical Personal (Category-III). (Sh. R.S. Haldar)
48.	05.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on DPC committee for merit promotion of Technical Personal (Category-III). (Sh. BaldevSingh)
49.	07.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on Uttarakhand Rajya Matasya Palak Vikas Abhikaran Meeting convened by Directorate of Fisheries, Badasi Grant (Dhanyadi), Dehradun under the chairmanship of Smt. Rekha Arya, Hon'ble Minister of Fisheries, Dehradun.
50.	08.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on meeting with DDG (F.S), ICAR, New Delhi.
51.	08.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on DPC committee for merit promotion of Technical Personal (Category-II). (Sh. Gopal).
52.	10.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on the occasion of the 26th Pt. Govind Ballabh Pant Memorial Lecture and Annual Day Function of the Institute (GBPNIHE) as Honoured Guest at G.B.Pant National Institute of Himalayan Environment, Kosi -Katarmal, Almora.
53.	10.09.2020	ICAR-DCFR Bhimtal	◆ E-launch of Pradhan Mantri Matsya Sampada Yojana (PMMSY). (Foundation laying of various academic facilities and inauguration in Dr. Rajendra Prasad Central Agricultural University, Samastipur Bihar (Atamanirbhar Bihar).
54.	11.09.2020	ICAR-DCFR Bhimtal	◆ Webinar of PM address on Shiksha Parv.
55.	11.09.2020	ICAR-DCFR Bhimtal	◆ VC under Co-chairpersonship of Secretary (M/o FPI & D/o Fisheries)
56.	11.09.2020	ICAR-DCFR Bhimtal	◆ Introductory online meeting of Third Party Evaluation of DARE/ ICAR schemes under the chairmanship of DDG (FS).
57.	16.09.2020	ICAR-DCFR Bhimtal	◆ Interaction meeting with all the Deans of Fisheries College of the Country with DoF under the Chairmanship of the Secretary DoF.
58.	18.09.2020	ICAR-DCFR Bhimtal	◆ Virtual Interactive Meet under SCSP Programme on ''Fish Production and Productivity Enhancement among Scheduled Caste Fish Farmers through Scientific Hill Fish Farming under the chairmanship of Dr. Pravin P. ADG (M.Fy.).
59.	24.09.2020	ICAR-DCFR Bhimtal	◆ Webinar on ICAR-DCFR 33rd Foundation Day in collaboration of Coldwater Fisheries Society of India (CFSI) under the chairmanship of Director & DDG (FS) participated as a Chief Guest.
60.	26.09.2020	ICAR-DCFR Bhimtal	◆ Meeting with all Directors' of ICAR Fisheries Institutes under the chairmanship of DDG (F.S).
61.	28.09.2020	ICAR-DCFR Bhimtal	◆ Meeting with Sh. Manas D. Arora CA on Solar Rooftop Meet
62.	03.10.2020	ICAR-DCFR Bhimtal	◆ Meeting with Director, ICAR-IARI along with All Directors' and ADG's for Agro-economy and Food Security-Review meeting under the chairmanship of The Secretary DARE & DG ICAR New Delhi.
63.	05.10.2020	ICAR-DCFR Bhimtal	◆ Meeting of SCSP Training Programme on Scientific Fish Culture with Assam Agriculture University (AAU), Assam.

S. No	Date	Place	Purpose
64.	09.10.2020	ICAR-DCFR Bhimtal	◆ Meeting with British High Commission on 'Seed Funding and Research Linkage' under the chairmanship of DDG (F.S).
65.	15.10.2020	ICAR-DCFR Bhimtal	◆ Stakeholders meeting for discussion with World Bank Project Preparation Mission for Fisheries Sector COVID-19 Recovery Project-New Value & Chains & Diversification (Ornamental Fisheries, Coldwater Fisheries, Seaweed mariculture).
66.	15.10.2020	ICAR-DCFR Bhimtal	◆ First Review Meeting of Network Project on Mahseer entitled "Species and stock validation of mahseer species of genus Tor and Neolissocheilus from Central and North East Himalayan region for its propagation and conservation" under NEH activities of this Institute under the chairmanship of DDG (F.S)
67.	16.10.2020	ICAR-DCFR Bhimtal	◆ Webinar on "Release of Commemorative Coin" on the occasion of 75th Anniversary of Food & Agriculture Organisation (FAO) & World Food Day addressed by Sh. Narendra Modi, Hon'ble PM of India.
68.	19.10.2020	ICAR-DCFR Bhimtal	◆ Review Meeting- Foreign-aided International Collaborative Research Projects under Fisheries Science Division (FSD) under the chairmanship of DDG (F.S).
69.	20.10.2020	ICAR-DCFR Bhimtal	◆ "Collaboration on Cold water fisheries in the hills" to develop common understanding for better implementation of Cold Water fishery interventions in the hills, Kalimpong District.
70.	17.11.2020	ICAR-DCFR Bhimtal	◆ Monthly Meeting of the Division (Senior Officers Meeting of Fisheries SMD) under the chairmanship of DDG (F.S).
71.	21.11.2020	ICAR-DCFR Bhimtal	◆ Webinar on World Fisheries Day- 2020" under the chairmanship of Director & DDG (FS) participated as a Patron & Dr. Kartik Baruah, Associate Senior Lecturer and Head Artemia Division, Swedish University of Agricultural Sciences, Department of Animal Nutrition and Management Sweden as a Resource Person conducted by ICAR-DCFR Bhimtal with special lecture on "Can Aquaculture become the blue biotechnology of the Future".
72.	24.11.2020	ICAR-DCFR Bhimtal	◆ Webinar on Third Party Evaluation.
73.	25.11.2020	ICAR-DCFR Bhimtal	◆ Webinar on Fisherman training on "Mahseer production practices" organized by ICAR-DCFR.
74.	26.11.2020	ICAR-DCFR Bhimtal	◆ Webinar on Vaarshik Rajbhasha Samaroh -2020 organized by ICAR, New Delhi. Sh. Narendra Singh Tomar Ji, Hon'ble Minister of Agriculture & Farmers Welfare participated as a Chief Guest and Sh. Kailash Chaudhary, Hon'ble Minister of State for Central Agriculture & Farmers Welfare participated as a Guest of Honor.

- A.K. Giri attended a five days training program on 'Analysis of Experimental data using SAS' during 9-14 Nov 2020, organized by ICAR-NAARM, Hyderabad.
- A.K. Giri attended CAS webinar series on "Save our ocean, Save our health" during 14-16 May, 2020 organized by Annamalai University, Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Tamil Nadu, India.
- A.K. Giri participated in 5 days Online Nanotech Training during 23-27 Nov 2020, organized by ICAR-CIRCOT, Mumbai.
- A.K. Giri participated in launching of E-Gopala App. and Pradhan Mantri Matshya Sampada Yojana (PMMSY) on 10th September 2020 & Sikshak Parv on 11th September 2020.
- A.K. Giri participated in National webinar on Climate resilient livestock production: Opportunities and Threats on 3rd November 2020, organized by ICAR-NIASM, Baramati.
- A.K. Giri participated in the "International Webinar on Mahseer" organized by ICAR-DCFR, Bhimtal on 16th December 2020 with the deliberation of lectures on 'Mahseer (*Tor spp.*) of the World: status and conservation challenges' and 'Mahseer in India: strategies & approaches for rehabilitation and conservation' by Dr. Adrian Pinder, Associate Director, Bournemouth University, UK and Dr. M.S. Akhtar, Scientist respectively.
- A.K. Giri participated in the Hon'ble Prime Minister's virtual programme on Vaishwik Bharatiya Vaigyanik (VAIBHAV) Summit, Global Summit of Overseas and Resident Indian Scientists and Academicians during Oct-Nov 2020.
- A.K. Giri participated in the Hon'ble Prime Minister's virtual programme on RAISE 2020 during 5-9 October 2020.
- A.K. Giri participated in the National webinar on "Increasing Coldwater Fish Production and Enhancing Farmers Income" organized by ICAR-DCFR, Bhimtal on the eve of 20th National Fish Farmers Day on 10th July 2020.
- A.K. Giri participated in the National webinar on Climate-smart integrated farming system followed by scientist-farmer interactive meet on 18th September 2020, organized by ICAR-NIASM, Baramati, Pune.
- A.K. Giri participated in the Prime Minister's "Mann Ki Baat 2.0" programme such as inauguration of Rani Lakshmi Bai Central Agriculture University, Jhansi on 29th August 2020.
- A.K. Giri participated in the Resource Conservation Technology (V16H2S2) under VAIBHAV Summit on 9th October 2020.
- A.K. Giri participated in the virtual interactive meet on 'Fish production and productivity enhancement among scheduled caste fish farmers through scientific hill fish farming' organized by ICAR-DCFR, Bhimtal in collaboration with College of Fisheries, AAU, Raha, Assam; Livestock Research Station, AAU, Mondira, Assam and Dept. of Fisheries, Govt. of Uttarakhand under SCSP programme on 18th September 2020.
- A.K. Giri participated in the virtual interactive meet, organized on the eve of 33rd Foundation Day by ICAR-DCFR on 24th September 2020, Bhimtal in collaboration with Coldwater Fisheries Society of India.
- A.K. Giri participated in the Virtual Review meeting of the Network Project on Ornamental Fish Breeding and Culture with all other partner institutes, ADGs (Inland and Marine Fy.), representatives from SMD, Fisheries on 14th August 2020 and was chaired by Dr. J.K. Jena, DDG (Fisheries Science), ICAR.
- A.K. Giri participated in the virtual training program on Breeding and seed production of rainbow trout and its best management practices on 29.12.2020, organized by ICAR-DCFR, Bhimtal.
- A.K. Giri participated in the webinar lecture series on 'Indian Fisheries & Sustainable Development Goals' and 'Fisheries and Aquaculture Entrepreneurship in India: Present Status and Future Outlook' by Dr. M.V. Gupta,

World Food Prize Laureate and Dr. J.K. Jena, DDG (Fisheries Science), ICAR respectively on the eve of World Fisheries Day, 21st November 2020, organized by ICAR-CIFA, Bhubaneswar.

- A.K. Giri participated in the webinar lectures on 'Poverty and hunger through the prism of Gandhian principles' and 'India wakes to its fundamental simplicity' (speaker: Shri Arun Tiwari, Indian Missile Scientist, Author and Professor, Co-author of Wings of Fire) on 29th September 2020 and 2nd October 2020 respectively, organized by ICAR-IIMR, Hyderabad under the webinar series on "Gandhiji's thought in agriculture and agricultural research".
- A.K. Giri participated in the webinar on 'Ecology includes the economy' (lecture by Padma Bhushan Dr. Anil Prakash Joshi) on 1st October 2020, organized by ICAR-IGFRI, Jhansi.
- A.K. Giri participated in the webinar on Generic Online Training Course in Cyber Security on 16th December 2020, organized by Ministry of Electronics and Information Technology (MeitY), Govt. of India.
- A.K. Giri participated the 150th Mahatma Gandhi Anniversary Webinar Series during 25-30 Sept. 2020, organized by ICAR-NIASM, Baramati.
- Amit Pande participated in International Webinar on Mahseer Wednesday, 16th December 2020.
- Amit Pande participated in National Fish Farmers Day entitled "Increasing Coldwater Fish Production and enhancing farmer's income" on 10th July 2020.
- Amit Pande participated in National Webinar Coldwater Fisheries for Nutritional Security and Livelihood of the Hill Population. Mon 20th Jul 2020.
- Amit Pande participated in National webinar on Coldwater fisheries for nutritional security and livelihood of the hill population on 12th July 2020 organized by ICAR-DCFR.
- Amit Pande participated in Virtual Interactive Meet under SCSP Programme on ''Fish Production and Productivity Enhancement among Scheduled Caste Fish Farmers through Scientific Hill Fish Farming' 18th September 2020.
- Amit Pande participated in किसानों के साथ माननीय प्रधानमंत्री की बातचीत। माननीय प्रधानमंत्री के साथ वीडियो सम्मेलन में भाग लिया गया। 25 दिसंबर, 2020, पीएम इंटरेक्शन्सटीम, प्रधानमंत्री कार्यालय भारत सरकार।
- B.S. Kamalam attended the conference on 'Ecosystem Health and Fisheries of Indian Inland Waters: Multiple Stressors, Management & Conservation' held at GBPUAT, Pantnagar during 17-19 February 2020 and delivered an oral presentation on 'Environment and husbandry factors shape the gut microbiome of Himalayan snow trout, *Schizothorax richardsonii*'.
- B.S. Kamalam attended the International webinar on Advances in Aquaculture Nutrition Research organised by Tamil Nadu Dr. J. Jayalalithaa Fisheries University, DIVA, Chennai, during 24-25 September 2020 and delivered an invited talk on 'Classical and advanced research approaches for fish meal replacement in fish feeds'.
- B.S. Kamalam attended the online thematic (fisheries) technical program finalization workshop of National Innovations on Climate Resilient Agriculture project on 20th August 2020 and presented the progress and proposal of ICAR-DCFR project component.
- B.S. Kamalam attended the stakeholder meeting for discussion with World Bank Preparation Mission for Fisheries Sector Covid-19 Recovery Project-New Value Chains & Diversification (Ornamental Fisheries, Cold Water Fisheries, Seaweed mariculture) organised by Ministry of Fisheries, Animal Husbandry & Dairying on 15th October 2020.
- B.S. Kamalam attended the Vaishwik Bharatiya Vaigyanik (VAIBHAV) virtual summit session V16H6 on 'Modern Fisheries, Aquaculture and

Seed Production' organised by ICAR-Central Institute of Freshwater Aquaculture on 16th October 2020.

- B.S. Kamalam attended the webinar on 'Can aquaculture become the blue biotechnology of the future' organised by Coldwater Fisheries Society of India on 21st November 2020.
- B.S. Kamalam attended the webinar on 'Circular economy and the role of fish meal and fish oil producers' organised by World Sustainability Organization on 23rd September 2020
- B.S. Kamalam attended the webinar on 'Harnessing Pradhan Mantri Matsya Sampada Yojana (PMMSY) scheme for Aquapreneurship Development in Tamil Nadu' organised by Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Chennai on 10th September 2020.
- B.S. Kamalam attended the Zonal Technology and Management Centre webinar on 'Entrepreneurship opportunities in Indian fisheries sector' organized by ICAR-Central Institute of Fisheries Technology, Kochi on 12th June 2020.
- B.S. Kamalam completed the ICAR-NAHEP sponsored training programme on 'Science communication for smart scholars' organised by ICAR-Central Institute of Fisheries Education, Mumbai, during 12-25 May 2020.
- B.S. Kamalam participated in the virtual workshop cum training programme on 'Intellectual property rights in agricultural research and education in India' organized by ICAR IP&TM unit and NAHEP, New Delhi, during 12-28 September 2020.
- Ciji Alexander attended the International webinar on "Advances in aquaculture nutrition-2020" hosted by Tamil Nadu Dr. J. Jayalalithaa Fisheries University during 24-25th September 2020.
- Ciji Alexander attended the webinar on "Can aquaculture become the blue biotechnology of the future?" organized by the Coldwater Fisheries Society of India on 21st November 2020.
- Ciji Alexander attended the webinar on "Increasing coldwater fish production and enhancing farmer's income" organized by ICAR-DCFR on 10th July, 2020.
- D. Thakuria attended the webinar on 'Can aquaculture become the blue biotechnology of the future' organised by Coldwater Fisheries Society of India on 21st November 2020.
- D. Thakuria attended workshop on "IPR dimensions in coldwater fisheries" organized at ICAR-DCFR, Bhimtal on 7th March 2020.
- D. Thakuria gave a poster presentation on Development of Antimicrobial Peptide through Artificial Designing Approach" under scientific session, Emerging, re-emerging and transboundary diseases affecting livestock and control measures, in International e-conference on "New generation vaccines and animal disease control strategies: roadmap for enhancement of animal and human health" organized by Department of Veterinary Microbiology, Veterinary college and research institute, Orathanadu, Tamil Nadu and Department of Veterinary Microbiology, C.V.Sc.& A.H. Pookode, Kerala, during 02-04th December 2020.
- D. Thakuria gave an oral presentation on "Antimicrobial activity of a novel bio-engineered synthetic peptide against common fish pathogen" in Online International Conference on "Science, Technology & Environment: Current Scenario and Future Challenges (ICSTE-2020)" held at Career Point University, Himachal Pradesh, India on 27th & 28th November, 2020.
- D. Thakuria participated in 21 days International online training program on "Physio-biochemical and biotechnological approaches for optimization of health and reproduction in animals" held at College of Veterinary Science and Animal Husbandry, Mhow, Madhya Pradesh during 1-21st December, 2020.
- D. Thakuria participated in International e-conference on "New generation vaccines and animal disease control strategies: roadmap for

enhancement of animal and human health" organized by Department of Veterinary Microbiology, Veterinary college and research institute, Orathanadu, Tamil Nadu and Department of Veterinary Microbiology, C.V.Sc. & A.H. Pookode, Kerala, during 02-04th December 2020.

- D. Thakuria participated in International Webinar on Mahseer held at ICAR-DCFR, Bhimtal on 16th December 2020.
- D. Thakuria participated in National Webinar in "Physical Chemistry" organized by Karnataka Science and Technology Academy [KSTA], held during 24-26th November, 2020.
- D. Thakuria participated in Online International Conference On "Science, Technology & Environment: Current Scenario and Future Challenges (ICSTE-2020)" held at Himachal Pradesh, India during 27-28th November 2020.
- D. Thakuria participated in the virtual interactive meet, organized on the eve of 33rd Foundation Day by ICAR-DCFR on 24th September 2020, Bhimtal in collaboration with Coldwater Fisheries Society of India.
- D. Thakuria participated in Virtual training on breeding and Seed production of Rainbow trout and its best management practices held at ICAR-DCFR on 29th December 2020.
- D. Thakuria participated in webinar on "Coldwater fisheries for Nutritional security and Livelihood of the hill population" held at ICAR-DCFR on 20th July 2020.
- D. Thakuria participated in 5th Biennial e-Conference of PAI and International e-Symposium on the "Probiotics and Immunity: way forward to microbial therapy" held during 19 – 20th November 2020.
- Kh. Victoria Chanu attended the webinar on 'Can aquaculture become the blue biotechnology of the future' organised by Coldwater Fisheries Society of India on 21st November 2020.
- Kh. Victoria Chanu attended workshop on "IPR dimensions in coldwater fisheries" organized at ICAR-DCFR, Bhimtal on 7th March 2020.
- Kh. Victoria Chanu gave an oral presentation on "Evaluation of Puf locus targeted PCR for easy identification of *Saprolegnia parasitica*" in International Conference on Environmental, Agriculture and Rural Development (EARD-2020) organized by International Research and Development Centre for Publication (IRDCP) held during 17-18th October, 2020.
- Kh. Victoria Chanu gave an oral presentation on "First record of *Achlya bisexualis* infection in endangered golden mahseer, *Tor putitora* (Hamilton, 1822)" in Online International Conference on "Science, Technology & Environment: Current Scenario and Future Challenges (ICSTE-2020)" held at Career Point University, Himachal Pradesh, India on 27th & 28th November, 2020.
- Kh. Victoria Chanu participated in "International Conference on Environmental, Agriculture and Rural Development(EARD-2020)" held during 17-18th October, 2020.
- Kh. Victoria Chanu participated in International e-conference on"New generation vaccines and animal disease control strategies: roadmap for enhancement of animal and human health" organized by Department of Veterinary Microbiology, Veterinary college and research institute, Orathanadu, Tamil Nadu and Department of Veterinary Microbiology, C.V.Sc.& A.H. Pookode, Kerala, during 02-04th December 2020.
- Kh. Victoria Chanu participated in International Webinar on Mahseer held at ICAR-DCFR, Bhimtal on 16th December 2020.
- Kh. Victoria Chanu participated in Online International Conference On "Science, Technology & Environment: Current Scenario and Future Challenges (ICSTE-2020)" held at Himachal Pradesh, India during 27-28th November 2020.

- Kh. Victoria Chanu participated in the virtual interactive meet, organized on the eve of 33rd Foundation Day by ICAR-DCFR on 24th September 2020, Bhimtal in collaboration with Coldwater Fisheries Society of India.
- Kh. Victoria Chanu participated in Virtual training on breeding and Seed production of Rainbow trout and its best management practices held at ICAR-DCFR on 29th December 2020.
- Kh. Victoria Chanu participated in webinar on "Coldwater fisheries for Nutritional security and Livelihood of the hill population" held at ICAR-DCFR on 20th July 2020.
- Kh. Victoria Chanu participated in 21 days International online training program on "Physio-biochemical and biotechnological approaches for optimization of health and reproduction in animals" held at College of Veterinary Science and Animal Husbandry, Mhow, Madhya Pradesh during 1-21st December, 2020.
- Kh. Victoria Chanu participated in 5th Biennial e-Conference of PAI and International e-Symposium on the "Probiotics and Immunity: way forward to microbial therapy" held during 19 – 20th November 2020.
- Kh. Victoria Chanu participated in International e-Conference on" Expanding Horizons in Physio-Biochemical and Molecular Approaches for Improving Livestock Health and Production" at Tamil Nadu, India during 19 -20th October, 2020.
- Kh. Victoria Chanu participated in National Webinar in "Physical Chemistry" organized by Karnataka Science and Technology Academy [KSTA], held during 24-26th November, 2020.
- M. S. Akhtar attended a webinar on "Coldwater Fisheries for Nutritional Security and livelihood of the hill population" organized by the Coldwater Fisheries Society of India on 20th July, 2020.
- M. S. Akhtar attended the International webinar on "Advances in aquaculture nutrition-2020" hosted by Tamil Nadu Dr. J. Jayalalithaa Fisheries University during 24-25th September 2020.
- M. S. Akhtar attended the webinar on "Can aquaculture become the blue biotechnology of the future?" organized by the Coldwater Fisheries Society of India on 21st November 2020.
- M. S. Akhtar attended the webinar on "Increasing coldwater fish production and enhancing farmer's income" organized by ICAR-DCFR on 10th July, 2020.
- M. S. Akhtar participated and delivered an oral presentation on 'Effect of temperature on maturity and other physiological indicators of golden mahseer broodstock under captive conditions' in International Conference on 'Impact of Climate Change on Hydrological Cycles, Ecosystem, Fisheries and Food Security (ClimFishCon 2020)' organized by CUSAT, Kochi during 11-14 February, 2020 at Le Meridien Convention Centre, Kochi.
- Neetu Shahi attended "International Webinar on Mahseer" on 16th December 2020, organized by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, Uttarakhand, India.
- Neetu Shahi attended and gave oral presentation on topic "RNA-Seq revealed differentially expressed reproduction related genes in the brain of matured golden mahseer, *Tor putitora*" at "2nd International Mahseer Conference" organized by Maejo University, Chiang Mai, Thailand from 11th - 15th February 2020. The travel fellowship to attend this conference was provided by Department of Biotechnology CTEP, Delhi, India.
- Neetu Shahi attended national webinar on "Challenges, Opportunities and the Future of Indian Fisheries post COVID-19 Era" organized by College of Fisheries Science, JAU, Veraval, Gujarat from 28th – 30th May, 2020.
- Neetu Shahi attended one day online workshop of "Training Management Information System (TMIS) for HRD nodal officers of ICAR" on

8th May 2020, organised by Human Resource Management unit of ICAR, New Delhi, India.

- Neetu Shahi attended online training on "Breeding & seed production of rainbow trout and its best management practices" on 29th December 2020, organized by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, India

Fig.: Women participants at 2nd International Mahseer Conference at Chiang Mai, Thailand on Feb 2020

- Neetu Shahi attended online webinar on "Gene Editing for Agriculture, Society & Sustainable Development: Prospects and Perspectives" on 15th December 2020, organized by Tata Institute for Genetics and Society (TIGS), India.
- N. N. Pandey attended the conference on 'Ecosystem Health and Fisheries of Indian Inland Waters: Multiple Stressors, Management & Conservation' held at GBPUAT, Pantnagar during 17-19th February 2020.
- N. N. Pandey attended EFC meeting organized by Fisheries Sciences Division –ICAR, New Delhi and chaired by DDG-Fisheries on 17th March 2020.
- N. N. Pandey participated in National Webinar on "Mahseer Fisheries in Meghalaya: Startegies for Conservation and Propagation" on 11th June 2020 at ICAR-DCFR Bhimtal in collaboration with the Department of Fisheries, Government of Meghalaya.
- N. N. Pandey participated in the International webinar on 'Strategies against COVID-19 pandemic' organized by Dept. of Biotechnology, Kumaun University, Nainital on 18th June 2020.
- N. N. Pandey participated in XXVI meeting of ICAR Regional Committee No. I comprising the states of Uttarakhand, HP & the UTs of J&K & Ladakh being organized on 30th June, 2020.
- N. N. Pandey participated in the National webinar on "Increasing Coldwater Fish Production and Enhancing Farmers Income" organized by ICAR-DCFR, Bhimtal on the eve of 20th National Fish Farmers Day on 10th July 2020.
- N. N. Pandey participated in National webinar on Coldwater fisheries for nutritional security and livelihood of the hill population on 12th July 2020 organized by ICAR-DCFR.
- N. N. Pandey coordinated a webinar on "Biosafety measures and quarantine of imported improved strain of rainbow trout" for departmental personnel of Directorate of fisheries, Sikkim state and NFDB, Hyderabad on 24th August 2020.
- N. N. Pandey participated in the virtual interactive meet on 'Fish production and productivity enhancement among scheduled caste fish farmers through scientific hill fish farming' organized by ICAR-DCFR, Bhimtal on 18th September 2020.
- N. N. Pandey participated in 5th meeting of the Technical Expert Committee on Aquaculture and Marine Biotechnology and presented progress of the project entitled "triploidy induction in rainbow trout for aquaculture enhancement and reducing environmental risk" on 23rd September 2020.
- N. N. Pandey participated in the virtual interactive meet, organized on the eve of 33rd Foundation Day by ICAR-DCFR on 24th September 2020, Bhimtal in collaboration with Coldwater Fisheries Society of India.
- N. N. Pandey participated in International Web Conference on Perspective on Agricultural and Applied Sciences in COVID-19 Scenario (PAAS-2020), organized by the Agricultural & Environmental Technology Development Society (AETDS), Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh; Shobhit Institute of Engineering & Technology, Meerut, India; Soils, Water and Environmental Res. Inst, (SWERI), Agriculture Research Center, (ARC) Giza, Egypt, Rajiv

Gandhi Central University, Itanagar, and Corteva agriscience during October 4-6, 2020.

- N. N. Pandey attended the stakeholder meeting for discussion with World Bank Preparation Mission for Fisheries Sector Covid-19 Recovery Project-New Value Chains & diversification (Ornamental Fisheries, Cold Water Fisheries, Seaweed mariculture) organised by Ministry of Fisheries, Animal Husbandry & Dairying on 15th October 2020.
- N. N. Pandey attended the webinar on 'Can aquaculture become the blue biotechnology of the future' organised by Coldwater Fisheries Society of India on 21st November 2020.
- N. N. Pandey participated and delivered a lecture in training programme on "Value addition in fish" at village Verijala, district Nainital under PMMSY scheme on date 9th December 2020.
- N. N. Pandey coordinated a Virtual Programme for Students of Fisheries College and Research Institute, Toothukudi and presented an overview of Coldwater Fisheries on 14th December, 2020.
- N. N. Pandey participated in the "International Webinar on Mahseer" organized by ICAR-DCFR, Bhimtal on 16th December 2020.
- N. N. Pandey participated in किसानों के साथ माननीय प्रधानमंत्री की बातचीत। माननीय प्रधानमंत्री के साथ वीडियो सम्मेलन में भाग लिया गया। 25 दिसंबर, 2020, पीएम इंटरेक्शन्सटीम, प्रधानमंत्री कार्यालय भारत सरकार।
- N. N. Pandey participated in Interactive Lecture on Biofloc technology for aquaculture: Benefits and Opportunities, conducted by IDP-NAHEP, Pantnagar on 26th December 2020.
- N. N. Pandey coordinated virtual training program on Breeding and seed production of rainbow trout and its best management practices on 29th December 2020, organized by ICAR-DCFR, Bhimtal.
- N. N. Pandey coordinated closing ceremony of Swachhata Pakhwada and awareness workshop for PMMSY scheme on 30th Dec. 2020.
- Parvaiz Ahmad Ganie attended International webinar on Mahseer organized by ICAR-DCFR, Bhimtal on 16th December 2020 with the deliberation of lectures on 'Mahseer (*Tor spp.*) of the World: status and conservation challenges' and 'Mahseer in India: strategies & approaches for rehabilitation and conservation'.
- Prakash Sharma attended Indian Fish Nutritionist Forum Online Meet on 7th November, 2020.
- Prakash Sharma attended International webinar on Mahseer organized by ICAR-DCFR, Bhimtal on 16th December 2020 with the deliberation of lectures on 'Mahseer (*Tor spp.*) of the World: status and conservation challenges' and 'Mahseer in India: strategies & approaches for rehabilitation and conservation'.
- Prakash Sharma attended webinar on "Fish for Change" organized by Centre for Sustainable Tropical Fisheries and Aquaculture (CSTFA) 11th August 2020.
- Prgyan Dash attended webinar for "Launch of The State of the World Fisheries and Aquaculture", conducted by Food and Agriculture Organization on 8th June 2020.
- Prgyan Dash attended webinar on "Fish Farming with Biofloc Technology" on 16th October 2020 conducted by Karnataka Veterinary Animal & Fisheries Science University.
- Prgyan Dash attended webinar on Virtual Training on Recirculating Aquaculture System for Intensive Farming of Rainbow Trout on 29th Jan 2021
- Prgyan Dash attended webinar on World Fisheries Day-2020 on 21st Nov 2020 conducted by Coldwater Fisheries Society of India.
- R.S. Tandel attended international webinar on "Launch of The State of the World Fisheries and Aquaculture", conducted by Food and Agriculture Organization on 8th June 2020
- R.S. Tandel attended international webinar on "Beauty and the Beast: Important Parasites of Fish" on 9th Dec 2020 organised by Network of Aquaculture Centres in Asia-Pacific, Thailand.

- R.S. Tandel attended national webinar on "Fish Farming with Biofloc Technology" on 16th October 2020 conducted by Karnataka Veterinary Animal & Fisheries Science University
- R.S. Tandel attended Virtual Interactive Meet under SCSP, ICAR DCFR on 18th September 2020
- R.S. Tandel attended webinar on World fisheries day-2020 on 21st Nov 2020 conducted by Coldwater Fisheries Society of India
- R.S. Haldar participated in the "Conference on Ecosystem Health & Fisheries of Indian Inland Waters: Multiple Stressors, Management & Conservation" organized by Inland Fisheries Society of India (IFSI), Barrackpore in collaboration with College of Fisheries, GBPUAT, Pantnagar; Aquatic Ecosystem Health & Management Society, Canada; ICAR-CIFRI, Barrackpore and Professional Fisheries Graduates Forum (PFGF) during February 17-19, 2020 at Govind Ballav Pant University of Agriculture and Technology, Pantnagar (Uttarakhand).
- R.S. Haldar participated in the 1st Angling Competition cum Interactive Workshop (A step Towards Promotion of Mahseer Sport Fisheries and Eco-Tourism along the Confluence of River Ganga and Nayar) jointly organized by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal; Department of Fisheries, Pauri Garhwal, Govt. of Uttarakhand; Department of Tourism, Pauri Garhwal, Govt. of Uttarakhand and District Administration, Pauri Garhwal, Govt. of Uttarakhand during 20-22 November, 2020.
- R.S. Haldar participated in the International Webinar on the "Exploring the impact of COVID 19 on the ecosystem health of rivers and its dolphin population: present status and future strategy for conservation in India-Bangladesh-Myanmar-Nepal" jointly organized by ICAR-CIFRI, NMCG, IFSI PGFG and AEHMS during 24-25 August, 2020.
- R.S. Haldar participated in the International Webinar on "Small scale Fisheries in Inland Open Waters: Status and Opportunities" organized by ICAR-CIFRI, Barrackpore in collaboration with IFSI and PGFG during 9-10 September, 2020.
- R.S. Haldar participated in the International Webinar on "Challenges and Opportunities for Fisheries under the COVID Pandemic – Country perspectives" organized by College of Fisheries, Central Agricultural University, Imphal on 29th September, 2020.
- R.S. Haldar participated in the National Webinar on "Coldwater Fisheries for Nutritional Security and Livelihood of the Hill Population" organized by Coldwater Fisheries Society of India, Bhimtal on 20th July, 2020.
- R.S. Haldar participated in the National Webinar on "Capture Fisheries in Post-Pandemic (COVID-19) Situation: Environmental and Economic Perspectives" organized by Department of Fishery Economics and Statistics, Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata on 28th August, 2020.
- R.S. Haldar participated in the International Webinar on "Current Advances in Epigenetics and Vaccine Development in Aquaculture" organized by Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana, Punjab on 9th August, 2020.
- R.S. Haldar participated in the "World Food Day 2020" and Webinar on "Fish Farming with Biofloc Technology" organized by Karnatakas Veterinary, Animal & Fishery Sciences University, Bidar and Fisheries Research and Information Centre, Hebbal, Bengaluru, India on 16th October, 2020.
- R.S. Haldar participated in the National Webinar on "Fisheries in COVID Times and After: Gender, Ground Truths and Growth" organized by Department of Fisheries Extension, Economics and Statistics, Dr. M.G.R. Fisheries College and Research Institute, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Thalainayeru during 12-16 October, 2020.

- R.S. Haldar participated in National Webinar on "Fisheries in COVID Times and After: Gender, Ground Truths and Growth" organized by Department of Fisheries Extension, Economics and Statistics, Dr. M.G.R. Fisheries College and Research Institute, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Thalainayeru during 12-16 October, 2020.
- R.S. Haldar participated in the "World Fisheries Day 2020" and Webinar on "Can Aquaculture become the Blue Biotechnology of the future" organized by Coldwater Fisheries Society of India, Bhimtal on 21st November, 2020.
- R.S. Haldar participated in the International Webinar on "Mahseer (*Tor* spp.) of the World: Status and Conservation Challenges" organized by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal on 16th December, 2020.
- R.S. Haldar participated in the "20th Indian Science Communication Congress (ISCC-2020) and Web-Conference on COVID19 Pandemic: Assessing Public Awareness and Response" organized jointly by Indian Science Writers' Association; Indian Science Communication Society; Vigyan Bharati Awadh Prant and Faculty Development Centre, HNB Garhwal Central University on 20th December, 2020.
- R.S. Patiyal attended webinar on Entrepreneurship opportunities in Indian Fisheries Sector organized by ICAR-Central Institute of Fisheries Technology (CIFT), Cochin on 12th June, 2020.
- R.S. Patiyal attended National Skill Development Agency – Stakeholder Consultation organized by Ministry of Skill Development and Entrepreneurship on 17th July 2020.
- R.S. Patiyal attended Intellectual property rights in agricultural research and education in India organized by National Agricultural Higher Education Project (NAHEP) and Intellectual Property and Technology Management (IP&TM) unit of ICAR during 12-28 September, 2020.
- R.S Patiyal participated in webinar "Increasing coldwater Fish production and enhancing farmers income. on the occasion National Fish Farmers' Day, on 10th July 2020 organised by ICAR-DCFR , Bhimtal.
- R.S Patiyal attended workshop organised by district administration at village Pangu on 29th November. 2020, and also organised Exhibition, distributed seed and feed to tribal farmer of the region.
- R.S Patiyal attended webinar on "National innovations in climate resilient agriculture" organized by ICAR - Central Research Institute for Dryland Agriculture (CRIDA) Hyderabad on 20th August, 2020.
- R.S Patiyal participated in the PM Programme "Inaugurations of Academic and Administrative Building of Rani Lakshmi Bai Central Agricultural University Jhansi.
- R.S Patiyal participated in Swachhata pakhwada organised by ICAR-DCFR, during 16031 December, 2020 and distributed ornamental fishes to farmers.
- R.S Patiyal participated in Webinar on the occasion of World Fisheries Day on 21st November, 2020 organized by ICAR-DCFR, Bhimtal.
- R.S Patiyal participated in Conference on Ecosystem Health and Fisheries of Indian Inland Waters: Multiple Stressors, Management & Conversations during 17-19 February, 2020, at GBPUA&T Pantnagar.
- Rajesh M attended the conference on 'Ecosystem Health and Fisheries of Indian Inland Waters: Multiple Stressors, Management & Conservation' held at GBPUAT, Pantnagar during 17-19 February 2020 and delivered an oral presentation on 'Environment and husbandry factors shape the gut microbiome of Himalayan snow trout, Schizothorax richardsonii'.
- Rajesh M. attended the International webinar on Advances in Aquaculture Nutrition Research organised by Tamil Nadu Dr. J. Jayalalithaa Fisheries University, DIVA, Chennai, during 24-25 September 2020.

- Rajesh M. attended the online thematic (fisheries) technical program finalization workshop of National Innovations on Climate Resilient Agriculture project on 20 August 2020 and presented the progress and proposal of ICAR-DCFR project component.
- Rajesh M. attended the Vaishwik BharatiyaVaigyanik (VAIBHAV) virtual summit session V16H6 on 'Modern Fisheries, Aquaculture and Seed Production' organised by ICAR-Central Institute of Freshwater Aquaculture on 16th October 2020.
- Rajesh M. attended the webinar on 'Can aquaculture become the blue biotechnology of the future' organised by Coldwater Fisheries Society of India on 21st November 2020.
- S. Ali Attended EFC meeting organized by Fisheries Sciences Division –ICAR, New Delhi and chaired by DDG-Fisheries on 17th March 2020.
- S. Ali attended the webinar on 'Can aquaculture become the blue biotechnology of the future' organised by Coldwater Fisheries Society of India on 21st November 2020.
- S. Ali Attended workshop on "IPR dimensions in coldwater fisheries" organized at ICAR-DCFR, Bhimtal on 7th March 2020.
- S. Ali participated in the International webinar on 'Strategies against COVID-19 pandemic' organized by Dept. of Biotechnology, Kumaun University, Nainital on 18th June 2020.
- S. Ali participated in the International Webinar on "Mahseer, (*Tor* spp) of the world: Status and Conservation challenges' held at ICAR-DCFR, Bhimtal on 16th December 2020.
- S. Ali participated in the National Fish Farmers Day entitled "Increasing Coldwater Fish Production and enhancing farmer's income" on 10th July 2020.
- S. Ali participated in the virtual interactive meet, organized on the eve of 33rd Foundation Day by ICAR-DCFR on 24th September 2020, Bhimtal in collaboration with Coldwater Fisheries Society of India.
- S. Ali participated in webinar on "Coldwater fisheries for Nutritional security and Livelihood of the hill population" held at ICAR-DCFR on 20th July 2020.
- S. Ali participated in Webinar on "Fundamentals of flow cytometry and its applications" organized by Dept. of Biotechnology, Kumaun University, Nainital on 8th July 2020.
- S K Mallik participated in the "International Webinar on Mahseer" organized by ICAR-DCFR, Bhimtal on 16th December 2020:'Mahseer in India: Strategies & approaches for rehabilitation and conservation' by Dr. Adrian Pinder, Associate Director, Bournemouth University, UK.
- S K Mallik participated in the National webinar on "Increasing Coldwater Fish Production and Enhancing Farmers Income" organized by ICAR-DCFR, Bhimtal on the eve of 20th National Fish Farmers Day on 10th July 2020.
- S K Mallik participated in the Prime Minister's "Mann Ki Baat 2.0" programme such as inauguration of Rani Lakshmi Bai Central Agriculture University, Jhansi on 29th August 2020.
- S K Mallik participated in the virtual interactive meet on 'Fish production and productivity enhancement among scheduled caste fish farmers through scientific hill fish farming' organized by ICAR-DCFR, Bhimtal in collaboration with College of Fisheries, AAU, Raha, Assam; Livestock Research Station, AAU, Mondira, Assam and Dept. of Fisheries, Govt. of Uttarakhand under SCSP programme on 18th September 2020.
- S K Mallik participated in the virtual interactive meet, organized on the eve of 33rd Foundation Day by ICAR-DCFR on 24th September 2020, Bhimtal in collaboration with Coldwater Fisheries Society of India.
- S K Mallik participated in the virtual training program on Breeding and seed production of rainbow trout and its best management practices on 29.12.2020, organized by ICAR-DCFR, Bhimtal.

- S K Mallik participated in the webinar on 'Can aquaculture become the blue biotechnology of the future' organized by Coldwater Fisheries Society of India on 21st November 2020.
- S K Mallik participated in webinar on "Coldwater fisheries for Nutritional security and Livelihood of the hill population" held at ICAR-DCFR on 20th July 2020.
- S K Mallik attended & conducted 21st Institute management committee meeting on 23rd December 2020 at ICAR-DCFR.
- S K Mallik participated in FAO-ICAR TCP inception workshop on 'Support mitigation of Antimicrobial Resistance (AMR) risk associated with aquaculture in Asia' virtually organized on 10th December 2020 by ICAR- National Bureau of Fish Genetic Resources (ICAR-NBFGR) as the lead institute and ICAR-Central Institute of Fisheries Technology (ICAR-CIFT) as the partner institute.
- S K Mallik participated in a training programme on 'Quality Management System in AMR Laboratories for INFAAR' organized by FAO-India on 14th Sepetember 2020.
- S K Mallik participated in 'Third Annual Review Meeting of the Indian Network for Fisheries and Animals Antimicrobial Resistance (INFAAR)' organized virtually on 15th September 2020 chaired by Dr. J.K. Jena, DDG (Fy), ICAR New Delhi and presented the progress report on NP-AMR as ICAR-DCFR project component.
- S K Mallik participated in 'Annual Review Meeting of the All India Network Project on Fish health-AINP-FH' organized virtually on 11th September, 2020 chaired by Dr. J.K. Jena, DDG (Fy), ICAR New Delhi and presented the progress report on AINP-FH as ICAR-DCFR component.
- S K Mallik participated in 'LOGON: Palisade meeting on the use of software program for estimation of economic loss due to diseases in aquaculture' under All India Network Project on Fish health-AINP-FH' organized virtually on 4th September, 2020 by ICAR-CIBA, Chennai.
- S K Mallik participated in the virtual meet on discussing work programme and progress made under All India Network Project on Fish health (AINP-FH) on 27th August 2020 with coordinator Dr P. K Patil, Principal Scientist, ICAR-CIBA.
- S K Mallik participated in the virtual training programme on 'Understanding Basics of Antibiotics in Context of Antimicrobial Resistance' for Indian Network for Fisheries and Animal Antimicrobial Resistance (INFAAR) Members on 22-23 June 2020 organized by FAO.
- S K Mallik participated in the virtual meet on formulation of work programme on the list of hypotheses and questions prepared for estimation of economic loss due to diseases under All India Network Project on Fish health (AINP-FH) on 22nd June 2020 with coordinator Dr P. K Patil, Principal Scientist, ICAR-CIBA.
- S K Mallik participated in the virtual meet on sampling design for assessment of economic loss due to diseases under All India Network Project on Fish health (AINP-FH) on 29th June 2020 with coordinator Dr P. K Patil, Principal Scientist, ICAR-CIBA.
- S K Mallik participated in the virtual meeting under All India Network Project on Fish health (AINP-FH) on 19th June 2020 with coordinator Dr P. K Patil, Principal Scientist, ICAR-CIBA.
- S K Mallik participated in the meeting convened by Dr. J.K. Jena, DDG (Fy.Sc.), ICAR on 27th, 2020 through video conferencing to discuss on the modalities for inclusion of ongoing programme of the Indian Network for Fisheries and Animal Antimicrobial Resistance (INFAAR) in the SFC for the 13th plan period (2020-21 to 2024-25).
- S K Mallik participated in the online video conference meeting to discuss sample collection methods for detection of residues in tissue and environmental samples, the internationally accepted method with references, conducted on 21st April 2020 under All India Network Project on Fish health (AINP-FH) with coordinator Dr

P. K Patil, Principal Scientist, ICAR-CIBA and other partner institute.

- S K Mallik participated in the online zoom meeting convened by Dr. J.K. Jena, DDG (Fy. Sc.), ICAR on 20th April 2020 to discuss work programmes need to be implemented during COVID 19 outbreak along with other scientific staff of the institute.
- S K Mallik participated in the ITMU workshop on 'Intellectual Property Right Dimensions in Coldwater Fisheries' on 7th March, 2020 at ICAR-DCFR
- S K Mallik participated in the Institute Animal Care and use Committee (IACUC) meeting held on 20th January 2020 at ICAR-DCFR.
- S. Chandra as a member, attended online Institute Biosafety Committee meeting on 17th December 2020.
- S. Chandra as an expert did evaluation/ assessment of 20 fish farmers on the job role ornamental fish farmer Under the Skill Development Program of the Agricultural Skill Council of India on 16th March 2020.
- S. Chandra attended attended virtual ICAR-DCFR 33rd foundation Day celebration on 24th September 2020.
- S. Chandra attended online fish farming training Q&A session organised by Hesco-Kaathkuniedu, Dehradun along with DCFR, Bhimtal on 21st June 2020.
- S. Chandra attended virtual World Fisheries on the theme 'Can aquaculture become the blue biotechnology of the future Day; on 21st November 2020.
- S. Chandra participated in conference on 'Ecosystem Health and Fisheries of Indian Inland Waters: Multiple Stressors, Management& Conversations' 17-19 February 2020, AEHMS12 at Pantnagar, Nainital, Uttarakhand.
- Siva, C participated in the International webinar on Advances in Aquaculture Nutrition-2020 organized by Directorate of Incubation and Vocational training in Aquaculture, TNJFU, Tamil Nadu from 24-25th September 2020.
- Siva, C participated in the National webinar on Advances in Fish Vaccines and Prophylactics organized by the Fisheries College and Research Institute, Thoothukudi on 30th September, 2020.

Library and Information Services

18

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) 2020, the library finalized the process of procurement scientific books of approx. Rs. 17 thousands only. The current holdings of the library includes~ 7115 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 2020, 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 2019, three bulletins, three leaflets, one Hindi magazine (Himjyoti) and one coffee table book of the Directorate.

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

19 Combating COVID-19

19.1 Participation in COVID-19 testing

The COVID-19 pandemic is now declared as most crucial global health clamity which have been trated as the greatsest challange for the humankind. India also got affected with this pandemic and as a precautionary measures suggested by the World Health Organization (WHO) a complete lockdown was announced in the country at the end of March 2020. The situation was critical and all works and activities had been shut down to contain the spread of the disease. A new challange was before us to keep the institutional research work continue as sudden lockdown has brought everything stand still. The Institute adhered to all guidelines from Min. of Home Affairs, GoI and ICAR for the safety of all staff and personnels working in the institute

Further, the state government and district authorities requested rather commanded to participate in the Covid-19 testing operation. Twenty volunteers from ICAR-DCFR comprising seven Scientists, two technical officers and eleven research scholars from ICAR-DCFR were deputed for one to two months at the COVID-19 testing facility either at IVRI Mukteshwar or Government Medical College, Hadwani on the request of the local administration. Our Corona Warriors' enhanced the ability to test clinical samples by means of qRT-PCR. This opportunity to serve the country during the pandemic was enthusiastically and instantly taken up. During the COVID-19 pandemic, Dr. Amit Pande (Principal Scientist), Mr. Siva C (Scientist), Dr. Biju Sam Kamalam (Scientist), Dr. Rajesh M (Scientist), Mr. Ritesh Tandel (Scientist), Mr. Raja Aadil Hussain Bhat (Scientist), Dr. Arul S. (Scientist) served the Nation with great zeal and pride by being actively involved in diagnosis of clinical samples. Moreover, the morale of our Technical officers Shri Gopal Chandra and Santosh Kumar as well as research scholars Maneesh Dubey, Krishna Kala, Preetam Kala, Ms. Gunja, Ms. Manisha Gupta, Ms. Richa Pathak, Ms. Somya Pant, Ms. Vineeta Pant, Mr. Anupam Pandey, Mr. Bhupendra Singh and Mr. Dinesh Mohan too was highly commendable in providing their services during this difficult time.

19.2 Distibution of food packets during COVID-19 Lockdown

A group of Scientists and Senior technicals from ICAR-DCFR namely, Dr. R.S. Haldar, Dr. Dimpal Thakuria, Dr. Rajesh M. and Dr. Biju Sam Kamalam extended their help to the stranded labours in Bhimtal and Naukuchiatal by distributing ration in the presence of Patwari of Bhimtal area. These labours had run out of money during the lockdown and thus unable to buy food items. The team of scientists contributed money and procured food

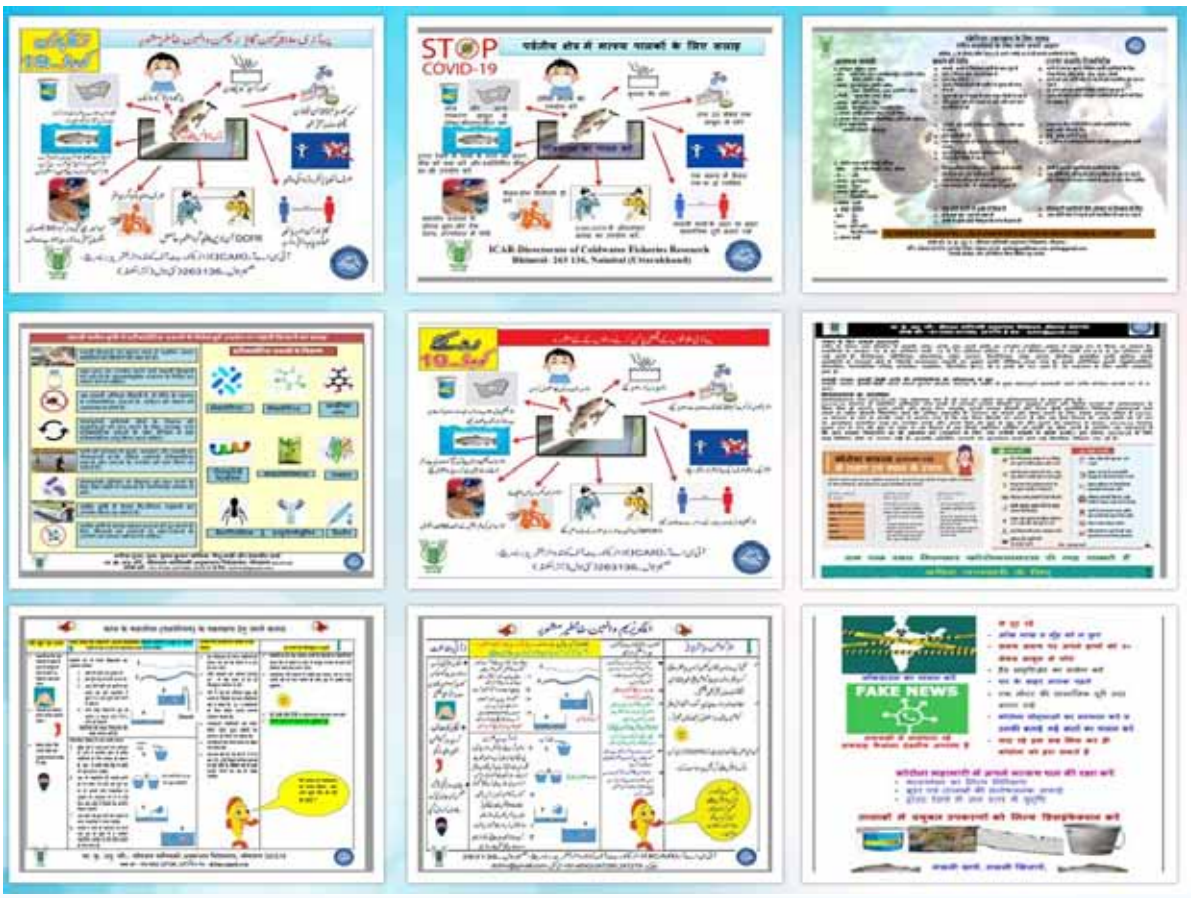
Fig.: Distibution of food packets during COVID-19 Lockdown

materials for the labours. Each person was provided with adequate rice, pulses, vegetables, tea, sugar, salt and spices.

19.3 Advisory to farmers during COVID-19

A number of advisories were designed and displayed in form of posters at different places to create awareness on COVID-19 among farmers as well as other villagers. These posters laid stress on practicing of social distancing, personal hygine, washing of hands, using alcohol based sanitizers, avoiding touch of unsanitized materials, use of face mask and moving out from home only when required. These posters also carried a message for the fishing community that there was no risk of infection with COVID-19 on harvesting, transport or eating fish. Simply practicing personal hygene was the only way forward to beat this deadly viral infection.

- Provided Farm advisories on carp culture and mid hill carps with 20 fish farmers of East Siang district, Arunachal Pradesh and trout growers of Menchukha valley, Arunachal Pradesh.
- Prepared 17 advisories in seven local languages that were circulated among farmers and officers of State Fisheries Department of the seven hill states.
- Provided advisory to the fisheries department of seven hill states and 200 farmers of Himachal Pradesh, Arunachal Pradesh, Sikkim and Uttarakhand.



Advisories to fish farmers during Covid-19 lockdown

20 Important Committees

20.1 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. Pravin Putra, Asst. Director General (Marine Fisheries), ICAR, Krishi Anusandhan Bhawan-II, New Delhi-110012.	Member
Dr. Debajit Sarma, Director (Acting), ICAR-DCFR, Bhimtal.	Member
Dr. Suresh Chandra, Principal Scientist, ICAR-DCFR, Bhimtal.	Member Secretary

20.2 Members of Institute Management Committee

Dr. Debajit Sarma, Director (Acting), ICAR-DCFR	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

20.3 Members of Prioritization Monitoring & Evaluation Cell

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

20.4 Members of Prioritization Monitoring & Evaluation Committee

Dr. Debajit Sarma, Director (Acting)	Chairman
Dr. S. Chandra, Principal Scientist	Member
Dr. R.S. Patiyal, Principal Scientist	Member
Dr. N.N. Pandey, Principal Scientist	Member Secretary

20.5 Members of Institute Technology Management Committee

Dr. Debajit Sarma, Director (Acting)	Chairman
Dr. Veena Pande, Head, Dept. of Biotechnology, Kumaon, University, Bhimtal Campus.	External Member
Dr. N.N. Pandey, Principal Scientist	Member
Dr. Neetu Shahi, Scientist	Member
Dr. M.S. Akhtar, Scientist	Member
Dr. Biju Sam Kamalam, Scientist	Member
Mr. R. S. Tandel, Scientist	Member
Dr. R.S. Patiyal, Principal Scientist	Member Secretary

20.6 Members of Institute Technology Management Unit

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

20.7 Members of Agricultural Knowledge Management Unit

Sh. R. S. Tandel, Scientist	In-charge
Sh. S. K. Mallik, Scientist	Member
Dr. M. S. Akhtar, Scientist	Member
Sh. A.K. Saxena, Technical Officer	Technical support

20.8 HYPM, PIMS

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

20.9 Library Advisory Committee

Dr. D. Sarma, Director (Acting)	Chairman
Dr. N.N. Pandey, Principal Scientist	Member
Dr. Shahnawaz Ali, Scientist	Member

Smt. Khilawati Rawat, Administrative Officer	Member
Sh. Baldev Singh, Senior Technical Officer & I/c Library	Member
Sh. Sayed Mohsin Ali, Asst. Fin. & Acc. Officer	Member

20.10 Institute Joint Staff Council

Official side	
Dr. Debajit Sarma, Director (Acting)	Chairman
Dr. R.S. Patiyal, Principal Scientist	Member
Dr. R. S. Haldar, ACTO	Member
Sh. Sayed Mohsin Ali, Asst. Fin. & Acc. Officer	Member
Smt. Khilawati Rawat, Administrative Officer	Member Secretary
Staff side	
Sh. Ankesh Sinha, Assistant Admin. Officer	Member, CJSC
Sh. Hansa Singh Bhandari, LDC	Member
Sh. T. M. Sharma, Sr. Technical Assistant	Member Secretary
Sh. Gopal, Sr. Technical Assistant	Member
Sh. Manoj Kumar, Skilled Supporting Staff	Member
Sh. Ravinder Kumar, Skilled Supporting Staff	Member

20.11 Institute Biosafety Committee

Dr. Debajit Sarma, Director (Acting), 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.	Member
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.	Member
Dr. Kh. Victoria Chanu, Scientist, ICAR-DCFR, Bhimtal.	Member
Dr. Amit Pande, Pr. Scientist, ICAR-DCFR, Bhimtal.	Member Secretary

20.12 Institutional Animal Care & Use Committee

Dr. Debajit Sarma, Director (Acting)	Chairman
Sh. Sumant Kumar Mallik, Scientist	Member
Dr. Shahnawaz Ali, Scientist	Member
Dr. Dimpal Thakuria, Scientist	Member
Dr Neetu Shahi, Scientist	Member Secretary

20.13 Store Purchase Advisory Committee

Dr. Shahnawaz Ali, Scientist	Chairman
Sh. S. K. Mallik, Scientist	Member
Dr. Neetu Shahi, Scientist	Member
Dr. M. S. Akhtar, Scientist	Member
Dr. Dimpal Thakuria, Scientist	Member
Smt. Khilawati Rawat, Administrative Officer	Member
Sh. Sayed Mohsin Ali, Asst. Fin. & Acc. Officer	Member
Sh. Ankesh Sinha, Assistant Admin. Officer & I/C Store & Purchase	Member Secretary

20.14 Women Cell Committee

Smt. Pragyan Dash, Scientist	Incharge
Dr. Neetu Shahi, Scientist	Member
Dr. Kh. Victoria Chanu, Scientist	Member
Dr. Ciji A., Scientist	Member
Dr. Dimpal Thakuria, Scientist	Member
Smt. Susheela Tewari, PS to Director	Member
Dr. Deepjyoti Baruah, Pr. Scientist	Member
Sh. Amit Kumar Saxena, Technical Officer	Member

21 Staff News

21.1 Promotions

- Smt. Khilawati Rawat promoted from Asstt. Admn. Officer to Administrative Officer with effect from 22nd October, 2020.
- Sh. P.C. Tewari promoted from Assistant to Asstt. Admn. Officer with effect from 04th November, 2020.
- Sh. Gopal promoted from Sr. Tech. Assistant to Technical Officer with effect from 17th September, 2020.
- Sh. Hansa Singh Bhandari promoted from LDC to UDC with effect from 1st January, 2020.
- Sh. Mangla Prasad promoted from SSS to LDC with effect from 20th January, 2020.

21.2 Transfer

- Sh. Ravindra Singh Negi promoted from Administrative Officer to Senior Administrative Officer and transferred from ICAR-DCFR, Bhimtal to ICAR-VPKAS, Almora on 13th August, 2020.
- Dr. Raghvendra Singh, Scientist transferred from ICAR-DCFR, Bhimtal to ICAR-NBFGR, Lucknow on 23rd July, 2020.

Personnel

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Staff list as on 31.12.2020

22.1 Research Management

Dr. Debajit Sarma	Director (Acting)

22.2 Scientific Staff

1.	Dr. Amit Pande	Principal Scientist (Biotechnology-Animal science)
2.	Dr. Nityanand Pandey	Principal Scientist (Aquaculture)
3.	Dr. Suresh Chandra	Principal Scientist (Fish Pathology)
4.	Dr. R.S. Patiyal	Principal Scientist (Fish Genetics & Breeding)
5.	Dr. Deepjyoti Baruah	Senior Scientist (Fish & Fishery Science)
6.	Dr. Shahnawaz Ali	Scientist (Aquaculture)
7.	Sh. Sumanta Kumar Mallik	Scientist (Aquaculture)
8.	Dr. Neetu Shahi	Scientist (Biotechnology-Animal Science)
9.	Dr. Md. Shahbaz Akhtar	Scientist (Fish & Fishery Science)
10.	Dr. Dimpal Thakuria	Scientist (Biochemistry-Animal science)
11.	Dr. Kh. Victoria Chanu	Scientist (Biochemistry-Animal science)
12.	Dr. Ciji Alexander	Scientist (Fish Nutrition)
13.	Dr. Biju Sam Kamalam J.	Scientist (Fish Nutrition)
14.	Dr. Rajesh M	Scientist (Fish Nutrition)
15	Sh. Tandel Ritesh Kumar Shantilal	Scientist (Fish Health)
16.	Sh. Abhay Kumar Giri	Scientist (Aquaculture)
17.	Smt. Pragyan Dash	Scientist (Aquaculture)
18.	Dr. Prakash Sharma	Scientist (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.	Dr. Arul S.	Scientist (Biotechnology-Animal Science)
24.	Smt. Garima	Scientist (Fisheries Resource Management)

22.3 Technical Staff

1.	Dr. R.S. Haldar	Assistant 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. Gopal C. Arya	Technical Officer
8.	Sh. HansaDutt	Sr. Technical Assistant
9.	Sh. T.M. Sharma	Sr. Technical Assistant
10.	Sh. R.K. Arya	Sr. Technical Assistant
11.	Sh. Partha Das	Technical Assistant
12.	Sh. Manoj Kumar Yadav	Driver (Technical Assistant)

22.4 Administrative Staff

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

22.5 Skilled Supporting Staff

1.	Sh. Ravinder Kumar	Skilled Supporting Staff
2.	Sh. Om Raj	-do-
3.	Sh. Sunder Lal	-do-
4.	Sh. Dharam Singh	-do-
5.	Sh. Pooran Chandra	-do-
6.	Sh. Manoj Kumar	-do-
7.	Sh. Kuldeep Kumar	-do-
8.	Sh. Bhola Dutt Mouni	-do-
9.	Smt. Basanti Devi	-do-

ICAR-Directorate of Coldwater Fisheries Research

Bhimtal-263 136, Nainital, Uttarakhand, India

E-mail: director.dcfr@icar.gov.in, dcfrin@gmail.com

Website: www.dcfr.res.in