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FROM DIRECTOR'S DESK

Fish has been recognized as a functional food that can contribute to food and nutritional security to populations of all age groups. Fish is a major source of animal protein, overshadowing most other sources such as poultry and other land-based animal protein sources. The Himalayan region is endowed with unique fish diversity and therefore, amid various challenges also provides numerous opportunities for sustainable utilization of available aquatic resources for fisheries development. ICAR-DCFR has been working in these vast, difficult and varied climatic regions of the Himalaya for developing fisheries and aquaculture through different research, development, and capacity-building programmes. Over the years the directorate has gained momentum in developing fish farming technologies and transferring these to farmers for increasing production, and productivity as well as providing better management of resources for ensuring their socio-economic upliftment. The directorate has developed various GIS-based maps which are useful in the correct assessment of fishery resources of hilly regions and also working in health assessments of important rivers and streams. Ecotourism and angling are one of the avenues for resource conservation and revenue generation. The mahseer-based angling is a popular sport in Himalayan rivers and it needs due attention. The detailed information, collected on angling and fish-based ecotourism, is quite essential in developing conservation models for endangered golden mahseer. In continuation, it is also essential to validate different mahseer species and assess the genetic structure through molecular tools that help in resolving taxonomic ambiguities and identification of stocks. The directorate has been working in these areas and contributed valuable knowledge and information that are available in the public domain.

Species diversification for coldwater aquaculture remained a major challenge and concerted efforts have been made to bring native species into the culture system. A few snow trout species seem to be promising species for aquaculture due to their high nutritional values. Apart from this, integration and intensification in the aquaculture system are the need of the hour. ICAR-DCFR has worked to develop an Integrated Agri-Aquaculture Farming (IAAF) model for pilot scale fish-vegetable production in Indian uplands which is a low-cost and low-tech coldwater re-circulatory aquaponics model. Understanding the nutritional requirements of fish and designing appropriate feed underpins a successful aquaculture practice. On-farm performance of a high-energy rainbow trout grower feed developed by ICAR-DCFR has been evaluated in terms of weight gain percentage and feed conversion ratio between different stocks which provided necessary baseline information to understand production trait variability between the examined rainbow trout families in India. Furthermore, initial efforts have been made towards fish meal

substitution with a blend of alternate protein ingredients and also to develop broodstock feed for rainbow trout. Stress management in fish is another important area that gained attention as a mitigation measure for addressing global climate change. Studies have been undertaken to assess the gender-specific transcriptomics response of temperature stress in golden mahseer. The directorate has also attempted to develop a cell line from the fish muscle that would pave the way for developing a method for the production of fish meat *in vitro*. Disease diagnosis and health management of fishes are inevitable for the maintenance of healthy aquaculture stock. Novel antimicrobial peptides have been developed which showed potential to inhibit the growth of *A. salmonicida* and *A. hydrophilla in-vitro*. In addition, a multiplex PCR based method was developed for easy identification of *Saprolegnia parasitica*, and an effective formulation was also tested to prevent saprolegniosis in aquaculture.

Collaborative programmes were taken up under SCSP, TSP, and NEH. A survey of Mechuka, Shi-Yomi district (Arunachal Pradesh) was conducted to explore the feasibility of establishing a trout hatchery. Training programmes on different aspects such as ornamental fish breeding and culture and best management practices for trout culture were organized in collaboration with the Department of Fisheries, Tripura, and Department of Fisheries, Arunachal Pradesh respectively under NEH programme. Various training-cum awareness programmes have been organized and suitable interventions were made in different districts of Uttarakhand and Assam for the socio-economic upliftment of SC communities under SCSP. Under TSP, ICAR-DCFR organized a stakeholder's meeting in August at Leh to explore and formulate a road map and strategic action plan to sustainably develop and harness the potential of fisheries and aquaculture for the tribal population of high-altitude cold arid regions. In addition, ICAR-DCFR has established the first scientifically designed and validated Re-circulating Aquaculture System (RAS) based rainbow trout hatchery in Ladakh. Apart from this, different input distribution, training, and awareness programmes were also organized. Training and awareness programme under Mera Gaon Mera Gaurav has also been organized at the village level for awareness of farmers and their encouragement to adopt scientific fish farming. ICAR-DCFR organized a "Scientists-Farmers interface on climate-resilient varieties, technologies, and practices as a part of the "Azadi Ka Amrut Mahotsav" to commemorate 75 Years of India's Independence. The directorate has also participated in a national campaign on nutri-garden and tree plantation with respect to International Year of Millets 2023. ICAR-DCFR has also celebrated National Fish Farmers Day on the theme of 'Ecosystem Management for Sustainable Fisheries'. Hindi saptah samaroh was organized and all the staff and research scholars participated in various types of the competition organized on this occasion. ICAR-DCFR has proudly celebrated 34th Foundation day by inviting farmers, entrepreneurs, and other stakeholders. In addition, the directorate also organized other programmes on World Food Day, Mahila Kisan Diwas, Rashtriye Ekta Diwas, Waste to Wealth, National Campaign on Antimicrobial Resistance in Fish and Swachhta Pakwara. As a National campaign on Azadi Ka Amrut Mahotsav, a series of lectures delivered by eminent scientists and academicians were also organized during the period. The directorate's Scientists and Staff actively participated in the Independence Day celebration and other programmes organized at Bhimtal and its field center, Champawat. I am happy to share that all the scientists and staff of the directorate are working hard for the development of the Institute and to make it a 'Centre of Excellence' for coldwater fisheries but still, many challenges are ahead to conquer the peak.

At the end, I would like to thank Dr. T. Mohapatra, Secretary, DARE and Director General, ICAR, and Dr. J.K. Jena, Deputy Director General (Fisheries Science) for their constant support and guidance. My appreciation to the editorial committee of the Newsletter for their meticulous efforts in compiling and presenting the scientific achievements and activities of the ICAR-DCFR.

(Pramod Kumar Pandey)
Director

Fisheries Resource Management

Aspect and slope delineation of Ladhiya and Saryu river basins

Advanced space borne thermal emission and reflection radiometer ASTER DEM (30 m) satellite data was investigated using spatial analyst tool of ArcGIS. The aim was to study the run-off and infiltration characteristics of Ladhiya and Saryu basins. The aspect (direction of slope with respect to horizontal plane) characteristics of both, Ladhiya and Saryu basins revealed dominance of south-eastern and south-western facing slopes than their northern counterparts.

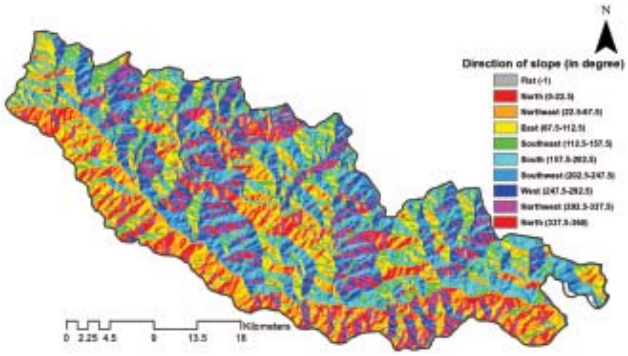


Fig. Aspect of Ladhiya basin

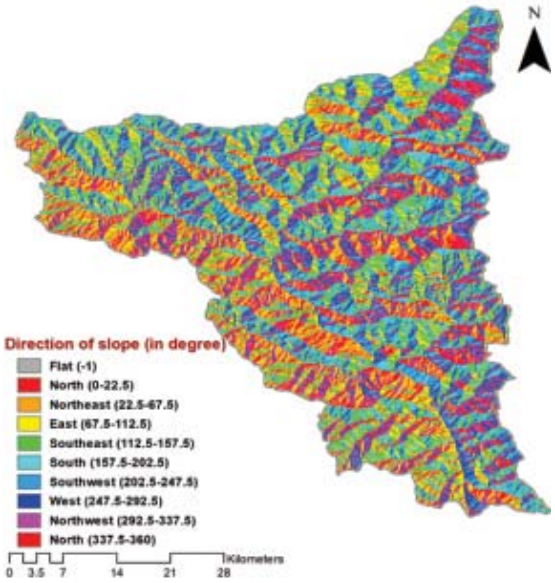


Fig. Aspect of Saryu basin

Ladhiya basins slope ranged from 0.04º to 56.62º and that of Saryu basin, from 0.02° to 68°. Both the basins are predominated by Slope (>20°) throughout barring some western, eastern and south western extremes in Saryu basin and north-eastern region in Ladhiya basin, where 5-20-degree slope prevails. Steep to moderate slope throughout the basin is indicative of moderate infiltration rate and moderate drainage density characteristics. It further indicates basins to be in later youth to mature stages of development.

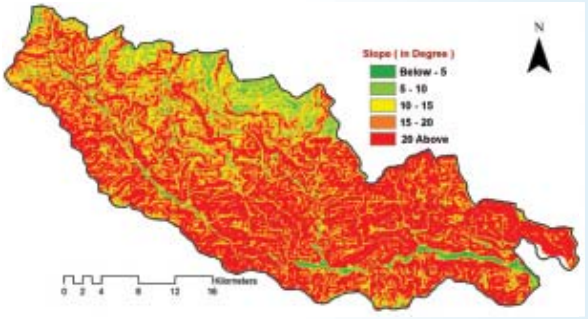


Fig.: Slope of Ladhiya basin

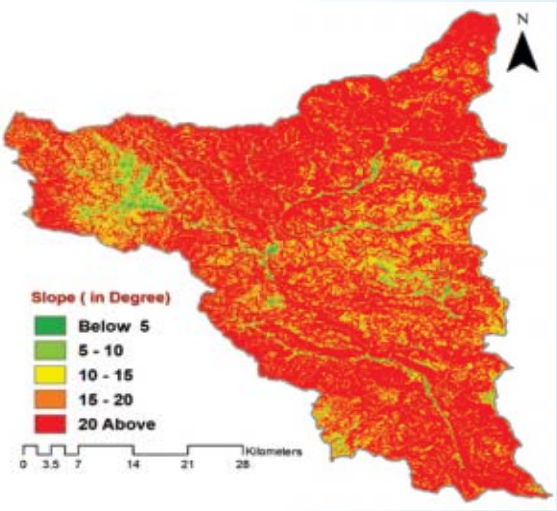


Fig. Slope of Saryu basin

Ichthyofaunal diversity and health assessment of Central Himalayan River Saryu, Uttarakhand

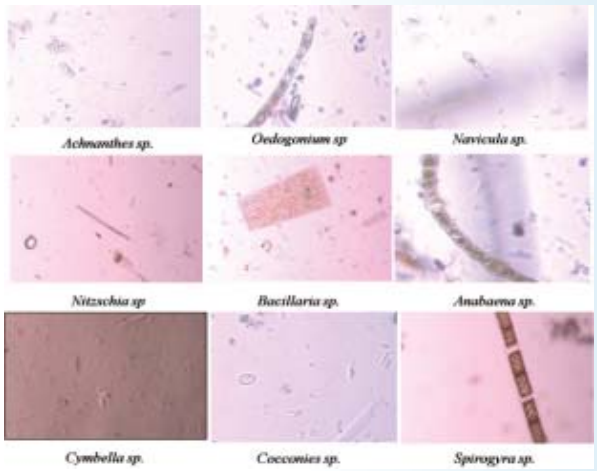


Fig. Few dominant phytoplankton species from river Saryu

Ichthyofaunal and plankton diversity was studied at six different stations: Kapkot, Bageshwar, Seraghat, Panar, Ghat, and Rameshwar. Among the selected stations, commercial fishery is mainly practiced at Seraghat. Seven fish species were recorded with the dominance of *Schizothorax richardsonii* and *Naziritor chelynoides*. The length-weight relationship was calculated for both the species, according to which for

S. richardsonii, the relative condition factor (Kn) was 1.02±0.15, and the condition factor (K) was 0.80±0.18. For *Naziritor chelynoides*, the relative condition factor (Kn) was recorded as 1.3±0.10 and the condition factor (K) as 1.07±0.06. A total of 27 species of phytoplankton from 11 genera were identified with the dominance of the *Bacillariophyceae*, followed by *Chlorophyceae* and *Cyanophyceae* in river Saryu. The maximum diversity of phytoplankton was recorded at Seraghat and the minimum at Kapkot. Dominant genera of phytoplankton included *Navicula, Bacillaria, Nitzschia, Spirogyra, Oedogonium, Anabaena, Cocconies, Achnanthes* and *Cymbella.*

Angling status of mahseer in Kumaun region for Eco-tourism and conservation

An inventory of 112 local and professional anglers was prepared while some consulted online. Information on catch size, fishing spots, adoption of catch and release approach, conservation efforts by anglers and local people etc. was collected. Survey data revealed that most of the professional anglers practise catch and release for promoting conservation and to create awareness among locals. Secondary source data on total angling licensing, anglers, angling sites, camps organized and revenue generated were collected for the Kumoan region, covering district Almora, Bageswar, Champawat and Nainital for the period of 2014 to 2019. Data on mahseer catch size, fish size is being collected for mahseer angling at Pancheswar of *River Kali* for the year 1998.

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

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

Species and stock validation of mahseer species of genus *Tor* and *Neolissochilus* from central and eastern Himalayan region of India

A repository of voucher specimens of *Tor* spp. collected from various geographical locations of Uttarakhand was created at ICAR-DCFR, Bhimtal museum. Fish with different head and median lobe characteristics were collected from various locations. Presently there are 21mahseer specimens with unique ID deposited in the museum for future reference and identification. The collaborating partner from the College of Fisheries, Raha, Assam collected mahseer samples from the Jia Bharali, Diyung Rivers of Assam and River Tirap of Arunachal Pradesh. Morphometric and meristic measurements were recorded and fish specimens were preserved at Department of AEM, College of Fisheries, Raha fish museum as per the standard protocol. Ten *Neolissochilus hexagonolepis* and three species of *Tor putitora* from *River* Jia bhoroli, Assam were identified by molecular methods. From River Tirap in Arunachal Pradesh, two species of *Neolissochilus hexagonolepis,* one species of *Neolissochilus hexastichus* and six species of *Tor putitora* were identified. Altogether, 22 mahseer specimens were identified by nucleotide sequence of *coxI* gene.

Fig. Mahaseer specimen collected from Garudh Tal, Nanital District, Uttarakhand

Fig. Voucher specimens of mahaseer

Study on habitat ecology and biodiversity of mahseer and other indigenous species for developing conservation strategies in the Vyasi Hydroelectric project on river Yamuna, Dehradun Uttarakhand"

The habitat ecology and biodiversity of mahseer and other indigenous fish species were studied in river Yamuna at the Vyasi Hydroelectric Project site, Dakpatthar, Dehradun, Uttarakhand during Aug-Dec, 2021. The plankton and periphyton observation showed the dominance of *Bacillariophyceae* on upstream and downstream the river. Stone fly larvae and dragon fly larvae were observed in the benthic study. During the ichthyofaunal diversity exploration, *Tor putitora*, *Tor tor*, *Schizothorax richardsonii*, *Barilius bendelisis*,

Barilius vagra, *Glyptothorax pectinopterus* and *Naemacheilis botia* were recorded. A high CPUE was witnessed at the downstream sites which show the abundance of the fish species caught during sampling period and a lower CPUE was recorded at the upstream site. The length-weight and condition factor of the species showed that the species are healthy and in good condition at the selected sites.

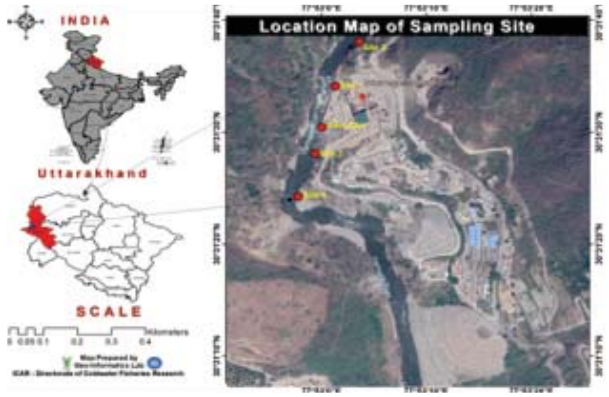


Fig.: Location map of the study area

Aquaculture

Observation on pre-seasonal gonadal maturity in both the sexes for *Schizothorax progastus* and *Schizothorax richardsonii*

Pre-season gonadal maturity in both the sexes for *Schizothorax progastus* and *Schizothorax richardsonii* was achieved with dietary intervention and thermal regulation. Moreover, administration of inducing hormones enabled the pre-season breeding of *Schizothorax progastus* and *Schizothorax richardsonii* under captivity. Initial success has been achieved in voluntary spawning in *Schizothorax richardsonii*.

Fig. Gravid females of snow trout

'Integrated Agri-Aquaculture Farming' (IAAF) model for uplands

An 'Integrated Agri-Aquaculture Farming' (IAAF) model has been developed for pilot scale fish-vegetable production in Indian uplands. The low-cost and low-tech Coldwater recirculatory aquaponics model has been designed in such a manner that some of the components viz., hydroponic cum biofiltration unit, sump cum base addition tank etc. can be used for more than one function so as to cut short the space and cost.

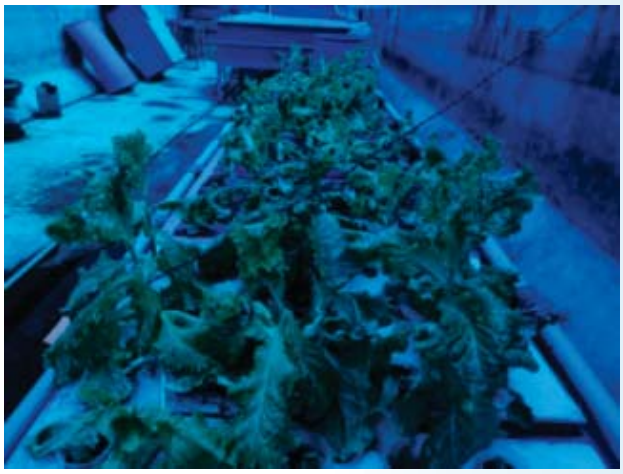


Fig.: Lettuce endive (Lactuca sativa) at the time of harvest

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

Fish Nutrition and Feed Development

Evaluation of rainbow trout grower feed performance with respect to genetic background

The on-farm performance of a high energy rainbow trout grower feed developed by DCFR in collaboration with Growel Feeds was comparatively evaluated in two families of fish sourced from Jammu and Kashmir (JK) and Champawat (CWT). At the end, the weight gain percentage (651 - 745 %) and feed conversion ratio (1.1) was equally good in both the groups, regardless of the genetic background. Likewise, carcass composition and sensory characteristics of steaks was not significantly different between the two groups. Corresponding to the higher body weight, body condition factor and carcass yield was higher in CWT fishes. On the contrary, JK fishes showed higher lipid retention, nitrogen gain, cardio-somatic index and blood haemoglobin levels. These

findings indicate that the performance efficiency of the high energy grower feed is high regardless of the trout family. The findings also points to interesting production trait variabilities betweenthe examined rainbow trout families in India.

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

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

In this study, a 15-week feeding trial was carried out with four experiment diets that contained different fish meal levels (20-65%). Triplicate groups of rainbow trout juveniles were fed the four experimental diets to visual satiation, in the glass aquaria of an experimental RAS unit. At the end of the trial, there were no significant differences between the dietary groups in feed intake (13.9-14.7 g/kg/day), feed efficiency (0.8-0.9), protein efficiency ratio (1.85-1.99), weight gain percentage (329-375 %) and other growth indices.

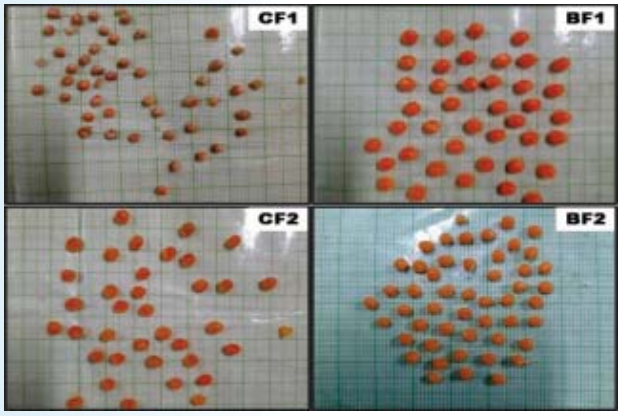


Fig. Comparative follicular analysis from randomely selected rainbow trout females from control feed (CF) fed group and brooder feed (BF) fed group

Likewise, body condition factor, viscero-somatic index, hepato-somatic index, whole body composition and nutrient retention / loss estimates were not significantly different between the four dietary groups. The phenotypic results indicate that it is possible to substantially lower fish meal inclusion levels in rainbow trout grower feeds without compromising growth and welfare of the fish.

Development and validation of efficient brood stock feed for rainbow trout

Production of good quality seed depends on the availability of proper brooder and starter feeds. Due to the unavailability of proper broodstock feed, trout hatchery runners face spawning failures, which includes asynchronous gonadal maturation, poor fecundity and poor gamete quality. Rainbow trout brooder feed was formulated and field trials were conducted at ICAR-DCFR, Experimental Field Centre, Champawat and a few field validation experiments were carried out in Kashmir, Himachal Pradesh and Sikkim. The response of newly formulated rainbow trout brooder feed was consistent and promising.

Seed production of *Garra gotyla and* triploid rainbow trout

Captive bred F1 generation of *Garra gotyla* was reared and the seed produced successfully. Triploid rainbow trout were produced by pressure shock with 100% efficiency. By means of better management & efficient brooder feed, breeding and production of quality eyed ova of rainbow trout was carried out at Experimental Field Centre, Champawat.

Garra gotyla

Molecular Genetics & Biotechnology

Gender specific transcriptomic response to environmental stress in golden mahseer (*Tor putitora*)

Freshwater fishes are ectotherms, and thus, metabolically sensitive to environmental temperature. Himalayan or golden mahseer (*Tor putitora*) exhibits a skewed sex ratio where males are mostly predominant. In order to understand how different sexes of the golden mahseer respond to environmental stress (e.g. temperature), transcriptome profiling of different tissues (e.g. gonads and brain) was carried out to identify sex specific stress responsive transcripts. DEseq was used to screen differentially expressed genes (DEGs) in gonads with a false discovery rate (FDR) adjusted p value ≤ 0.05. The results revealed significant gene expression changes during the course of the high-temperature treatment. However, while comparing gonads of fish exposed to normal and high temperatures, 24 DEGs were found in both sexes,

suggesting that there is likely a common genetic mechanism to cope with exposure to high temperature. These DEGs were enriched in the KEGG pathways related to sex differentiation, nitrogen metabolism, glucagon signalling pathway, protein digestion and absorption, phototransduction, and adipocytokine signalling pathway. Therefore, exposure to high temperature influenced metabolism, signal transduction, cell growth and proliferation.

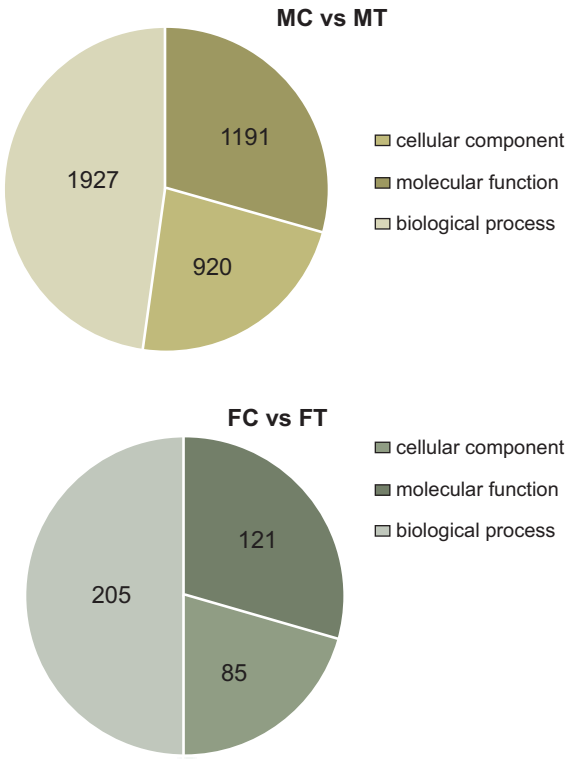


Fig: GO terms for the heat treated versus control group

Genome editing in common carp, *Cyprinus carpio* using CRISPR/Cas system

In this investigation, 12 common carp *Cyprinus carpio* and 80 WT zebra fish, *Danio rerio* brooders are maintained as live gene bank for microinjection of RNPs and for other research and academic purposes. All the initial procedures of microinjection and volume optimization were carried out in single cell fertilized embryo of zebra fish, using pulled glass capillary. From the nucleotide sequence of *dnd* gene of common carp, sgRNA template was synthesized. This sgRNA template was transcribed *in vitro* and mixed with Cas9 protein at different concentrations and volumes. These RNPs were used to microinject the fertilized eggs using pulled glass capillary under stereo zoom microscope, along with fluorescent tracers. Subsequent hatchability, survivability and deformity were evaluated in RNPs injected common carp embryo.

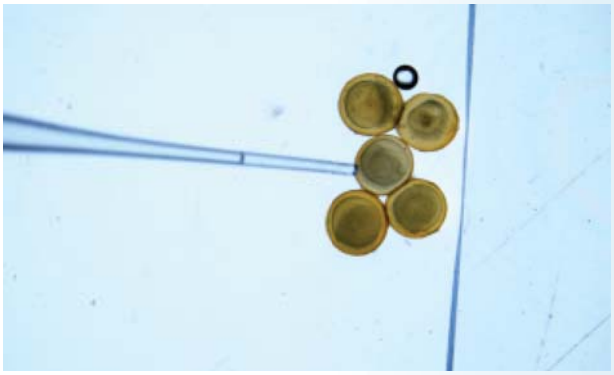


Fig.: Microinjection of RNPs into common carp eggs for knocking out the dnd gene

Development of complete mitochondrial genome and phylogeny of selected coldwater fish species

The piscine diversity of the Himalayan region is unique in terms of both variety as well as endemism. Conservation, protection and rehabilitation of species start with their correct and unambiguous identification and characterization. Fish identification is traditionally based on morphological features. As a standardized and universal method, DNA barcoding identification systems have been widely advocated to identify species and uncover biological diversity in these years. Keeping in view the diversity and endemism of coldwater fish species, it is necessary to characterize the coldwater species at molecular level for ascertaining its correct taxonomic position as well as phylogenetic relationship with other species. With the advent of next generation technology (NGS) and availability of different high throughput sequencing platform have made it possible to easily and quickly sequence and assemble entire mitochondrial genomes from almost any eukaryotic species for which total DNA can be isolated. Therefore, species characterization of fish species based on complete mitochondrial genome using NGS technology will provide more reliable and useful data for molecular systematic, species identification, and conservation.

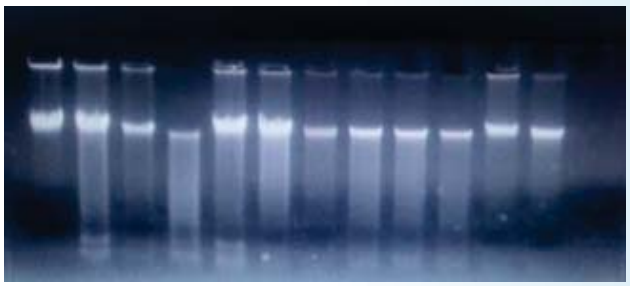


Fig. Genomic DNA of targeted species

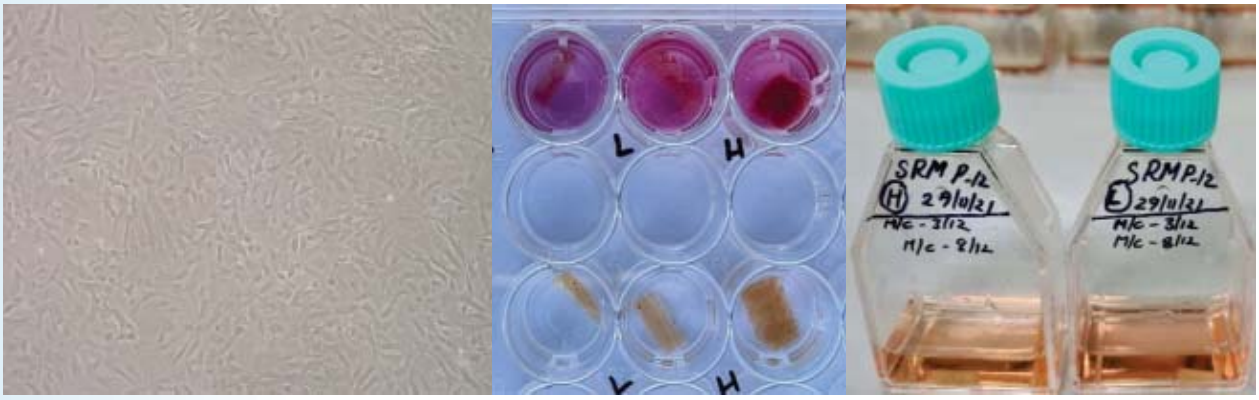
Fish samples of the target species namely *Bangana dero,* and *Labeo dyocheilus* were collected from the hatchery and wild. Genomic DNA was isolated from 50mg muscle tissue sample by the phenol-chloroform procedure.

Fish without water: *In vitro* meat

An attempt was made to develop a cell line from fish muscle that would pave the way for developing a method for the production of fish meat *in vitro*. In this direction, primary culture of muscle cells was attempted from snow trout. Two methods of primary culture were attempted. In the first method, muscle tissue was trypsinized for isolating muscle cells however, this method proved futile as only few cells could be recovered after trypsinization. Therefore, explant culture of snow trout muscle was attempted to culture muscle cells. Cell radiation could beobserved from the explants incubated at 27°C after 14 days. Muscle cells so obtained were sub-cultured and the cells could be maintained up to 19th passage in L-15. The muscle cells from snow trout are being maintained at passages 16, 18 and19 and have been preserved in liquid nitrogen at passages 3, 4, 5, 7, 11, 15 and 17.

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

Further 3D culture of muscle cells was attempted in 12.5cc non adherent tissue culture flasks in presence of unique protein scaffolds. The growth of the cells was visualised in the flasks by change in pH of the medium. Flasks with scaffolds and cells had their medium acidic while the ones with scaffolds but no cells turned basic with time which was usually 5-6 days after the culture. The scaffolds were analysed for the metabolic activity of cells by resazurin assay. Resazurin, a cell permeable redox indicator can be used to monitor viable cell number. It can readily dissolve in physiological buffers resulting in a deep blue solution that can be added directly to cells in culture in a homogeneous format. Viable cells with active metabolism can reduce resazurin into the resorufin product which is pink and fluorescent. To test whether the cells were present over the scaffolds, scaffolds with or without cells cultured in 12.5cc flasks were transferred in a 24-well plate and resazurin was added to them. The medium turned pink after 24hours in the wells that had scaffolds with cells compared with the controls which did not have the cells. Further attempts are being made to culture the cells with more amount of medium in a larger flask to see if the cells can be cultured over the scaffolds.



A. **B.** **C.**

Fig. A. Snow trout muscle cells, B. Muscle cells cultivated over scaffolds, C. Resazurin Assay showing development of pink colour in medium containing cells and scaffolds.

Fish Health Management

Discovery of antimicrobial peptides through phage display technology against fish pathogens

Antibiotic resistance develops when microbes change over time and succeed in escaping the effect of drug targeted against them. It has become a threat to global public health as it impairs the efficacy of antimicrobial chemotherapy. Due to the emergence of multidrug-resistant bacteria, few or no treatment options are left to treat infections caused by certain microorganisms. It is therefore, essential to develop novel antimicrobials to combat the drug resistant microbes. Among the prospected alternate molecules, antimicrobial peptides have stimulated research and clinical interest. We have identified some novel 12-mer peptides using 'peptide phage display technology'. It was done through three rounds of bio-panning to identify the peptides of highest affinity against two important fish bacterial pathogens, *Aeromonas salmonicida* and *Aeromonas hydrophilla.* Bound phages were eluted and their DNA was sequenced. *In silico* translation of the DNA sequences resulted into peptides of 12 amino acids. The peptides were synthesized at peptide synthesis facility in ICAR-DCFR and purified by high-pressure liquid chromatography (HPLC). Preliminary study showed that the peptides have a potential to inhibit the growth of *A. salmonicida* and *A. hydrophilla in-vitro*.

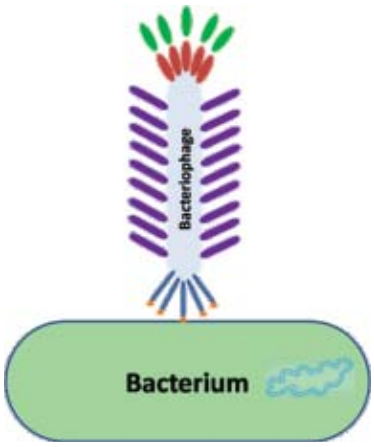


Fig. Biopanning of phage displayed peptide libraries for identification novel antimicrobial peptides

Evaluation of anti-saprolegnia activity of Chloramine-T

Saprolegnia parasitica is one of the highly virulent species under the genus, *Saprolegnia* responsible for huge economic loss in aquaculture. Earlier, *Saprolegnia* infections were controlled by using malachite green. However, the drug has been banned for use in aquaculture due to its carcinogenic effect. Since then, *Saprolegnia* particularly *S. parasitica* has re-emerged as economically important pathogen. Therefore, it is of paramount importance to discover or develop new drugs or formulations that will kill the pathogen while posing no health hazards to the handler. Chloramine-T has been tested in vitro for its anti-*Saprolegnia* activity. It showed potent anti-oomycete activity against *S. parasitica*. *In vitro* findings suggest that Chloramine-T can be further studied to develop a safe and effective formulation to prevent Saprolegniosis in aquaculture.

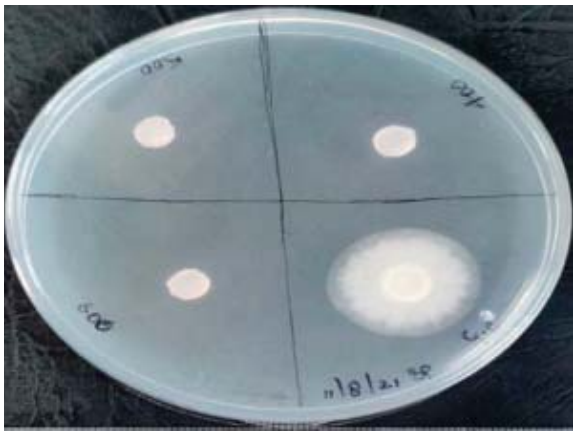


Fig. Absence of hyphal growth of Saprolegnia under the effect of Chloramine T

Multiplex PCR to for easy identification of *Saprolegnia parasitica*

Sequencing of the rDNA-ITS region is the most common molecular method for identifying *Saprolegnia* species, which is time consuming and requires specialized instruments. It will thus be advantageous to develop a molecular tool that can rapidly identify *Saprolegnia parasitica,* the most destructive pathogen among Saprolegnia species. For easy identification of *S. parasitica,* a multiplex PCR targeting rDNA-ITS region and a hypothetical protein gene was developed using two sets of primer pair. In this PCR, *S. parasitica* is the only species with two amplicons of different sizes 750 bp and 365 bp, whereas other *Saprolegnia* species produced one. Further, the amplicon size resulting from the first set of primers can differentiate *Saprolegnia* species from other fungus. In this protocol, species identification was achieved in a single PCR reaction without sequencing, significantly reducing time, effort, and cost.

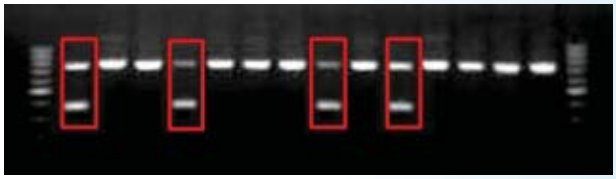


Fig.: Gel electrophoresis of multiplex PCR products with 100 bp ladder. Two bands of PCR product in S. parasitica marked red and single band of 750 bp in other Saprolegnia species

Activities under NEH

Exploratory survey for establishment of trout hatchery at Arunachal Pradesh

A survey of Mechuka, Shi-Yomi district (Arunachal Pradesh) during 15th-16th November, 2021 in connection with to explore the feasibility of establishing a trout hatchery was conducted by Dr Amit Pande, Principal Scientist and Dr R.S. Haldar, Chief Technical Officer.

The team also visited Lhaullung village (Lat 28.59071, Long 94.13042, altitude 2002 m), which is about 12 km away from the town of Mechuka. The proposed site for a "Centre of Excellence in Trout farming" was also visited.

Fig.: Proposed site for centre of excellence

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

A training programme on "Entrepreneurship development on ornamental fish breeding and culture" was organised during 11th-13th November, 2021, under NEH activity by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal in collaboration with the Department of Fisheries, Government of Tripura at Lembucherra Fish Seed Centre, Agartala, Tripura. Sri Mevar Kumar Jamatia, Hon'ble Minister of Fisheries, Government of Tripura inaugurated the programme as the Chief Guest. Sri Dilip Kumar Chakma, Director of Fisheries, Tripura and Dr. Pramod Kumar Pandey, Director, ICAR-Directorate of Coldwater Fisheries Research, Bhimtal also graced the occasion.

Training Programme on "Best management practices on trout culture"

A training programme on "Best management practices on trout culture" was organised on 16th Nov 2021, under NEH activity by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal in collaboration with the Department of Fisheries, Government of Arunachal Pradesh at Convention Centre, Mechuka, Shi-Yomi district (Arunachal Pradesh). In total 78 persons were present during the training. The programme was inaugurated by Mr. Mito Dirchi, Deputy Commissioner, Shi-Yomi district as Chief Guest. Mr. Jaysil Taba, Director of Fisheries, Govt. of Arunachal Pradesh was present as Guest of Honour. The training programme was coordinated by Dr Amit Pande, Principal Scientist, and Dr R. S. Haldar Chief Technical Officer.

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

Input distribution at Tripura

During the training on Entrepreneurship development in ornamental fish breeding and culture at Lembucherra Fish Seed Centre, Lembucherra, Agartala during November 11-13, 2021, the inputs for making of new aquariums like Glass for aquarium (5 mm thickness) Size: 2.0 x 1.0 ft each (3 nos. per aquarium/ person); Glass for aquarium (5mm thickness) Size: 1.0 x 1.0 ft each (2 nos. per aquarium/person); Silicon tube glue (280 ml); Silicon gun; Glass thermostat (100 watt); Power head (15 watt); Aquarium cover (fibre); Marble stone (8 mm/10 kg. per bag); Hand net (6"); Back poster (both side 2 x 1ft); Plant (8"); PVC pipe (20 mm) 20 ft; Siphon pipe set; Masking tape (20 m); PVC L Bow (20 mm); PVC T (20 mm); Diamond knife, Training Kit etc. were distributed among the 20 participated fish farmers of the area.

Activities under scheduled caste sub-plan (SCSP)

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

Fig.: ICAR-DCFR Scientist interacting with farmers

Under Schedule Cast Sub Plan training cum critical input distribution program was organized at village Nai, Bhumka on 28 August, 2021. During the program villagers were sensitized towards fish farming and scientist discussed about the basic farming techniques suitable for the area, PMMSY and ongoing directorate SCSP scheme for the welfare and upliftment of SC farmers. Farmers were encouraged for integrated fish farming, ornamental fisheries and value addition along with carp polyculture. The Program was carried out under the guidance of Director Dr Pramod Kumar Pandey and coordinated by Dr Suresh Chandra, Principal Scientist & Nodal Officer SCSP and Ritesh S.Tandel, Scientist & Co-Nodal officer, SCSP.

Three days Training-cum-Awareness program organized

Under the SCSP scheme, a three days Training cum Awareness Program was organized during 28-30 October, 2021 to sensitize the SC fish farmers of Dungsil and Hari Nagar area on "Management Measures for Carp Culture Ponds". A scientist-farmer's interaction meet was also arranged to address the farmer's quarries and measures to be adopted to save the pond during natural calamities. Live demonstration on application of feed, and disinfectants and fish pond water analysis were given to participants. Total 31 villagers attended the training. For measuring total dissolved solids and water temperature TDS meter was also distributed under SCSP. The Program was carried out under the guidance of Director Dr P. K. Pandey and coordinated by Dr Suresh Chandra, Principal Scientist & Nodal Officer SCSP.

Fig.: Scientist–farmer's interaction

Socioeconomic upliftment of SC community of Thekeraguri Village, Nagaon & Morigaon district, Assam through scientific fish farming and fish based ecotourism interventions

A programme was organized by ICAR-DCFR, Bhimtal and College of Fisheries, AAU, Raha under the Scheduled Caste Sub Plan. A total number of 160 SC beneficiaries of the village were trained on different aspects of Scientific Fish culture through a series of 4 Skill development training programme organised during 5thOctober 2021 to 21stOctober 2021. Experts from different fields of Fisheries Science and Veterinary Science conducted theory and practical classes for the trainees. A training manual was also developed and distributed for benefit to the trainees during the training programmes. The programme was coordinated by Dr. D. Sarma, Principal Scientist, ICAR-DCFR, Bhimtal.

Fig.: FRP fish watching boats

A collaborative programme was undertaken by ICAR-DCFR with Nowgong Girls' College, Nagaon (Assam) on "Rural Livelihood and Socio-Economic improvement among Scheduled Caste population of Nagaon district, Assam by adapting to scientific interventions in fish farming practices". The programme was coordinated by Dr. R.S. Haldar, Chief Technical Officer of this Directorate with the Nowgong Girls' College.

Fig.: Input distribution programme organized

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

Hands-on training programme on ornamental fish culture for livelihood upliftment" under Scheduled Caste Sub Plan (SCSP) was organised at Experimental Fish Farm, Champawat on 8th November, 2021. Total number of 30 farmers participated from various villages of Champawat such as Mudiyani, Furkiyajhala, Chauki, Narsinghdanda, Poth, Thulakot and Pati, among them 5 were women and 25 were men. In the end 10 seeds of ornamental fishes were distributed to each farmer present in programme.Sh Kishor Kunal,Scientist, and Smt GarimaScientist, EFF, ICAR-DCFR, Champawat co-ordinated the programme.

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

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

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

Cluster based carp farming in Harinagar: a SC village in Uttarakhand

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

Activities under Tribal Sub-plan (TSP)

Stakeholder meetings and field exploration in Ladakh

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

Fig.: Joint meeting with the Honourable Lieutenant Governor of Ladakh

Scientific team of ICAR-DCFR visited Pangong Tso lake on 21st August 2021, collected baseline limnological data, and fish and aquatic invertebrate specimens that inhabit this high altitude brackish water lake. Following that, the team visited all the functional government and private fish farms in Leh, Nubra valley, Kargil and Drass, including those in the border villages of Ladakh and assessed the source-specific water quality conditions and documented the farming practices and challenges in fish production.

Fig.: Field exploration and data collection

Fig.: Data collection from trout farms, Leh at Pangong Tso Lake

First RAS based rainbow trout hatchery established in Ladakh

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

In Ladakh, ICAR-Directorate of Coldwater Fisheries Research has established the first scientifically designed and validated Recirculating Aquaculture System (RAS) based rainbow trout hatchery at DCFR adopted farmer Mr. Zabir Ahmad's farm in Chuchot Shamma village, Leh (above 3000 msl), during November 2021.With a production capacity of 50,000 advanced fry, this hatchery can support the production of healthy stock-size fish under controlled environmental conditions.

ICAR-DCFR developed rainbow trout feed distribution and demonstration

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

Fig.: Feed distribution to tribal fish farmers in Leh

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

ICAR-Directorate of Coldwater Fisheries Research organised a one-day training on 'Best management practices for rainbow trout farming in high altitudes' at Government Trout farm, Chuchot,

Leh, on 27th November 2021. In total, 50 tribal farmers, fisheries department officials and interested public participated in the training. This training was coordinated by Dr. Biju Sam Kamalam, Dr. Rajesh, M. and Dr. R.S. Patiyal.

Fig.: Pictorial presentation delivered during the training

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

The Directorate organised an exhibition, demonstration and input distribution programme for tribal farmers at Khatima, Udham Singh Nagar, during 18-19th December 2021. Nearly 225 tribal farmers and villagers of that area visited the exhibition stall of DCFR. This activity was coordinated by Dr. R.S. Patiyal, Mr. Abhay Kumar Giri and Mr. Santhosh Kumar.

Fig.: Farmers' visiting DCFR exhibitions stall at Khatima, Uttarakhand

Field visit and feed distribution program at Baksa, Assam

Fig: Interaction with the participants

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

Activities under Mera Gaon Mera Gaurav (MGMG)

Awareness cum training programme on fish farming at JyurKafun, Almora

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

Fig.: Fish stocking in farmers pond

Fig.: Fish feed preparation and stocking

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

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal organised a awareness on fish farming under the "Mera Gaon Mera Gaurav" programme at Government Inter College, Talla

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

Fig.: Address by Dr PK Pandey, Director, ICAR-DCFR, Bhimtal

Fig.: Discussion on fish farming & vermicomposting

Hon'ble Prime Minister's Interaction with MGMG adopted farmers

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised a "Scientists-Farmers interface on climate-resilient varieties, technologies and practices on 28th September 2021. The session started with the virtual inauguration of the ICAR-National Institute of Biotic Stress Management (NIBSM), Raipur and the release of35 crop varieties with unique traits by Honorable Prime Minister of India.In the inaugural address, Dr.Pramod Kumar Pandey, Director, ICAR- DCFR, Bhimtal, spoke about the importance of climate-resilient crops to address general challenges associated with climate change to participants.Dr Suresh Chandra Pr. Scientist coordinated the programme. Dr. Amit Pande, Pr. Scientist, ICAR-DCFR, Bhimtal,delivered a lecture on climate-resilient agriculture. He said that droughts, floods, and other extreme events make farming more challenging and threaten crop yields worldwide. To cope with the changing climatic conditions, he highlighted the climate-resilient crop varieties and technologies developed by ICAR institutes would helpto achieve long-term higher productivity and farm. Several progressive farmers including public representatives shared their experiences about fish farming and highlighted the profitability of the venture and the support given by the ICAR-DCFR, Bhimtal.The programme was organised as a part of the *"Bharat KaAmrut Mahotsav"* to commemorate *75 Years of India's Independence*. The event witnessed a gathering of 147 participants, including 105 farmers of MGMG adopted villages, officials, scientists, students, staff members, and stakeholders. A formal vote of thanks was proposed by Dr. Suresh Chandra, Pr. Scientist, ICAR-DCFR, Bhimtal.


Fig.: Glimpses of activities of Hon'ble Prime Minister's Interaction with MGMG adopted villages paricipants

Activities at Experimental Fish Farm, ICAR-DCFR, Champawat

Fish seed distribution at EFF, ICAR-DCFR, Chamapawat

On the occasion of Fish Farmers Day i.e, 10.07.2021, One-day Fish farmer seminar was organised at Experimental Fish Farm, ICAR-DCFR, Champawat The seminar was attended by 30 fish farmers from Mudiyani, Pati, Bigrakot, Khunari, Salli, Lohaghat, Banlekh, Dudhpokhara, Chaukuni-Bora, Chauda Sethi, Chauki and Fungar village. A brief session on fish diseases, their symptoms, prevention, cures and fish farming and its associated problems was taken by Scientist and Office in charge Mr. Kishor Kunal. Fish farmers were also briefed upon various state government schemes for the well being of fish farmers. Apart from these sessions fish seed was also distributed to 12 fish farmers of locality.The event was attended by all the staff (permanent and contractual) of the farm.

Fig.: Distribution of fish seed to the farmers

Plantation drive at EFF, ICAR-DCFR, Champawat

On the occasion of ICAR Foundation day, a tree plantation programme was organised on 16.07.2021 at Experimental Fish Farm, ICAR-DCFR, Champawat. On this occasion 25 citrus, 25 walnut, 25 grape, 50 deodar, 50 *tejpatta* and 25 *morpankhi*saplings were planted in the premises of Experimental Fish Farm, Champawat. The event was attended by all the staff (permanent and contractual) of the farm.

Fig.: Sh Kishor Kunal planting morpankhi at farm premises,Champawat

Campaign on Nutri-garden and Tree Plantation

Experimental fish farm, ICAR-DCFR, Champawat Participated in Campaign on Nutri-garden and Tree Plantation 17.09.2021 with respect to International Year of Millets 2023. On the occasion a total of 100 saplings were planted in the premises of Experimental Fish Farm, Champawat.

Fig. Smt Garima planting a sapling in farm premises

Visitors

- G. Susheel, President, Wild Life Association of South, Bangalore visited Experimental Fish Farm, ICAR-DCFR, Champawat on 13.10.2021.
- Thirty-two (32) IAS & IFS trainees (probationers) visited Experimental Fish Farm, Champawat on 28.12.2021 and learned about fish culture in mid hills.

Fig. Sh K. Kunal, Scientist Interacting withIAS & IFS trainees

Events and Meetings

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

ICAR-DCFR celebrated National Fish Farmers' Day on 10th July, 2021. This event is also a part of the ongoing celebrations for the upcoming 75th Independence Day of India named 'Azadi ka Amrut Mahotsav'. The theme for the event was 'Ecosystem Management for Sustainable Fisheries'. Dr. Pramod Kumar Pandey, Director, ICAR- DCFR, Bhimtal, underlined the importance of induced breeding in fishes that paved the way for assured seed supply and sustainable aquaculture development in the country.

Prof. Tej Partap, Vice-Chancellor, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, was the Chief Guest on this occasion. He emphasized on developing the market linkages and distribution channels of cultured fish in Uttarakhand. He also underlined the Institute's role in achieving food and nutritional security. Prof. Ajay Rawat, Kumaon University, Nainital was Guest of Honour on this occasion. He urged studying and combining traditional wisdom and modern technology in fish farming. Dr. R.P. Singh, Director, Directorate of Foot and Mouth Disease, IVRI Campus, Mukteswar, Kumaon Nainital urged the farmers to take up the integrated fish farming and value addition technology for doubling the income. Dr. J.K. Jena, DDG, ICAR (Fisheries division) presided over the interaction through the virtual platform and stated about the technological advancements made in the field of freshwater aquaculture.

Fig.: Inauguration of programme

Fig.: Address by DDG (Fisheries Sciences)

Celebration of Independence Day

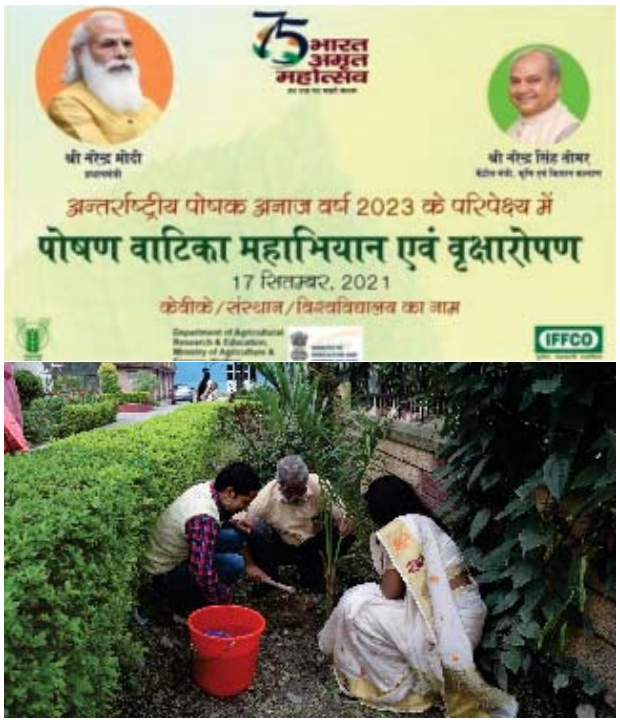
Independence Day celebration at ICAR-DCFR, Bhimtal and Experimental Field Centre, Champawat

The 75th Independence Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate. Dr. Parmod Kumar Pandey, Director, ICAR-DCFR unfurled the national flag and saluted the patriots who fought for our freedom besides the importance of 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. Dr. Pramod Kumar Pandey, Director, ICAR-DCFR congratulated and felicitated the scientists who participated in COVID-19 testing duties at IVRI, Mukteshwar.

International Year of Millets 2023 campaign on Nutri garden and tree plantation

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



Hindi Saptah Samaroh

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

Fig: Participants in hindi Saptah competition

Celebration of 34th Foundation Day of ICAR-DCFR

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, celebrated its 34th foundation day on 24th September, 2021. In his welcome address, Dr Pramod Kumar Pandey, Director, ICAR- DCFR, Bhimtal, congratulated all scientists, progressive fish farmers, and stakeholders who were part of the momentous 33 years journey of the ICAR-DCFR success story. The Chief Guest, Shri Dinesh D. Kulkarni, National Organising Secretary, Bhartiya Kisan Sangh, applauded the Director and scientific staff of ICAR-DCFR on the momentous occasion. He appreciated the commendable work done by the scientists of this Directorate in Himalayan states for the overall growth of coldwater fisheries and aquaculture. The Guest of Honor, Shri Bhuwan Vikram Dabral, member of National Executive Committee, Bhartiya Kisan Sangh, congratulated the Director, DCFR, for excellent leadership and conveyed his best wishes on this occasion. He underlined the importance of linkages between scientific institutes and stakeholders for better dissemination of the technologies among end-users.

Fig.: Release of publications

Fig.: Distribution of aquaculture inputs to farmers

On this occasion, fish feed and seed were distributed among the farmers. The event witnessed a gathering of 220 participants, including 85 fish farmers, officials, scientists, students, entrepreneurs, and stakeholders. Vote of thanks was proposed by Dr. Amit Pande, Pr. Scientist, ICAR-DCFR, Bhimtal.

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

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal organised a programme on 'Waste to Wealth' under the "Special National Swachhta Campaign" of Govt. of India in association with Fisheries Department, Bhimtal and National Service Scheme (NSS), Ramgarh, at Government Inter College, Talla Ramgarh, Nainital on 12th October, 2021. On this occasion, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, addressed the gathering and reminded about the responsibility of every citizen to keep the environment clean and healthy. He further stressed upon the significance of converting kitchen and farm waste into compost, complying with the theme "Waste to Wealth". Dr. N.N. Pandey and Dr. Amit Pande, Principal Scientists, ICAR-DCFR encouraged young students and farmers to efficiently manage household and farm waste. Dr. Pandey also explained the methodology of vermicomposting. A quiz competition was also conducted for the benefit of school students.

ICAR-DCFR celebrated Mahila Kisan Diwas

Fig.: Inauguration of programme and lecture delivered by the guest speaker

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised a "Mahila Kisan Diwas" on 15th October 2021 as a part of the "Azadi Ka Amrut Mahotsav" to commemorate 75 Years of India's Independence. Mrs. Pragyan Dash, Scientist ICAR-DCFR. Welcomed all the Women farmers and congratulated them for playing a multi-dimensional role in agriculture and allied sectors. In the inaugural address, Dr. Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal highlighted the incredible contribution of the women workforce in Indian agriculture. He said that women in India undertake about 80 percent of farm work. Dr. Shweta Rai, Assistant professor, Department of Foods & Nutrition, G.B. Pant University of Agriculture & Technology, Pantnagar, delivered a lecture on value addition in fruits and vegetables. The programme ended with a formal vote of thanks by Dr. K. Victoria Chanu, Scientist ICAR-DCFR.

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

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal celebrated 'World Food Day' under the "National level Campaign" of Govt. of India in association with Green Mount Global School, Kwerali, Bhimtal as a part of the ongoing celebrations of 75 years of independence being celebrated as "Azadi Ka Amrut Mahotsav" on 16th October, 2021. On this occasion, Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, addressed the gathering and highlighted the importance of celebrating World Food Day. He said that our country needs collective action to combat the issue of hunger and ensure healthy diets for all and encouraged the students to include fish in their diet for boosting brain development and other health benefits. Dr. Biju Sam K., Scientist, ICAR-DCFR, Bhimtal, delivered a talk on the role of fish in food & nutrition.

Dr. Debajit Sarma and Dr. N.N. Pandey, Principal Scientists, ICAR-DCFR, graced the occasion and emphasised upon eating healthy foods for overall health and development. A quiz competition was also conducted for the benefit of school students. Approximately 100 participants, including students, teachers and scientists, attended the programme. The programme ended with a formal vote of thanks.

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

Under the National Innovations in Climate Resilient Agriculture (NICRA) Project, ICAR-Directorate of Coldwater Fisheries Research organised a workshop on 'Climate resilient and efficient rainbow trout farming' for a group of ten adopted SC farmers in Urgam village, Joshimath, Chamoli district, Uttarakhand during 29-30th October, 2021. During the workshop, different practical aspects and challenges in farm operation, feed management, disease control, water quality monitoring, post-harvest marketing and government support mechanisms were elaborated to the farmers by Dr. Biju Sam Kamalam, Mr. Anupam Pandey and Mr. Maneesh Kumar Dubey. This programme was coordinated by Dr. Biju Sam Kamalam, Dr.Debajit Sarma, Dr. Rajesh, M and Dr. Prakash Sharma.

Activities undertaken under Special campaign for disposal of pending matters

Under the 'Special campaign for disposal of pending matters and cleanliness drive' during 02-31st October, 2021, a total of 155 files have been reviewed and 55 of them have been identified for disposal at the Directorate. During the period, various shramdaan activities for weeding out of files and scraps were carried out at different facilities such as laboratories, hatchery, ornamental unit, recirculatory aquaculture system, library, institute premises, etc. Additionally, an outdoor programme on 'Waste to Wealth' was organized at Government Inter College, Talla Ramgarh, Nainital. A total of 200 participants, including students, farmers, members of local civic bodies, teachers, scientists, technical staff and other stakeholders, attended the programme.

ICAR-DCFR celebrated "Rashtriye Ekta Diwas"

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

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

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organised campaign on the theme of "Agriculture and Environment: the citizen face" to commemorate "Azadi ka Amrit Mahotsav", by interacting with school children on 26th November, 2021. The programme was conducted at Government High School, Sattal Road, Mehragaon, Bhimtal, District Nainital, Uttarakhand. The programme was coordinated by Dr. Dimpal Thakuria, Dr.Kh. Victoria Chanu, Dr. Pragyan Dash and Dr. Ritesh Tandel.

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

A program of Swachhaata Abhiyan on 22nd December, 2021 was organized at Khirola Pandey Village in Nainital District. 40 villagers participated in the program including 14 lady participants. Dr. D. Sarma, Dr. Neetu Shahi, Dr. Sumanta Mallik from DCFR organised the program. Mr. Bhuvan Chandra Palaria, Gram Pradhan of the village participated in the program and expressed his positive views. During the program in Gram Panchayat Hall, several discussions were made with the village people on the Swachhata Mission and its importance. The theme of the program was "technology demonstration of agriculture technology for conversion of waste to wealth".

Swachhta Pakwara 16-31 December, 2021

Fig.: Swachhata pledge and cleaning drive

ICAR-DCFR, Bhimtal and its field centre EFF, ICAR-DCFR, Champawat organised a series of events on the occasion of Swachhta Pakhwada from 16.12.21

to 31.12.21. The activities undertaken were display of banners, Swachhta pledge taking, plantation of trees, cleanliness and sanitation drive in nearby villages, markets places and MGMG adopted villages, Awareness creation on utilisation of organic wastes, recycling of wastes, organising awareness campaign on conversion of waste to wealth, farmers interaction, etc. the said activities were undertaken in campuses, selected villages and market places of Champawat and Nainital districts of Uttarakhand. The activities were undertaken on daily basis and were displayed in directorates website and social media handles. The programme ended with highlighting and publicising the activities undertaken in fortnight in the print media. The programme was coordinated by Parvaiz Ahmad Ganie, Scientist with the support of all the staff members of the directorate.

Fig.: Cleanliness campaign was organized by the staff members of ICAR-DCFR Field Centre, Champawat with the involvement of villagers at Mudiyani village

Fig.: Swachhata campaign was also organized by the staff members of ICAR-DCFR, teachers, students and villagers in the school campus and Suryagaon village

Fig.: The programme was organized at Village: Khairola Pandey in Nainital District.

Fig.: The competition on Essay and slogan writing was based on the theme "Swachh Bharat Abhiyan" followed by an extempore competition on the topic "Plastic pollution: impacts and mitigation".

Fig.: Sh. Anil Chanautiya, Member, Zila Panchayat, Nainital participated in the awareness programme on waste management under the Swachhata Pakhwada

Fig.: An awareness programme on community waste management and compost pits cleaning was organized at the Government Primary School, Tirchakhet, Distt. Nainital with the involvement of DCFR staffs, teachers & students of the school and local residents.

Fig.: A swachhta awareness program on "plastic waste management" was organised at village Doodhpokhra, champawat wherein participants were made aware of plastic pollution and its consequences on environmental health.

आइसीएआर में मनाया गया स्वच्छता पखवाड़ा, रोपे पौधे

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

भाकृअप के स्वच्छता पखवाड़े का समापन

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

Fig: SWP activities in print media

National Campaign on Antimicrobial Resistance in Fish

ICAR-Directorate of Coldwater fisheries Research, Bhimtal organised six programmes at different locations in Nanital district under "National campaign on antimicrobial Resistance in fish" from 22-

24th November 2021, which aims to increase awareness on antimicrobial resistance and to encourage best practices among the general public, fish farmers, fisheries department officials, students and policy makers to avoid the emergence and spread of antimicrobial resistant bacteria. Dr. Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, expressed concern on the rising tide of antimicrobial resistance in the world and encouraged the scientists of the Directorate to organise awareness programmes on AMR for the general public, fish farmers, fisheries officials and office staff. The programme was coordinated by Sh. Sumanta K. Mallik, Scientist, Nodal officer, National Campaign on AMR, Dr. Suresh Chandra (Principal Scientist), Dr. Neetu Shahi (Senior scientist), Dr. R.S. Tandel (Scientist) and Dr. Raja Aadil H. Bhat (Scientist), of ICAR-DCFR, Bhimtal.

Fig.: Farmers scientist meet on antimicrobial resistance in Aquaculture at Harinagar on 23.11.21

Fig.: Easy writing competition on antimicrobial resistance in aquaculture at ICAR-DCFR, Bhimtal on 23.11.21

Fig.: Awareness camp on prudent use of chemicals and drugs in Hill aquaculture at Mouna village, Ramgarh on 23.11.21

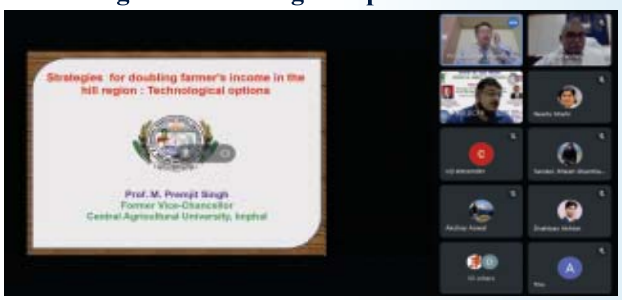
Fig.: Awareness camp on Antimicrobial resistance and one health approach in fisheries and aquaculture on 24.11.21

Fig.: Slogan writing completion Antimicrobial resistance in fish at ICAR-DCFR, Bhimtal on 24.11.21

Fig.: Group discussion on use of chemicals and drugs in Hill aquaculture with state fisheries officials of Uttarakhand on 24.11.21

National Campaign on Azadi Ka Amrut Mahotsav- Lecture Series

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

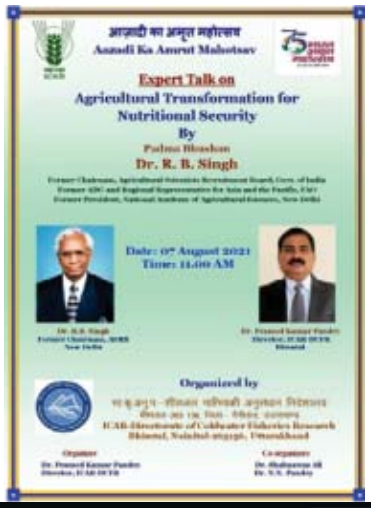


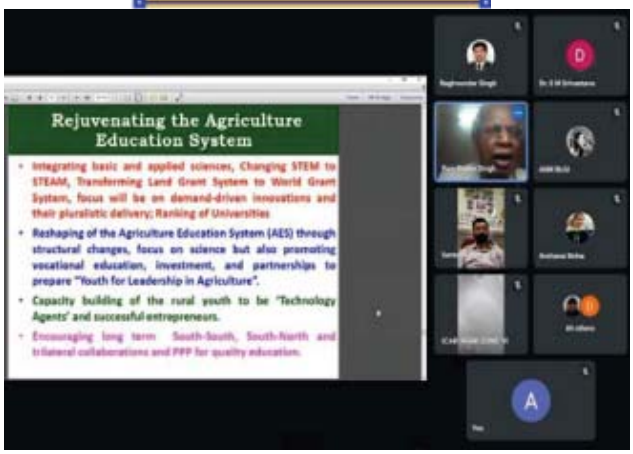
As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the 75 years of India's Independence, a talk on **"Strategies for doubling farmer's income in**

the hill region: Technological options" was delivered by an eminent speaker Prof. M. Premjit Singh, Former Vice-Chancellor Central Agricultural University Imphal, on 3rd July 2021.The programme was organised by the ICAR-Directorate of Coldwater Fisheries Research (ICAR-DCFR), Bhimtal, Nainital, Uttarakhand under 'DARE-ICAR for India@75. The programme was coordinated by Dr. S. Ali, Senior Scientist, Dr. Ritesh S. Tandel, Scientist and Dr. N.N. Pandey, Principal Scientist, ICAR-DCFR, Bhimtal.

Talk on "Agricultural Transformation for Nutritional Security"

As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the 75 years of India's Independence, a talk on **"Agricultural Transformation for Nutritional Security"** was delivered by an eminent speaker Padma Bhushan Dr. Ram Badan Singh, Former Chancellor, Central Agricultural University, Imphal, on 7th August 2021. The programme was organised by the ICAR-Directorate of Coldwater Fisheries Research (ICAR-DCFR), Bhimtal, Nainital, Uttarakhand under 'DARE-ICAR for India@75. The programme was coordinated by Dr. S. Ali, Senior Scientist, Dr. Ritesh S. Tandel, Scientist and Dr. N.N. Pandey, Principal Scientist, ICAR-DCFR, Bhimtal.





Talk on "Food and Nutrition for Farmers"

As a part of 'Azadi Ka Amrut Mahotsav' to commemorate the @75 years of India's Independence, and a National Campaign on **"Food and Nutrition for Farmers",** ICAR-Directorate of Coldwater Fisheries Research (ICAR-DCFR) has organized a webinar on the topic "Food and Nutrition for Farmers" on 26th August 2021. A talk on the above topic was delivered by Prof. R.S. Chauhan, Dean, College of Fisheries, GBPUA&T, Pantnagar. The programme was coordinated by Dr. S. Ali, Senior Scientist, Dr. Ritesh S. Tandel, Scientist and Dr. N.N. Pandey, Principal Scientist, ICAR-DCFR, Bhimtal.

Talk on "Diversification in Aquaculture"

In commemoration of 75 years of India's independence (Bharat ka Amrit Mahotsav) and a National Campaign on "System Diversification in Aquaculture" a talk on "**Diversification in Aquaculture"** was organized by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, on 1st September 2021. A talk on the above topic was delivered by Dr. A.P. Sharma, Former Director, ICAR-CIFRI, Barrackpore. The programme was coordinated by Dr.S. Ali, Senior Scientist, Dr. Ritesh S. Tandel, Scientist and Dr. N.N. Pandey, Principal Scientist, ICAR-DCFR, Bhimtal.

Training and Capacity Building

Virtual training on 'Rainbow trout nutrition and feeding'

The ICAR-Directorate of Coldwater Fisheries Research organized a virtual training on 'Frequently asked questions (FAQs) on rainbow trout nutrition and feeding' for farmers, fisheries officials and other

stakeholders, on 4th December 2021. The training was attended by nearly 70 participants from Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Ladakh, Tamil Nadu and Kerala. This training was coordinated by Dr. Biju Sam Kamalam, Dr. Rajesh, M., Dr. Prakash Sharma and Dr. N.N. Pandey.

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

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

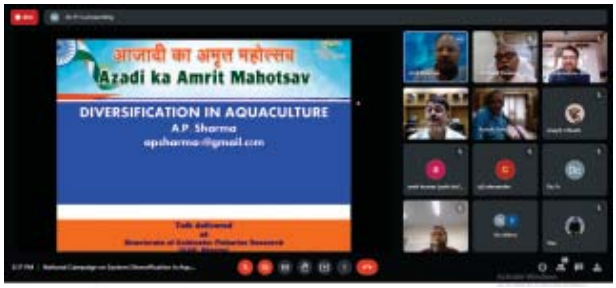


Fig.: Participants in the virtual training programme

Publications

- Durge, S.M., Das, A., Saha, S.K., Pande, A., Thakuria, D., Saxena, A., Bhardvaj, Y. and Verma, A.K. 2022. Dietary lutein supplementation improves immunity and antioxidant status of captive Indian leopards (Panthera fusca). Zoo Biol. doi: 10.1002/zoo.21671. Epub ahead of print. PMID: 35014724.
- Kumari, A., Tripathi, A.H., Gautam, P., Gahtori, R., Pande, A., Singh, Y., Madan, T. and Upadhyay, S.K. 2021. Adhesins in the virulence of opportunistic fungal pathogens of human. Mycology, 12(4): 296-324.
- Akhtar, M.S. Ciji, A. Tripathi, P.H. and Sharma, P. 2021. Dietary β-glucan influences the expression of testicular aquaporins, anti-oxidative defence genes and sperm quality traits in endangered golden mahseer, Tor putitora (Hamilton, 1822). International Journal of Biological Macromolecules, 193: 1286-1293.
- Akhtar, M.S., Tripathi, P.H., Pandey, A. and Ciji A. 2021. Transgenerational effects of β-glucan on thermal tolerance, growth performance, and immune gene expression of endangered cyprinid Tor putitora progeny. Journal of Thermal Biology, 102: 103120.
- Akhtar, M.S., Tripathi, P.H., Pandey, A. and Ciji, A. 2021. β-glucan modulates non-specific immune gene expression, thermal tolerance and elicits disease resistance in endangered Tor putitora fry challenged with Aeromonas salmonicida. Fish and Shellfish Immunology, 119: 154-162.

Lectures/talks delivered

- Dr Amit Pande Delivered a talk on "जलवायु अनुकूलकृषि during the Scientists-Farmers' interface on climate resilient agriculture" on 28th Sept 2021.
- Dr Debajit Sarma delivered talk in DISTF Agriculture and Technology Conclave, 2021 at Regional Science Centre, Dehradun on 28.11.2021 "Diversification of aquaculture: Way Forward for Blue Revolution in Hilly Region".
- Dr Debajit Sarma delivered talk as a Resource Person to the farmers and state fisheries officers organized by National Co-operative Development Corporation, Dehradun on 29.11.2021 in presence of Minister of Fisheries, Govt. of Uttarakhand.
- ShKishor Kunal delivered an online invited lecture to Bachelor Degree students of Neotia University, Kolkata, on the topic "Practical learning and reflections on breeding and larval rearing of coldwater fishes" on 18.09.2021.

Students guided

- Ms. Surabhi Rawat, a PhD student in Biotechnology, submittedher PhD thesis to Kumaun University entitled "Characterization of bacterial isolates from coldwater bodies of Himalayan region of Uttarakhand for their algicidal property against *Microcystis*spp" in December 2021. The research work was accomplished under the guidance of Dr Neetu Shahi, Sr. Scientist.
- Mr Krishna Kala, a PhD student in Biotechnology, submitted his PhD thesis on "Study on efficacy and bio safety level of OTC in selected coldwater fish species" in September 2021. The research work was accomplished under the guidance of Dr Neetu Shahi, Sr. Scientist.
- Mr Mohan Singh, a M.Sc. student in Biotechnology, at Department of Biotechnology, Sir J.C. Bose Technical Campus, Bhimtal, Kumaun University, submitted his thesis on "Isolation and characterization of bacteria and fungi pathogen from diseased rainbow trout (*Oncorhynchusmykiss*) with associated clinical sign of abdominal distension" in August 2021. The dissertation was accomplished under the guidance of Dr Neetu Shahi, Sr. Scientist.

Trainings/Meetings/Webinars/Symposiums

- Dr Neetu Shahi attended the "Basic coding skill in R" for beginners' course for biologists from 29th June to 27th July, 2021, conducted by AFS talks and rainbow analytics, Australia via zoom.
- Dr Amit Pande participated in the Webinar/Online Training on "Online Training on Advance Course on Disciplinary Proceedings" from 22/07/2021-23/07/2021 conducted by National Productivity Council, Government of India.
- Dr Amit Pande participated in the Online Training on "Design Thinking for Research Project Formulation and Implementation" from 24-28 August, 2021 conducted by NAARM, Hyderabad.

Disaster encountered

The flash floods triggered by very hefty rainfall and cloudbursts in Uttarakhand during 18 - 19 October 2021 badly affected the Mahseer Hatchery of the Directorate. The deluge has washed away and caused damage to many infrastructures existing in the mahseer hatchery, including the boundary wall, hatchery tanks and cisterns, ponds, generator, pieces of furnitures, mahseer livestock, nets, motors, and other items. The Competent Authority, ICAR-DCFR, has constituted a committee to assess the loss and damage caused by this natural disaster.

Glimpses of damage caused in the Mahseer Hatchery by the flash floods

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