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The Indian Himalayas have a rich biodiversity and endemic floral and faunal resources encompass rich diversity. The Himalayan Rivers are important resources of surface water and thus, provide multiple services in terms of domestic use, irrigation, fisheries and hydropower development. At the same time aquatic resources including fish fauna are also vulnerable due to various anthropogenic activities and climatic change. Under this scenario, it is imperative to ascertain a sustainable use of resources without further disturbing the habitat. It is also required to map, monitor and assess the health status of these natural resources. The indigenous fish fauna endemic to the region needs to be conserved for ecological sustenance.

ICAR-DCFR is developing models for sustainable resource use to assess the Himalayan aquatic resource health. We used geoinformatics to create a coldwater fishing database and aquaculture site suitability map for Arunachal Pradesh. This information can help plan northeastern Himalayan fisheries and aquaculture. Central Himalayan River habitat and health assessments have shown ichthyofaunal diversity, water quality, and hydrobiological attributes influencing species distribution. Ecotourism and sports fishery play an important role in species conservation and employment generation. The Directorate created a database on golden mahseer angling in Kumaon and identified fish-based ecotourism destinations. Stock validation of distinct mahseer species using genetic methods helps to identify and conserve endangered fish fauna. Efforts are also made to enhance the fertility traits of golden mahseer. The ornamental fishery has potential for hill inhabitants' small businesses therefore, the Directorate is working to breed ornamental indigenous fish species. A mini-RAS model and biofilter substrates were tried for intensive rainbow trout aquaculture. A field study was conducted to optimise safe loading density for live transportation of rainbow trout yearlings to enable safe transportation. The directorate also created an effective rainbow trout broodstock meal to improve trout brooder feeding. In addition, a comparative evaluation of trout feed was conducted to study the performance at different locations as well as with respect to genetic background of the species.

A sustainable aquaponics strategy for pilot-scale fish-vegetable production in mid-hill Himalaya has

FROM DIRECTOR'S DESK



shown promise in system diversification, however it requires modification before reaching the end users. The directorate is working on developing fish cell linebased in-vitro meat. Molecular analysis of Tor putitora's sex-linked genes helps comprehend this endangered species' sex determination and differentiation. A detailed investigation of health disorders associated with trout loss during seed production helped in the identification of different causative agents and factors as well as the developing remedial measures. The directorate conducted SCSP, TSP, and NEH outreach in Manipur, Arunachal Pradesh, and Uttarakhand. Coldwater fisheries training and awareness programmes were also held. The directorate held a national conference on "Fisheries and Aquaculture for Livelihood and Nutritional Security" at Bhimtal on 18-19 November 2022. The directorate also participated in 'Swachhata Abhiyan' during October and December, 2022 and also in different National campaigns organized by ICAR.

Finally, I sincerely acknowledge Dr. Himanshu Pathak, Secretary DARE and Director General, ICAR, and Dr. J.K, Jena, Deputy Director General (Fisheries Sciences), for their encouragement and insightful advice. The editorial team is highly appreciated for their efforts in collating and archiving the directorate's scientific accomplishments.

(Pramod Kumar Pandey) Director

Fisheries Resource Management

Digital database on coldwater fishery resources of Arunachal Pradesh

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



Fig. Digital elevation model and slope of the Arunachal Pradesh

Development of Aquatic Resources Database: A database of aquatic resources, namely riverine network, upland lakes and existing ponds and tanks of Arunachal Pradesh has been developed. For that,

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DEM, LISS III and spatial analyst tools of ArcGIS 10.8 were employed. The aim was to identify and demarcate the aquatic resources such as stream network of the districts and identify the streams that can be considered in selecting the final aquaculture suitable sites.

Development of Decision support framework for final aquaculture suitability: The selection was made using a variety of input parameters based on the district's topographic features (3 criteria), infrastructure features (4 criteria), soil qualities (3 criteria), and water quality (8 criteria). In the context of AHP, these input criteria were placed via pair-wise comparison (Saaty, 1977) in order to create a set of relative weights for each parameter. The decision model for determining the relative value of each criterion included preferences for fisheries development in relation to the evaluation criteria. The final site suitability equation was developed based on the weights determined for each criterion, which resulted in the classification of districts into several zones that includes high potential zones and moderate potential zones.



Fig. Final aquaculture site suitability of Arunachal Pradesh

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

The Saryu River originates from south of Nandakot Mountain in Bageshwar district in Uttarakhand, India. It flows through Kapkot, Bageshwar, and Seraghat



Fig. Aquatic resources of Arunachal Pradesh

towns before discharging into the Sharda River at Pancheshwar at the India–Nepal border. Stations were selected which were Kapkot, Bageshwar, Seraghat, Ghat, Panar and Pancheswar along the stretch of river from its origin to end. Altitude of different stations was ranged from 426-1677 masl along the river stretch. Seasonal sampling was done to collect different samples.

Morphometric parameters characterisation of Saryu basin: The Saryu River, was analysed for detailed study using Advanced Spaceborne Thermal Emission and Reflection (ASTER-30 m) data and topographic sheets of Survey of India. Nineteen (nineteen) watersheds were identified within the basin for calculating the morphometric parameters in the linear, areal and relief directions. The total drainage area of the basin is 754.23 km².

Habitat assessment: Habitat assessment was carried out based on the locations of sampling stations, weather conditions, stream characterization, watershed features, riparian vegetation, instream features, in-stream sediment and substrate features, physicochemical characteristics of water, phytoplankton, periphyton and zooplankton diversity distribution. Different physicochemical and biological parameters were studied to assess the drainage habitat. The water quality index was analyzed to find out the level of pollution in the area. The value of the water quality index (31.02-95.05) shows the condition of water quality from good to poor based on its physicochemical characteristics. A total 15 species of fish were identified with Schizothorax plagiostomus, richardsonii, S. progastus, S. S. esocinus, Gylptothorax telchitta, G. alkanandi, Naziritor chelynoides, Tor putitora, Barilius bendelisis, B.



Fig. Drainage pattern of Saryu basin

vagra, B. barila, Garra gotyla, Bagarius bagarius, Osparius barna and Nemacheilus corica. A total of 41 species of phytoplankton under three major groups Bacillariophyceae Chlorophyceae and Cyanophyceae were identified with dominant genera *Cymbella*, *Nitzschia*, *Navicula*, *Stigeoclonium* and *Oscillatoria*. Pielou's evenness index (J'), Shannon -Weiner's diversity index H'(loge) and Simpson's diversity index (1-lambda) value indicate the no pollution in the river. Temporal variation was more dominant than spatial. A total of 17 periphyton were identified with a density of 187-1670 individuals/cm². The density of the plankton and periphyton at different sampling stations showed negative correlation with water or stream velocity.



Fig. (a) Bar plot showing the distribution of fish at different sampling stations (b) Bray-Curtis similarity among stations based on phytoplankton diversity and abundance

Assessment of health status and influence of hydrobiological variations on fish assemblages' pattern in River Ladhiya Central Himalayas, Uttarakhand

Anthropogenic activities have overexploited and put strain on India's rivers, particularly the Himalayan rivers. Various stressors, including nutrient enrichment, pollution, sediment buildup, erosion, changes in stream hydrology, and habitat changes, threaten to the ecological integrity and health of streams. A periodic examination of their health is necessary to determine rivers' and streams' actual conditions and rate of change.

Field sampling was carried out at six different locations of the River Ladhiya (Sunnegaon, Sunnkot, Reetha Sahib, Belkhet, Chalthi and Chukka) during the study period for recording and collection of species and hydrobiological data. A total of 36 species of phytoplankton, belonging to three major groups: Bacillariophyceae, Chlorophyceae, and Cyanophyceae were identified from the river. The most dominant genera observed were Nitzschia, Navicula, Synedra, and Cymbella. Pollution level in the river were assessed using indices such as, Pielou's evenness index (J'), Shannon -Weiner's diversity index H'(log₂) and Simpson's diversity index (1-lambda). The results indicated that the river is largely unpolluted. There were17 periphyton species with a density of 388-2045 ind./cm² were recorded and among them filamentous algae like Stigeoclonium and Spirogyra were found dominant.



Fig. (a) Dominance plot among stations based on phytoplankton diversity and abundance (b) Bar plot showing the distribution of periphyton at different station

Five species of fish, namely *Schizothorax richardsoni, Barilius bendelesis, Tor putitora, Barilius vagra, and Garra gotyla*, have been identified in the riverine region. It was discovered that *Barilius bendelesis* was the most dominant fish species and *Garra gotyla* was the least dominant.

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

Sports fishery has immense potential for fishbased eco-tourism generating sufficient employment opportunities for local inhabitants. Mighty golden mahseer is a world-famous sport fish and has been the icon of sport fisheries in the Kumaon region of India that has the world's most potential hotspot for mahseer angling. However, there is a need for strategy and guidelines for organized programs, coordination, and compilation of status reports on angling.



Fig. Data collection from professional anglers of Kumaun region

Information has been generated on angling catch status, angling licensing, hotspots of angling sites, conservation sites, fish species-specific potential streams, and documentation on angling operators, fish landing data and ecotourism beets in six districts of the Kumaon region viz Almora, Udhamsingh Nagar, Champawat, Bageshwar, Pithoragarh, and Nainital. Further, data on the mahseer catch size and fish sizes collected from angling operators and on



Fig. Mahseer angling and fishing camps sites at Kumaun region

licensing revenue generation were collected from the Department of Forest, Department of Fisheries, and beet operators. Data revealed the two main hotspots for angling: Pancheswar and Marchula. There are seven rivers in the Kumaon region where Mahseer and Goonch are available for angling. During the period, one golden mahseer ranching program was organized with district administration and released 10000 fingerlings in Nainital Lake. A digital map was prepared to highlight the potential angling site and sports fish availability.

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

Exploratory surveys were carried out to collect mahseer germplasm from the Nayar River (Vyasghat) and Ganga River (Lakshar) in Pauri and Haridwar districts of Uttarakhand, India. Both morphometric and molecular tools were applied for the identification and characterization of species. More than 30 voucher specimens are preserved and labelled with respective museum ID in DCFR museum. *College of Fisheries*, Raha, Assam carried out sampling in three rivers namely Jia Bhoroli, Diyung, and Dhansiri. Samples of 52 mahseer specimens were analysed and preserved in the Fish Museum of the Department of Aquatic Environment Management, College of Fisheries, Raha. *D.M. College of Science*, Imphal had done sampling in the Chindwin watershed of Nagaland on the Teithung River of the Tuensang District; the Zungki river of Kiphire District and the Tizu river of Phek District. *St. Anthony's College*, Shillong conducted mahseer sampling in the streams that drain into the Umngot River. All specimens were characterized based on morphometric and molecular tools using mitochondrial genes *Cytb, Cox-I* and *ATPase* 6/8. The gene sequences were submitted to NCBI GenBank.

Aquaculture

Thermal and size-dependent fertility traits of male golden mahseer brooders in captive conditions

An experiment on size-dependent fertility traits has been initiated to understand the optimum size of male brooders for maximizing hatchery output. There are three size treatment groups (250 - 350g, 500 -600g, and 900 - 1200g), each containing eight male brooders being reared in 1000L circular FRP maturation tanks. Three milt samplings have been carried out, and seminal plasma has been isolated. Size-dependent sperm count and sperm morphology are being assessed. Initial results are indicative of



Fig. Sampling of mahseer specimens in Nayar river, Pauri, Uttarakhand and Jia Bhoroli river, Assam



Fig. Sampling site and morphometric analysis of mahseer at Nagaland



Fig. Golden mahseer sperm morphology – (a) small size group (b) medium size group (c) large size group

comparatively higher reproductive efficiency among the mid-size group.

Upscaling of the seed production protocol of chocolate mahseer, *Neolissochilus hexagonolepis*

Photoperiod is an important environmental cue, effects of which on gonadal development have been well investigated in several fishes but yet to be envisaged in chocolate mahseer. Around 18 females and 12 males were equally distributed to six of FRP tanks with three treatment groups (12hL: 12hD, 16hL: 8hD, 8hL: 16hD) in duplicate. Milt samples were analyzed to assess sperm viability, sperm morphology and spermatocrit % and sperm abnormality index. In 8hL: 16hD treatment sperm viability index is lower whereas, the abnormality index is higher showing poor milt quality compared to other treatments.



Fig. Assessment of sperm morphology of chocolate mahseer

Development of breeding protocol and larval rearing technique of the selected indigenous hill stream ornamental fishes

Breeding protocol for *Barilius vagra* in captivity was developed in two flow-through tanks equipped with under gravel filter and temperature of 22-23°C. Four different ovatide doses were administered by intramuscular injection to 16 pairs of males and females (1:1). Spawning pair response, spawning fecundity, fertilization, and hatching percentage were significantly higher in one of the ovatide dosage groups. No spawning was recorded when a high dose was administered and 70% fish mortality was noted. Fertilized eggs were transparent, spherical, and demersal.



Fig. Adult B. vagra in aquarium tank and fully grown larvae

Mini RAS for small scale coldwater fish production - Suitability and efficiency of ammonia removal in different biofilter substrates for small-scale aquaculture

The right proportion of biofilter for removing ammonia and nitrite is essential for the success of small-scale RAS. Locally available media such as gravel, sand, and expanded clay aggregates of different size grades have been utilized as biofilter in contrast to commercially available engineered plastic media (MBBR) to remove ammonia. Experimental set-up to test their volumetric nitrification rate (VNR) efficiency was devised. The initial results suggest that crushed gravels had VNR of ~300 g TAN /day/m³.



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

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

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



Development of a sustainable aquaponics model for pilot scale fish-vegetable production in mid-hill Kumaun Himalaya

For sustainable farming in hills, for the first time a novel coldwater aquaponics model was indigenously designed. The research validation was undertaken for the low-tech backyard model and the technology for grow-out production was developed using rainbow trout and lettuce as experimental species. The model can afford the production of three crops of salad greens in a single fish crop. An assessment on technoeconomic feasibility of the aquaponics model showed the potentiality of the system with productivity of 22.3 kg m⁻³ for rainbow trout and 4.22 kg m⁻² for lettuce. Further, the model was used for the sustainable growout production of carps like common carp and grass carp and leafy vegetables such as Swiss chard and pak chov in a low-tech manner with minimal use of mechanical implements. Common carp and grass carp were recorded with a productivity of 35.2 kg m⁻³ and 18.4 kg m⁻³ respectively in six months. The salad greens like Swiss chard and pak choy displayed a

productivity of 3.32 kg m⁻² and 2.58 kg m⁻² respectively within crop duration of two months. To produce tablesize carps, the feed consumption rate was ~ 44.73 kg m⁻³ with FCR ~ 1.67. The system utilizes energy @ ~ 7.312 KWh day⁻¹ and the approximate total energy consumed to produce 1 kg carp and 0.496 kg salad vegetable was ~ 16.37 KWh.



Fig. Harvestable size of salad vegetables and a haul of carp in aquaponics unit

Fish Nutrition and Feed Development

Nutritional intervention for improving reproductive competence and larval quality traits of golden mahseer, *Tor putitora* in captivity

One of the major challenges in the successful rehabilitation and conservation efforts of endangered golden mahseer is the unavailability of a suitable artificial diet for their early larval stages. Therefore, an artificial larval diet has been prepared and evaluated. For this, triplicate groups of golden mahseer larvae, after yolk sac absorption, were fed with goat liver alone, or in combination with an artificial larval diet (mixed feeding), and artificial larval diet alone for 60 days. Then the performance of the larvae under different feeding regimes was assessed in terms of their growth, survival and fitness. Larvae under mixed feeding showed higher growth (in length and weight; see figure) and survival.



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

Formulation, development and validation of efficient brood stock feed for rainbow trout

Rainbow trout farming in India is a profitable business, provided quality seed and cost-effective feed are available plentily when required. Presently, the farmers are facing various problems like mortality at the embryonic and larval stages, spawning failures, asynchrony in gonadal development, or developmental incompetency. The main reasons for these seed production-related problems are inappropriate nutritional and reproductive health of brooders.



An effective brooder feed for rainbow trout has been developed and trials were made at different locations. The ICAR-DCFR formulated brooder feed consistently improved the gonadal development, synchrony in gonad developmental pattern, spawning capacity, fecundity, fertilization rate, and larval development. It exhibited uniformity in their



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

development, especially at eyed ova formation, hatching and yolk sac absorption. The farmers who participated in field trials also reported similar responses. Overall, the intervention of ICAR- DCFR through this improved brooder feed has helped the rainbow trout hatchery operators to obtain superlative seed production compared to earlier breeding cycles. The feed is now being considered for commercialization, and in future, it will be available throughout the country on demand.

Development of a nutrient sensitive and effective package of feeds and feeding strategies for augmenting rainbow trout production

Considering the critical role of feed and feeding in the success of rainbow trout farming, this project was aimed at developing high-performance rainbow trout grower feeds and effective feed management strategies. We partnered with Growel Feeds Pvt. Ltd., Andhra Pradesh, through a research and development memorandum of understanding for commercial relevance.

Comparative evaluation of nutritionally a balanced rainbow trout feed: Firstly, we scientifically developed a high protein-lipid grower feed based on the nutritional requirements of rainbow trout. Subsequently, we comparatively evaluated the performance of this rainbow trout specific feed (RBT: 45% protein and 18% lipid) and a generic carnivorous feed (GEN: 40% protein and 10% lipid), under experimental and farm conditions. After a 10-week feeding trial, under controlled conditions at 15±2°C, the RBT fed juvenile fish outperformed the GEN feed group in terms of final mean weight (+20%), thermal growth coefficient, feed conversion efficiency (FCR was -20%) and protein efficiency ratio, with relatively less feed intake (18 vs. 22 g/kg fish/day). The body condition was similar, but the hepato-somatic index and the viscero-somatic index were high in the RBT group. Whole body lipid was higher in RBT group, but protein and ash content were similar. Further, a



Fig. Summary of the comparative performance of troutspecific and generic feed



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

nine-month production trial in outdoor flow-through raceways at Anantnag, Jammu and Kashmir, across a seasonal water temperature range of 2-19°C was also conducted. Corresponding to our experimental findings, RBT feed resulted in significantly higher growth (40%; 405 vs. 290 g) and unit productivity (16 vs. 11 kg/m³), concomitantly with lower FCR (-31%), cost of feeding (-12%), culture period reduction (2 months) and associated water foot print (-39%). Overall, these results validated the necessity of a nutritionally adequate trout feed.

Evaluation of grow-out feed performance with respect to genetic background: In another on-farm experiment, the performance of a highenergy rainbow trout feed in two families of fish sourced from different locations, namely Jammu and Kashmir (JK) and Champawat (CWT) were compared and evaluated. The seven-month trial was carried out at the Directorate's experimental fish farm, Champawat. At the end of the trial, the CWT fish (642 g) was significantly heavier than the JK fish (535 g) and this was reflected in the mRNA expression of *igf1* and *igf2*. Corresponding to the higher body weight, body condition factor and carcass yield (71.8 vs. 68.4 %) were also higher in CWT fishes. However, the feed conversion ratio was equally good in both groups, regardless of the genetic background. The

two groups also showed significant differences in morphometric features such as dorsal / anal / caudal fin dimensions, jaw length and body depth. Other carcass nutritional composition and sensory characteristics of steaks was not significantly different between the two groups.

Molecular Genetics & Biotechnology

Fish without water: In vitro meat

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

Further, the optimum number of cells required for resazurin assay was standardized and $2x10^5$ cells were found to be adequate to measure the absorbance after 3 hours. Cell seeding efficiency was determined by the static method along with the scaffolds. Moreover, it was observed that under different seeding and treatment conditions there was no significant difference in the way the cells were seeded along with the treated or untreated scaffolds. Further, the



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



Fig. SRM-1

Fig. EPC 2

Fig. SRM 1

data revealed that out of 60000 cells, up to 74% could attach to the scaffolds.

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





Characterization of aerolysin gene of *Aeromonas* hydrophila

Aerolysin, is a pore forming toxin which is secreted as an inactive precursor proaerolysin. It is activated by proteolytic removal of about 40 amino acids from the C-terminus. This proteolysis can be achieved by proteases produced either by the bacterium itself, enzymes of the digestive tract such as trypsin or chymotrypsin. It then binds to eucaryotic cells and aggregates to form holes leading to lysis of the cell. Aerolysinis the founding member of a β -pore forming toxins and they are emerging as potential biotechnological sensors and delivery systems. Aerolysin gene was amplified from genomic DNA of *A. hydrophila*using AHAF (forward) and AHAR (reverse) primers. The amplicon size was 1500 bp approximately. The amplified preproaerolysin gene was found to have an ORF of 1482 bases which codes for 493 amino acids including a signal peptide of 23 amino acids at the N-terminal. Removal of signal peptide resulted to proaerolysin of 470 amino acids which gets activated to aerolysin of 404 residues after cleavage at C-terminal by trypsin.



Fig. (a) Gel electrophoresis of amplified product of aerolysin gene of Aeromonas hydrophila. M: 1Kb ladder, 1 and 2: PCR products (b) Homology modelling of three dimensional structure of activated aerolysin by cleaving with trypsin at C-terminal

Characterization of sex-related genes in *Tor* putitora

A survey on sex related genes in different fishes have been conducted and a battery of genes playing a role in sex differentiation and sex determination were identified. Nucleotide sequences of these genes were downloaded for closely related species such as Cyprinus carpio and Danio rerio. Downloaded nucleotide sequences were blasted against the golden transcriptome assembly of mahseer. Transcripts with high similarity were extracted from the assembly. ORF of the identified transcripts were identified using the ORF finder tool. Nucleotide sequences were translated in to amino acid sequences using Expasy tool Nucleotide sequences of the following genes were submitted to the NCBI database. Multiple sequence alignments of these proteins with the related fish species revealed that dmrt proteins are relatively conserved in golden mahseer during the evolutionary process.



Fig. Amino acid sequence alignments of dmrts



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

Fish Health management

Integration of *in silico* drug designing methods for development of potential antimicrobial agents against fish pathogens

The present study is aimed to develop a computational framework that can be used to identify potential target proteins and their inhibitors for drug designing. The framework was designed to use various computational methods to analyze large datasets of biological and chemical information to identify proteins and small molecules that could be used as drug targets and inhibitors. After applying different computational frameworks, the software predicted nine poses of the ligand-receptor complex, and several ligands showed good interactions with the aerolysin, including morin and magnolol. The antibacterial activities of morin against fish pathogens such as *Aeromonas salmonicida, Pseudomonas aeruginosa, Edwardsiella tarda*, and *A. sobria* were tested using the micro-dilution method. The morin showed growth inhibitory effects against all four fish pathogens, with MIC ranging from 7.8 to 125 µg/ml. The minimum bactericidal concentrations (MBC) and killing kinetics of morin was also studied which indicated antimicrobial activity against all tested bacteria with lower values for *A. sobria* at 50 µg/ml. Morin was found to bind with aerolysin, reducing the virulence of *A. salmonicida* (fig. 1), and was reported to compromise the integrity of the bacterial cell membrane, leading to leakage of cytoplasmic contents (fig. 2), ultimately causing bacterial cell death.





Bacterial strain having anti-Saprolegnia property

Saprolegniasis, an oomycete disease caused by Saprolegnia species, can occur in all life stages of fish and other aquatic animals. Earlier, the disease was controlled by use of various chemical agents, out of which some are banned or others have the issues of health hazards. Therefore, in order to control Saprolegnia infections in aquaculture, new sustainable techniques or alternatives to chemical agents must be developed. We have isolated few bacterial strains that can inhibit the growth of Saprolegnia in vitro. When co-cultured on glucose yeast extract agar, a clear zone of no hyphal growth of Saprolegnia around the bacterial colony was observed. The bacterial strains were identified based on biochemical tests and nucleotide sequence of 16S rDNA. The bacterial culture supernatant could inhibit the growth of Saprolegnia and did not lose its activity even when diluted 8 times. The bacterial cell lysates showed inhibitory activity against Saprolegnia but not as significant as that of culture supernatant. Till date, several bacterial species having anti-fungal and antioomycete property have been proposed as promising biocontrol agents. Therefore, further study on these bacterial isolates may be carried out to identify the

bioactive compounds for development of nature derived anti-*Saprolegnia* agents.



Fig. Bacterial isolates (Laboratory code, ASA4 and ASE11) inhibiting the hyphal growth of Saprolegnia

Investigation on health disorder associated with trout loss during seed production in hatcheries

Timely detection and early response to fish health disorders are key factors for achieving better fish survival and production. Under the project objectives, epidemiological detail, including physicochemical parameters in selected trout hatcheries and brooder raceways, was collected to isolate and characterize the causative agent(s) through laboratory investigations and develop suitable remedial measures for mitigation. A total of 104 trout raceways and six hatcheries, including three government hatcheries, located in the Uttarakhand districts of Rudraprayag, Chamoli, Bageshwar, Nainital, and Champawat were covered during the period under report. Samples from fertilised eggs, eved ova, alvein fry, juveniles, and brooders were collected and the water quality parameters of the source water and the farms were also recorded.



Major problems in brooder raceways were ulceration and whitening of the anal fins, enlargement of the abdominal cavity, hemorrhages in the alimentary canal and pyloric ceca, presence of undigested feed in dead trout brooders (3–5%), over-repining and whitening of eggs during peak breeding months, smaller eggs (3–4 mm), and higher mortality in the summer months. During this period, ich disease, or "white spot" (*Ichthyophthirius multifiliis*), was frequently observed in nurseries, resulting in largescale mortality of up to 58%. Temperature stress, and rearing conditions were found to be important factors in infection multiplication. In some of the farms studied, the fry death was a result of whirling diseaselike symptoms.

National Surveillance Programme for Aquatic Animal Disease-Surveillance of coldwater fish diseases in Uttarakhand (NSPAAD)-II

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



Fig. Farms visited for the collection of baseline data and awareness program on Fish Health organized at Harinagar, District Nainital

Functional feeds for augmenting thermal safety margins in rainbow trout (under NICRA)

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



Fig. Antioxidant supplementation and improved thermal acclimation in rainbow trout

Activities under NEH

Training Programme Organized

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



Fig. Training program at Manipur University, Imphal,

Survey for rainbow trout farm site selection

A site survey was conducted at Tongou village of Lungchong Meiphai (LM) Tehsil, District Ukhrul, Manipur during August 2022 to explore the feasibility of rainbow trout farming and establishment of rainbow trout hatchery/raceways. A team comprising of scientist and technical officer collected the water samples from different sites and analyzed for its suitability for trout farming. Further, the quantity and year round availability of water was also assessed.



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

Activities under Tribal Sub-plan (TSP)

Input distribution, capacity building programmes at Uttarakhand

Various developmental activities among the tribal farmers in the Pithoragarh and Uddham Singh Nagar districts of Uttarakhand were conducted. Trainings were conducted on best aquaculture practices, aqua gardening, aquaponics, feed management and rainbow trout breeding. Likewise, awareness programmes and exposure visits were organised for



Fig. Input distribution among tribal farmers

the tribal farmers regarding fish-based livelihood security avenues. For input distribution, 4000 kg of carp and trout feed, 7000 fish seed, and water quality analysis kits were distributed to 55 tribal beneficiaries in the two districts. Also, one community fish pond was renovated in Pithoragarh district.

Activities under Scheduled Caste Sub-plan (SCSP)

Training programme organized

"Farmer training and Farm Demonstration" under Scheduled Caste Sub Plan (SCSP) was organised by ICAR-DCFR, Experimental Fish Farm, Champawat at Bajarikot Village of Champawat District on 21st December 2022. Total number of 30 farmers participated in the programme.



Rainbow trout culture at Chamoli district of Uttarakhand

All necessary support in terms of input distribution, technical support for proper feed and feeding to rainbow trout along with pond water quality management were provided to trout growers of Urgam, Chamoli, under Himalayan trout Machhali Palak Cooperative Society. Inputs such as trout feed, rainbow trout seed, wader, hand nets and therapeutic medicines were provided to to the 11 selected farmers of the society. A vertical trout egg incubator, trough and trays were also provided to the society for trout seed rearing. Data on growth and yield is being monitored regularly. Farmers are being supported for



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

rearing brood stock to make the cluster efficient for trout breeding and seed rearing.

Extension activities

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

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



Conservation of endangered golden mahseer

ICAR-Directorate of Coldwater Fisheries Research (DFCR), Bhimtal has consistently been doing rehabilitation and conservation efforts for several years through ranching of hatchery-bred fry and fingerlings into rivers, lakes and reservoirs of Himalayan region. In continuation of the bonafide conservation efforts, the Directorate in collaboration with the Nainital district administration successfully organized a seed ranching programme of golden mahseer in Nainital lake, Nainital on 23rd July, 2022. In this event, ten thousand fingerlings were stocked. Shri Dhiraj Singh Garbiyal, District Magistrate and Shri Sandeep Tiwari, Chief Development Officer



Fig. Mahsser seed ranching Nainital lake

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graced the occasion and emphasized upon the need of conservation of mahseer in the lakes of Kumaon. Dr. Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal interacted with media and expressed his concerns to save golden mahseer in the natural water bodies of Kumaon region.

Farm advisories and field days organized at Experimental Field Centre, Champawat

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

- Field Day on "Pond preparation and seed stocking" was conducted on 5th December, 2022 at Shaktipur Bunga, Champawat. Dr. Kishor Kunal, Mrs. Garima, Mr. Hansa Datt, Mr. Bhola Datt and Mr. Vijaydeep Dhapola conducted and coordinated the program.
- Farm advisory on "Brood stock management of common carp" was conducted on 7th December, 2022 at village-Mudiyani, Champawat. Dr. Kishor Kunal, Mrs. Garima, Mr. Hansa Datt, Mr. Omraj and Mr. Vijaydeep Dhapola conducted and coordinated the program.

Awareness programme organized at Experimental Field Centre, Champawat

- One Day awareness programme cum Field Day on "Poly-culture of carps in mid hills" was conducted on 6th September, 2022 at Village- Mudiyani, Champawat. Dr. Kishor Kunal, Mrs. Garima and Mrs. Basanti Devi conducted and coordinated the program.
- One day awareness cum demonstration programme on "Preparation of carp feed using locally available ingredients" was conducted on 26th October, 2022 at village- Mudiyani, Champawat. Dr. Kishor Kunal, Mr. Parviaz Ahmad Ganie, Mrs. Garima, Mr.HansaDatt and Mr. Bhola Datt conducted and coordinated the program.
- One Day awareness programme cum Field Day on "Food and feeding habits of carps" was conducted on 3rd November, 2022 at Village-Dudhpokhara, Champawat. Dr. Kishor Kunal, Mrs. Garima, Mr.Hansa Datt and Mr. Bhola Datt conducted and coordinated the program.

Events, Training and Meetings organized

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

The ICAR-DCFR celebrated national campaign on "Emerging Aquaculture Systems and Practices" and farmers' meet on the day of National Fish farmers' day on 11th July, 2022, under Azadi ka Amrut Mahotsava-75th year of celebration of Independence. The Chief Guest of the programme, Padma Bhushan Dr. Anil Prakash Joshi an environmentalist, green activist and founder of HESCO underlined the importance of natural farming and indigenous technical knowledge for sustainable development. He urged the farmers



Fig. Inauguration of National Campaign and address by Padma Bhushan Dr. Anil Prakash Joshi

to utilise local resources that may bring sustained economic growth in rural India. The four selected progressive fish farmers from Meghalaya, Manipur, Sikkim and Uttarakhand state were felicitated and honoured on this occasion. The farmers shared their success stories and emphasised the profitability of the venture. The event witnessed a gathering of 194 participants, including 95 fish farmers, officials, scientists, entrepreneurs, and stakeholders. Several KVKs and scientists also participated through virtual mode.

National campaign on 'Fish for Health and Prosperity'

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

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

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



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



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

fisheries officials, professors from SKUAST, industry representatives and interested public.

Hands-on training on Recirculating Aquaculture System for Intensive Farming of Coldwater Fish"

ICAR-Directorate coldwater of Fisheries Research, Bhimtal, conducted three days handson training on "Recirculating aquaculture system for intensive farming of coldwater fish" from 1-3rd August 2022. The training was attended by 17 trainee/participants, including farmers, entrepreneurs, aquaculture/fisheries start-ups, and marketing executes. The training program included a lecture and practical demonstration of all the aspects of RAS. The training was coordinated by Dr. Rajesh M and co-coordinated by Dr. Debajit Sarma, Dr. R.S. Patiyal and Dr. Biju Sam Kamalam.



Independence Day Celebration

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

Kunal along with other staff of the farm remembered the freedom struggle and paid homage to the freedom fighters on this occasion.





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

Hindi Pakhwara

Hindi Pakhwara was organized ICAR-DCFR, Bhimtal from 1st to 15th September 2022. On this occasion different programmes such as debate, quiz, easy competition, Hindi typing, and Hindi translation were organized. The programme was coordinated by Mr. Amit Joshi, Hindi Officer, ICAR-DCFR. The staff and students participated in the programme.

Recirculating Aquaculture System (RAS) training for Jharkhand farmers

The Directorate of Fisheries, Jharkhand, organised a three days training for the farmers and entrepreneurs of the state who are presently doing or planning to start fish farming in RAS, during 13-15th September 2022, at the Fish Farmers Training Centre, Ranchi. The training was attended by 50 keen participants and



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

PMMSY scheme beneficiaries. Dr.Rajesh, M. and Dr.Biju Sam Kamalam Scientists from ICAR-DCFR were invited to serve as the resource persons for this training.

Celebration of 35th Foundation Day of ICAR-DCFR

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal celebrated its 35th foundation day on 24th September 2022. Dr Pramod Kumar Pandey, Director, ICAR-DCFR, Bhimtal, congratulated all the scientists, progressive fish farmers, and stakeholders who were part of the momentous 35 years journey of the ICAR-DCFR success story. The Chief Guest, Professor Aditya Kumar Misra, Former Chairman, ASRB, New Delhi, applauded the Director and scientific staff of ICAR-DCFR on the historic occasion. The guest of honour, Dr. Dilip Kumar, Former Director & Vice Chancellor, ICAR-CIFE, Mumbai, congratulated the Director, DCFR, for excellent leadership and conveyed his best wishes on this occasion. Dr. Lakshmi Kant, Director ICAR-



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



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

Vivekananda Parvatiya Krishi Anusandhan Sansthan (ICAR-VPKAS), Almora, while appreciating the Directorate, expressed concern over groundwater depletion and spoke about the simultaneous use of polyethylene lined ponds for storage of water and fish culture in hilly regions.

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

ICAR-DCFR, Bhimtal organized a three-day training programme on "Hands-on-training on hatchery management and seed production of golden mahseer" during 29th September-01st October, 2022. State Fisheries Department officials, entrepreneurs and students attended the training, which was coordinated by Dr M.S. Akhtar (Course Director), Dr Ciji Alexander, and Dr Renu Jethi (Co-course Directors).



Workshop on climate resilient rainbow trout farming

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



Celebration of Agri Start up conclave and Famers meet

ICAR-DCFR, Bhimtal organized live telecast of Agri Startup Conclave and Exhibition. Honorable Prime Minister inaugurated the Agri Startup Conclave and Exhibition at a two-day event titled "PM Kisan Samman Sammelan 2022" on 17th October 2022 at the mela ground of ICAR-Indian Agricultural Research Institute (IARI), New Delhi. Hon'ble MLA Bhimtal, Mr. Ram Singh Kaira attended the programme as the chief guest. All the gathering of farmers, farmwomen, and staff listened to the lectures of Shri Narendra Singh Tomar, Minister of Agriculture & Farmers Welfare, and Prime minister Shri Narendra Modi through live telecast. The Prime Minister released the 12th instalment amount of Rs. 16,000 crores under the Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) through Direct Benefit Transfer. In this programme Prime minister also inaugurated 600 "Pradhan Mantri



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

Kisan Samruddhi Kendras (PMKSK)", launched Pradhan Mantri Bhartiya Jan Urvarak Pariyojana – One Nation One Fertiliser and an e-magazine 'Indian Edge'.

National Symposium on "Fisheries and Aquaculture for Livlihood and Nutritional Security"

The ICAR-DCFR in collaboration with Coldwater Fisheries Society of India (CFSI) has organized two days "National Symposium on Fisheries and Aquaculture for Livlihood and Nutritional security"during 18-19 November, 2022 at Bhimtal. Padam Bhushan Dr. R.S. Paroda, Former Secretary DARE & Director General ICAR. New Delhi graced the ocassion as Chief Guest. On this occasion Dr. Paroda, appreciated the work done by the directorate in the field of coldwater fisheries research. He highlighted the importance of rainbow trout, tilapia and other species and elaborated on doubling the livelihood of the fish farmers of the country, along with the vision of Hon'ble Prime Minister Shri Naremdra Modi's Jawan, Jai Kisan, Jai Vigvan and Jai Anusandhan slogan. Explained and shared his views on the topics of global hunger, global nutritional scurity, and Covid-19 environment security.

On this occasion, Dr. B.P. Mohanty, Assistant Director General, ICAR New Delhi, Dr. G. Sugumar, Vice-Chancellor, TNJFU, Tamilnadu, Dr. Dilip Kumar, Former Director, ICAR-CIFE, Mumbai, Dr. K.M.L. Pathak, Former DDG (Animal Science), ICAR, Dr. Wazir Singh Lakra, Former Director, ICAR-CIFE, Mumbai also presented his views. During the symposium different technical sessions were organized in which scientists, academicians and students presented their research work. Oral and poster competition were also organized. The symposium was attended by scientists, faculties and research scholars from all parts of the country.



Fig. Dignitaries during the National Symposium at ICAR-DCFR

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Fig. Glimpse of National Symposium organized at ICAR-DCFR, Bhimtal

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

ICAR-Directorate of coldwater Fisheries Research, Bhimtal, conducted five days of handson training on "Recirculating Aquaculture System for Intensive Farming of Fish" from 5-9th December 2022. Twenty trainees attended the training, including state fisheries department officials, farmers, entrepreneurs, aquaculture /fisheries start-ups, and marketing executes. The training was coordinated by

Dr Rajesh M (Course Director) and cocoordinated by Dr Biju Sam Kamlam (Course Codirector), Dr Renu Jethi (Course Codirector), Dr Debajit Sarma (Course Codirector) and Dr R. S. Patiyal (Course Co-director).



Participation in exhibition

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



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

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Swachhta Abhiyan

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

Staff members of the directorate at the Bhimtal campus and its field station, Champawat, observed the Special Campaign-2 implementation phase with joy and vigour on 153rd birth anniversary of Mahatma Gandhi. Dr. Pramod Kumar Pandey, Director, urged the employees to actively participate in this noble endeavor and raise awareness among the locals and villagers and keep the workplace tidy. Informing the date-wise designated cleaning and pending issue

disposal activities, Dr. S. Chandra, Nodal Officers made an appeal to the participants to take the activity earnestly for making the month long program successful. Cleaning pledge was taken by staff members.

Swachhta Pakhwara -16-31 December, 2022

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



Fig. Special Cleanliness Drive -2nd to 31st October, 2022



Fig. Swachhta Pakhwara 16-31 December, 2022 organized at various places by ICAR-DCFR

Other programmes organized

•	ICAR Foundation Day celebration at Experimental Fish Farm, Champawat	16 th July 2022
•	National campaign on Non-Conventional Aquaculture System	27 th July 2022
•	Parthenium Awareness Week	16- 22 nd August 2022
•	IUCN workshop organized at at Department of Zoology, Manipur University, Manipur.	5-9th September 2022
	Gandhi Jyanti	2 nd October 2022
	Live telecast global launch of Mission Life	20 th October 2022
•	Communal Harmony Day	25 th October 2022
•	Rashtriye Ekta Diwas	31 st October 2022
•	Vigilance Awareness Week	31 st Oct- 6 th November 2022
•	World Fisheries Day	21 st November, 2022
•	World Soil Day	5 th December 2022
•	22 nd Institute Management Committee (IMC) meeting	28 th December 2022

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Fig. 22nd Institute Management Committee meeting held at ICAR-DCFR, Bhimtal



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

Important Visitors

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•	Sh. Narender Bhandari (IAS), District Magistrate, Champawat visited Experimental Field Centre, Champawat.	30 th August 2022
•	B.Sc agriculture students of Graphic Era Hill University, Bhimtal visited ICAR-DCFR, Bhimtal.	28 th September 2022
•	Sh. Dilip Ghosh, Vice President, BJP, West Bengal, visited ICAR-DCFR, Bhimtal.	3 rd October 2022
•	Students of B.Sc Life Sciences, Department of Zoology, Ramjas College, University of Delhi along with faculty members visited ICAR-DCFR, Bhimtal.	7 th November 2022
•	Padam Bhushan Dr. R. S. Paroda, Former Secretary, DARE & DG, ICAR and Dr. K.M.L. Pathak, Former DDG (Animal Sciences), visited ICAR-DCFR, Bhimtal.	17 th November 2022
•	Dr. Basava Purushottam (IAS) Secretary, Animal Husbandry, Cooperatives, Dairy Development, Agriculture, Horticulture · Government of Uttarakhand visited at Experimental Fish Farm, Champawatn.	26 th December 2022





Fig. Visitor at ICAR-DCFR

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