



ICAR-DCFR

NEWSLETTER



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FROM DIRECTOR'S DESK

I am pleased to present this edition of the ICAR-DCFR newsletter, showcasing our latest research, innovations, and initiatives in coldwater fisheries and aquaculture, reflecting our commitment to scientific excellence and sustainability.

The geospatial decision-support framework for coldwater aquaculture site selection, integrating GIS-based analysis with high-resolution satellite imagery, marks a significant step toward unlocking the aquaculture potential in high-altitude regions. Our research on plastic-degrading bacteria addresses the rising threat of microplastic pollution. The identification of potential plastic degrading bacteria may pave the way for eco-friendly remediation strategies.

The taxonomic reassessment of snow trout (*Schizothorax* sp.) from the Indian Himalayas resolves species ambiguities, contributing to effective management and conservation of this vital coldwater fishery resource. On the other hand, our IUCN threat status assessment of Himalayan fish species, through field surveys and expert consultations, supports the formulation of conservation strategies for threatened biodiversity.

In aquaculture, our temperature-dependent fertility studies on golden mahseer brooders and the upscaling of chocolate mahseer seed production protocols demonstrate significant strides. The trademark registration of ICAR-DCFR's technology—"Captive Maturation and Multiple Breeding of Golden Mahseer"—underscores our scientific innovation and conservation efforts. In fish nutrition, the advancement in the development of RAS-specific rainbow trout feeds and weaning strategies for golden mahseer larvae enhance fish health and productivity. Our molecular genetics and biotechnology advancements, including lab-grown meat from coldwater fish and novel bio-engineered antimicrobial peptides & *in-silico* methods for identification of cell penetrating peptides, reflect our commitment to cutting-edge solutions for aquaculture sustainability. The institute's proactive approach to fish health management is evident in the development of vaccines against *Aeromonas salmonicida* and *Lactococcus garvieae*, alongside promising advances



in aquaphage therapy, reducing antibiotic dependency and enhancing disease management.

ICAR-DCFR remains committed to innovation, sustainability, and knowledge dissemination, empowering local communities and fish farmers through NEH, TSP, and SCSP training programs and outreach initiatives. By equipping them with farm technologies and best practices, we enable them to thrive in the evolving aquaculture sector.

I am very thankful to the scientists, staff, and collaborators whose dedication and hard work continue to drive our Directorate's success. I am confident that the research and technologies showcased in this newsletter will inspire and benefit stakeholders, contributing to the sustainable development of coldwater fisheries and aquaculture in India.

I extend my sincere gratitude to Dr. Himanshu Pathak, Secretary DARE & Director General, ICAR, and Dr. J.K. Jena, Deputy Director General (Fisheries Science), for their unwavering support, insightful guidance, and encouragement. I also commend the editorial team for their diligence and creativity in compiling and eloquently presenting the scientific achievements of the Directorate.

(Pramod Kumar Pandey)
Director

Fisheries Resource Management

Decision support framework for coldwater aquaculture in Kargil

A geospatial decision-support framework was developed for coldwater aquaculture site selection in Kargil, integrating various environmental and infrastructural factors. Topographical characteristics such as elevation, slope, aspect, and land use/land cover pattern; essential soil parameters such as texture, pH, organic carbon content, depth, and erosion; as well as infrastructure-related factors, including road networks, market accessibility, farm locations, and government institutions were used to generate thematic maps. High-resolution satellite imagery, GIS-based analysis, and thematic mapping facilitated precise identification of suitable sites, supporting sustainable aquaculture expansion and livelihood enhancement in high-altitude regions.

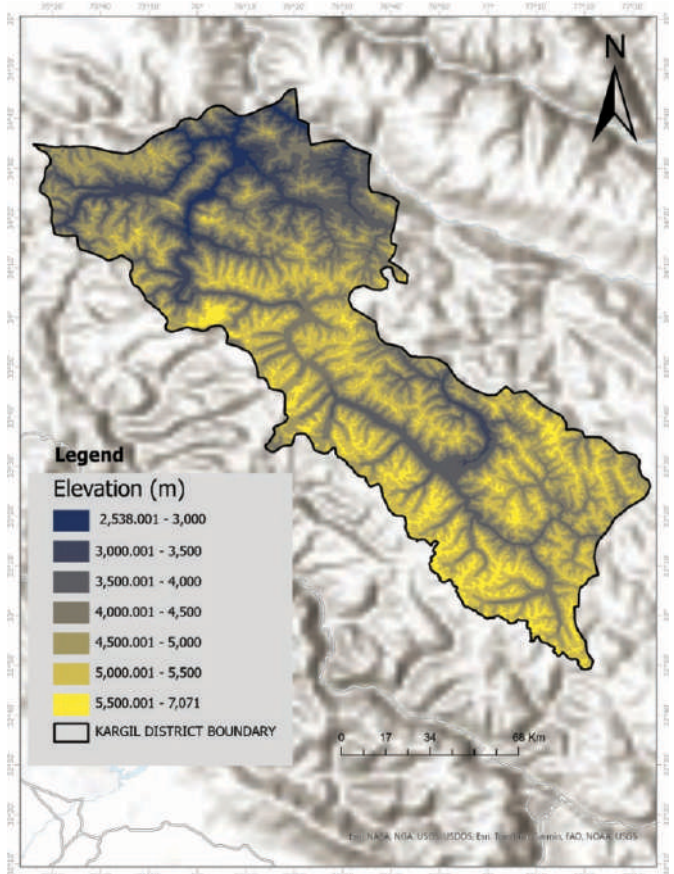


Fig. Spatial distribution of elevation classes of the study region

Identification of plastic degrading bacteria from the Jhelum River, Kashmir

Microplastics are emerging pollutants in the aquatic environment. Microplastic debris (<5 mm) is a prolific environmental pollutant, found worldwide in marine, freshwater and terrestrial ecosystems. Our research findings revealed alarming prevalence of microplastic in the lakes and rivers of Kashmir valley, posing significant risks to aquatic life and human health. Further, we identified a few potential plastic-degrading bacteria from soil and water samples of the Jhelum River, Kashmir through 16S rRNA sequencing, highlighting microbial

prospects for bioremediation. These bacteria include *Bacillus subtilis*, *Micrococcus* sp., and *Pseudomonas* spp.

Revisiting the taxonomy of snow trout (*Schizothorax* sp.) from Indian Himalayan Region

Snow trout is an important group in coldwater fisheries and contribute more than 70% of capture fisheries. The most important genus of snow trout is *Schizothorax*. In this study, an attempt has been made to resolve taxonomic ambiguities in snow trout (*Schizothorax* sp.) from the Indian Himalayan waters using classical identification tools. Eight species have been identified so far, with detailed morphometric and meristic analyses highlighting key distinguishing traits. The identified species are *Schizothorax richardsonii*, *S. plagiostomus*, *S. esocinus*, *S. molesworthi*, *S. niger*, *S. planifrons*, *S. progastus*, and *S. nasus*.

Assessment of IUCN threat status of fishes from Himalaya

Under the IUCN project, the threat status of fish of the Eastern and the Western Himalayas was assessed to develop strategies for their conservation. The extensive data collected through field surveys, literature reviews, historical records, and expert consultations has led to the evaluation of 45 fish species from the Western Himalayas and 300 species from the Eastern Himalayas using the IUCN Species Information Service (SIS) Toolkit.

Aquaculture

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

With the goal of identifying the optimal rearing temperature for golden mahseer male brooders to maximize hatchery output, an experiment has been conducted to evaluate temperature-dependent fertility traits in male brooders. The study involved three temperature treatment groups-ambient, 23°C, and 26°C. Key parameters such as temperature-dependent sperm count, spermatocrit, volume, and sperm morphology were assessed. In vivo milt quality was evaluated by fertilizing eggs and monitoring subsequent developmental events. The impact of milt from the different temperature groups on breeding efficiency, including fertilization and hatching rates, was also examined. Additionally, the levels of thiobarbituric acid reactive substances and total antioxidant potential in the seminal plasma were measured. Further analyses included glucose, triglyceride, and total protein levels in the seminal plasma of males reared at different temperatures.

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

A study demonstrated that a nutrient-enriched broodstock diet marginally improved sperm count and spermatocrit while significantly enhancing sperm viability and reducing abnormalities. Moreover, improved broodstock dietary formulation enhanced seminal plasma total antioxidant capacity while reduced TBARS values, indicating increased scavenging ability of reactive oxygen species.

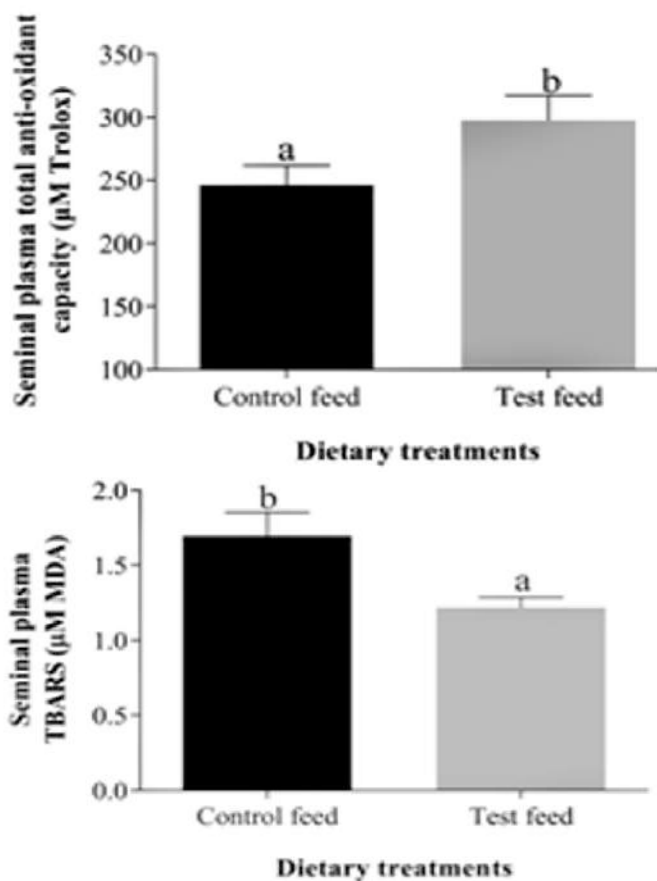


Fig. Effect of broodstock diet on seminal plasma antioxidant status

Breeding of *Botia almorhae*

The brooders of Almorha loach (*Botia almorhae*) were kept in glass aquaria with a gravel bed biofilter and a powerhead pump. They were fed an artificial diet (40% protein, 12% lipid) year-round and Tubifex worms for two months before breeding (June–September). Breeding was achieved using controlled hormone-induced spawning (Ovatide™; a diluted dose 0.2 ml/kg). The eggs could hatch well in the confinement and noticed the whitish/translucent larvae of the almorha loach.



Fig. Spawning substrate: Type and pattern

Fish Nutrition and Feed Development

Development of a weaning strategy for golden mahseer, *Tor putitora*

A preliminary trial was conducted to understand the effect of different weaning strategies on survival and growth of golden mahseer larvae. We formulated an artificial diet (300 and 500µ) containing 50% crude protein and 10% crude lipid. The physical characteristics of the larval feed were also studied. The diameter/size of the feed was

recorded under a stereo microscope attached to a camera. The water stability of the feed was calculated by determining the percentage dry matter losses at different durations (30, 60 and 120 minutes) of immersion in water. Additionally, a 75-day field validation trial of the larval diet was conducted at Departmental Mahseer Farm, Machhyal, Mandi, Himachal Pradesh from 18th June 2024 to 6th September 2024 and got encouraging result.



Development of RAS specific rainbow trout feeds

For evaluating RAS-specific rainbow trout feeds, we designed and fabricated an experimental set-up with three separate replicate RAS loops. Each RAS loop comprises of a 200 L HDPE cylindrical fish culture tank; faecal collection and settling unit; and mixed bed biofilter tank with Kaldnes filter media and gravel. Seven experimental feeds were formulated with different inclusion levels of synthetic binder, guar gum and binder combinations. The in vivo fish trial for evaluating response criteria such as growth, feed utilisation, digestibility and ammonia excretion rate is in progress. Additionally, a pilot study was conducted to ascertain the impact of medicated feeds with antibiotics on RAS biofilter microbiome and water quality parameters, during a bacterial (saddleback) disease outbreak.



Fig. Experimental set-up for the RAS feed evaluation

Molecular Genetics & Biotechnology

Thermal influence on expression profiles of sex-differentiation related genes at early developmental stages of *Tor putitora*

Exposure to stress induces a series of responses and influences a wide range of biological processes including sex differentiation in fish. Stress causes a variety of responses and affects a wide range of biological processes, including sex differentiation in fish. There are a number of molecular

players that are involved in sex differentiation of teleosts. Profiling the expression pattern of candidate sex-differentiation genes at early stage of teleost development would be helpful in understanding its role in sex determination. Therefore, effect of temperature on expression profile of different sex-differentiation related genes such as *amh*, *cyp19a* and *cyp19b* were studied during the early stages of development (50dph to 100dph) in golden mahseer larvae exposed to different temperatures. The mRNA expression profile of *cyp19a* and *cyp19b* showed no significant difference ($p>0.05$) between different temperature treatments in the age group of 50dph, however a significant difference was observed at T2 and T3 compared to the control (22 °C) in the age group of 100dph that indicated initiation of ovarian differentiation. No significant differences ($p>0.05$) were found in the expression level of *amh* between different temperature treatment groups at examined age groups that indicated no testicular development. The expression pattern of these genes provided important clues of sex differentiation in this species. However, further study is required to ascertain the fact at higher developmental stages. The present study provides insight into the sex differentiation in this species and role of temperature which are highly relevant under the climate change scenario.

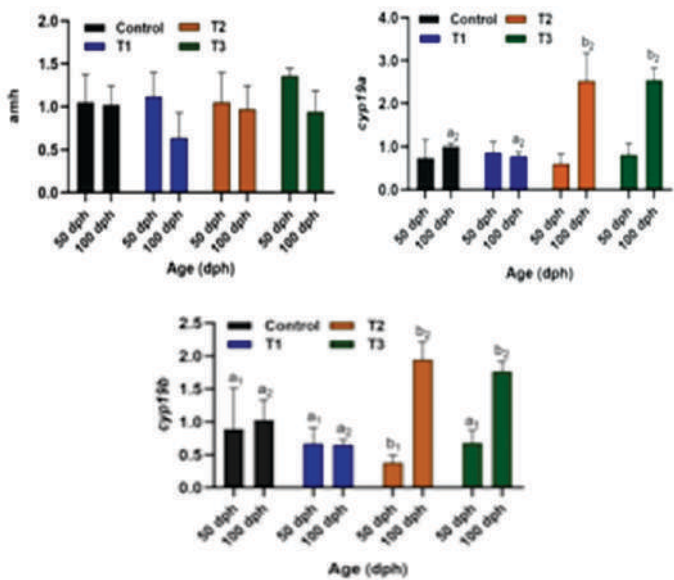
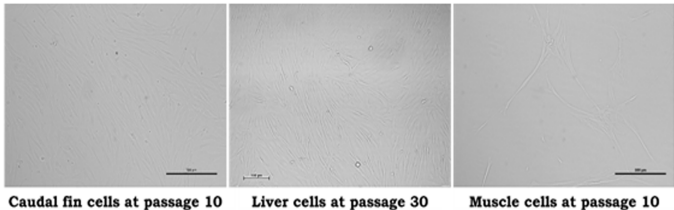


Fig. Effects of temperature on expression of *amh*, *cyp19a* & *cyp19b* at different developmental stages

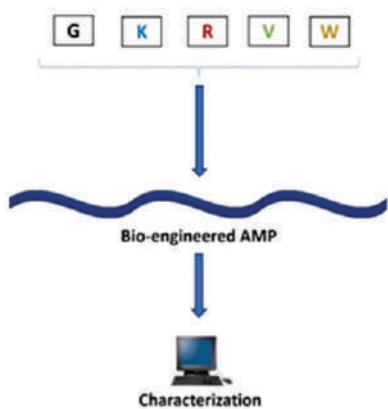
Development of lab grown meat from coldwater fish

Rainbow trout liver, caudal fin, and muscle cell lines were developed, characterized, and cryopreserved, with cell proliferation studies completed. We have inked an MOU with BioKraft Foods, a start-up of the Institute of Chemical Technology for the development of a prototype of *in vitro* fish meat.



Generation of a novel bio-engineered of antimicrobial peptide

Antimicrobial peptides (AMPs) have emerged as a highly promising alternative to conventional antibiotics for treating various infections. Despite their natural occurrence



and numerous advantageous properties, the therapeutic application of AMPs is limited by challenges such as susceptibility to proteolytic enzymes, extreme pH levels, and notably, the high production costs associated with their longer sequences. To overcome these obstacles, short peptides with antimicrobial properties can be designed and synthesized in the laboratory using bio-engineering approach. The advantages of bio-engineered AMPs compared to their natural equivalents include a short length, which results in lower manufacturing costs, as well as the potential for easier modifications to enhance stability and reduce toxicity. In this research, a short peptide composed of 13 amino acids was engineered using glycine (G), lysine (K), arginine (R), valine (V), and tryptophan (W). This peptide was designed to adopt an alpha-helical structure, with one side featuring hydrophobic residues and the opposite side containing hydrophilic residues. The engineered peptide has a net charge of +7 and is predicted to exhibit good water solubility, strong antimicrobial activity, and low toxicity based on various prediction tools.

Optimization of *in-silico* methodology for discovery of novel cell penetrating peptides (CPPs)

Viruses represent molecular structures that exist in a wide range of environments and conditions, making them the most common entities within the biological landscape. Traditionally viewed as threats to various living organisms, viruses are now increasingly recognized for their potential applications in biotechnological and biomedical research. Their inherent characteristics, such as material encapsulation, self-assembly, and multiple mechanisms for cellular entry, combined with their capacity for multivalent post-translational and chemical modifications for surface ligand presentation, render viruses essential tools in the domains of nanoengineering and nanomedicine. In this study, several novel cell-penetrating peptides (CPPs) have been identified from the viral proteins of various fish viruses, including Infectious Pancreatic Necrosis Virus (IPNV), White Spot Syndrome Virus (WSSV), Red Spotted Grouper Nervous Necrosis Virus (RGNNV), Infectious Hematopoietic Necrosis Virus (IHNV), Epizootic Haematopoietic

Necrosis Virus (EHNV), and Cyprinid Herpes Virus (CyHV). These CPPs have been predicted and characterized through various online platforms. In-silico analyses indicate that these novel CPPs may serve as promising candidates for the development of transfection reagents in the future. Furthermore, the optimized in-silico methodologies and pipelines will facilitate the identification of novel CPPs from other viral sources. This study was undertaken under the DBT funded project on 'Computational prediction and characterization of novel cell penetrating peptides from fish virus protein'

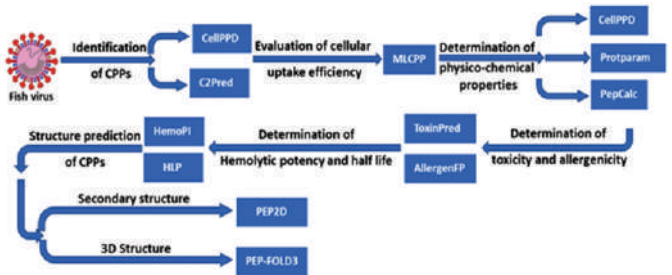


Fig. Pipeline for identification of CPPs from viral proteins

Development of vaccine against *Aeromonas salmonicida* infection for rainbow trout

The virulent *Aeromonas salmonicida* strain Rt6 was revived, characterized, and tested for antibiotic susceptibility. An inactivated *A. salmonicida* vaccine (2×10^8 cells/mL) was prepared and administered to rainbow trout fry via immersion, followed by a booster and homologous challenge, marking a significant step towards vaccine development for sustainable trout aquaculture in India. Biosafety of the vaccine was assessed in EPC cell line and also *in vivo* in rainbow trout fingerlings. Both *In vivo* and *In vitro*, the vaccine did not show any adverse effect.

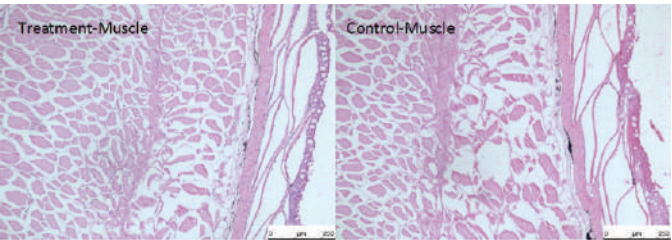


Fig. *In vivo* biosafety assay of vaccine in rainbow trout. No histopathological changes were observed in muscle after 7 days of exposure to vaccine. Staining-H&E.

A methodology combining in silico and in vitro approaches to predict and identify anti-oomycete compounds

During isolation of *Saprolegnia*, a common oomycete pathogen, from infected fish, a bacterial colony was found growing in the same agar plate. Notably, there was no growth of *Saprolegnia* hyphae around the bacterial colony. The bacterium was identified as *Pseudomonas fluorescens* based on the nucleotide sequence of 16s rDNA. *P. fluorescens* known to produce antifungal compounds including 2,4-diacetylphloroglucinol (DAPG), phenazine and pyoluteorin. To assess the potential interactions of these compounds with critical proteins of *Saprolegnia* that

may contribute to their antioomycete activity, molecular docking studies were conducted. The results indicated that all aforementioned compounds interacted with essential enzymes of *Saprolegnia*, such as tryptophan synthase, 1,3-Beta-glucan synthase, urease, and dihydrofolate reductase, exhibiting binding energies between -5.7 and -8.1 kcal/mol. Furthermore, the supernatant from the bacterial culture demonstrated an inhibitory effect on the growth of *Saprolegnia*, suggesting that the antioomycete compounds produced by *P. fluorescens* are released into the surrounding environment. This methodology facilitates the identification of potential inhibitors of essential macromolecules which can be explored for drug development to manage *Saprolegnia* infections.

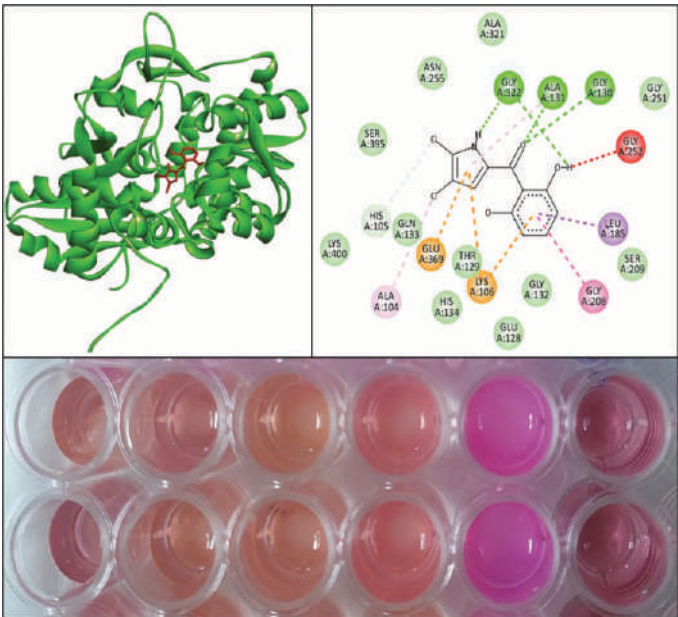


Fig. Interaction between tryptophan synthase of *S. parasitica* and pyoluteorin. Upper panel: 3D and 2D presentation of the molecular docking assay. Lower panel: Resazurin assay to determine the growth inhibition of *S. parasitica*

National surveillance programme on aquatic animal diseases (NSPAAD)-II

Under NSPAAD Phase II, active and passive surveillance were carried out to monitor fish health status in aquaculture practices in Uttarakhand from July to December 2024 with the primary objective of proactively identifying potential disease threats and implementing targeted interventions to minimise their impact. The disease surveillance in four Uttarakhand districts identified bacterial, fungal, and parasitic infections, with no viral detections. Further, two awareness programs trained 50 farmers on disease prevention and reporting via the "ReportFishDisease" app.

Evaluation of the pharmacokinetics of oxolinic acid and its in vitro antibacterial effectiveness

Under the All India Network Project on Fish Health, we assessed oxolinic acid pharmacokinetics and antibacterial efficacy in juvenile rainbow trout, revealing high drug accumulation in the kidney and intestine, strong pharmacokinetic modeling fit, and potent activity against key pathogens, providing insights for optimized dosing and antimicrobial resistance mitigation in aquaculture.

Characterization of sentinel taxon of Himalayan aquatic systems

For sentinel taxon characterization, we comparatively elucidated the differences in the physiology and behaviour of two co-inhabiting cyprinids, namely snow trout and dark mahseer, in wild and captivity. Wild collected snow trout showed active swimming behaviour and correspondingly higher routine and maximum metabolic oxygen consumption rates. After 15-weeks in captivity, snow trout showed significantly higher feed intake, growth, feed efficiency and risk-taking capacity than dark mahseer. In both species, wild to captivity transition was found to enhance body condition factor, muscle protein and lipid content, and hepatocyte size; routine metabolic rate was also altered. Our findings highlight the ability of both these fish species to adapt to environmental transitions in distinct ways. We also studied and described the taxonomical identity, morphological features, biology and behaviour of a brachyuran crab *Himalayapotamon emphysetum*, belonging to the family Potamidae. Male and female could be easily differentiated based on the shape of the abdominal flap; presence of two pairs of gonopods in males; and presence of vulvae and four pairs of swimmerets in females. Behavioural observations indicated that the crabs were nocturnal, territorial and carnivorous benthic feeders. They exhibited cannibalism, periodic moult cycles and the ability to regenerate legs. Habitat-wise, they preferred to stay more in water than terrestrial, and preferred stone shelters over gravel and sand.



Fig. Dorsal and ventral view of *Himalayapotamon emphysetum*

Development of autogenous vaccine against *Lactococcus garvieae* in rainbow trout

An inactivated immersion vaccine (Lg IIV) was developed using a *Lactococcus garvieae* strain isolated from Indian trout farms. The biosafety of the vaccine was assessed *in vitro* using epithelioma papulosumcyprini (EPC) cell line, and *in vivo* using rainbow trout challenge model by immersion and confirmed no cytotoxic effects. The efficacy trials demonstrated an 83.78% relative percentage survival, with significantly enhanced immune responses in vaccinated fish.

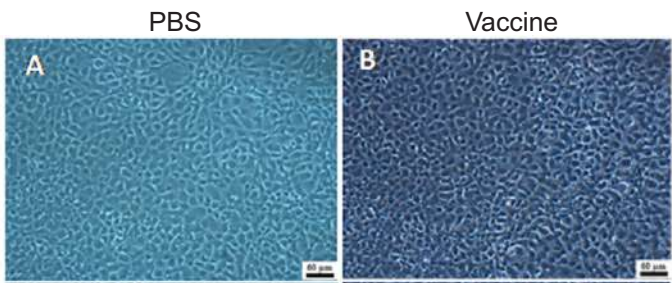


Fig. Biosafety assay of *L. garvieae* vaccine in EPC cell line. Panel at left side of the image is control EPC cell exposed to PBS, and panel at right side of the image is cells exposed to vaccine for 48 h.

Development of aquaphage therapy as an alternative to antibiotics for bacterial infections

Significant progress was made in developing aquaphage therapy for controlling bacterial infections in rainbow trout farms of the Indian Himalayan Region. A total of 15 highly specific bacteriophages with 5 phages each targeting *Aeromonas hydrophila*, *A. salmonicida* and *Lactococcus garvieae* were successfully isolated and characterized from 250 water samples, demonstrating strong potential for targeted biocontrol in coldwater aquaculture.

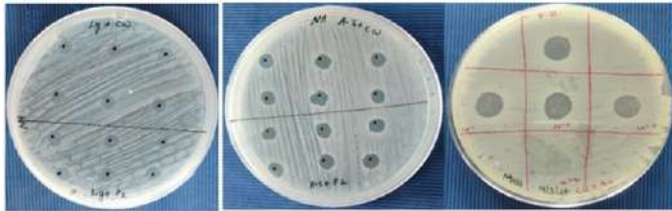


Fig. Spot assay results- Plaque formation on bacterial lawn indicates the presence of phage against the respective bacteria: A. *L. garvieae*, B. *A. salmonicida* and C. *A. hydrophila*

Activities under Scheduled Caste Sub-plan (SCSP)

Training and input distribution programmes organized

During July to December 2024, ICAR-DCFR, Bhimtal as well as its Experimental Fish Farm, Champawat, organized several training programmes for the farmers of the Scheduled Caste community. The various trainings conducted include a three-day training programme on “Breeding and seed production of carps” at Bhimtal during 10-12 July, 2024 which was attended by 16 fish farmers of Nainital. A five-day training was conducted on “Livelihood generation through value added fish and fishery products” during 14-18 October, 2024 at EFF, Champawat. It was attended by 30 farmers from Champawat and Pithoragarh district of Uttarakhand. Another three-day training programme on “Grow-out culture of minor carps and barbs” was organized in collaboration with Krishi Vigyan Kendra, Andro, Imphal East from 02-04 December 2024 with the participation of 25 SC farmers from East Imphal district.

One day training-cum-input distribution programme on “Feed and disease management in trout farming” was organised on 24 October 2024 at Bhimtal. The training was attended by 22 SC farmers engaged in trout farming from Chamoli and Nainital district of Uttarakhand. Another one-day training cum input distribution program focusing on

health management in rainbow trout farming was successfully organized on 7 November, 2024 at Barot Valley, Mandi, by ICAR-DCFR, Bhimtal in collaboration with the Department of Fisheries, Himachal Pradesh.



Fig. Glimpses of trainings conducted

Field days and farmer-scientists interactions organized

A field day-cum-input distribution programme was conducted in Darim village of Nainital district on 6 August 2024. Another field day-cum-input distribution programme was organized at village Pandechore, Bhimtal on 30 August 2024 and was attended by 16 SC fish farmers engaged in composite carp culture. Besides, a field day-cum-input distribution programme was organized at village Harinagar, Bhimtal on 05 December 2024.

Activities under Tribal Sub-plan (TSP)

Field validation of 'Har Ghar Trout' backyard farm model

An alternative small-scale rainbow trout production model was developed to address the issues with traditional rainbow trout culture in flow-through raceways such as high capital costs, huge water requirements and susceptibility to extreme events. During 15-17 October 2024, we inspected potential backyard rainbow trout farming locations in Pangu, Sosa, Sidang, Himkhola, and Sirkhaa villages in Pithoragarh, Uttarakhand. Based on site inspection and suitability, four 'Har Ghar Trout' system was installed in Pangu and Sosa for field validation. Technical advisory and input support is also being provided for the adopted farmers.

Capacity building programmes and farm advisory

ICAR-DCFR organised seven trainings, farm demonstration and awareness programmes on hatchery

management and best aquaculture practices in rainbow trout farming in Pithoragarh district during 15-17 October 2024. Critical aspects of trout farming such as hatchery operation, water quality monitoring, fish husbandry, feed management, record keeping and production economics were explained and demonstrated to the participants. Nearly 246 participants including tribal farmers and fisheries officials from Sirdang, Samare, Himkhola, Pangu and Makam villages benefitted through the capacity building programs. Concurrently, we visited nine farms of tribal farmers, analysed important water quality parameters, and provided on-site scientific advisory on



Fig. Awareness program and farm inspection visit

Input distribution activities

To cater to the input requirements of tribal fish farmers in Uttarakhand, we arranged and distributed 1400 kg of ICAR-DCFR high performance rainbow trout feed to 22 farmers and 4305 kg of carp feed to 42 farmers to support the fish production cycle. Other basic inputs such as nets and water analysis kits were also distributed to 51 farmers.

Extension Activities at Experimental Fish Farm, ICAR-DCFR, Champawat

Farm advisories and field days organized

- Field day was organized along with release of fish seeds at Mayawati Ashram Lake on 22nd September 2024.

Awareness programme organized

- An awareness program on 'Water quality management in rainbow trout pond' was organized at Bardoli village on 12th November 2024 and at Kathar village on 17th December 2024.

Events, Training and Meetings organized

National Fish Farmers Day

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal observed the 24th National Fish Farmers Day on 10th July 2024. Prof. Pradeep Kumar Joshi, Chancellor, CAU, Imphal, Manipur and Chairman, National Testing Agency graced the occasion as the Chief Guest. He emphasized the pivotal role of fisheries in uplifting the



socio-economic status of fish farmers and ensuring nutrition and food security for the country. Dr. Kamal Malla Bujarbaruah, Former DDG (Animal Sciences) and Vice Chancellor, Assam Agricultural University, Jorhat; Prof. W.S. Lakra, Former Director and Vice Chancellor, ICAR-CIFE, Mumbai; Shri. Vivek Chandel (IAS), Director-cum-Warden, Department of Fisheries, Govt. of Himachal Pradesh were the other dignitaries present. On this occasion, six progressive fish farmers from the Himalayan states were felicitated and honoured for their contributions in coldwater aquaculture and fish seed were distributed among the farmers. The event witnessed a gathering of around 200 participants, including 80 fish farmers, officials, scientists, entrepreneurs, and stakeholders.

Prime Minister dedicates 109 climate-resilient and bio-fortified varieties of crops

On 11 August 2024, an online programme was telecast at ICAR-DCFR, Bhimtal in which 109 varieties of field and horticultural crops which was released by honourable Prime Minister, Shri Narendra Modi in Pusa, New Delhi. This programme was viewed online by the staff of the Directorate along with fish farmers of nearby village,



Harinagar, Nainital. The programme highlighted importance of these 109 varieties in enhancing food security, boosting agricultural diversity, and tackling pressing nutritional issues prevailing in the country.

Independence Day Celebration

The 78th Independence Day was celebrated with flag hoisting ceremony attended by staff of Directorate at Bhimtal and Champawat campus. On the occasion, Dr. Pramod Kumar Pandey hoisted national flag at Bhimtal with patriotic fervour and enthusiasm. In his address, he acknowledged the institute's contribution to the country. Dr. Kishor Kunal hoisted national flag at Experimental Fish Farm, Champawat.



National Space Day Celebration

To commemorate the successful launch of Chandrayaan-3 Mission, and soft landing of the Vikram Lander and deployment of the Pragyaan Rover on the Moon on 23rd August, 2023, the Government of India has declared 23rd Day of August of every year as the National Space Day. In this regard, the Department of Fisheries, Government of India, State Governments, and DoF Institutes organized a series of events with active support from ISRO. As part of these ongoing activities, the Department of Fisheries is also organized an event for "Celebration of National Space Day" on 13 August 2024, through hybrid mode which was telecast at ICAR-DCFR, Bhimtal and attended by the staff.



Stakeholders Consultation on Transforming Agriculture Research-Enhancing Role of Private Sector

On 3 September 2024, a stakeholder's consultations meet was organized by Ministry of Agriculture and Farmers Welfare in association with other concerned departments/ ministries, including Indian Council of Agricultural Research (ICAR) on the theme 'Transforming Agriculture Research-Enhancing Role of Private Sector'. It was inaugurated in hybrid mode at Krishi Bhawan, New Delhi. It was attended online by scientists of the Directorate along with invited progressive farmers. After the online programme, scientists-farmers interaction meeting was also organised in the Directorate.



Hindi Pakhwada

Hindi Pakhwada was organised by Hindi section of the Directorate during 1-15 September 2024. During the period, various competitions viz., hindi essay, hindi word knowledge, hindi translation, hindi skill, hindi debate, hindi typing competitions were organised for employees of hindi speaking and non-hindi speaking states. Awards and certificates of these competitions were given to winners on the occasion of foundation day of the Directorate on 24 September 2024.



Celebration of 37th Foundation Day of ICAR-DCFR

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal celebrated its 37th foundation day on 24 September 2024. Dr. Sanjay Kumar, Chairman, ASRB, New Delhi was the chief guest on the occasion. He applauded the Director and scientific staff of ICAR-DCFR on the momentous occasion. He appreciated the



commendable work done by the scientists of the Directorate in Himalayan states for the overall growth of coldwater fisheries and aquaculture. Dr. Ashok Kumar Mohanty, Director, ICAR-Central Institute for Research on Cattle, Meerut; Dr. Y.S. Malik, Joint Director, ICAR-Indian Veterinary Research Institute, Mukteshwar,

Nainital; Shri Hage Tari, IOFS, Secretary Fisheries, Department of Arunachal Pradesh were also present. On this occasion, farm inputs were distributed to the fish the farmers of a village adopted by ICAR-DCFR.

Vigilance Awareness Week and Campaign

Vigilance Awareness Week, themed “Culture of Integrity for Nation's Prosperity,” was observed at ICAR-DCFR, Bhimtal, from 28 October to 3 November 2024. Various activities were organized for students, contractual staff, and the communities of nearby schools and villages to promote awareness about integrity and ethical work practices. An integrity pledge was taken by all staff members, including contractual employees and students at



ICAR-DCFR Bhimtal and the Experimental Fish Farm, Champawat. Additionally, staff members participated in the e-pledge through the Central Vigilance Commission's web portal. As part of the week's activities, an awareness program (goshti) was conducted in Mudiyani village, Champawat, emphasizing the role of vigilance in preventing corruption. A sensitization workshop was also held at a school in Borakhund, Bhimtal, where students were educated on the importance of integrity in personal growth and nation-building. Furthermore, research scholars and contractual staff participated in an essay-writing and quiz competition centered on the theme.

Swachhta Hi Seva Campaign 2024

The 'Swachhta Hi Seva Campaign 2024', themed 'Swabhav Swachhata – Sanskaar Swachhata' was conducted at ICAR-DCFR, Bhimtal from September 15 to October 2, 2024. The campaign concluded with the celebration of Swachh Bharat Diwas on October 2, 2024, in accordance with the directives issued by the Department of Drinking Water & Sanitation (DDWS), Ministry of Jal Shakti, and the Ministry of Housing and Urban Affairs.

Special Campaign 4.0 for Institutionalizing Swachhata and Minimizing Pendency in Government Offices

The Special Campaign 4.0 for Institutionalizing Swachhata and Minimizing Pendency in Government Offices was carried out at ICAR-DCFR, Bhimtal from 02-31 October 24. The campaign focused on improving cleanliness and minimizing administrative delays within government offices. Its primary objectives involved updating outdated procedures, optimizing office space, enhancing sanitation practices, and integrating technology. Efforts were also directed towards clearing old files and records, resolving pending public grievances, improving

record management, streamlining interdepartmental communications, and disposing of scrap materials.

Swachhta Pakhwada

Swachhta Pakhwada was organised at ICAR-DCFR, Bhimtal during 16-31 December 2024. Various cleanliness activities were undertaken during the period with active participation of staff and students.

Exposure Visit and Training on Feed and Disease Management

ICAR-DCFR organized a two-day exposure visit and training on 'Feed and disease management' for rainbow trout farmers from Himachal Pradesh during 31 July to 1 August 2024, at Bhimtal. During this program, lectures on best feed and health management practices in trout farming and control of common diseases in trout farms was delivered to the farmers, followed by question-and-answer sessions. The farmers were also demonstrated feed mill operation, feed types and intensive culture of rainbow trout in recirculating aquaculture systems (RAS). This program was coordinated by Dr. Biju Sam Kamalam and Dr. Renu Jethi from ICAR-DCFR and Mr. Arun Kant from Department of Fisheries, Himachal Pradesh.

Training on CRISPR Editing in Fish

ICAR-DCFR conducted seven days hands on training 'CRISPR Editing in Fish' from 27 August to 2 September 2024. The training was attended by 13 participants from various organisations like College of Fisheries, CAU, Imphal; ICAR- CIBA, Chennai; Palmor Bioscience, Telangana; State Fisheries, Meghalaya; Kumaun University, Nainital, Uttarakhand. The training programme covered various aspects of gene editing such as sgRNA primer design, Invitro transcription of guide RNA, RNP preparations, qPCR and mutation detection. The training was coordinated by Dr. Neetu Shahi, Mr. Sumanta K Mallik and Dr. Renu Jethi.



Training on Nutrition and Feed Management in Coldwater Aquaculture

ICAR-DCFR organized a five-day training on 'Nutrition and feed management in coldwater aquaculture' during 5-9 August 2024, at Bhimtal. The training was attended by 21 participants which include fisheries officials from Himachal Pradesh, feed industry personnel, aquaculture entrepreneurs / farmers, research scholars and students

from nine different states. The course modules was structured to include an overview of coldwater aquaculture in India, global trends in aquaculture nutrition, rainbow trout nutrition and feeding, feed formulation and feed milling basics, nutritional interventions for stress mitigation, digestive physiology of fish, aquaculture nutrition research methodology, prevention of nutritional diseases, role of nutrition in conservation of endemic fish, carp feed management, precision (RAS) feeds, intelligent feeding systems and nutrient delivery methods. The participants were also provided hands-on demonstration on various aspects of nutrition and feed management. This training was coordinated by Dr. Biju Sam Kamalam, Dr. Renu Jethi and Dr. Ciji Alexander.



Training on Health Management in Coldwater Fishes

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organized a three-day training programme on 'Health Management in Coldwater Fishes' from 9-11 September 2024. The programme brought together experts and 10 participants from various institutions, providing a platform to discuss critical health challenges in coldwater aquaculture. The training programme covered various aspects of health management in coldwater fish viz., viral diseases and their management, fish bacterial diseases covering significant bacterial pathogens reported from aquaculture and their treatment, role of bioinformatics in aquaculture, antibiotic alternatives in aquaculture, fungal diseases and their management, practical session on identification of fungal diseases and drug sensitivity assay, prevention and control of nutritional diseases emphasizing the importance of nutrition in fish health. The training programme was coordinated by Dr. Raja Aadil Hussin Bhat, Dr. Neetu Shahi and Dr. Kh. Victoria Chanu.



In-plant Attachment Training for B.Sc (Hons.) Fisheries Students, ITM university, Gwalior

ICAR-Directorate of Coldwater Fisheries Research conducted twelve weeks attachment training for two B.Sc. (Hons.) Fisheries students from ITM University, Gwalior during 22 July to 18 October 2024 at Bhimtal and Champawat. During the training period, students were given practical hands-on exposure and lectures on different aspects of coldwater aquaculture and fisheries including fish production systems, coldwater fish breeding and culture procedures, fish nutrition and feed management, fish diseases and health management, ornamental fish culture and aquarium fabrication, CRISPR/Cas9, biotechnological applications and cell culture, and application of geospatial tools in resource assessment. Exposure visits to rainbow trout farms, hatcheries, RAS systems, feed mill, and mahseer hatchery were also organised. The training was coordinated by Dr. Ciji Alexander.

Training on Coldwater Fisheries and Aquaculture

ICAR-Directorate of Coldwater Fisheries Research, Bhimtal, organized field training during 21-29 November 2024 at ICAR-DCFR, Bhimtal and EFF, Champawat. It



was attended by 11 M.FSc students of ICAR-CIFE. The training programme covered various aspects of coldwater aquaculture viz., fish diseases and their management, nutrition and feeding of coldwater fishes, demonstration of feed mill operation, different aspects of RAS, visit of cage farming and mahseer hatchery at ICAR-DCFR, Bhimtal. At EFF, Champawat participants learnt about various aspects of trout culture. Training programme was coordinated by Mr. S. K Mallik and Dr. Renu Jethi at ICAR-DCFR, Bhimtal and Dr. Kishor Kunal and Ms. Garima at EFF, Champawat.

Participation in Exhibition

Name of the programme	Organizer	Duration	Place/venue
2 nd Fisheries Summer Meet 2024	Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, GoI	22 July 2024	IDA Scrudder Trade Centre, Madurai, Tamil Nadu
Farmers Fair	ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, (ICAR -VPKAS) Almora, Uttarakhand	27 September 2024	ICAR-VPKAS, Almora, Uttarakhand



Fig. ICAR-DCFR Stall

Important Visitors

▪ Prof. Pradeep Kumar Joshi, Chancellor, CAU, Imphal, Manipur and Chairman, National Testing Agency, visited ICAR-DCFR, Bhimtal.	11 th July 2024
▪ Dr. Sanjay Kumar, Chairman, ASRB, New Delhi and Dr. Ashok Kumar Mohanty, Director, ICAR - Central Institute on Cattle, Meerut, visited ICAR-DCFR, Bhimtal	24 th September 2024
▪ Shri Deepak Rawat (IAS), Kumaon Commissioner visited Experimental Fish Farm, Champawat	30 th September 2024
▪ A group of 90 Students of Atal Utkrisht Govt. Inter College, Pulhindola, Distt-Champawat visited Experimental Fish Farm, Champawat	7 th October 2024

▪ A group of 88 Students of Govt. Girls Inter College, Madhyagangol, Distt -Champawat visited Experimental Fish Farm Champawat	16 th October 2024
▪ Mrs. Ranjita Rashmi (IAS), IFOS, Director, MMA visited Experimental Fish Farm, Champawat	13 th November 2024
▪ A group of 64 students of Government Polytechnic College, Bhimtal, visited ICAR DCFR, Bhimtal	19 th November 2024
▪ A group of 34 students of Government High School, Devdwar, Nainital visited ICAR-DCFR, Bhimtal	3 rd December 2024

Publications

- Bhat, R.A.H., Sidiq, M.J. and Altinok, I., 2024. Impact of microplastics and nanoplastics on fish health and reproduction. *Aquaculture*, pp.741037.
- Ganie, P.A., Posti, R., Kunal, K., Pandey, N. and Pandey, P.K., 2024. Morphometric analysis and hydrological implications of the Himalayan River Basin, Goriganga, India, using remote sensing and GIS techniques. *Journal of Groundwater Science and Engineering*, 12(4), pp.360-386.
- Gehlot, B., Chandra, S., Joshi, R., Arya, M. and Chakrabarti, R., 2024. Temporal Variations in Plankton Communities and Environmental Factors in the Shipra, a Central Himalayan Tributary of the Kosi River in Uttarakhand, India. *Environmental Monitoring and Assessment*, 196(3), pp.326.
- Kala, K., Mallik, S.K., Shahi, N., Pathak, R., Sharma, P., Chandra, S., Patiyal, R.S., Pande, V., Pandey, N., Pande, A. and Pandey, P.K., 2024. Emergence of *Aeromonas salmonicidasubsp. masoucida* MHJM250: unveiling pathological characteristics and antimicrobial susceptibility in golden mahseer, *Tor putitora* (Hamilton, 1822) in India. *Veterinary Research Communications*, 48(6), pp.3751-3772.
- Khangembam, V.C., Thakuria, D., Tandel, R.S., Pant, V., Pandey, N. and Pandey, P.K., 2024. Identification and antifungal sensitivity of *Fusarium* species isolated from piscine hosts. *Diseases of Aquatic Organisms*, 159, pp.117-126
- Mallik, S.K., Patil, P.K., Shahi, N., Kala, K., Singh, S., Pathak, R., Tandel, R.S., Pande, A. and Pandey, P.K., 2024. Assessing safety, efficacy and residue depletion in golden mahseer, *Tor putitora* (Hamilton, 1822): biochemical and physiological responses to graded concentrations of oxytetracycline dietary

supplementation. *Veterinary Research Communications*, 48(3), pp.1573-1593.

- Sidiq, M.J., Ciji, A., Siva, C., Chadha, N.K., Sawant, P.B., Pandey, P.K. and Akhtar, M.S., 2024. Ambient ultraviolet-B exposure brings quantum changes in phenotypic and molecular signatures of the embryo of a high-altitude fish, *Tor putitora*. *Environmental Science and Pollution Research*, 31(59), pp.67121-67139.

NCBI Submissions

- Khangembam, V.C., Ali, S. and Thakuria, D (2024). *Aspergillus aculeatus* isolate AsA/TP/ UK/S3/2024 internal transcribed spacer region. (Accession no. PQ037179).
- Khangembam, V.C., Ali, S. and Thakuria, D (2024). *Fusarium solani* isolate FS/TP/UK/S5/ 2024 internal transcribed spacer region. (Accession no. PQ037180).
- Khangembam, V.C., Ali, S. and Thakuria, D (2024). *Alternaria alternata* isolate AIA/TP/ UK/ S7/2024 internal transcribed spacer region. (Accession no. PQ037181).
- Khangembam, V.C., Ali, S. and Thakuria, D (2024). *Fusarium equiseti* isolate FE/TP02/UK/ S8/2024 internal transcribed spacer region. (Accession no. PQ037182).
- Khangembam, V.C., Ali, S. and Thakuria, D (2024). *Trichoderma lixii* isolate TL/TP/UK/ S10/2024 internal transcribed spacer region. (Accession no. PQ037183).
- Khangembam, V.C., Ali, S. and Thakuria, D (2024). *Saprolegnia parasitica* isolate SP/TP02/ UK/S12/2024 internal transcribed spacer region. (Accession no. PQ037184).

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