ICAR-DCFR
NEWSLETTER

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FROM DIRECTOR'S DESK

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

In order to achieve the target of 1 lakh tonne coldwater fish production including 10,000 tonne of rainbow trout by 2024-25 and sustainable development of coldwater fisheries in Himalayan states, the specified thrust areas are to be given priority and challenges to be addressed to convert it to the opportunities for sustainable and inclusive development of coldwater fisheries sector. I am also happy to inform that we have filed 2 patents during this period based on our scientific results, organized 3 international webinar with large participation and started a new network project on species and stock validation of mahseer in eastern and western Himalayan region.

DCFR scientists, staff and research scholar have given admirable and fearless services for the COVID-19 sample testing at VRDL, Haldowani and IVRI, Mukteshwar for more than a period of 7 months continuously.

I complement the editorial board members for bringing out this issue of news letter in a much comprehensive manner with all hard work presenting all the scientific achievements and activates undertaken at its headquarter Bhimtal and Champawat field centre.

I wish you all a very happy and prosperous

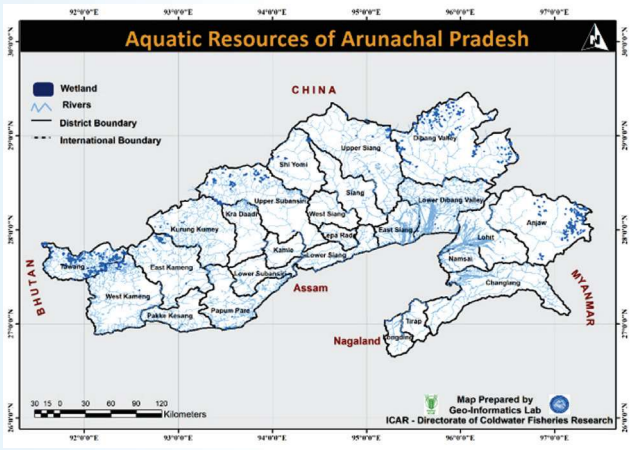
New Year 2021

Debajit Sarma
(Director)

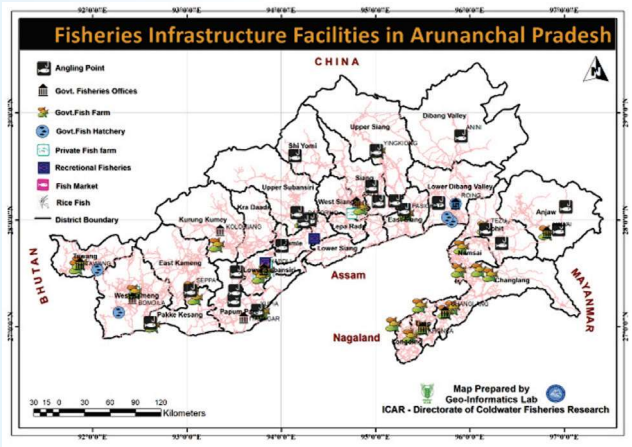
RESEARCH HIGHLIGHTS

Fisheries Resource Management

Aquatic resources in the form of major rivers, their connecting channels, streams and the high altitudinal wetlands in the form of upland lakes in the 25 districts of Arunachal Pradesh using SOI toposheets and satellite data were digitized. Drainage network, stream order and their combined length, area of upland lakes, their GPS coordinates, size wise distribution, altitude wise distribution, connectivity to road, LULC, slope-wise and elevation wise distribution of area in 25 districts of Arunachal Pradesh upto block level were analyzed. Thematic maps on aquatic resources, stream order, infrastructure, land use land cover, DEM, slope, fisheries potential site suitability area was developed.



(A)



(B)

Fig.: (A) Aquatic Resources of 25 districts of Arunachal Pradesh and (B) Fisheries Infrastructure Facilities

Aquaculture

Breeding and seed production of Chocolate mahseer (*N. hexagonolepis*)

Chocolate mahseer (*Neolissochilus hexagonolepis*) is widely recognized as sport fish and food fish in Coldwater rivers and streams of India, Bangladesh, Bhutan, Nepal and Myanmar. The population of chocolate mahseer in the natural water bodies had declined alarmingly due to the over-exploitation and loss of habitat over the years in most of its range. To enhance the natural population of chocolate mahseer, several conservation programmes like building up of sanctuaries, restricted fishing, imposed high penalty for the destructive fishing have been implemented over the years. Breeding and seed production of chocolate mahseer has not been standardized in captivity. Chocolate mahseer adults were procured from Meghalaya, and maintained in captivity in mahseer hatchery of ICAR-DCFR, Bhimtal. Broodstock reared in flow-through rectangular tanks were provided with required environmental conditioning. Stripping was carried out after visualization of the spawning behaviour. Continuous seed production was achieved from the month of July-Nov, 2020. A total of 23,000 eggs were produced and around 15000 fry reared in the hatchery.

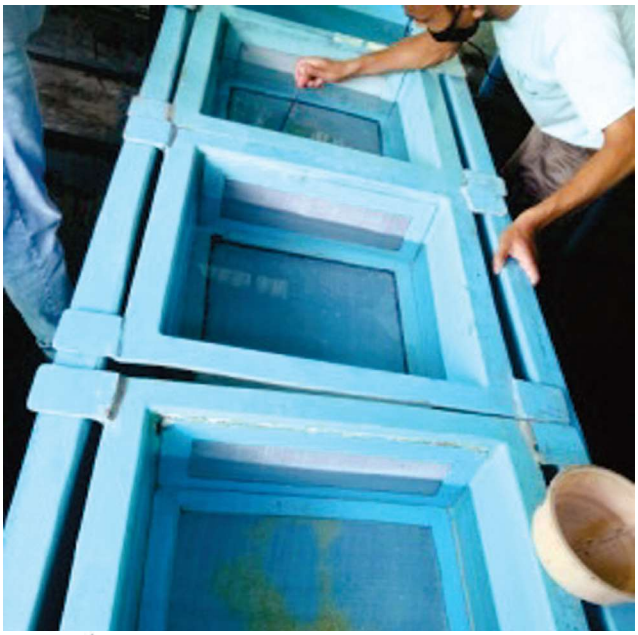


Fig.: Breeding and seed production of Chocolate mahseer in captivity

Feasibility of rainbow trout farming in Recirculating Aquaculture System (RAS)

Production trial is underway in re-circulating aquaculture system to study feasibility and economic viability for farming of rainbow trout in a pilot scale RAS. Growth curves, feed utilization and energy usage are being studied. Current growth curves are depicted in figure below.

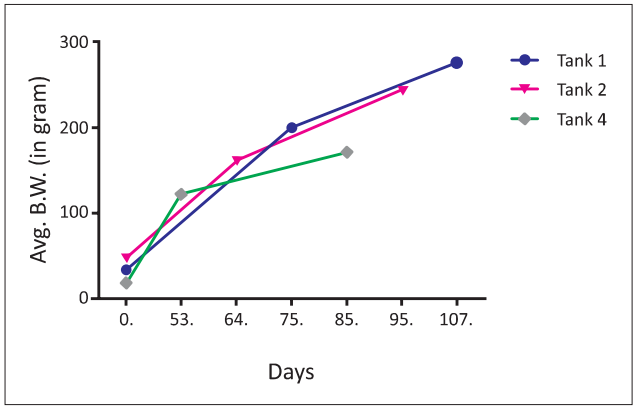


Fig.: Rainbow trout growth trial in pilot scale RAS

16S RNA Phylotyping revealed bacteria harboured in recirculating aquaculture system (RAS) gravel bed biofilter

A 16S RNA phylotyping of DNA extracted from different biofilters maintained under different conditions revealed diverse bacterial profile harboured in fixed gravel biofilter. A major genus observed across the treatment was Nitrospira, its abundance decreased with reducing temperature and addition of organic matter (69.2 to 11.7%). While the other known Nitrifying bacteria found was *Nitrosomonadacea* unclassified, and its abundance was low in practical RAS biofilters. It seems that Nitrospira is a major nitrifying organism found in coldwater RAS biofilter while Nitrosomans abundance is quite less in practical scenario. Considering the dominance of Nitrospira it may be possible that some of the Nitrospira may be comammox as there is sufficient evidences for presence of comammox Nitrospira in RAS biofilter. Overall, the result suggests that the enrichment of Nitrospira is possible which can be used for speeding up the biofilter startups. However, functional annotation and gene study (i.e.AmoA and Nxr) is required to identify some novel nitrifying microorganisms.

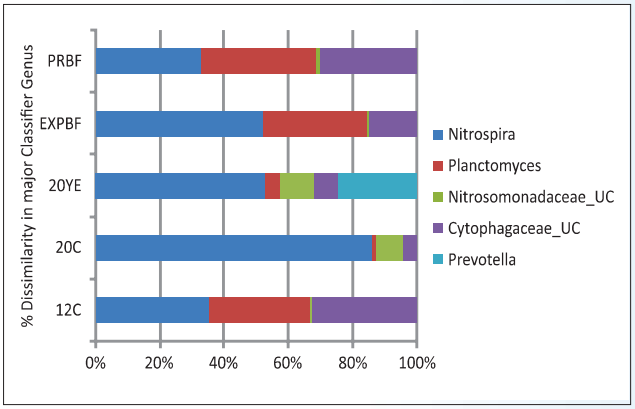


Fig.: The percentage dissimilarity in major genus found in biofilter under different conditions

Fig.: Growth curve of rainbow trout in different stocking density in RAS

Development of a protocol for mass scale production of triploid rainbow trout

Hundred percent success was achieved for induction of triploidy in rainbow trout by pressure shock treatment using aqua pressure vessel. Karyotyping and erythrocytes measurement was standardised as direct methods for confirming the induction of triploidy. However, AgNOR was standardised as an applicable indirect method for triploidy detection. Growth of triploids stock is better in comparison with diploids. Mass scale production of triploids of rainbow trout is feasible by pressure shock. Results of the pressure shock are comparatively better than the heat shock and other methods without

any detrimental side effect and decrease in viability. The protocol developed has direct application in the field for the production of triploid rainbow trout and to achieve better growth of rainbow trout in hills.

Fish Health Management

Evaluation of antimicrobial and immunostimulatory activity of *Myrica esculanta* by molecular dockingand *in vivo* approach

The Himalayan ecosystem has a rich repository of medicinal herbs and *Myrica esculenta* is one amongst them. It is a large shrub commonly known as box myrtle or bay berry belonging to the family *Myricaceae* and native to the hilly regions of northern India, Nepal and Southern Bhutan. The study was carried out to investigate the antimicrobial and immunomodulatory activity of *Myrica esculenta* ethanolic leaf extract (MeALE) in rainbow trout. The fish juveniles were immersed in different doses of MeALE and finally challenged with pathogenic bacteria, *Aeromonas hydrophila*. The immuno-haematological parameters were recorded for seven days post-challenge with *A. hydrophila*. In order to find out the mechanism of antimicrobial activity of MeALE, we attempted molecular docking of the myricetin (active ingredient of *M. esculenta*) with aerolysin and β-ketoacyl acyl synthase I by AutoDock Vina software. We reported

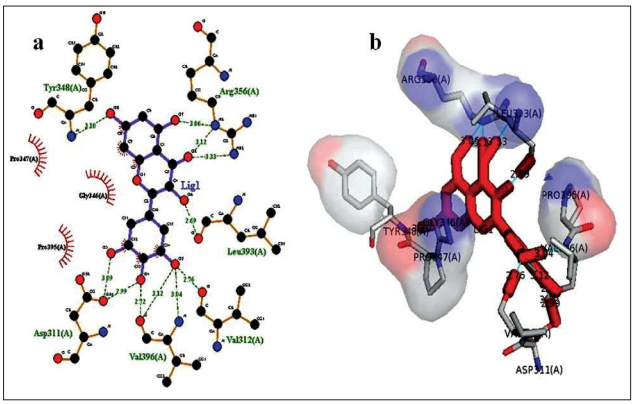


Fig.: Interaction of aerolysin amino acids with myricetin depicted in (a) 2D and (b) 3D

11 hydrogen bonds between myricetin and aerolysin with the binding energy of -7.8 kcal/mol^{-1}, that can inhibit its activity and decrease the virulence of *Aeromonas hydrophila*. Further, the myricetin also showed a significant binding affinity with Beta keto acyl synthase 1 by forming 3 hydrogen bonds, and enable the bacteria to elongate the unsaturated fatty acids. In conclusion, it was found that *M. esculenta* leaf extract has the potential to act as antimicrobial and immunostimulatory agent in aquaculture for treatment of hemorrhagic septicemia. The presence of flavonols like myricetin gives the antimicrobial property to the MeALE. The possible antimicrobial mechanism investigated by molecular docking revealed that it could inhibit vital proteins of *A. hydrophila* crucial for its survival. Further, in our study, non-specific immune parameters were triggered by MeALE. The presence of flavonoids in *Myrica esculenta* may be a possible reason for triggering the innate immune parameters of rainbow trout. The current study found that MeALE can be used against *Aeromonas* infection in the early stage of rainbow trout.

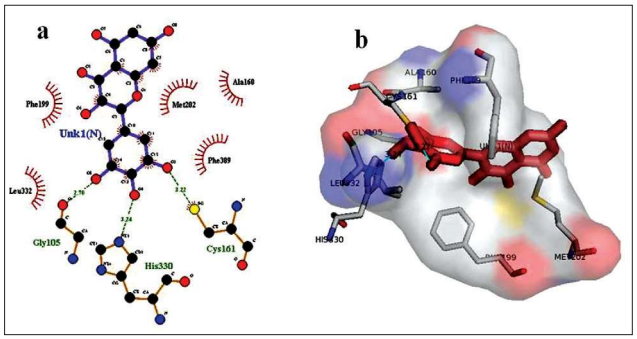


Fig.: Interaction of β ketoacyl acyl carrier protein synthase I amino acids with myricetin depicted in (a) 2D and (b) 3D

Isolation of *Achlya bisexualis* from golden mahseer (*Tor putitora*)

Achlya is a genus of oomycetes under order Saprolegniales. Under this genus, *A. bisexualis* is

reported to have broad host range with the potential to cause emerging disease in farmed fishes. Earlier, many species of *Achlya* have been identified from India, but first isolation of *A. bisexualis* was reported only in July 2020. During the same period, we have isolated *A. bisexualis* from captive-reared golden mahseer. When cultured on PDA agar, it showed white hyphae growing into the substratum as well as above the surface as in case of *Saprolegnia.*

The hyphae were long, slender, aseptate and sparingly branched. The matured zoosporangium showed inflation at the hyphal tip with a papilla like outgrowth. Presence of spherical gemmae confirms the species morphologically as it is the only species of *Achlya* in which spherical gemmae are found. For further confirmation, ITS region was amplified and sequenced. The sequence had more than 99% identity with *A. bisexualis* (EU441154) at 100% coverage.

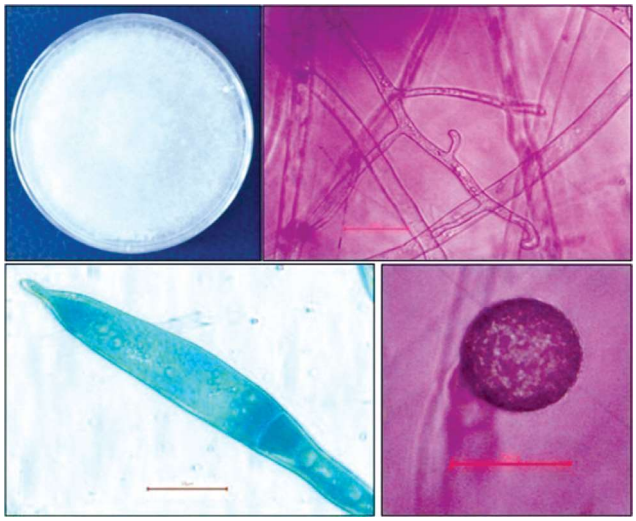


Fig.: *Achlya bisexualis*, on PDA agar, aseptate hyphae, inflated hyphal tip and spherical gemmae

Anti-oomycete activity of antimicrobial polymer 'X'

The anti-oomycete potential of antimicrobial polymer 'X' on *Saprolegnia parasitica* was tested for the minimum inhibitory concentration (MIC) on zoospores and inhibition of mycelial growth. The polymer inhibits zoospore production at MIC value of 100 µM and inhibits hyphal growth.

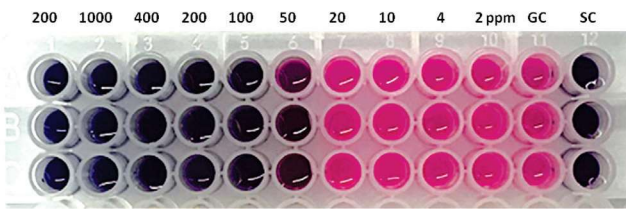


Fig.: Minimum Inhibitory concentration against *Saprolegnia parasitica* spores in GY broth containing different concentrations of polymer after 24h of incubation. GC: Growth control; SC: Sterile control

Bio-engineered peptide as anti-infective agent

The KK16, a novel bio-engineered antimicrobial peptide, have been designed and synthesized. The peptide showed promising antimicrobial activities against various bacterial pathogens including antibiotic resistant bacteria. It retained its activities even in the presence of salts, serum and at higher temperatures. The peptide has membrane damaging activity and also the ability to bind with the genetic material of bacteria. Our results suggest that KK16 could be a promising therapeutic agent in aquaculture.

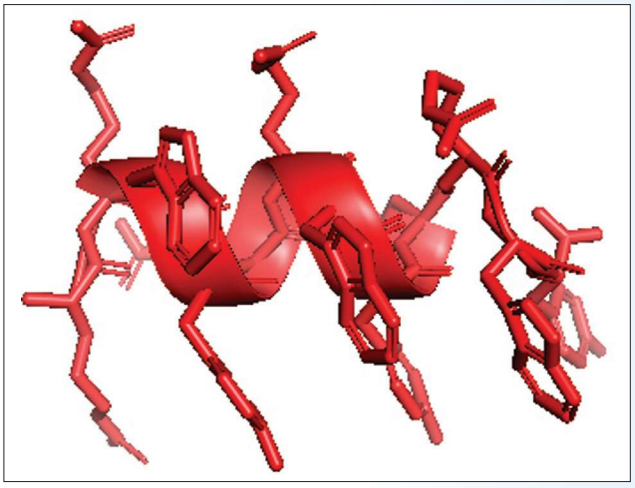
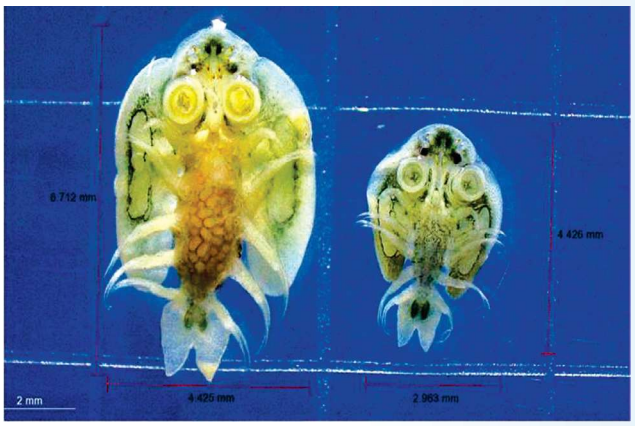


Fig.: Tertiary structure of KK16 antimicrobial peptide

Identification of *Argulus sp* from coldwater fish

Two species of *Argulus* were identified and characterized from golden mahseer and snow trout. Morphological identification was done based on respiratory areas, secondary maxillae and swimming appendages of male specimens under light microscope. Amplification of 18srDNA expressed 98.55% sequence similarity in NCBI BLAST analysis verifying the molecular identification of *Argulus siamensis* and *Argulus japonicus*. The parasitic frequency index (PFI) of infestation was calculated from severe to moderate range with gravels in the bottom.



Antimicrobial resistance, intermediate & sensitive profile of *Escherichia coli* isolated from fish farms in Kullu-Mandi, Himachal Pradesh

Intestines from 33 fish samples; rainbow trout (29), common carp (4) were collected from 33 fish farms in district Kullu-Mandi in Himachal Pradesh and processed aseptically for isolation and purification of *Escherichia coli*. Antimicrobial resistance pattern among isolates of *E. coli* (n=25) was determined against 17 antibiotics by disk diffusion method as per CLSI guidelines. 40% of *E. coli* isolates were resistant to cefoxitin and cefotaxime, whereas 28% isolates were resistant to ampicillin. Low antibiotic resistance in *E. coli* isolates was recorded against amoxicillin/clavulanic acid, cefpodoxime, ceftazidime, ceftriaxone, imipenem, gentamicin, tetracycline, ciprofloxacin, nalidixic acid and trimethoprim-sulfamethoxazole. 32% of isolates had shown intermediate response to ceftazidime, followed by 28% of isolates to cefotaxime and 24% of isolates to imipenem and amikacin. 100% of the isolates were susceptible to aztreonam and colistin, followed by 96% to gentamicin, trimethoprim-sulfamethoxazole and 92% to amoxicillin/clavulanic acid.

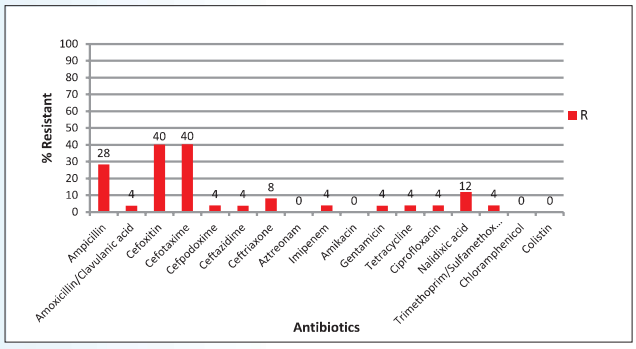


Fig.: Showing antibiotic resistance pattern of ***E. coli*** (n=25) isolated from Kullu-Mandi, Himachal Pradesh

Antimicrobial resistance, intermediate & sensitive profile of *Staphylococcus* spp isolated from fish farms in Kullu-Mandi, Himachal Pradesh

Gill tissues from 33 fish samples; rainbow trout (29), common carp (4) were collected from 33 fish farms in district Kullu-Mandi in Himachal Pradesh and processed aseptically for isolation and purification of *Staphylococcus* spp. (n=23). Antimicrobial resistance pattern among the isolates of *Staphylococcus* spp. (n=23) was determined against 10 antibiotics by disk diffusion method as per CLSI guidelines. The results showed that the highest antimicrobial resistance was observed against penicillin G (43.5%), followed by cefoxitin (39.1%) and oxacillin (39.1%). 21.7% of *Staphylococcus* isolates were resistant to tetracycline and trimethoprim / sulfamethoxazole, whereas 17.4% of isolates were resistant to erythromycin. Low antibiotic resistance among *Staphylococcus* spp. was recorded against ciprofloxacin, chloramphenicol and linezolid, whereas the isolates demonstrated intermediate resistance to erythromycin (17.4%), ciprofloxacin (13%), oxacillin (8.7) and tetracycline (8.7%). 95.7% of the isolates were susceptible to gentamicin, followed by chloramphenicol (91.3%) and linezolid (87%).

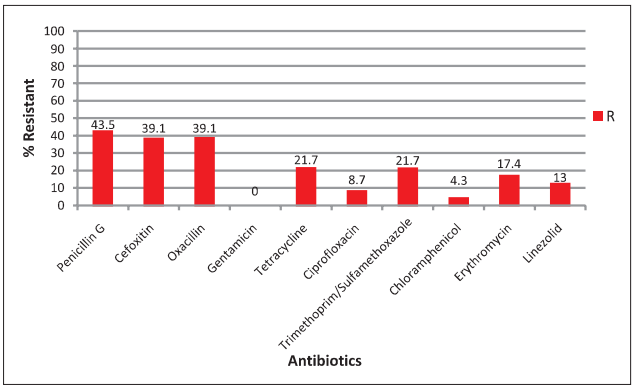
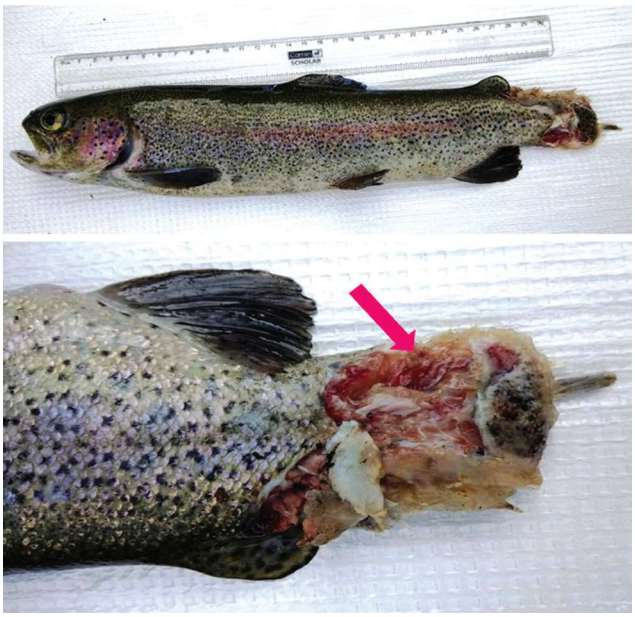


Fig.:Antibiotic resistance pattern of *Staphylococcus* spp. (n=23) isolated from Kullu-Mandi, Himachal Pradesh



First report on isolation of *Yersinia rukerii*, from diseased rainbow trout, Uttarakhand

Swab samples collected from a diseased rainbow trout, *Oncorhynchus mykiss* showing deep ulceration of caudal peduncle and complete loss of caudal fin in state trout farm, Bairangna, Chamoli, Uttarakhand. Samples were processed aseptically in 5% blood agar plate, incubated at 28°C for 48hrs. After 48hrs of incubation period, four colonies of bacteria were further purified and two of them were subjected to molecular and biochemical identification. The isolates were identified as *Yersinia rukerii*, the causative agent for enteric red mouth (ERM) disease in rainbow trout.

One of the isolate is designated as *Yersinia rukerii*, Lab strain no. RTACPB 288 is stored in the laboratory as a glycerol stock (30%) for future study. To best of our knowledge this is the first report of isolation of *Yersinia rukerii* from rainbow trout in our country.

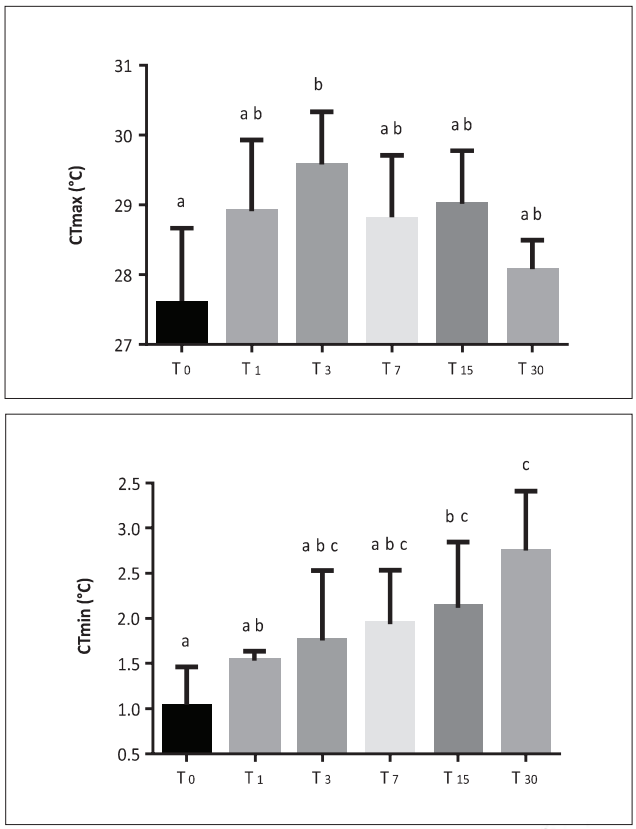
Fish Feed Development

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

Under the ICAR National Innovations in Climate Resilient Agriculture project (NICRA), two feeding trials were conducted to evaluate the potential ability of specific nutritional supplements (i.e., antioxidants and immunostimulants) to improve the thermal tolerance capacity of rainbow trout. Growth, feed use, tissue indices, metabolic rates and critical thermal tolerance limits were used as the phenotypic response variables. Interestingly, the antioxidant supplements were found to augment the upper and lower critical temperature tolerance limits of rainbow trout by 1.5 and 3°C, respectively (the critical thermal scope was enhanced by more than 4°C). Further analysis of biochemical and physiological indices is in progress.

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

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



Fish Genetics and Biotechnology

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

Protocol has been developed and standardized for inserting RNPs into single cell stage of fertilized eggs of common carp for knocking out the MSTN and dnd gene. Common carp reference genome database (http://www.carpbase.org/login.phpweb address) was used to evaluate the sgRNAs with potential off-targets with Cas-OFFinder. The degeneracy in protospacer adjacent motif (PAM) recognition by Cas9 was accounted for, while searching for potential off-target sites.

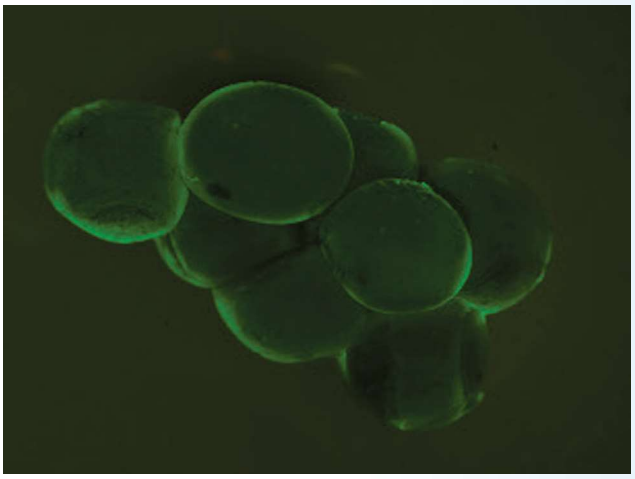


Fig.: Detection of fluorescence in common carp embryo at 48 hpf

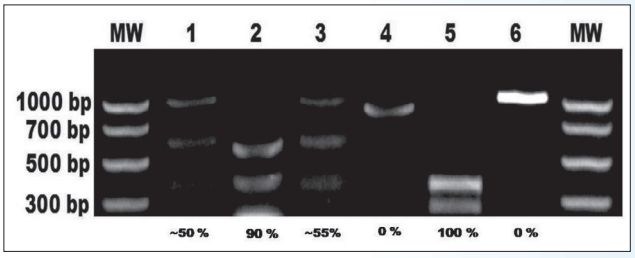
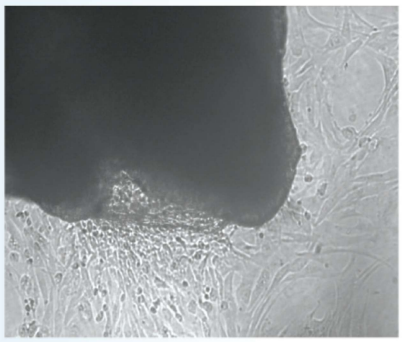


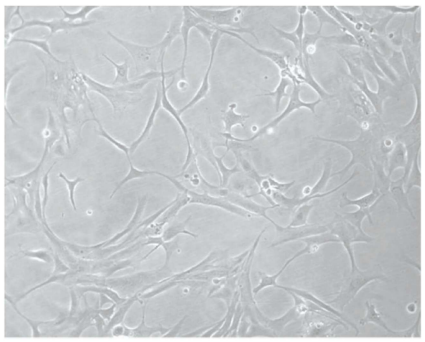
Fig.: *In vitro* cleavage efficiency of three different sgRNAs targeting the MSTN gene of common carp. Lane 1, 2 and 3 is cc sgRNA1/Cas9, cc sgRNA2/Cas9 and cc sgRNA3/Cas9 RNPs, respectively. Lane 4, 5 and 6 is wild type (WT) MSTN, positive control provided and negative control.

Development of cell lines from different organs of Rainbow trout

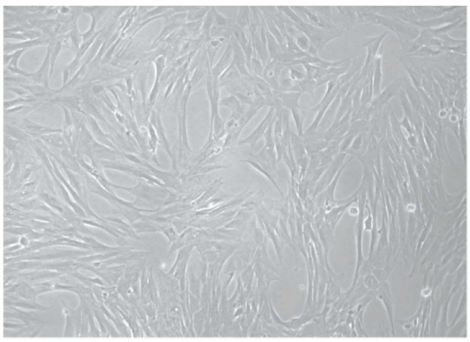
Explants of rainbow trout prepared from different tissues of rainbow trout were supplemented with growth medium (Eagle's minimal essential medium containing 40% fetal calf serum) to enable *in vitro* propagation of fish cells. The cells from the explants of gills, eye stalk, caudal fin, brain, liver and spleen were lost in due course of time due to degeneration. However, cells from heart explants survived but struggled with a serious problem of slow growth and profuse cell death even in growth medium enriched with 30-40% FCS. Therefore, to evade the problem of cell propagation *in vitro*, a novel medium was constituted and fish cells cultured in this medium responded well with a substantial enhancement in growth which was encouraging. With this novel medium, rainbow trout heart cells (RBT-H) could be cultured *in vitro* in 30 % instead of 40% FCS. Further, the serum content in the growth medium was reduced from 30% to 10% and the cells were propagated till the 16th passage. RBT-H cells were preserved in liquid nitrogen at passages P10, P12 and P14 for both backup and further use. The cryopreserved cells were successfully revived to check cell viability as good number of healthy cells were recovered. Moreover, RBT-H cells were treated with BM-Cyclin to eliminate mycoplasma and ensure a mycoplasma free cell line. The BM-Cyclin treated cells were later adapted in L15 medium containing 10% FCS. These cells have been successfully expanded upto 18th passage and being passaged further to enhance passage level.



Cells radiating from heart explant



Heart cells after sixth passage



Heart cells with almost complete monolayer

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

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

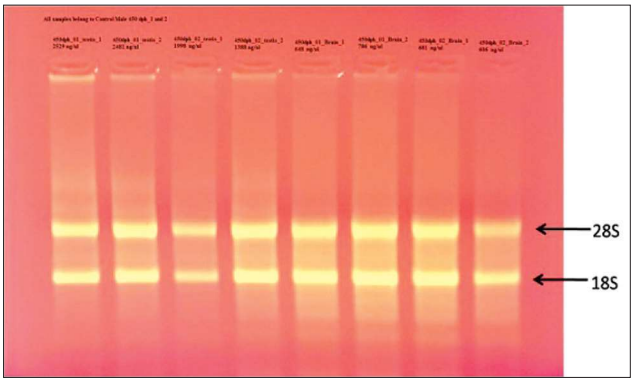


Fig.: Total RNA isolation from different tissue samples

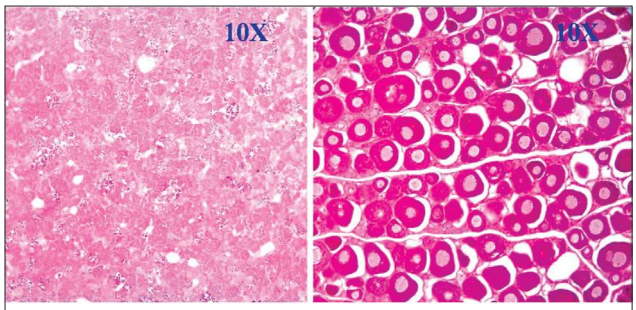
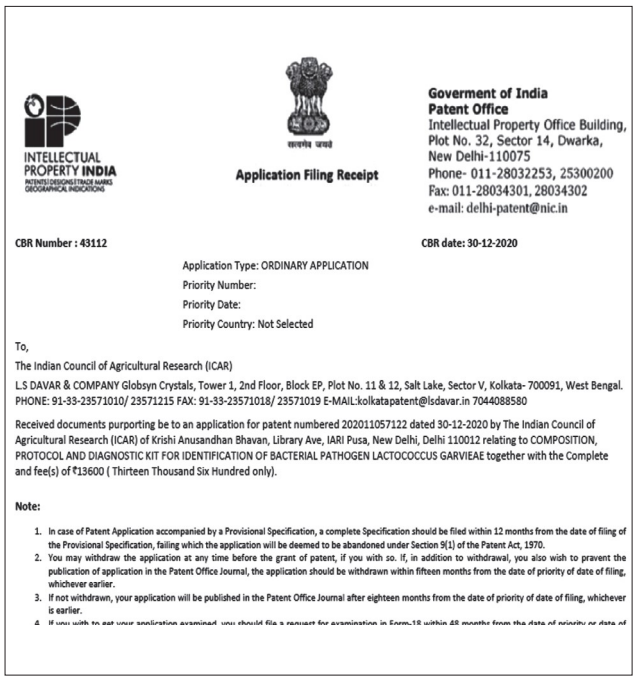


Fig.: Histological examination of gonads of sampled golden mahseer

Technology developed

A diagnostic kit for rapid and specific identification of bacterial pathogen *Lactococcus garvieae* was developed by ICAR-Directorate of Coldwater Fisheries Research, Bhimtal. The inventor of this diagnostic kit are Dr. Neetu Shahi, Mr. Sumanta K Mallik, Mr. Krishna Kala and Dr. Debajit Sarma. The invention is filed for Indian patent with application number 202011057122 dated 30-12-2020.



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CBR Number : 43112 **CBR date: 30-12-2020**

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To,
The Indian Council of Agricultural Research (ICAR)
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Received documents purporting be to an application for patent numbered 202011057122 dated 30-12-2020 by The Indian Council of Agricultural Research (ICAR) of Krishi Anusandhan Bhavan, Library Ave, IARI Pusa, New Delhi, Delhi 110012 relating to COMPOSITION, PROTOCOL AND DIAGNOSTIC KIT FOR IDENTIFICATION OF BACTERIAL PATHOGEN LACTOCOCCUS GARVIEAE together with the Complete and fee(s) of ₹13600 (Thirteen Thousand Six Hundred only).

Note:

1. In case of Patent Application accompanied by a Provisional Specification, a complete Specification should be filed within 12 months from the date of filing of the Provisional Specification, failing which the application will be deemed to be abandoned under Section 9(1) of the Patent Act, 1970.
2. You may withdraw the application at any time before the grant of patent, if you with so. If, in addition to withdrawal, you also wish to prevent the publication of application in the Patent Office Journal, the application should be withdrawn within fifteen months from the date of priority of date of filing, whichever earlier.
3. If not withdrawn, your application will be published in the Patent Office Journal after eighteen months from the date of priority of date of filing, whichever is earlier.

Rehabilitation and conservation of endangered golden mahseer (*Tor putitora*) in Kumaon lakes of Uttarakhand

ICAR-DFCR, Bhimtal successfully organized a seed ranching programme of golden mahseer in three prime lakes of Kumaon region, in Uttrakahnd *viz*. Bhimtal lake, Naukuchiatal lake and Sattal Lake on November 4, 2020 as an attempt to save and increase the population of golden mahseer in their natural abode. Sh. Deepak Chanotiya, Chairman, Bhimtal Nagar Panchayat and Sh. Surendra Surya, Gram Pradhan, Sattal graced the occasion and emphasized upon the need of people's participation in the conservation of mahseer. Dr. Debajit Sarma, Director (Act.) DCFR, Bhimtal expressed his concern to save golden mahseer in the natural water bodies of Kumaun region. On this occasion, thirty thousand fingerlings (10 thousand fingerlings in each lake), which were produced from the captive matured brooders in ICAR-DCFR's Mahseer hatchery, were ranched/stocked in all the three Kumaon lakes. More than 30 participants including Scientists, Dr. Suresh Chandra, Principal Scientist; Dr. Siva C., Scientist; Dr. M. S. Akhtar, Scientist, and staff of DCFR and Fisheries Department, Bhimtal and local people participated in the event.

Fig.: Ranching of golden mahseer fingerling in Bhimtal and Naukuchiatal lakes

Activities under SCSP

Fish Farm Input (Feed & Seed) distribution programme

ICAR-DCFR, Bhimtal organized fish farm input distribution programme in five districts of Uttarakhand namely Tehri, Rudraprayag, Nainital, Champawat and Pithoragarh during November-December 2020 under Scheduled Caste Sub Plan (SCSP). Altogether, 10,000 kg of quality fish feed was distributed among the SC fish farmers @ 70-105 kg per farmer based on their requirement. More than 100 SC fish farmers of the Uttarakhand state were benefited under the programme.

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

Three days Angling Competition cum Interactive Workshop was successfully conducted by ICAR-DCFR in collaboration with Department of Fisheries, Govt. of Uttarakhand at Vyasghat of Pauri Garhwal region during 20-22 November 2020. In the angling competition, 21 avid anglers participated from Marchula, Almora, Pancheswar, Pauri, Dehradun, Uttarakhand and other neighbouring states. During the competition, the anglers could hook mahseer *Tor putitora* and Indian hill trout *Raiamas bola* as the major catch in rivers Nayar and Ganga. The largest catch weighed 13 pounds in the hooks of Mr. Satpal from Himachal Pradesh, followed with a 10 pound mahseer caught by Mohd. Ali Khan and 5 pound by Mr. Tegbir Mann from Dehradun at Vyasghat. This programme has given recognition to Vyasghat as a major mahseer angling destination for the tourist for the upliftment of the SC village (Baggi) to earn revenue through mahseer based recreational fisheries and eco-tourism. Dr. Deepjyoti Baruah, Sr. Scientist; Dr. RS Haldar, ACTO; and Mr. Ravindra Posti, YP-II coordinated the programme.

Socioeconomic upliftment of Scheduled Caste community of Thekeraguri Village, Nagaon and Morigaon district, Assam – A collaborative projects

A collaborative programme was undertaken by ICAR-DCFR with College of Fisheries, AAU, Raha, Assam on the title "Socioeconomic upliftment of Scheduled Caste community of Thekeraguri Village, Nagaon and Morigaon district, Assam through adoption of scientific fish farming and fish-based ecotourism" at Thekeraguri Village, Nagaon district, Assam. Altogether 900 SC fish farmers belonging to 160 households were benefited. During the programme community fish ponds of 0.27 and 1 ha size, 3.78 ha of individual fish ponds and 1 *beel* of 30 ha size were stocked with advanced sized fish seeds at Thekeraguri village, Assam. Other farm inputs in the form of fish feeds, fish nets, prophylactic chemicals etc were distributed free of cost among the beneficiaries.

Sustainable ornamental fisheries development for scheduled caste women households in lower Brahmaputra Valley Zone of Assam for livelihood security and income generation

A collaborative programme was undertaken by ICAR-DCFR with Livestock Research Station, AAU, Mondira, Assam on the title "Sustainable ornamental fisheries development for scheduled caste women households in lower Brahmaputra Valley Zone of Assam for livelihood security and income generation" in rural Kamrup & Goalpara districts, Assam. Altogether 30 SC women fish farmers were benefited.

Socioeconomic upliftment of Scheduled Caste population of Chamoli district through Rainbow trout farming intervention under SCSP at Chamoli district, Uttarakhand

A collaborative programme was undertaken by ICAR-DCFR with Department of Fisheries, Chamoli district, Govt. of Uttarakhand on "Socioeconomic upliftment of Scheduled Caste population of Chamoli

district through Rainbow trout farming" under SCSP project, 2019-20" in Chamoli district, Uttarakhand. Altogether 18 SC fish growers were benefited.

Virtual interactive meet

A Virtual interactive meet was conducted by ICAR-DCFR on September 18, 2020 (1100-1500 hrs) on the title "Production and Productivity Enhancement among Scheduled Caste Fish Farmers through Scientific Hill Fish Farming". The programme was chaired as Chief Guest by Dr. Pravin P., ADG (Marine Fisheries), ICAR New Delhi and other dignitaries Dr. Prem Kumar, Principal Scientist, ICAR New Delhi; Dr. (Mrs.) Yasmeen Basade, Principal Scientist and Nodal Officer (SCSP), ICAR New Delhi; Dr. Hare Krishna Purohit, Joint Director, Department of Fisheries, Govt. of Uttarakhand; Dr. Krishna KantaTamuli, Dean, College of Fisheries, AAU, Raha as Guest of Honour. A total of 40 farmers of Assam and Uttarakhand participated in the interaction.

Activities under TSP

- Under the "HRD Programme on Development of Hill Fisheries for the upliftment of Tribal Fishermen of Madan Nonglakhiat of Ri Bhoi district of Meghalaya state", a training on Integrated Fish Farming System was organized for the fish farmers of Madan Nonglakhiat followed by distribution of various farming inputs including 13,000 Amur carp fingerlings.
- A Training program was organized for 26 farmers of village-Darlak, Mizoram with the distribution of carp feed, carp seed, nets, lime and disinfectants.
- Under the project, "Socio Economic Development through Scientific Fish Farming" of TSP scheme, an awareness camp was organized. Distribution of aquaculture inputs such as fish seed, fish feed, disinfectants and nets to 30 fish farmers of village-Kohima Nagaland was also taken up.
- A workshop on "Development prospectus of remote tribal areas in the village Pangu, District Pithoragarh was organized by district administration during November 29, 2020. ICAR-DCFR participated in the said workshop and created awareness about prospectus of fish farming in remote tribal area or livelihood and nutritional security. During workshop an exhibition on aquaculture in Himalayan region was also dsplayed. Workshop was participated by about 250 participants including farmers, gram pradhan and sarpanch and state fisheries officers. Invited guest lecture on " Prospectus of

fisheries in tribal areas of district Pithoragarh was given by Dr R.S.Patiyal Principal Scientist and Nodal officer TSP. Exhibition was inaugurated jointly by Commissioner Kumoan Shri Arvind Hyanki and Dr Jogdande District Magistrate, Pithoragarh. During the workshop, 2,000 carp seeds and ornamental fingerlings and 1155 Kg of feed were also distributed to tribal farmers.

Activities under NEH

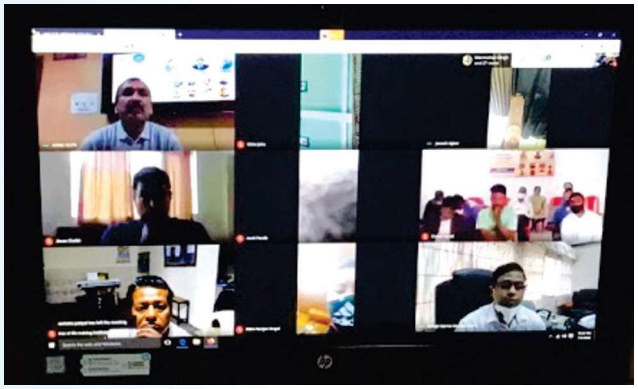
To popularize rainbow trout farming in Nagaland, another three trout raceways are under construction with necessary technical and financial support from this Directorate for rearing of Rainbow Trout at Dzuleke, Kohima district, Nagaland. Starter feed of Rainbow trout formulated by DCFR, has been

provided to Shergaon (Arunachal Pradesh) Govt. trout farm for better growth and survival of the species. Grow-out feed of Rainbow trout has been provided to the Department of Fisheries & Aquatic Resources, Government of Nagaland for rainbow trout stocks being reared in raceways at Dzuleke, Kohima district for better growth and survival of the species. 4.5 lakh eyed ova have been provided to Arunachal Pradesh and 0.5 lakh to Nagaland.

Important Events

National Fish Famer's Day Celebration

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

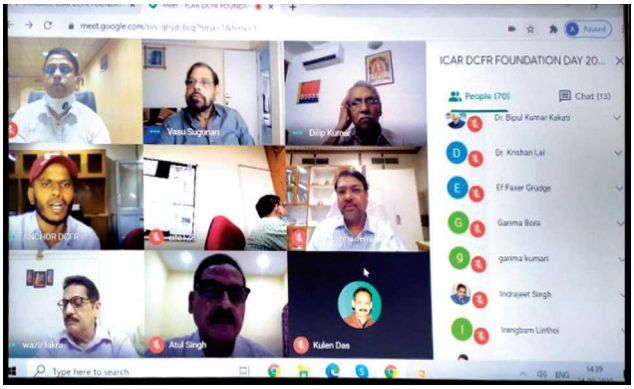


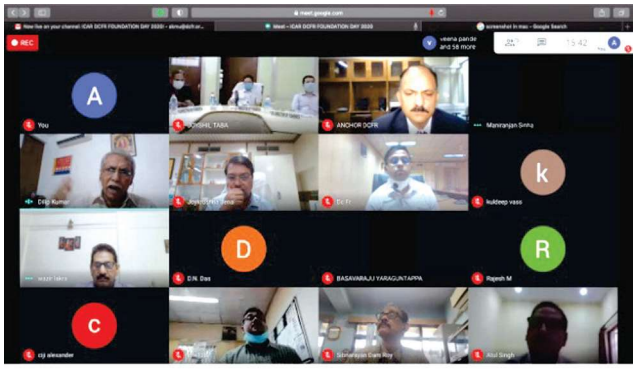
Independence Day celebration

The 74th Independence Day was celebrated with flag hoisting ceremony attended by all Scientists and staff of the Directorate. The Director unfurled the National Flag and saluted the patriots who fought for our freedom besides the importance of 15th August. In his address to the staff of DCFR, he laid stress upon working in harmony and putting up the best for the progress of the organization and the country.

ICAR-DCFR 33rd Foundation Day Celebration

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





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

Institute Management Committee (IMC) meeting

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

Swachhata Pakhwara

ICAR-DCFR organized Swachhata Pakhwara during 16-31 December 2020. During the pakhwara various programmes such as cleaning of premises and adjoining areas, awareness campaign for cleanliness and hygiene, lecture, student's essay competition were organized. A mega event was organized on the occasion of closing ceremony of the Swachhata Pakhwara on

December 30, 2020. On this occasion Brigadier H.M. Pant (Retd.) was invited as the Chief Guest of the programme alongwith Sh.Vivek Sah (IMC Member) & Sh. Pushkar Joshi (IMC member), Sh. P.K. Shukla, Dy. Director of Fisheries, Government of Uttarakhand, Bhimtal; Zila Panchayat Member, Chairman Vyapar Mandal, Bhimtal. Besides, more than 70 farmers including a large group of women farmers participated in this programme. Informative lectures on swachhata were delivered by the dignitaries. The farmers were given advisories by the scientists of DCFR on different aspects.

Activities at Experimental Fish Farm, Champawat

Breeding and seed production of Rainbow trout

Breeding, seed production and culture of rainbow trout are important activities at the Experimental

Fish Farm, ICAR-DCFR, Champawat. At present, 1200 adult, 600 table size and 3500 yearlings with weight range of 1.5-3.2 kg, 800-1.2 kg and 220-250 g respectively are being maintained at the farm. The farm raised rainbow trout brooders were deployed for the breeding and seed production during Nov-Dec, 2020. For breeding purpose, a total of400 numbers of female (wt. range: 1605- 2990 g) and 400 males (wt. range: 1415-2340g) were selected. Around 650000-700000 numbers of fertilised eggs of size 2.5.-3.7 mm with pale yellow colour were obtained. Recorded fertilization rate was about 80-85% and the eggs are currently being incubated in the flow through hatchery system of the farm.

Training programmes on "Scientific methods of integrated hill Fish farming

One day training cum awareness programme on **"Scientific Methods of Integrated Hill Fish Farming"** was organised at Experimental Fish Farm, ICAR-DCFR, Champawat on 15.12.2020. A total of 116 participants including the active fish farmers, entrepreneurs, students, fisheries department officials and media personnel were present. The participants were from the villages, Mudyani, Banlekh, Chhataar, Doodhpokhra, Narsing danda, Kaflang and Pati, of the district Champawat district. The director ICAR-DCFR, Bhimtal Dr. Debajit Sarma addressed the gathering and briefed the gathering about the PMMSY. He also highlighted the efforts put in and the scientific inputs emanating from this Directorate contributing to the sustainable development of Coldwater fisheries in the country. Mr Kishor Kunal, Scientist and In-charge of the farm addressed the gathering and briefed about the activities of the experimental fish farm. Mr Parvaiz Ahmad Ganie, Scientist provided an overview on scope, methods, prospectus and challenges of integrated fish farming to the participants. Mr Abhinendra, Senior Fisheries inspector, Department of Fisheries, Uttrakhand gave detailed information about the terms and conditions of PMMSY along with other fisheries schemes. On the occasion, a feed and seed distribution session was also arranged for the participants. A total of 2400 kg carp feed and 2500 carp seed were distributed to the farmers. The programme concluded with a vote of thanks by Mrs. Garima, Scientist.

Other programmes organized

- One day awareness programme on "Poly culture of carps in Mid hills" was conducted on 17.07.2020 at Mudiyani of Champawat.
- Farm advisory on "Health management of carps in mid hills" was provided at Village Shaktipur-Bunga on 20.07.2021.
- One day awareness Cum demonstration programme on "Estimation of water parameters of carps ponds" was organized on 25.07.2020 at Village Doodhpokhra, Champawat.

- One day awareness programme on "Food and feeding habits of Carps" was conducted on 28.07.2020 at Village Shaktipur Bunga, Champawat.
- Farm advisory on "weed management of fish Ponds" was provided at Village Chaeukoni, Champawat on 30.07.2020.
- One day awareness Cum demonstration programme on "Preparation of carps feed using locally available ingredients" was conducted on 01.08.2020 at Village Doodhpokhra, Champawat.
- One day awareness Cum demonstration programme on "Estimation of water Quality parameters of carp ponds" was conducted on 11.11.2020 at Village Doodhpokhra, Shaktipur Bunga.
- One day awareness cum demonstration programme on "Estimation of water and Soil quality parameters of carps ponds" was conducted on 12.11.2020 at Village Mudiyani, Chaeukoni bora etc.

WEBINARS & MEETINGS

- National webinar on "Coldwater fisheries for nutritional security and livelihood of the hill population" held on July 20 2020.
- Network programme on mahseer was held on July 28, 2020.
- Special Lecture on Gram Swaraj of Gandhiyan Philosophy was organized on September 29, 2020.
- World Fisheries Day was celebrated and Webinar on "Can aquaculture become the blue biotechnology of the future" was organized on November 21, 2020.
- Fisherman training on "Mahseer production practices" was organized on November 25, 2020.
- International webinar on mahseer was held on December 16, 2020. Dr. Adrian Pinder, Associate Director, Bournemouth University, United Kingdom presented a talk on mahseer conservation and rehabilitation.
- Institute Biosafety Committee Meeting was held on December 17, 2020. The meeting was chaired by Dr. D. Sarma, Director, ICAR-DCFR as Chairman.
- Virtual Training on "Breeding and seed production of rainbow trout" and its best management practices was organized on December 29, 2020.

COMBATING COVID-19

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

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