FROM DIRECTOR’S DESK

During the reporting period, the ICAR-Directorate of Cold water Fisheries Research actively pursued its focus on improving the productivity of hill aquaculture practices and conserving important cold water fishes through various research and development activities. To mention some noteworthy scientific achievements, 27 SSR markers have been identified for brown trout (Salmo trutta fario) population characterization, prototype of a zero water exchange glass hatchery have been developed for cold water fishes. Mx protein linked to the antiviral state of fish have been characterized in snow trout (Schizothorax richardsoni), three peptide nano delivery system exclusively designed for fish have been synthesized and growth related gene markers in snow trout (Schizothorax richardsoni) have been partially characterized. Further, experimentation on captive maturation of golden mahseer (Tor putitora), surveillance of cold water fish diseases, habitat assessment and GIS mapping of cold water resources in Western Himalayas and operation of germplasm centre for conservation aquaculture are systematically undertaken. Besides, several extension and capacity building activities such as farmers meet, awareness programme, hands-on training and seed distribution were also carried out. Several distinguished authorities namely Dr. T. Mohapatra, Secretary (DARE) and Director General (ICAR), Shri Chhabilendra Rod, Additional Secretary (DARE) and Secretary (ICAR), Shri S.K. Singh, Additional Secretary and Financial Advisor (DARE/ICAR) and Dr. J.K. Jena, Dy. Director General (Fisheries) visited the Directorate during the reporting period. I appreciate the sincere efforts of all the scientists and staff of this Directorate and encourage them to achieve more.

A. K. Singh (Director)

Research highlights

Identification of SSR markers for brown trout

Simple Sequence Repeat (SSR) or microsatellite markers were identified in the genome of brown trout (Salmo trutta fario) using the Illumina MiSeq next generation sequencing platform. A total of 3,19,440 contigs were obtained after quality filtration and de novo assembly. The N50 value was 480 and maximum contig length obtained was 16,677 bp. From the assembled sequences, a total of 19,786 repeat motif or microsatellite loci were identified using Perlscript MISA. It comprised 9229, 950, 7267, 996 and 348 numbers of di, tri, tetra, penta and hexa nucleotide repeats, respectively. Perfect SSR repeats were further screened and in the first phase 27 SSR markers (with more than 20 continuous repeats) have been selected for validation in 5 populations of brown trout.

Zero water exchange fish hatchery

A prototype zero water exchange glass aquarium hatchery (90x45x60 cm) with a water holding capacity of 150-175 L and under gravel filtration system has been developed. A thick layer (8-10 cm) of sand gravel (3-5 mm size) was used as a substrate for the biological filtration system, which was operated by power-head pump having a capacity of 1500 L per hour and
matured with nitrifying bacteria. The hatchery was loaded with fertilized eggs of Labeo dulcehils and continuously churned by the internal water circulation. The hatching percentage was observed to be 95% after 72 hours. The spawn was fed egg yolk suspension after complete yolk-sac absorption. At the end of 21 days, the survival percentage of the fry was 95%, with no water exchange. Water quality parameters were at optimum level and the produced fry were healthy. Upscaling of this technology is promising for minimum water aquaculture.

Characterization of Mx protein from Indian snow trout

In vertebrates, Mx protein is produced as a result of interferon induction and is linked to the establishment of an anti-viral state in the host. We have identified and characterized the complete cDNA sequence encoding Mx protein in Schizothorax richardsonii, Indian snow trout. In silico analysis of the snow trout Mx coding region revealed an open reading frame (ORF) of 1854 bases which encodes a polypeptide of 617 amino acids. The homology model of snow trout Mx protein shows that it consists of a dynamin-type guanine nucleotide-binding (G) domain, a bundle-signaling element (BSE) and a stalk-dynamin GTPase effector domain (GED).

Synthesis of peptide nano delivery systems for fish

Three presynthesized peptide nano systems (RR28, LR28 & KR24) have been successfully synthesized by solid phase peptide synthesis using Fmoc chemistry on resin in MBHA resin. These peptides were purified by semi-preparative RP-HPLC and their purity was further checked by analytical RP-HPLC. Purity of the peptides was found to be more than 80%. The mass of the peptides was confirmed by mass spectrometry (MALDI-TOF-MS). In the next step, the ability of these nano systems to deliver nucleic acids inside fish cells will be tested.

Characterization of growth related gene markers in Indian snow trout

In order to decipher the molecular mechanisms underlying slow growth in the Indian snow trout Schizothorax richardsonii, important growth related genes such as those encoding digestive enzymes amylase (amy), trypsin (tryp) and chymotrypsin (cter); myogenic regulatory factors myogenin (myg) and myoath; growth hormone (gh) and heat shock protein 70 (hsp70) were amplified, cloned and sequenced. Post sequencing analysis indicated that majority of the partially characterized snow trout genes showed high similarity to common carp.
Concurrently, a field exploration was carried out at the BHDC project site, Tehri, Uttarakhand to assess the breeding possibilities of golden mahseer for conservation and rehabilitation. Samples were taken from adult golden mahseers to assess their gonadal maturity level by profiling plasma hormone levels, gonadal histology and gene expression analysis.

Preponderance of Enterococcus faecalis in rainbow trout culture

A persistent infection of Enterococcus has been observed to be a health concern in rainbow trout, Oncorhynchus mykiss. In total, 75 isolates of Enterococcus were purified from eyes, brain, kidney, liver, gall bladder, intestine, spleen and gill tissue of moribund fingerling and adult fish samples collected from trout farms in Himachal Pradesh, Sikkim and Uttarakhand. The infected fish showed symptoms such as black coloration of the body, external and internal hemorrhages. Biochemical analysis followed by PCR detection has shown predominance of Enterococcus faecalis (28%) in the infected tissue samples suggesting their emergence as opportunistic pathogens. The presence of virulence genes (ace, geF, esp, clyA) in isolates of Enterococcus is presently under investigation.

Coldwater fish disease surveillance

Under the NSPAAAD project, disease surveillance activities were carried out in carp ponds, trout raceways and mahseer hatcheries in different parts of Uttarakhand. Baseline data, GPS coordinates and
water quality parameters were also collected from the surveyed sites. Tissue samples were collected from 3-5 mortabased fish of each farm unit for screening of bacteria, fungal and parasitic infections. Screening for parasites revealed that Ichthyophonus multiloculis was associated with increased mortality of rainbow trout juveniles at higher water temperature. Mean prevalence and intensity of the itch parasite was 36.7% and 3.4, respectively. Another ciliate protozoan Trichodinida sp. was also observed, however the prevalence of trichodiniasis in trout raceways was low. The analysis of collected bacterial and fungal samples is in progress.

Habitat assessment and ichthyofaunal diversity of Western Ramganga

The distribution and abundance of fish species is a tangible indicator of the habitat conditions in riverine ecosystems. In this context, the river Western Ramganga in Uttarakhand was surveyed to collect basic information on ichthyofaunal diversity and distribution. A total of seven sampling stations were surveyed covering a stretch of around 95 km of the river and diversity indices were measured. The species diversity increased with decreasing altitude and the species dominance showed Baril as the dominant group, followed by minor carp and mahseer. Seasonal difference in species diversity was also observed during the study period. Shannon-Weiner index ranged 1.5 to 2.5, indicating a moderately stressed riverine habitat condition.

Spatial database of cold water resources in Western Himalayan region

ETS based thematic map of 2nd district in Jammu & Kashmir and Kullu valley in Himachal Pradesh has been prepared incorporating the physico-chemical parameters of major water bodies. These maps could be further used as a primary tool for preparing aquaculture suitability site maps.

Establishment of germplasm centre for conservation aquaculture

Under the Agri-Consortia Research Platform initiative, exploratory surveys were conducted in the rivers and streams of upland Ganga river basin viz. Kosi, Ganga, Saryn, Mahakali, Western and Eastern Ramganga, Lohawati, Gaudi, Ladihya and Chhibritani. Live specimens of different fish species such as Schizothorax richardsonii, Nazimotus chelnomys, Barilus bendelisis, Gurra sp. and Tor putitora were collected from the sampling sites. Besides, breeding trial of Schizothorax richardsonii was successfully carried out at Champawat field.
centre and approximately 9000 fry were produced. Likewise, breeding of Garra gosyri was also attempted. Reproductive parameters of Schizothorax richardsonii and Nezarastron chalyboides are further being examined.

Extension activities and services

Seed production and distribution of common carp

Large scale seed production of the improved Hungarian scaly and mirror carp strains was carried out at Champawat field centre during April to June, 2016. Total 450 female brooders in the mean size range of 224-664 g were used for breeding and seed production. About 7.2 lakh fry were produced. Based on demand, seed of various size groups were supplied to fish farmers of Champawat, Almora and Nainital districts and state fisheries department of Uttarakhand.

Fish farmers’ day meet at Champawat

To commemorate Fish farmers’ day, a public awareness meet was organized on 10th July, 2016 at ICAR-DCFR field center, Champawat. A mixed group of 40 men and women fish farmers of Champawat area attended the meet. They were briefed about the prospects of cold water aquaculture and shown the various activities of the field center. Further, Hungarian strain common carp seed was distributed to interested fish farmers.

Awareness programme on rainbow trout farming at Leh

Keeping in view the harsh climatic and livelihood conditions in the cold and zone of Lidkhal, ICAR-DCFR has been painstakingly making efforts to establish rainbow trout culture in Leh by raising a cluster of raceways under the Tribal Sub Plan initiatives. Further to popularize trout culture as a source of employment and protein rich food, an awareness cum training programme on rainbow trout farming in highlands was organized at Chushbot Shamco village, Leh on 2nd October, 2016. The training was attended by 21 women of a self-help group and 4 youths. Some of the participants expressed interest in adopting the technology. Considering the difficulties in transporting trout seed, the Directorate has also taken initiative to establish a trout hatchery facility to make farmers self-sufficient, with the support of scientists from HMAARI, Siakana and ICAR-CZARI, Leh.

Training programmes

Training on mahseer seed production

A five-day hands-on training programme on breeding and hatchery management of mahseer was organized at Bhimtal during 2-6 July 2016 for 20 fishery officials deputed from different hill states of India. The training was inaugurated in the presence of ICAR-DCFR NEWS • APRIL-SEPTEMBER 2016 | 5
of Dr. T. Mohapatra, Director General (ICAR) and Dr. J.K. Jena, Dy. Director General (Fisheries). Lectures and practical exposure on different aspects of mhaser seed production was given to the participants.

**Important events**

**Foundation day celebration**

The 29th foundation day of the Directorate was celebrated on 24th September 2016. The occasion was graced by Dr. B.S. Bish, former vice-chancellor, GBUAPAT, Dr. R. S. Chauhan and Dr. S. K. Verma. The function was attended by all the scientist, staff and research scholars of the Directorate and local dignitaries. Dr. A.K. Singh, Director, briefed the gathering about the various accomplishments, activities and vision of the Directorate. Dr. Dinesh Satl, a senior geologist, delivered the foundation day lecture on Himalayan geology and provided interesting insights on the formation and geological dynamicity of Himalayas.

**Environment Day celebration**

The scientist, staff and research scholars of the Directorate enthusiastically observed the world

**Institute Research Committee meeting**

The IRC meeting of the Directorate was held on 18-19 May 2016 under the chairmanship of Dr. A.K. Singh, Director. Progress of the ongoing research projects and proposals for new projects were presented by concerned scientists. This was followed by thorough discussion, appraisal and future orientation towards research gaps and challenges.

**Independence Day celebration**

On 15th August 2016, the Independence Day of our nation was celebrated with flag hoisting ceremony attended by all the scientist and staff of the Directorate. Dr. A.K. Singh, Director, unfurled the national flag and encouraged the gathering to work in unison to achieve scientific breakthroughs that will benefit the different stakeholders involved in cold water fisheries and aquaculture.
environment day on 5th June 2016, by planting trees around the Bhimtal main campus.

**International Yoga day celebration**

As per the Government of India directive, the Directorate observed the International Yoga day on 21 June 2016 by organizing yoga session and lecture at Bhimtal and Champawat. During the early morning yoga session, various yoga asanas were demonstrated to the participants. In the afternoon lecture, the importance of yoga for leading a healthy life was emphasized. The special resource persons were Dr. Shahla Zaidi, Dr. H.C. Kapil and Shri R. Gahtori.

![Yoga session at Champawat field center](image)

Dr. T. Mohapatra inaugurating the mahseer brood bank facility and inaugurated the mahseer brood bank facility developed in the hatchery complex at Bhimtal. He was accompanied by Dr. J.K. Jena Dy. Director General (Fisheries), Dr. R.K. Singh Director (ICAR-IVRI), Dr. A. Pattanayak, Director, ICAR-VPKAS and Dr. B. Pattania, Director, ICAR-DFMD.

Shri Chhabilendra Roul, Additional Secretary (DARE) and Secretary (ICAR) visited the Directorate on 28th May 2016, discussed with all the scientists and staff about several issues related to research and administration. He also inaugurated the molecular biochemistry laboratory at Bhimtal.

![Shri C. Roul visiting the farm complex at Bhimtal](image)

**Hindi ‘Saptah Samach’ celebration**

To promote and recognise Hindi knowledge among the staff of the Directorate, the Hindi section conducted several intramural linguistic competitions on September 2016. Prizes were distributed to the winners during the Foundation Day celebration.

![Active participation in Hindi competition](image)

**Distinguished visitors**

Dr. T. Mohapatra, Secretary (DARE) and Director General (ICAR) visited the Directorate on 2nd July 2016. He observed all the facilities, research activities and inaugurated the mahseer brood bank facility developed in the hatchery complex at Bhimtal. He was accompanied by Dr. J.K. Jena Dy. Director General (Fisheries), Dr. R.K. Singh Director (ICAR-IVRI), Dr. A. Pattanayak, Director, ICAR-VPKAS and Dr. B. Pattania, Director, ICAR-DFMD.

Shri S.K. Singh, Additional Secretary and Financial Advisor (DARE/ICAR) visited the Directorate on 30th April 2016. He observed all the facilities and encouraged further development.
Dr. J.K. Jena, Deputy Director General (Fisheries, ICAR) visited the Directorate on 31st May 2016. He inaugurated the renovated aquarium and fish nutritional physiology laboratory at Lilimital. He also interacted with all the scientists about the research projects undertaken and gave valuable suggestions.

Dr. J.K. Jena inaugurating the aquarium facility

Dr. Mark Everard, Environmentalist and Associate Professor, University of the West of England visited the Directorate during June 2016 and delivered a lecture on ecosystem services with respect to golden mahseer recreational fishing and interacted with the scientists.

Dr. Mark Everard interacting with researchers

Dr. Mark Everard receiving the AFS Kanazawa Research Grant

In the ICAR zonal sports meet (North zone) held at ICAR-NDRI, Karnal, Mr. Rajesh won second place in 800 m race and third place in 1500 m and 400 m track events.

Staff news

- Dr. Raghvendra Singh (Aquaculture), Shri Kishor Kanal (FRM), Shri Parvaiz Ahmad Ganie (FRM) and Shri Raja Asad Hussain Bhat (Fish Health) joined the Directorate as scientists under Agricultural Research Service.
- Shri Y.S. Dhanik, Administrative Officer, was promoted and transferred to ICAR-VPKAS, Atnora, by the Council. He was relieved from the Directorate with good wishes on July 2016.

Awards and Recognition

Mr. Rajesh, M., received the prestigious Asian Fisheries Society Kanazawa Research & Travel Grant - 2016 for his Ph.D. project and he subsequently attended the 11th Asian Fisheries and Aquaculture Forum held at Bangkok, Thailand during 3-7 August 2016.

Mr. Rajesh M receiving the AFS Kanazawa Research Grant

निना पायी बदले मलम-पोषणसंगठन
एक प्राथमिक प्रकार की 90x45x60 सेमी, आरक्षित ग्राहक का एक एक्सप्रेस हैंडर का निर्माण किया गया।
परिवारियों की तमाम बहू और बेटियों के लिए निश्चित विस्तार किया गया। इसके लिए उत्साहित होने वाले हैं उनके साथ अन्य देशों से भी अन्य देशों से।

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राकात का आयात करने के लिए एकलता के लिए योग्य है। इसलिए नीचे लिखी गई स्थितियों के साथ इसे काम करें। यह प्रातःकालीन आयात के लिए एक सजीवता का प्रयोग करता है। इस प्रकार के प्रातःकालीन आयातों के प्रयोग के लिए एक सजीवता का प्रयोग करना महत्वपूर्ण है।

परिस्थितियों के अनुसार एक साधन का निर्माण करना सही है।

अधिक जानकारी के लिए समाज में फैलाया गया जानकारी अवगत की जा सकती है। अधिक जानकारी के लिए समाज में फैलाया गया जानकारी अवगत की जा सकती है।

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सूर्यादेश संस्थेने 2016 मध्ये वातावरणाच्या अस्थायीता, चावकाळीन प्रदूषण, पाणीक्षण, उष्णकाळीन कालराजस्थान रुपांतरण आणि आवाढणी यांच्या असंख्य अस्थायीतांच्या दिशेने वातावरणाच्या स्वाभाविक स्वाभाव, अस्थायीता, वनस्पतीशास्त्र, वनशास्त्र, वनसंग्रह, वनसंग्रहसंबंधी, वनसंग्रहातील वनस्पती आणि वनसंग्रहातील वनस्पती के संबंधात वातावरणाची विविधता आणि समाजातील संविधानांच्या पर आमंत्रित केलेली आहे।

प्रमुख घटनांमुळे

स्वातंत्र्य दिनाच्या समाहार

प्रदूषणाच्या विचारधारेचे विस्तारात अंतरा डाव असे याचे वातावरण आणि समाजातील प्रदूषण, पाणीक्षण, उष्णकाळीन कालराजस्थान रुपांतरण, आणि आवाढणी यांच्या अस्थायीतांच्या दिशेने वातावरणाच्या स्वाभाविक स्वाभाव, अस्थायीता, वनस्पतीशास्त्र, वनशास्त्र, वनसंग्रह, वनसंग्रहसंबंधी, वनसंग्रहातील वनस्पती आणि वनसंग्रहातील वनस्पती के संबंधात वातावरणाची विविधता आणि समाजातील संविधानांच्या पर आमंत्रित केलेली आहे।
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