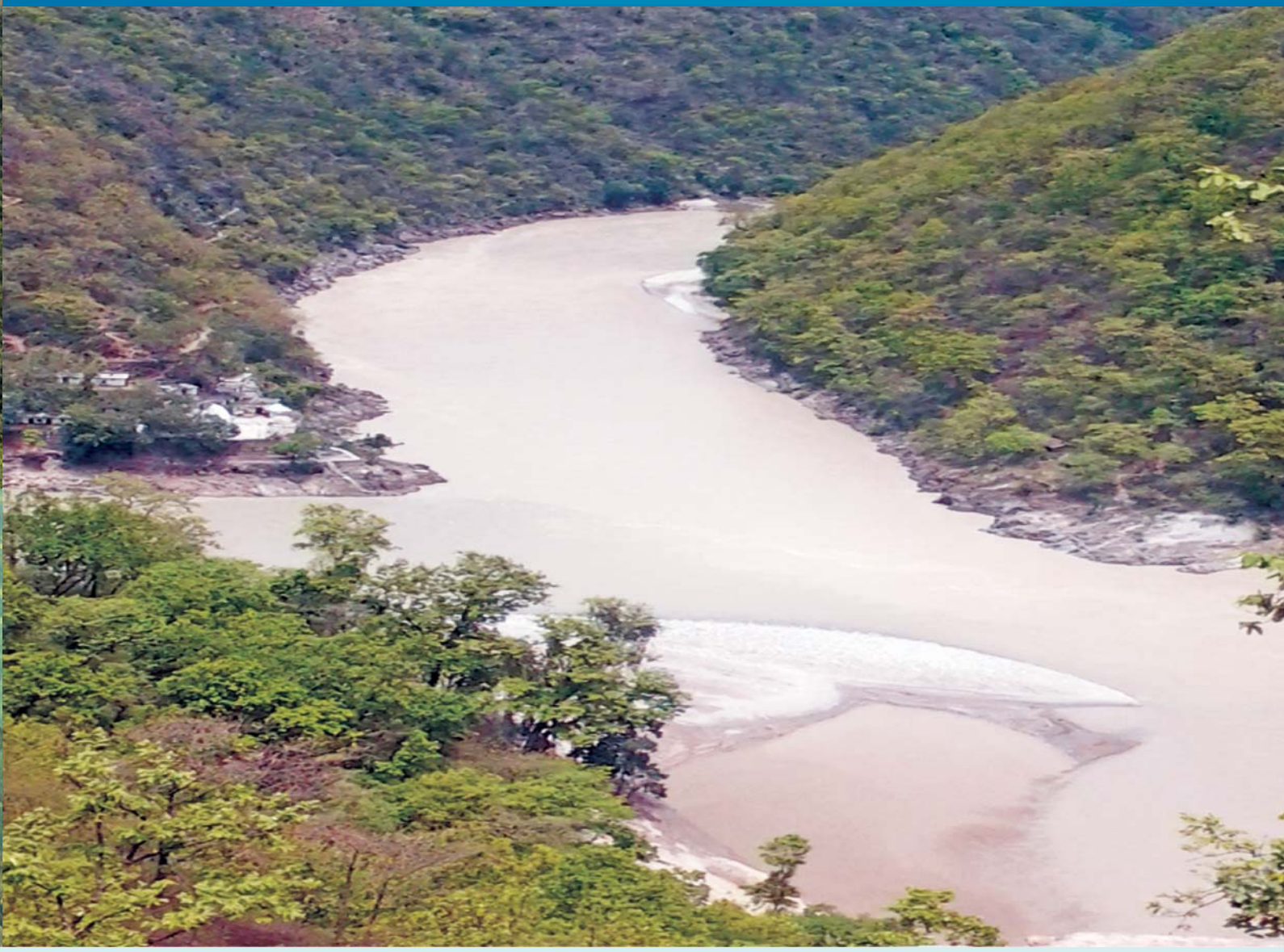
Annual Report
2011-12



शीतजल मात्स्यिकी अनुसंधान निदेशालय
(भारतीय कृषि अनुसंधान परिषद)
भीमताल 263 136, नैनीताल, उत्तराखण्ड

Directorate of Coldwater Fisheries Research
(Indian Council of Agricultural Research)
Bhimtal 263 136, Nainital, Uttarakhand
INDIA

Annual Report
2011–12

Directorate of Coldwater Fisheries Research
(Indian Council of Agricultural Research)
Bhimtal- 263136,Nainital, Uttarakhand, India

@ DCFR Annual Report 2011-2012

Published by
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Director

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Cover Page
A view of confluence of River Kali and River Saryu at Pancheshwar, Uttarakhand. The site is a natural breeding ground of mahseer and also a famous angling spot.
(*Photo by Dr. S. Ali*)

Back Cover
Mahseer sanctuary at Baijnath temple, Bageshwar, Uttarakhand
(Inset- Golden Mahseer *Tor putitora*, at sanctuary)
(*Photo by Dr. R.S. Patiyal*)

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Preface

During the year the Directorate has worked towards livelihood security of the hill community through aquaculture integration with the agriculture and horticulture activates. Use of poly tanks proved to be one of the major successes in fish culture and conservation of water for various uses. The feed is one of the important inputs for aquaculture. The Directorate has developed feed for grow-out culture of trout and mahseer larvae. Efforts to increase rainbow trout culture and production in potential areas resulted in expansion of trout culture activities in Sikkim. The species diversification is important for sustainability of aquaculture and the Directorate has made significant achievements in domestication and breeding of *Labeo dero and L. dyocheilus* for introduction in mid altitudinal areas. Another major issue is the problem of disease in aquaculture system. In order to contain the disease and to face any future challenges the directorate is doing sincere efforts for identification of pathogens and development of management measures. The modern techniques of molecular biology and biotechnology are imperative to address the problem related with aquaculture and species development more precisely. The directorate has made significant achievements in species characterization using different molecular markers and also for gene and allele mining for abiotic stress tolerance. The changing climate poised a new challenge for the coldwater sector and to mitigate such adversity in holistic approach, multidisciplinary research has become vital. In coming decades, the threat to the ecosystem by anthropogenic activities and natural causes need to be addressed and Directorate is becoming equipped to take up all future challenges.

DCFR is also developing its Field Centre, Chirapani, Champawat with new infrastructure facilities like new laboratories, dedicated internet facilities, training centre, residential accommodation etc. Scientists and staff have done sincere efforts in breeding and seed production of trout and in maintaining other resources.

During the year, we have conducted different training programmes and farmer based extension activities. National workshop has been organized to address various issues and action plan were prepared. The Directorate is doing sincere effort to involve KVKs in its linkage programme in order to reach farmers more effectively. The scientists of DCFR has also participated in various seminars, symposium and training programme for knowledge and skill development. It was the constant efforts of all scientists and staffs of this Directorate that made possible for such progress and achievements. The continuous support, guidance and encouragements received from Dr. S. Ayyappan, Secretary, DARE & Director general, ICAR was commendable. The support received from Dr. B. Meenakumari, DDG (Fisheries), Dr. S.D. Singh, ADG (I.Fy), ICAR are recorded with sincere thanks and gratitude.

Thanks are also due to Dr. A Barat, Principal Scientist and Dr. S. Ali, Scientist for bringing out the annual report. The efforts made by Sh. Amit Joshi, Technical Officer for Hindi version of the report and other assistance by Smt. Susheela Tiwari, PS to Director are also recorded with appreciation.

Date: 01 June, 2012

(P.C. Mahanta)
Director

Contents

Executive Summary

DIRECTORATE of Coldwater Fisheries Research during the year 2011-12 has successfully conducted research activities with eleven institute's ongoing projects, an outreach activity with five hill states as partners, three outreach programs with different fisheries institutes under Fisheries Division (ICAR), four externally funded projects and also successfully completed four institutional projects.

Under resource assessment project, three districts namely Bageswar, Chamoli and Pithoragarh, were selected to create a layer of suitable sites for aquaculture based on spatial database on physico-chemical parameters of soil, water and infrastructure facilities. The suitability map was created based on GIS which would be made available for common man use; it will enhance the possibility of developing aquaculture in hills.

Visit of RAC members to Field Centre, Champawat

A new initiative was conceptualised on the basis of RAC recommendation to create a database on present status of rainbow trout which was being practised for last 100 years in the different farms of coldwater states in the country.

Another new program was initiated during this year to document the ornamental fish resources in the coldwater regions of the country and initially surveyed three streams falling under the district of Champawat viz. Gauri (Champawat), Lodhia (Chalthi) and Lohawati (Lohaghat) were selected for this purpose. Maximum species recorded form the Lodhia (Chalthi) but from Gauri and Lohawati streams *Schizothorax richardsonii* was abundant in each cast netting operation.

Visit of French Students and Interaction with Scientist

The project entitled "Performance of chocolate mahseer (*Neolissochilus hexagonolepis*) in freshwater aquaculture systems in North Eastern and Western Himalayan region" revealed that chocolate mahseer at the temperature ranging from 19 – 23 °C gained maximum growth compared to the other months in the culture systems. Chocolate mahseer doesn't show any competition while culturing with golden mahseer and common carp.

Breeding of improved stain of Hugarian common carp Champa-1 (Ropsha scaly) Champa-2 (Felsosomogy Mirror Carp) was done at DCFR Experimental Field center Champawat. Five ponds of Fish farmers belonging to different locations of Uttarakhand and four places of different thermal region of North east region were selected for experimental rearing of Champa-1 & Champa-2.

During the year Directorate has initiated a project "Development of molecular markers for identification of usable traits in important coldwater fishes" to characterize the species and to detect genetic variation exists within the population which

will create a base for genetic maps for future application in formulation of molecular breeding strategies. The project was also aimed to detect some functional genes related to immune response as well as abiotic/biotic stress. With these objectives, initially fin tissue samples of *Schizothorax richardsonii*, *S. esocinus* and *S. niger* were collected from different geographical locations of Himachal Pradesh and Jammu & Kashmir and DNA/RNA were isolated for the construction of partial genomic library as well as cDNA library.

Director interacting with Scientist at Field Centre, Champawat

Species diversification is one of the major thrust area of cold water sector for the aquaculture prospects and to fulfil this objective successful breeding of *Labeo dyocheilus* was achieved in captivity at 18-20^{0}C. Mahseer seeds were also reared in newly installed cages at Bhimtal lake for broodstock raising under open water system.

In fish health project 47 samples were collected from different rainbow trout farms from Ladakh and Kashmir region of J&K state to investigate occurrence (if any) of viral diseases in those farms. Out of 47 samples screened so far, five have demonstrated cypotathic effect in cultured fish cells. Major parasitic and environmental health problems occurring in upland farmed fishes were also studied. Saprolegniasis in eggs, larvae and adults of rainbow trout and carps, dactylogyrosis and trichiodinasis infestation in fry of common carp, adults of silver carp and grass carp, eye infection in 3+ years rainbow trout and mass mortality due to oxygen depletion were the health related problems observed during the period. Estimation of bacterial flora, their distribution in hatchery and farm, seasonal occurrence, prevalence and identification of potentially bacterial pathogens in rainbow trout fish farms from northern India has been initiated in another fish health project.

Visit of Mrs. Veena Ghanekar, IAS, MD, Fisheries Federation of India, Bhopal, MP.

The project entitled "Sustainable utilization of Mountain Fishery Resources" under Outreach activity had progressed well even after financial constraints. Several field trips were undertaken in rivers and lakes of East Siang, and West siang districts of Arunachal Pradesh. Trout breeding was carried out in Arunachal Pradesh, Sikkim and Uttarakhand. In Himachal Pradesh an extensive survey of River

Release of fish seed at DCFR ponds by Sh. Harish Rawat, Hon'ble Minister of State for Agriculture

Ravi and Beas has been conducted for detail study to collect the fish fauna in relation to existing physico-chemical condition and to explore commercially important fish species. The work related to the Exploratory Survey of Fish biodiversity in Jammu and Kashmir with special reference to commercially important species was carried during 2010 at Gurez Valley, during 2011 at Jammu (sites J1 – J14) and Kashmir provinces.

Under Outreach Activity-Fish Genetic Stock, 123 samples of Mahseer (*Tor putitora*) from Beas River/ Jogindernagar and Satluj River/Bhakra

(Himachal Pradesh), and Chenab River/Anji and Ravi River/ Basoli (J&K), were analyzed using Length weight relationship,Truss network and molecular markers like Cyt b and ATPase gene and microsatellite. Under outreach activity on Fish Feed, investigation on digestive enzyme profile of golden mahseer larvae was made which provided an insight on the development of the larvae digestive functions in order to obtain essential data for the formulation of a compound diet adapted to larvae. Grow-out feeds (Floating pellets) were formulated with 3 levels of protein (45, 40 & 35%) with uniform lipid level of 14%. In another outreach activity- Nutrient Profiling and Evaluation of Fish as a Dietary component had detected nutrient content of different coldwater fishes.

Presentation by Dr. A. Barat, Pr. Scientist at International conference organized by DIHAR, DRDO at Leh-Ladakh

The project entitled "Investigation on coldwater fish pathogens and their environment" completed successfully with the most important achievements of establishment of a disease investigation set up for the entire cold water fisheries sector of the country. Preliminary studies based on simple serological tests like counter immuno-electrophoresis (CIE) and agar gel immune precipitation tests (AGPT) suggests the possible incidence of two important viral pathogens namely infectious pancreatic necrosis (IPN) and infectious hematopoietic necrosis (IHN). Another completed project entitled "Evaluation on growth performance in different strains of common carps" observed highest growth in Hungarian mirror carp (352gm) under polyculture system followed by Hugarian scale carp (304gm) and existing strain (187gm.). The project entitled "Study on water budgeting and water management for coldwater aquaculture practices" was concluded for water budgeting for polyculture of exotic carps and trout rearing in raceways, water availability, losses and requirement for trout production unit of Champawat Centre, rainwater harvesting and development of low cost Grit Filter for mid hill Aquaculture.

Dr. P.C. Mohanta, Director addressing the gathering during 31st session of AEB at Bundelkhand University, Jhansi

Two externally funded project namely, "Development and Characterization of microsatellite markers in Indian snow trout, *Schizothorax richardsonii*", funded by Department of Biotechnology was completed with major achievements of development of 34 microsatellite markers from Indian snow trout *Schizothorax richardsoni* and "Genome Scale Mining of *S. richardsonii* fish species for formulation of selective breeding Programm" sponsored by Department of Science and technology observed useful insights into phylogenetic relationships, genetic identity, and population structure of *S. richardsonii* particularly those from Uttarakhand regions using mtDNA markers.

Under the externally funded projects "Molecular characterization and development of a diagnostic test for the identification of a filterable agent isolated from diseased Rainbow trout" preliminarily observed symptoms of the disease in the samples of rainbow trout collected from from the Experimental Field Station DCFR, Champawat and State Fish Farm, Bairangana (Chamoli).

During the year salient achievements of the project entitled "Bioprospecting of Gene and allele mining for abiotic stress tolerance" under NAIP (Component 4) was the transcriptome profile of brain cDNA of *S. richardsonii*. A total of 1031 ESTs were sequenced from which 484 putative gene (consists of 73 contigs and 411 singletons) were identified. BLAST homology analysis indicated that only 9.3% of these ESTs were homologues of known genes while the remaining 90.7% appeared to be novel sequences. Based on sequence similarities, 45

putative genes were identified that encodes stress proteins, enzymes and signal transduction regulators. Our study thus provides both a large collection of novel transcripts and a detailed annotation of genes for an important snow trout species. Out of 10 primer pairs designed from the unknown sequences, two primer pairs from clone no. S-N-23-448 (JK088330) and SM-28-442 (JK088324) are found to be cold stress responsive genes using real time PCR analysis.

The project entitled "Enhancement of livelihood security through sustainable farming systems and related farm enterprises in North-West Himalaya" under NAIP (Component 3) used pond with polythene lining (Polytank) for harvesting rainwater/ low discharge spring water for fishery related activities.

The AICRP entitled "Enhancement of carp fish production by using polytanks in mid hills" observed higher growth rate of the exotic carps namely, silver carp, grass carp and common carp in the polytanks.

Display of books by publishers at DCFR, Bhimtal

Other than research activities the Directorate had also organized several other farmers related training programmes, meetings, like RAC, IRC, Institute Management Committee, IJSC and official language. The Directorate had also participated in several seminars, symposium, ICAR Zonal sports and celebrated various events like national days and sprit of communal harmony.

Introduction

The Directorate of Coldwater Fisheries Research (DCFR) came into existence as National Research Center on Coldwater Fisheries as an independent Research Center on 24 September 1987 during the VII Five Year Plan. This is the only national facility in the country to take up the research investigation on capture and culture aspects with a focus on exotic and indigenous coldwater fish species. Since its inception, the DCFR in spite of constraints in terms of manpower and infrastructure has made significant contribution for proper appraisal of coldwater fishery resources and developed suitable technologies to propagate important coldwater fish species in hills.

Keeping in view the ever expanding activities of NRCCWF and the greater potential of coldwater fisheries in different Himalayan states, in a significant decision during the XI plan, it has been made Directorate of Coldwater Fisheries Research (DCFR), to develop location, situation and system specific technologies by utilizing and augmenting resources in all the Himalayan states from Jammu & Kashmir to Arunachal Pradesh.

The Directorate has completed 25 years of establishment and now has entered into its "Silver Jubilee Year". During this period the Directorate has done sincere efforts to harness the available resource in a sustainable manner and equipped itself to face new challenges in coldwater fisheries research and development. The progress made in terms of infrastructure and research facilities are commendable. The DCFR is on its glorious path of virtually actualizing its vision by imparting boon of quality research in sustainable coldwater fisheries production, management and conservation

Location

The headquarters of DCFR is located at Bhimtal at an altitude of 1470 masl in the district of Nainital of Uttarakhand state. It is about 25 km away from the famous tourist place of Nainital. The nearest railway station is Kathgodam, which is about 280 km from Delhi. The nearest airport is Indira Gandhi International Airport, New Delhi. The experimental field station of the Institute at Chirapani in

Champawat district of Uttarakhand State is about 150 km from Bhimtal.

This Directorate is now emerging as the nodal facility in the country where research investigations are under taken both on capture and culture aspects with a focus on exotic and indigenous coldwater species.

Management

A high powered Research Advisory Committee (RAC) guides this Directorate in the research in thrust areas and on new initiatives. The RAC also evaluates and monitors the progress of research activities of this Directorate. The Management Committee (IMC) constituted and mandated by Indian Council of Agricultural Research under the Chairmanship of the Director, supervises various management aspects of this Institute. A number of internal committees such as Institute Research Council (IRC), Official Language Committee and Institute Joint Staff Council (IJSC) are in place of decentralized management.

Mandate

- To conduct basic, strategic and applied research in coldwater fisheries and aquaculture
- To develop stock management models and culture technologies for major coldwater fish species
- To create awareness and provide training and consultancy

Organizational set-up

Infrastructure

Building and Farm

The main building has various facilities such as library, laboratories, AKMU cell, aquarium and auditorium. A pilot scale mahseer seed production unit is also operating at Bhimtal on the land belonging to State Fisheries Department, Uttarakhand, which in addition to the mahseer hatchery houses, a laboratory which provides back up facilities to seed production activities of the directorate. The directorate has an experimental fish farm facility at Chhirapani in Champawat district of Uttarakhand State which has trout hatchery, cemented raceways for nursery and brood stock rearing and few circular iron tanks for conducting yard trials on various culture aspects of the indigenous and exotic fish species.

Fish Ponds & hatchery complex in the Directorate campus

Support Services

Project Implementation and Monitoring Cell

A separate cell called the Project Implementation and Monitoring Cell (PME) monitors the implementation and progress of research project programmes being conducted by the Directorate. This cell biannually organizes the meeting of Institute Research Council (IRC) to evaluate the progress made in each research project and accordingly approves the work programmes for the current year. The new proposals are also approved by the IRC after thorough evaluation of the objectives, practical utility, manpower support and financial involvement. The cell is also responsible for maintaining records of project reports through RPF system.

The PME cell has given the responsibilities of dealing with all technical matters within and outside matters of the ICAR system. The cell takes care of the training programmes, deputation and participation of scientists in seminars, symposia, workshop, meetings etc. and organizing conferences.

Library Section

The library of the Directorate subscribes about 19 foreign and 11 Indian Journals during the year. The current holding of the library includes more than 2000 books and 3000 other publications. It provides services to the scientists and other staff members of the institute apart from scholars, researchers, students and other local organizations interested in scientific literature on coldwater fisheries and other allied subjects. The library also provided facilities to access free online download of publications, articles of many international journals through www.cera.jccc.in. The library section is further continuing its efforts in collection, processing and disseminating scientific/ technical information to the potential users.

AKMU Cell

The AKMU Cell of this Directorate provides the facilities for Internet through VSAT, scanning,

printing to the Scientists and other staff members. It also acts as Network Administrator and monitors the LAN connectivity of around 50 computers at this Directorate. The Internet facilities were provided to all scientists, Library & Director cell, AKMU Cell. In AKMU Cell computer and Internet facilities also available for other research scholars and M.Sc./Ph.d. students working under various project/programmes. Administrative cases for LAN, VSAT Internet connectivity at institute were processed from time to time. The AKMU Cell also provides internet facilities at Experimental Field Centre, Champawat.

The website of this institute is being updated from time to time as per instructions of the ICAR and under the AGROWEB project. The site contains the information about manpower, institute mandate, project programmes and achievements, tenders & job announcements etc. The DCFR's website has been uploaded with the new domain name http://www.dcfr.res.in. After hosting the website on DCFR's name, it is easier to update regularly. The website is being updated with content management system for better usability as per the suggestions of AGROWEB project. The major achievements of the Directorate, the technology generated, consultancy services were incorporated in the site. Further, the ongoing and forthcoming training programmes, seminar/symposia conducted by the institute, recruitments, tender notice has been reflected in the website. The Directorate's website finds a place in the Indian Council of Agricultural Research (ICAR) website with the address: http://www.dcfr.res.in. The mail & messaging solutions, (mail server) maintained at this Directorate for smooth information communication via email. Individual user ids and passwords for new scientists and officers were allotted from time to time for proper use of the mail server at this organization. The upgraded website of the DCFR is now operational with a new features.

Laboratory Facilities

The Directorate has well equipped laboratories of Fish Nutrition, Environmental Fish Biology & Nutrient Profiling, Molecular Genetics, Fish Health Management (Diagnostic Virology Laboratory & Diagnostic Bacteriology Laboratory). A

Geoinformatics Laboratory is under the process of setting up to conduct research on Remote sensing and GIS application in coldwater fisheries. In addition to these there is a Wet laboratory facility equipped with flow through troughs for setting up physiological experiments and nutrition trials for coldwater fishes. One Feed mill also installed at the main campus of Institute to meet routine requirements of fish feeds.

Extension Wing

The extension wing carries out the various extension activities of the institute such as transfer of technology programmes, organizing the exhibitions, training programmes and other activities related to farmers.

ITMU

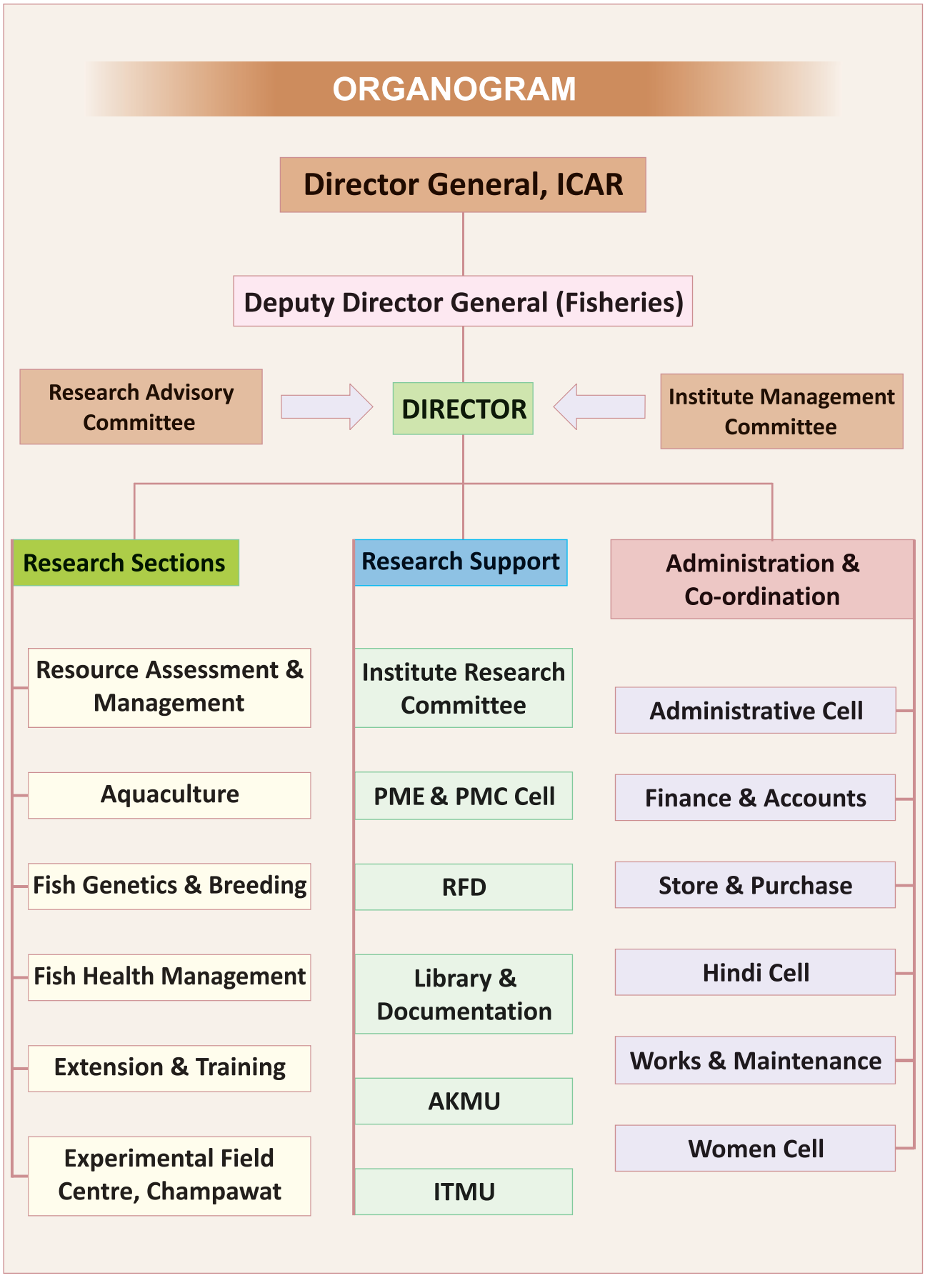
The Directorate has constituted Institute Technology Management Unit (ITMU). It is responsible for providing information about ICAR guidelines on IPR issues. Trainings to the concerned scientists have also been given regarding IPR issues. The ITMU Cell observes World Intellectual Property Day on 26th April. The ITMC has been constituted under the chairmanship of Director for dealing with patents and other intellectual property rights to recognize technologies developed at the Institute and their safe transfer.

Display of DCFR technologies in ICAR Industry meet 2011

Staff Strength (As on 31.03.2012)

Category	Sanctioned	Filled	Vacant
Director (RMP)	01	01	-
Scientific	30	16	14
Technical	14	13	01
Administrative	13	11	02
Supporting	15	12	03
Total	73	53	20

ORGANOGRAM

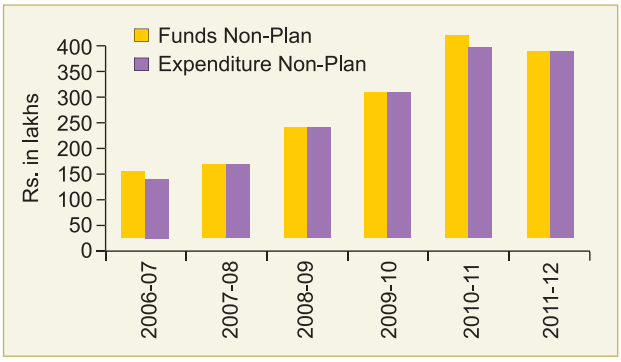

Director General, ICAR
Deputy Director General (Fisheries)
Research Advisory Committee
DIRECTOR
Institute Management Committee
Research Sections
Research Support
Administration & Co-ordination
Resource Assessment & Management
Aquaculture
Fish Genetics & Breeding
Fish Health Management
Extension & Training
Experimental Field Centre, Champawat
Institute Research Committee
PME & PMC Cell
RFD
Library & Documentation
AKMU
ITMU
Administrative Cell
Finance & Accounts
Store & Purchase
Hindi Cell
Works & Maintenance
Women Cell

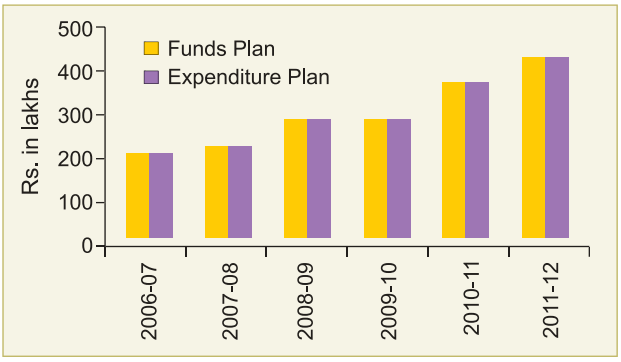
BUDGET 2011-2012

Financial Statement Abstract

(Rupees in Lakhs)

Year	Funds Non-Plan	Expenditure Non-Plan	Funds Plan	Expenditure Plan
2006-2007	124.50	116.21	192.91	186.26
2007-2008	146.00	142.40	208.00	207.65
2008-2009	217.30	214.91	270.00	269.23
2009-2010	282.32	278.23	270.00	269.95
2010-2011	394.00	371.17	350.00	349.46
2011-2012	364.01	360.43	401.00	400.27





Budget Statement for the Year 2011-2012

(Rupees in Lakhs)

Head of Accounts	Budget (R.E.)		Expenditure	
	Plan	Non-Plan	Plan	Non-Plan
Pay & Allowances	-	262.00	-	258.76
Traveling Expenses	20.00	2. 50	20.00	2.50
HRD	5.00	0.00	4.98	0.00
Other Charges including Equipment	203.00	87.51	202.84	87.17
Information Technology	10.00	0.00	9.69	0.00
(a) Major Works	83.00	0.00	82.03	0.00
(b) Repair & Maintenance	0.00	12.00	0.00	12.00
Other ItemsFellowship/ Scholarship/Awards including furniture for New Complex	15.00 65.00	—	14.93 65.00	—
Total	401.00	364.01	400.27	360.43

List of Projects

Institutional Projects (Ongoing)

Project Code	Project Title	Project leader & associate	Year of Start	Likely year of completion
CF-4	Study on selection of suitable sites for aquaculture in selected coldwater area using GIS tools	Prem Kumar	2011	2014
CF-5	Development of database and evaluation of culture and breeding status of rainbow trout (*Oncorhynchus mykiss*) in India	S. Ali P.C. Mahanta N.N. Pandey Prem Kumar R.S. Patiyal P.K. Sahoo	2011	2014
CF-3	Ornamental fish resources in coldwater region of India: Investigation and documentation	S.K. Gupta S.K. Srivaastava D. Sarma W. Vishwanath P.C. Mahanta	2011	2014
AQ-3	Performance of chocolate mahseer (*Neolissochilus hexagonolepis*) in freshwater aquaculture systems in North Eastern and Western Himalayan region	D. Sarma Md.S. Akhter	2008	2012
AQ-8	Development of molecular markers for identification of usable traits in important coldwater fishes	A. Barat P.K. Sahoo R.S. Patiyal S. Ali	2011	2014
AQ-9	Performance of Indigenous minor carps *Labeo dyocheilus* and *Labeo dero* as candidate species for hill aquaculture	N.N. Pandey Prem Kumar R.S. Patiyal S. Ali R. S. Haldar	2011	2015
AQ-10	Evaluation of seed rearing techniques of common carp and golden mahseer for stock enhancement in semi-temperate Himalayan lakes using floating cages	Md.S. Akhter N.N. Pandey S. K. Mallik D. Sarma R. S. Haldar	2011	2015
AQ-11	Study on viral diseases in trout producing states of India	Amit Pande D. Thakuria Ananda Kumar B.S R. S. Haldar	2011	2014
AQ-12	Seasonal Incidences of parasitic, fungal and non-infectious diseases in coldwater fishes and evaluation of herbal extracts for their control	S. Chandra Amit Pande S. K. Mallik	2011	2013
AQ-13	Potential bacterial pathogens in rainbow trout farms from northern India and maintenance of bacterial agents	S. K. Mallik Neetu Shahi Ananda Kumar B.S S. Chandra	2011	2016
AQ-14	Performance evaluation of improved strain of common carp, Champa-1 & Champa-2 at different thermal regimes	S.K. Srivaastava D. Sarma S. Chandra S.K. Gupta	2011	2014

Project Code	Project Title	Project leader & associate	Year of Start	Likely year of completion
DP-1	Sustainable utilization of mountain fishery resources – A partnership mode	DCFR Five hill states	2008	2012
Inter-institutional Outreach Activities (Fisheries Division-ICAR)				
NP1	Outreach Activity-Fish Genetic Stock	A. Barat Prem Kumar S. Ali R.S. Haldar	2008	2012
NP2	Outreach Activity-Fish Feed	N.N. Pandey D. Sarma S.K. Srivastava Md. S. Akhtar S.K. Gupta	2008	2012
NP3	Outreach Activity- Nutrient Profiling and Evaluation of Fish as a Dietary component	Debajit Sarma N.N. Pandey Neetu Shahi Md. S. Akhtar	2008	2012
Completed Research Projects				
AQ-6	Investigation on coldwater fish pathogens and their environment	Amit Pande N.N. Pandey S. K. Mallik D. Thakuria Ananda Kumar B.S	2007	2011
AQ-1	Evaluation on growth performance in different strains of common carps	S.K. Srivastava N.N. Pandey Prem Kumar Amit Pande S.K. Gupta	2008	2011
AQ-2	Study on water budgeting and water management for coldwater aquaculture practices	S.K. Srivastava N.N. Pandey Prem Kumar S.K. Gupta	2008	2011
DST	Genome Scale Mining of phylogenetic markers of *S. richardsonii* fish species for formulation of selective breeding Programme	S. Ali A. Barat	2009	2012
Externally Funded Projects				
DBT	Molecular characterization and development of a diagnostic test for the identification of a filterable agent isolated from diseased Rainbow trout.	Amit Pande N.N. Pandey	2011	2013
NAIP	Bioprospecting of gene and allele mining for abiotic stress tolerance	A. Barat S. Ali	2009	2012
NAIP (Comp-3)	Enhancement of livelihood security through sustainable farming systems and related farm enterprises in North-West Himalaya	Prem Kumar	2009	2012
AICRP	Enhancement of carp fish production by using polytanks in mid hills	N. N. Pandey Prem Kumar	2010	2013

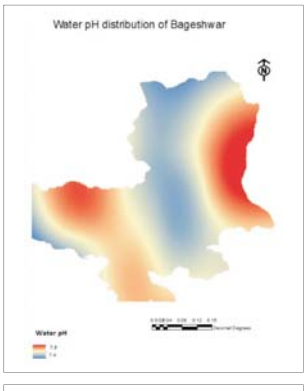
Research Achievements

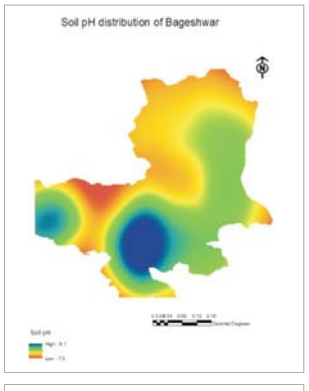
Institutional Projects

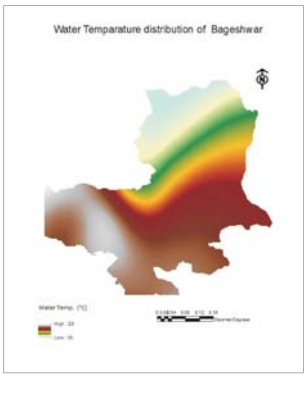
Project Code	CF-4
Project Title	Study on selection of suitable sites for aquaculture in selected coldwater area using GIS Tools
Personnel	Prem Kumar

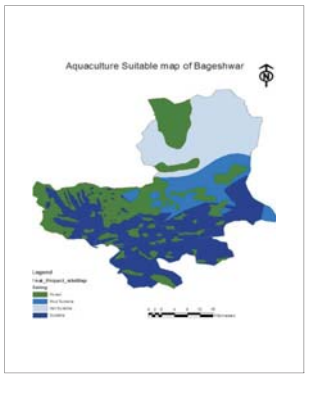
Bageshwar district is in the eastern Kumaon region of Uttarakhand, and is bounded on the west and northwest by Chamoli District, on the northeast and east by Pithoragarh District, and on the south by Almora District. The district has three blocks such as Kapkot, Bageshwar and Garun. The aim of present work was to create a layer of suitable sites for aquaculture based on spatial database on physico-chemical parameters of soil, water and infrastructure facilities.

Considering all required criteria an Analytical Hierarchy Process (AHP) model has been established for Bageshwar district. Water quality suitability is the most important for assessing site suitability for aquaculture development that contributes 54% importance and soil quality having 24% of importance whereas, infrastructure facilities having 22% importance. There are certain criteria established as indicated above for physico-chemical parameters of soil and water used for selecting suitable site for aquaculture productivity.









Project Code	CF-5
Project Title	Development of database and evaluation of culture and breeding status of rainbow trout (*Oncorhynchus mykiss*) in India
Personnel	S. Ali, P.C. Mahanta, N.N. Pandey, PremKumar, R.S. Patiyal, P.K. Sahoo

In the Indian Sub-continent two main types of trouts *viz.* brown trout (*Salmo trutta fario*) and rainbow trout (*Oncorhynchus mykiss*) were transplanted from Europe by British settlers around the beginning of the last century primarily to meet their needs for sport fishing or recreational angling. The transplantation of brown and rainbow trout was attempted independently in the Himalayan and in the non-Himalayan States. Later on, culture of these species was initiated for food and subsequently hatcheries were setup for the production of seed. In most of the cases same stocks were used for breeding purposes over the years. At few locations, new stocks were also introduced. Presently, there is no detailed information available regarding the status of the rainbow trout culture and breeding in India. The lack of information on the culture and breeding aspects including infrastructure, source of seed, stocking density and other intercultural operation restricts the decision making process and devising management

programmes for the expansion of trout farming in the country. Keeping in view the paucity of information the present study is proposed to collect the basic information on the culture, breeding and production status of rainbow trout both in private and state government owned farm from the coldwater regions of the country. The detailed database need to be developed for the identification of the constraints in the culture of rainbow trout, its breeding and other related intercultural operation. This will provide the basic data to understand the constraints in the expansion of trout culture as well as identification of potential areas for the introduction of trout farming. The study will also be helpful in devising management programme for trout farming in the country.

Preliminary data were collected from the two states namely Uttarakhand and Sikkim. There are about 199 trout farmers/growers in the Sikkim state. Out of which 52 are in East district, 72 are in West district, 42 in North district and 33 are in the South district. The maximum numbers of farmers are located in the West district. Out of these three farmers are also involved in trout seed production. Among the total trout farmers, around 17% farms are owned by women which indicates towards growing interest among women for trout farming in the Sikkim. Presently three functional trout breeding units are under State Fisheries Department which supplies trout seeds to govt. farms and also to the private farmers. There are around 35 raceways under the State Fisheries Department of Uttarakhand and around 8 raceways under the private sector. Presently there are only four private trout growers doing trout farming. However, the interest for trout farming among private farmers is growing in the state. The state has seed production unit at Bairangna which produces the trout seed. Annual trout seed production from state farm is around 2 lakh advanced fry. Apart from this, DCFR has trout raceways and seed production unit at Experimental Field Centre at Champawat.

Project Code	CF-3
Project Title	Ornamental fish resources in coldwater region of India: Investigation and documentation
Personnel	S.K. Gupta, S.K. Srivaastava, D. Sarma, W. Vishwanath, P.C. Mahanta

Survey of different streams of district Champawat was conducted for recording the coldwater ornamental fish resources. Mainly three streams falling under the district of Champawat viz. Gauri (Champawat), Lodhia (Chalthi) and Lohawati (Lohaghat) were selected for this purpose. For the collection of fishes, cast net of mesh size 0.5 cm was employed at different locations of stream. Different

Collection of coldwater ornamental fishes from Cherrapunji, Meghalaya

Coldwater ornamental fishes collected from Lohawati stream

Survey of coldwater ornamental fishes from Umiam lake area, Barapani

parameters viz. physical integrity of the streams, habitat, species richness, fish diversity, water quality and biological parameters were examined. Maximum species were recorded from the Lodhia (Chalthi) but from Gauri and Lohawati streams only *Schizothorax richardsonii* was collected in each cast netting operation. Four species were caught form the Lodhia streams namely *Garra gotyla gotyla*, (locally called Patharchatta) *Barilius bendelisis*, *Tor putitora* and *Schizothorax richardsonii*. In terms of ornamental value we could observe that *Barilius bendelesis* have better prospect due to conspicuous banding pattern on the dorsal part of the body. *Garra gotyla gotyla* is dull in appearance and sluggish in movement but very useful for cleaning the aquarium tank due to scrapping feeding habit. It feeds on growing algae on the interior surface of the tank. A detailed survey of coldwater ornamental fishes found in the Meghalaya states was also conducted. Three sites were surveyed namely UCC Umiam lake area, low lying area of Barapani and Cherrapunji. From the low lying area of UCC different species of coldwater ornamental fishes collected were *Badis badis, Chanda nama, Lepidocephalus guntea,Channa stewartii*, and *Channa orientalis* whereas from the low lying area of Barapani, we could collect *Danio dangilla*, *Danio rerio, Channa stewartii* and *Puntius* species. From the streams of Cherrapunji only single species of *Danio aequipinnatus* was collected with the help of dip net by involving the local fishermen. Live specimens were transported in oxygen packed polythene bags to laboratory of fisheries division of ICAR Research Complex for NE Region, Barapani to further study the biology and water quality parameters. Survey activities are in progress to investigate the occurrences of coldwater ornamental fishes from other coldwater states of India.

Some of the Coldwater Ornamental fishes collected from the Meghalaya

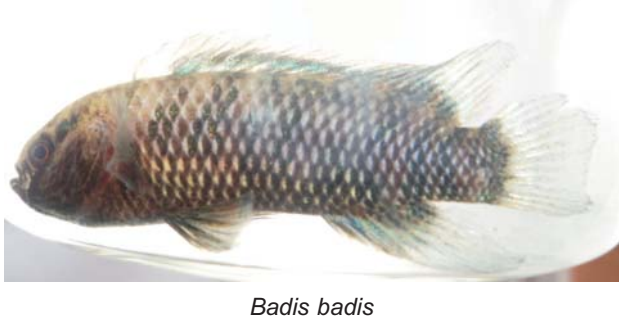
Danio aequipinnatus

Devario dangilla

Esomus danricus

Channa stewartii

Lepidocephalus guntea



Badis badis

Project Code	AQ-3
Project Title	Performance of chocolate mahseer (*Neolissochilus hexagonolepis*) in freshwater aquaculture systems in North Eastern and Western Himalayan region
Personnel	Debajit Sarma, Md. S. Akhter

Performance of chocolate mahseer *(Neolissochilus hexagonolepis)* in pond aquaculture of Kumaun Himalaya

The rearing of chocolate mahseer is being carried out in the hatchery complex of DCFR, Bhimtal to evaluate the growth performance in the pond environment. Growth performance of chocolate mahseer under poly-culture system shows that they were highly correlated ($r^2 = 0.80$) with the growth of golden mahseer. The physico-chemical parameters and biological factors of the experimental ponds were maintained adequate for good growth of the fishes. Analysis of length weight relationship of monoculture and polyculture shows that the non–linear model was comparatively better to its corresponding linearized model. Length-weight relationship, condition factor and relative condition factor of chocolate mahseer shows that this fish was found in good condition in terms of general well being to its new culture environment. Fry of chocolate mahseer are carni-omnivore, while the advanced fingerling and yearling are herbi-omnivore. Presence of sand and mud in the gut shows that fish is column to bottom dweller. The results of the present investigation revealed that chocolate mahseer at the temperature ranging from 19-23°C gained maximum growth compared to the other months in both the culture systems. Chocolate mahseer doesn't show any competition while culturing with golden mahseer and common carp. Their growth performance results also indicate that both the species under culture were highly correlated with each other.

Polyculture of chocolate mahseer and adult mahseer

Project Code	AQ-8
Project Title	Development of molecular markers for identification of usable traits in important coldwater fishes
Personnel	A. Barat, P.K. Sahoo, R.S. Patiyal, S. Ali

Molecular techniques allow characterizing the species and detecting variation or polymorphisms exists among individuals in the population for specific regions of the DNA. These polymorphisms can be used to build up genetic maps and to evaluate differences between markers in the expression of particular traits in a family that might indicate a direct effect of these differences in terms of genetic determination on the trait. The Snow Trout, (*Schizothorax sp*), is an important cold water and sport fish found in Himalayan region. In recent years, there has been a decline in this fish population in rivers and lakes and defined as one of the threatened species. Therefore, methods for the development of population management guidelines are of urgent need. This study aims to understand the genetic status of the fish and its natural biodiversity. Broad knowledge of genetic status can help in formulating breeding and conservation strategy of the species.

Fin tissue samples of *Schizothorax richardsonii*, *S. esocinus* and *S. niger* were collected from different geographical locations of Himachal Pradesh and Jammu & Kashmir. 41 no. *S. niger* and 17 no. *S. esocinus* samples were collected from Jhelum river and Dal Lake, J&K. 25 no. *S. richardsonii* from river

Ravi, at Chamba, Himachal Pradesh. Fin tissue samples were preserved in 70% alcohol for later analysis. Genomic DNA was isolated from 30 samples and high quantity of genomic DNA 5-10 µg/ µl were measured.

Sample collection at (1) Chamba H.P and (2) Srinagar, J&K

Field Survey

A survey was conducted in Gomti River near Baijnath, Bageshwar during 23-25 October 2011 to collect some samples to study the genetic diversity of some fishes. Main catch was consisted of *Barilius bendelisis, Garra gotyla*, *Schizothorax richardsonii* and *Tor chelynoides.* Different tissues like gill, liver, fin, kidney, brain and heart were collected for DNA/ RNA isolation. Three individuals of each species were injected intraperitoneally with 0.05% Colchicine and kept alive for 2hrs. Gill and kidney tissues were dissected out and homogenized in 0.56%KCl. The cell suspension was kept in 0.56% KCl for 30min. and centrifuged at 4000 rpm for 5min. The supernatant was discarded and cell suspension was fixed in aceto-ethanol fixative. The cell suspension was used for chromosomal preparation. Preliminary microscopic observation of metaphase complements revealed that *Tor*

Unique trap used by local people to catch fish

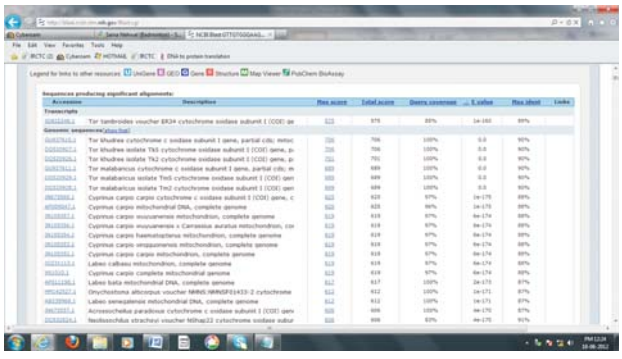
Fish Samples collected

Fish Samples collected

Chromosomes of *T chelynoides* and *B. bendelisis*

chelynoides has 2n= 90 chromosomes, where as *B. bendelisis*, *G. gotyla* have 2n=50 in each and *S. richardsonii* has 2n=98 chromosome.

Genomic DNA of *T chelynoides* was also amplified through PCR using universal cytochrome oxidase subunit I (COXI). The amplified product was purified and sequenced. The nucleotide sequences were confirmed using BLAST searches as COXI genes which showed high (90%) of similarities (E value 1e-160) with congneric species and other cyprinids.



NCBI BLASTn similarities of COXI gene with other teleostean fishes.

During the survey it was observed a unique religion approach of mahseer conservation near the Baijnath temple premises. People are not allowed to catch fish and pilgrims are used to feed them with puffed rice and pea nuts. The mahseer shoal is so much domesticated in the river that they do not swim away even people enter in to the river pools for holy dip and other activities.

Shoal of Golden mahseer, safely moving in the fast flowing river Gomti, near the Baijnath temple, Baijnath, Bageswar

Project Code	AQ-9
Project Title	Performance of Indigenous minor carps *Labeo dyocheilus* and *Labeo dero* as candidate species for hill aquaculture
Personnel	N.N. Pandey, Prem Kumar, R.S. Patiyal, S. Ali , R. S. Haldar

We collected brood stock of *Labeo dyocheilus* and *Labeo dero* from Kosi river and stocked in pond at Bhimtal. Fishes were fed@ 3% of their body weight daily with conventional carp feed prepared by mixing Rice bran and mustard oil cake in the ratio of 1:1. Both the species have browsing habit with 80% algae in stomach. The brooders having the age 3+ years and body weight as 350-700 g showed full maturity with eggs release and oozing milt during 3rd week of July to end of August in pond environment, while it was during first week of July to second week of August in wild stock. Gonadosomatic index (GSI) increased gradually from April to July and decreased in the August in females of pond and stream. GSI was significantly higher ($P<0.01$) during May to July in wild females compared to captive reared ones. GSI ranged from 3.436±0.236 to 14.465±1.342in captive reared females and 4.254±0.325 to 15.864±1.435 in wild females. Monthly variation was also significantly ($P<0.01$) different in both type of females. Early maturity and comparatively higher GSI in wild females might be due to the higher temperature in stream (24-31^{0}C). During spawning season females showed soft and bulged belly with swollen light reddish vent.

Labeo dyocheilus

It was tried to breed *Labeo dyocheilus* (McClelland) in captivity at 18-22^{0}C temperature with optimization of synthetic hormone dosage. Different doses of ovaprim (GnRH- domperidone) were injected intramuscularly. Spawning was carried out in cloth hapa (on 3.8.2011) and in FRP tanks (on 6.8.2011). Dry stripping method was also tried with

hormone treated females on 6.8.2011. Eggs were incubated in trays placing in trough having flowing water. It was observed that all females released viable eggs after 12-14 hrs of the hormone injection. Hormone dose of 0.6 ml kg^{-1}body wt. for females and 0.3 ml kg^{-1}body wt. for males was found optimum for spawning with 84-98% fertilization and high rate of hatching (54-78%). Breeding performance was better in the FRP tanks rather than in hapa and in dry stripping. The optimum temperature for successful spawning and egg incubation was observed as 18-22^{0}C. At the time of spawning little splashing of water was observed and female fish were chased by the males. Though, the fish is bottom dwelling and showed shy nature during the breeding. Therefore, late evening was the best time for the hormone injection. Eggs of the *L. dyocheilus* were creamy white in colour and the size of the ovarian eggs (Stage VI) ranged between 1.24±0.12 to 1.38±0.14mm. The observed fecundity was 188700 kg^{-1}. The fertilized eggs were semi adhesive and settled in the bottom. Water hardening of the fertilized eggs took 4-5 hrs. The average diameter of the fertilized egg was 2.6-3.4mm. Eggs of large sized female were larger in size than the egg of small sized female. One liter of egg volume contained 39,000 fertilized eggs. The hatching period was recorded as 20-46 hrs. at different temperature.

Gravid female of *L. dyocheilus*

Ranching of *L. dyocheilus* seed in river Kosi

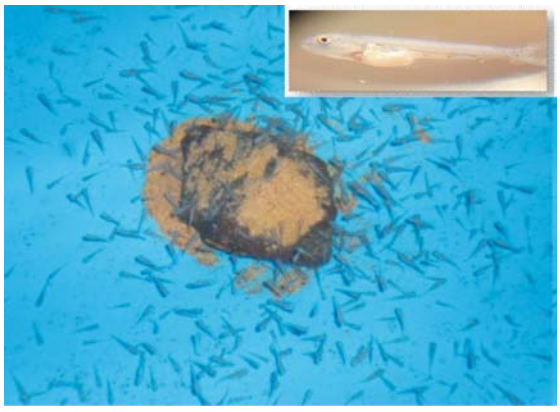
Early hatching was observed at higher temperature and late and prolonged hatching was observed at low temperature. 18-20^{0}C water temperature was observed optimum for the egg incubation with higher hatching rate and better recovery of larvae. Late and prolonged hatching resulted in healthy hatchlings and better recovery of spawn. At 20^{0}C hatching period was observed as 24-36hrs, which was resulted as 68% survival of 4 days old spawn and 54% survival of 20 days old fry.

The average size of one day hatchling was 3.48±0.24mm, weighing 0.006 gm. Yolk material was absorbed in 72-78 hrs of hatching at 20^{0}C temperature and larvae starts external feeding at 4th day. Filtered

Hormone injection to *L. dyocheilus*

Stripping of *L. dyocheilus*

Collection of fertilized eggs



One month old fry of *L. dyocheilus*

plankton was given for first 4 days then yolk of boiled egg was given for next one week. Finely powdered GNOC and rice bran was given to the larvae of 15 days old with simultaneously plankton feeding. The survival percent of fry was observed as 48-66% at 12-20^{0}C. Water temperature below 12^{0}C adversely affected the survival of fry in FRP tanks. The size of the fingerlings was observed as 3.5-4.0 cm, weighing 0.563-0.758g during the month of Nov (100 days of rearing). 2000 fingerlings of *L. dyocheilus* were stocked in the river Kosi as perthe commitment to the Forest Department at the time of broodstock collection.

Project Code	AQ-10
Project Title	Evaluation of seed rearing techniques of common carp and golden mahseer for stock enhancement in semi-temperate Himalayan lakes using floating cages
Personnel	Md.S. Akhter, N.N. Pandey, S. K. Mallik, Debjit Sarma, R. S. Haldar

Fishery enhancement in open water bodies like lakes and reservoirs etc are of important concern to increase fish productivity in these water bodies. However, protocols for *in situ* seed rearing upto advanced fingerling stage for stocking in coldwater lakes and reservoirs are not in place. Hence, to address this issue, the present project has been taken up for developing *in situ* seed rearing protocols for fishery enhancement in coldwater lakes. The sixteen units of 2 x 2 m floating cages made of high-density polyethylene (HDPE) blocks were installed in the Bhimtal Lake.

To optimize *in situ* rearing density of golden mahseer upto advanced fingerling stage for stock enhancement, fry of golden mahseer (av. weight 0.061 ± 0.012g and length 1.83 ± 0.23 cm) were stocked in four stocking densities viz. 60 nos/m^3, 70 nos/m^3, 80 nos/m^3 and 90 nos/m^3. Growth performance and water quality parameters are being monitored periodically.

Installation of HDPE floating cages in Bhimtal Lake

Stocking of mahseer fry in floating cages in Bhimtal Lake

Project Code	AQ-11
Project Title	Study on viral diseases in trout producing states of India
Personnel	Amit Pande, D. Thakuria, Ananda Kumar B.S, R. S. Haldar

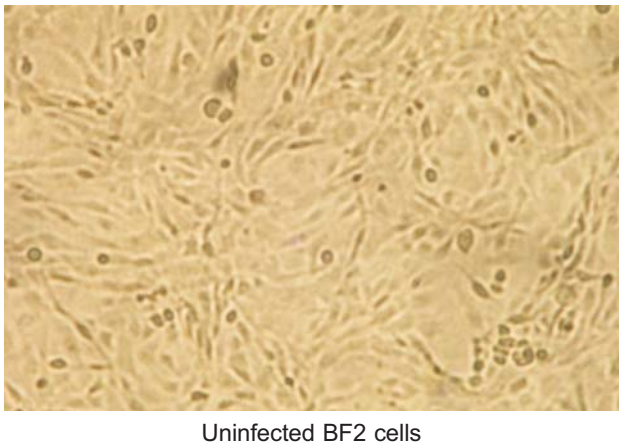
To address the incidence of viral diseases that we came across in the previous project, this project was conceived as per the recommendations of the RAC. It was advised to take up a project targeting the viral diseases in leading trout producing areas like Jammu & Kashmir and Himachal Pradesh as these are the most organized farms in the country

and supply seed to different part of the country. A total of 47 samples were collected from different rainbow trout farms from Ladakh and Kashmir region of J&K state. All the samples were processed and the materials were stored at -80°C for further screening of viruses by using different virological techniques.

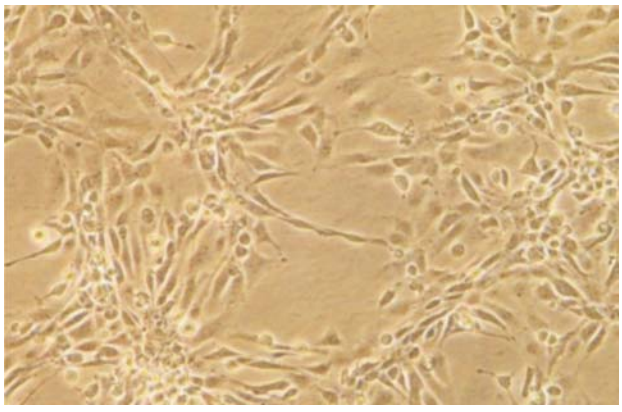
Yellow cattrahl exhudate oozing from vent *(left)* and intestine filled with the same *(right)*

Cell Culture Screening

The processed samples were inoculated at 1:20 dilution in 24hr old monolyers of BF-2 and RTG cell lines grown on cell culture flasks. The cell lines were observed for cytopathic effect for a minimum period



Uninfected BF2 cells



Infected cells

7-10 days. The suspected positive samples were further inoculated up to 4th passage for confirmation of the etiological agent of viral origin. Out of 47 samples screened so far, five have demonstrated cypotathic effect in cultured fish cells.

Counter Immunoelectrophoresis (CIE)

Again 47 samples were screened with CIE using rabbit anti-IPNV hyperimmune serum raised in our laboratory in the earlier project. Out of 47 samples screened four samples have been found to be positive which needs to be confirmed by molecular techniques.

RNA-PAGE and silver staining

RNA-PAGE and silver staining techniques is a one of the simplest methodology for the identification and screening of double stranded RNA viruses. Thus it can be used as an effective diagnostic tool for the identification of aquabirna viruses. Isolation of double stranded RNA was tried from all the samples by using trizol-lithium chloride method. The material was run on 6% resolving PAGE and analyzed by using silver staining technique. This technique is being standardized in the laboratory for the identification of aquabirna viruses.

Project Code	AQ-12
Project Title	Seasonal incidences of parasitic, fungal and non-infectious diseases in coldwater fishes and evaluation of herbal extracts for their control
Personnel	S. Chandra, Amit Pande, S. K. Mallik

Major parasitic and environmental health problems occurring in upland farmed fishes were studied. Saprolegniasis in eggs, larvae and adults of

rainbow trout and carps, dactylogyrosis and trichiodinasis infestation in fry of common carp, adults of silver carp and grass carp, eye infection in 3+ years rainbow trout and mass mortality due to Oxygen depletion were the health related problems observed during the period.

Studies on Dactylogyrosis

Severe outbreak of dactylogyrosis reported in fry of Ropsa scaly and Felsosomogy mirror carp (Hungarian imported strains) at Champawat fish farm resulted to mass mortality up to 46.6%. The existing Bangkok strain of common carp fry having same size reared at the farm under similar rearing condition did not showed acute clinical symptoms (Table1 &2) during early stages of life. The average water temperature of raceways during the outbreak was $23^0C \pm 1.0$ and pH of water varied in between 6.8-7.4.The outbreak was spontaneous initially and infection lasted for about one and half weeks. Prevalence varied significantly with respect to host size in length. Maximum prevalence (49%) was observed in the host size class of 10 to 20mm with highest number of parasites in the gills.

Table 1: Dactylogyrosis in Ropsa Scale Carp and Falsogammy Mirror Carp

Age days	Size range (mm)	Percent Population	Percent of infected fry	Av. Nos. of Parasites /field	Mortality of infected fry in %
35	10-15	24.0	48	5-6	80
35	15-20	30.0	50	5-6	80
35	20-25	04.0	20	2-3	30
35	25-30	12.0	02	0-2	0
35	30-35	24.0	01	0-2	0
35	35-40	06.0	01	0-1	0

Table 2: Dactylogyrosis in Existing Common Carp

Age days	Size range (mm)	Percent Population	Percent of infected fry	Av. Nos. of Parasites /field	Mortality of infected fry in %
35	10-15	80.0	3	0-1	0
35	15-20	20.0	1	0-1	0

Regular sampling of the fish tanks located in mid hill areas showed higher incidences of gill flukes in silver carp and grass carp leading to emaciation, poor gonadal development and mortality. Among three exotic carp species i.e. common carp, grass carp and silver carp, reared at Champawat farm, under the influence of lower water temperature during winter months, silver carp showed maximum mortality with presence of *Dactylogyrus* sp. in the gills. While initial study of grow out fish tanks stocked with strains of common carp @ 2-5 fish/sq m showed less parasitic infestation compared to other two carps in mid Himalayan tanks.

Dactylogyrosis infected grass carp

Eye infection in rainbow trout

With onset of monsoon, bigger 3+ year old *Oncorhynchus mykiss* (250-575g/225-360mm) reared at Champawat farm showed white opacity of eye lens in a population of 20-25%. At initial stages of disease, feed intake was normal and fishes remained in good condition. In advance stages of infection, liquefaction of cortical region was observed. Degeneration of lens with complete blindness of both the eyes in about 65% infected population reported with mortality rate of 30-40% of infected fishes. However, 1+ trout juveniles (97-109.5g/205-225mm) found free of this infection. Transmission and infectivity declined with reduction of temperature in winter months. Severely both eye infected female trout showed poorly developed ovary. Detailed etiological, hematological, histopathologica, gonadosomatic and hepatosomatic studies along with devising control measures on this economically important disease is under progress.

Eye infected trout

To minimize the transmission of eye disease in trout rearing ponds, a 30 sq m nursery raceway at Champawat farm was used as a quarantine tank for minimizing the adverse affect of eye infection in rainbow trout with application of medicines, vitamins and adequate feeding. The infected trout collected from bigger ponds were kept in the tank. As disease reduces the vision of fishes, feed searching and feed intake was also adversely affected. This management method in one way helped in further spread of disease in grow out trout raceways and on the other hand recovery rate and survival of infected trout increased in quarantine tank with better care.

Ovary of healthy & eye infected trout

Health monitoring of Champa 1 & Champa 2

Sampling of Champa-1 & 2 in adopted fish tank of Nariyal Gaon, Toli, Chamola and Banjgaon villages of Champawat district was carried out to monitor the health status of fishes. Fishes in weight range of 3.6 g-14.7 g in the month of November-December, 11 did not showed any significant parasitic infestation in gills and over body. During the period physicochemical parameters of theses farmers tank were found under normal range i.e. air/ water temperature 12-20^{0}C/6.0-12.0^{0}C; pH 7.0-8.0; hardness 110-125ppm;nitrate 25-50ppm.

Fungal Infections

Whitening of upper area of caudal and anal fins of rainbow trout in 10-15 % population was observed which increased during winter months. To find out the co-relation between whiting of fins and maturity, fifty fishes of 450-675 g sizes from RP1 &RP 2 showing above symptom were examined and found only 6 nos. were oozing males. Aggressive feeding habit of rainbow trout may also be one of the predisposing factors in imitation of this infection. Investigation on frequent incidences of *Saprolegnia* sp, in trout eggs revealed that development of unhygienic condition below the egg trays which was not visible from upper side and accumulation of organic material (dead and decayed leaves) in the pipe line and overhead water tanks were found to be one of the important causative factor. Fungal hyphae growing over dead eggs if not cleaned found penetrating in the living eggs of the hatching trays resulting to killing of the good eggs and lowering hatching and survival rate in the hatchery.

Studies on herbal extracts

Locally abundant (Pinus) *Pinus* sp. & (Bichhu gass) *Urtica dioica* having curative values was collected. Different extracts were prepared. Experimental trials were conducted for three weeks without fish. Initial physiochemical parameters were air/ water temp 8.0 $\pm$4.0^{0}C/ 4.5$\pm$3.0^{0}C,pH 7.3, hardness 25ppm, chlorides 30ppm, nitrate 20ppm, iron 0.1ppm. 1.0 kg of green pinus needles soaked in 20 L of tank water. Water pH sharply fell to 4.5

Leaves of *Urtica dioica* for extract preparation

Pinus application in fish tank

with increase of hardness and chlorides and started slight increase of pH after second week of application showing acidic nature with growth inhibiting character. At the end of 21 days air/ water temp was 11.8± 4.0/5.6± 2^{0}C, pH 5.0,hardness 75ppm,chlorides 80ppm, nitrate 25ppm and iron 0.1ppm. Effect of these extracts on parasites, physicochemical parameters of fish tank and fish is under progress.

Other disease problem

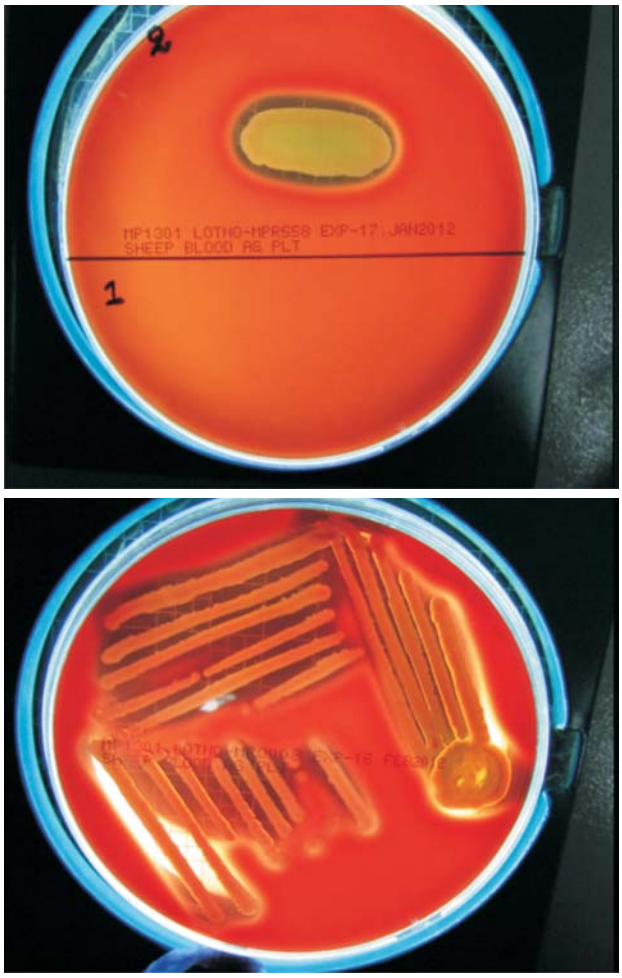
Mass mortality of stocked fishes in two occasions was reported due to Oxygen depletion during rainy season owing to cloudiness for three four days with higher stocking density. Fish health management techniques in lower thermal regimes of upland fishes were disseminated to visiting students and fish farmers of Almora, Champawat and other districts of Uttarakhand. Farmer Field day was organized to disseminate various useful and safe treatment methods used for fish disease control and importance of adopting in advance preventive measures.

Mass mortality due to asphyxiation

Regular dip treatment in salt solution

Project Code	AQ-13
Project Title	Potential bacterial pathogens in rainbow trout farms from northern India and maintenance of bacterial agents
Personnel	S. K. Mallik, Neetu Shahi, Ananda Kumar B.S, S. Chandra

Estimation of bacterial flora, their distribution in hatchery and farm, seasonal occurrence, prevalence and identification of potentially bacterial pathogens in rainbow trout fish farms from northern India has been initiated through this project. Initially, tissue samples (muscle, gill, liver, kidney, gut, eye,) from rainbow trout and water samples from storage and rearing tanks of experimental coldwater fish farm, Champawat, were collected aseptically and brought to the fish bacteriology laboratory, DCFR, Bhimtal for necessary analysis. Samples were processed on different selective and non-selective agar for estimation of total plate count (TPC) as well



(Fig 1(A) *Aeromonas hydrophilla* (B) *Aeromonas veronii* showing hemolytic activity on sheep blood agar)

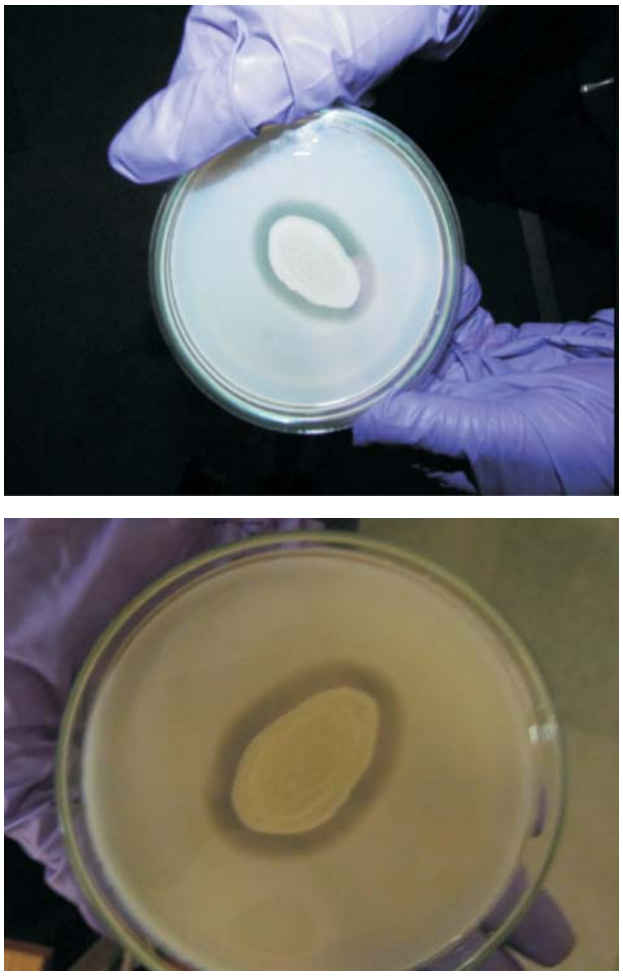


Fig 2(A) *Aeromonas hydrophilla* (B) *Aeromonas veronii* showing DNAase activity

as pure culture preparation. Total plate counts (CFU/ g or CFU/ ml) for muscle tissue (3.8 x 10^3), gill (6.6 x 10^3), spleen 2.1 x 10^2), kidney (1.68 x10^4), eyes (4.5 x 10^5), liver (2.6 x10^3), gut (1.88 x 10^3), storage tank (8.4 x 10^2) and rearing tank (9.9 x 10^2) were estimated. Biochemical assays showed 90% of bacteria were G-ve, motile, rod, fermentative, oxidase, catalase and gelatin positive. Identification of bacterial isolates was more confirmed by 16S rRNA molecular characterization. Bacteria flora identified from tissues of rainbow trout were *Enterobacter, Aeromonas hydrophilla, Brevibacillus agri, Aeromonas sp., Hafnia alvei, Aeromonas hydrophilla, A. popoffii, Rahnella, sp., Aeromonas cavie,, Aeromonas veronni.* Haemolysin and DNAase assays were performed to screen the potentially bacterial pathogen from non-pathogenic one. Two isolates *Aeromonas hydrophilla and Aeromonas veronii* were recorded showing ²-hemolytic activity in sheep blood agar and DNAase activity (Fig 1A & B, 2A & B).

The virulent properties of both the isolates were also established by intraperitonial injection of *A. hydrophilla* and *A. veronii* @ 10^5 to 10^8 CFU/fish. Symptoms of hemorrhage, cell shrinkage & vacoulation as well as mortality of Rainbow trout were observed within 24hr of injection with *A. hydrophilla*. Antibacterial susceptibility test of bacteria recorded 80% of isolate showing resistant to Bacitracin (B^{10}) & Penicillin (P^2, P^{10}) out of 16 tested market antibiotics. Dominance of *Aeromonands group* among bacterial flora during the study period was observed. Presence of virulent *Aeromonas hydrophilla* as opportunistic pathogen in rearing system might cause possible bacterial diseases in rainbow trout as well as *Aeromonas veronii* traveler's diarrhea to human being.

Project Code	AQ-14
Project Title	Performance evaluation of improved strain of common carp, Champa-1 & Champa-2 at different thermal regimes
Personnel	S.K. Srivaastava, S. Chandra, R.S. Patiyal, S.K. Gupta

Breeding of improved stain of Hugarian common carp Champa-1 (Ropsha scaly) Champa-2 (Felsosomogy Mirror Carp) was carried out at DCFR Experimental Field center Champawat. Brooder of Champa-1 Champa-2 and Bangkok strain were harvested from the ponds of Pocket-'B' and kept in breeding pond. Equal proportion of rice bran and oilcake were mixed and made into dough form to feed the brooders. They were fed twice daily to satiation. Breeding trails were conducted in the mid May month at water temperature ranging between 17.5 - 22^{0}C. So far five attempts were made with or without hormonal injection. Breeding response of

Brooders of Champa-1 & champa-2

Champa-1, Champa-2 and existing Bangkok strain in hapas were not more than 10-15% without hormonal injection while with hormonal (Ovatide) dose of 0.5 ml/kg for female and 0.3ml/kg for male brooders resulted in 70% , 100% and 100% respectively. For the adhesive eggs of common carp dry and green needles of pine tree were used as substrate for egg attachment which was placed in the center of hapas. Since the availability of aquatic weed is extremely less in the mid Himalayan areas, dry needle of pines can be used as alternative source for common carp breeding as leaves remain un-decomposed in the water without affecting the water quality. The latency period was observed to be 10-12 hrs at water temperature of 17.5± 2^0C in all the three strains. Similarly the average fertilization rate was 65%, 80% and 95% in Champa-1, Champa-2 and existing Bangkok strain. Hatching took place after 78 hrs of incubation period due to lower thermal regime in all the strains. After the fry rearing period of 45 days, Champa-1 and Champa-2 attained a size range of 10-40 mm with 48% of population attained size range above 20mm where as Bangkok strain of common carp was in range of 10-30mm with 80% population in the size range of 15mm under similar conditions.

Breeding trial of champa-1 & champa-2

Distribution of seeds

Five pounds of Fish farmers belonging to different locations of Uttarakhand and four places of different thermal region of North east region were selected for experimental rearing of Champa-1 & Champa-2. At Champawat center, rearing of Champa-1 & Champa-2 was also done. During the sampling, fishes were found in apparently healthy condition. Length and weight of fishes were recorded on monthly basis at different ponds. Average weight

Distribution of Champa-1 & champa-2 seed to farmers

Farmer's pond stocked with Champa 1 & Champa 2

1.2 g. fishes were stocked in the different ponds in the month of September-2011. 1500 seeds of Common carp, Champa-1 (Ropsha scaly) & Champa-2 (Felsosomogy Mirror carp) bred at DCFR field center Champawat were distributed to the different farmers of district Champawat. Each farmer was given 300 seeds of champa-1 champa-2 for rearing purpose. Rearing was done by keeping 5 fish per cubic meter.

Following farmers of Champawat district of Uttarakhand were selected for experimental rearing:

Shri Raghubar Datt Morari	Village- Bheti,, Karnaarayat
Shri Amba Datt Kharkawal	Village- Kharkbagar, Narial Gaon
Shri Krisnanad Gahtori	Village-Toli , Patti block
Mr. Pitamber Gahtori	Village- Toli, Khetikhan
Mr Hari Singh Deopa	Village-Bangaon

NE Regions of India

Total 3000 seeds of champa-1 champa-2 having av. sizes 20-40 mm were equally distributed to the following each sites for rearing purposes. Department of fisheries science ICAR complex for NEH region Barapani, Shillong, Department of Fisheries Sikkim & Arunachal Pradesh and Senchoa fish farm Assam (Naigoan). The water temperature, and air temperature at Senchoa farm Naigoan district (Assam) was reported to be 26.2^{0}C - 32.2^{0}C, and 28-35.2^{0}C respectively. The water temperature, Meghalaya farm was recorded ranging 19-23^{0}C, Sikkim 19-23^{0}C respectively during the reported period. Amongst the North east region, the maximum growth were recorded in Senchoa fish farm Assam 25± 6 gm as followed by Meghalaya farm 18± 5 gm, Sikkim 12± 5 gm, Arunanchal Pradesh10± 2 gm.

Evaluation of growth of champa-1 & champa-2 at Naigoan

Project Code	DP-1
Project Title	Sustainable utilization of mountain fishery resources – A partnership mode
Personnel	DCFR and Five hill states

Arunachal Pradesh

Department of Zoology, RGU, Itanagar

Exploration of commercial and food fishes from Arunachal Pradesh

Several field trips were undertaken in rivers and lakes of East Siang, and West siang districts of Arunachal Pradesh. In addition to river Siang, random sampling were performed in numbers of big tributaries, certain small streams and several perennial water bodies along with the record of local fish landing (landing sites mainly Pasighat and Along).

Basic biological studies on *Semiplotus semiplotus*: Reproductive Biology

For the purpose, reared fishes in the cemented cisterns as well as freshly collected river samples were used. As per requirement of the study, fishes were sacrificed as and when required. Among the biological feature *in-situ* breeding biology was given due importance for tracing out reproductive strategy of the fish in general. Knowledge acquired from the study will be immense value in developing captive breeding of the fish for seed production and artificial propagation. So, investigations and achievements were made on the following reproductive aspects related to breeding biology in particular.

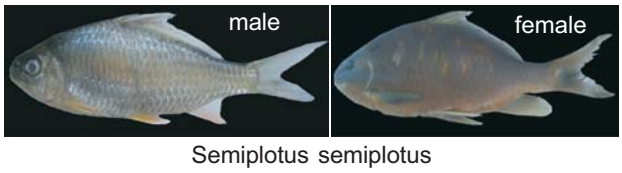
1. Sexual dimorphism

Based on the significant differences in morphometric and meristic features between male and female sexual dimorphisim detected.

2. Reproductive structure and related functional aspects

***Gonad structure**:* Freshly collected specimens as well as specimens preserved after morphometric measurement were used for gonad study. Testis and Ovary were carefully dissected out. Weights of the gonads were taken with digital balance (Anamed M-300). Histological examination of gonads was also performed. Gonadosomatic index and fecundity has also been calculated using standard methodology.

Therefore, most of activities performed during the financial year of 2010-11 were mainly confined to areas of 1a & 1b-ignoring 1c as stated above. So, proposed activities for financial year of 2011-12 for the net working project may be fine tuned as mentioned below.



Semiplotus semiplotus

Department of Fisheries

Trout Farming in Earthen Ponds of Arunachal Pradesh

In Arunachal Pradesh modification of existing trout hatchery and rearing of trout at Shergaon trout farm has been taken as one of the important activity. Breeding and rearing of trout has been carried out successfully. 15,000 seeds were produced in the farm. Hatchery produced seeds were reared in the farm and also stocked in Nuranang stream, a high altitudinal streams of Arunachal Pradesh. The trout seed stocked will certainly attract the anglers which in turn will increase the economy of the local people. It may be worth mentioning that the area is situated near to Tawang, which attract lot of tourists every year and there is a great potential to develop fish based eco-tourism in these selected water bodies of Arunachal Pradesh.

To improve the quality of the stock of Rainbow trout, 10,000 nos. of rainbow trout eyed ova were transported from Jammu and Kashmir to Arunachal Pradesh and reared at Shergaon trout farm. The survival percentage of hatching and rearing was quite good under the agro climatic conditions of the farm. The unique feature of Shergaon Trout farm is that rearing of trout from fry to fingerling stage is carried out in earthen ponds constructed maintaining the slopes. The water inlets and outlets were designed in a conventional way with the help of split bamboo/ wood to cut down the establishment cost. The hatchery complex, designed economically and eco-friendly is very much suitable and may be adopted by the local entrepreneurs and farmers to make trout farming popular in hilly areas and thereby to increase the trout production Dr. D. Sarma, principal scientists supervised the trout breeding programme.

Activities at Shergaon Trout farm, Arunachal Pradesh

Sikkim

Brooders of the age of 2^{+} years, weighing 200-250g were used for the breeding. On average 120-200 eggs were obtained from individual female. Onset of maturity was late in comparison to the brooder of 3^{+} years age. Breeding was started from 20^{th} Jan., and was continued upto 15^{th} March. Late maturity and late breeding was due to the comparatively low temperature and younger brooders. A total of 1 lakh eyed ova have been produced.

Broodstock of rainbow trout at State trout farm, Uttaray and Yaksom in Sikkim were maintained. Training was imparted on the brooder maintenance, trout breeding and transportation of green eyed ova to the department personnel and farmers. Different hatcheries including private farmer's hatcheries in the state produced about 90,000 of eyed ova. Significant achievement was that the state fishery personnel and farmers were able to maintain the broodstock and bred by their own. The impact of training was observed during the visit of different locations the farmers have started trout breeding and maintaining good broodstock.

State trout farm, Uttaray, Sikkim

Broodstock of rainbow trout at trout farm, Uttaray, Sikkim

Trout breeding at private trout farm in Sikkim

Sikkim State: leaping ahead in Trout farming

State Fisheries Department of Govt. of Sikkim is associated with Directorate of Coldwater Fisheries Research, Bhimtal under the project entitled "Sustainable Utilization of Mountain Fishery Resources: A Partnership Mode. The Directorate has taken all possible initiatives to promote trout culture in the state considering the suitable climatic condition and abundance of water. As desired to the state, programme on brood stock management and seed production have taken on the priority basis since last four years. Brood stocks of the trout were maintained at State trout farm Uttarey and Yuksom with technical guidance of the Directorate.

Presently, there are three trout breeding units in function for production of sufficient trout seed in order to stock in various Govt. farms and supply to the private farmers in the vicinity. This programme has given a boost in adopting technology in private sector as there are 199 farmers in the state (52 in East district, 72 in West district and 42 in North and 33 in South district) in comparison to 2008-09 when there was only one private farmer in the state.

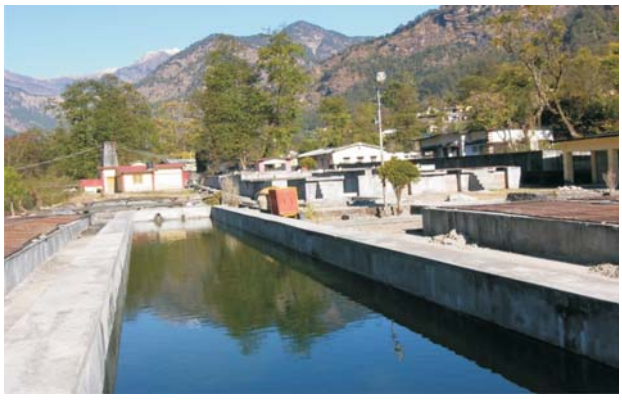
Under the supervision of scientist of DCFR trout breeding was done successfully. Training was imparted on the brooder maintenance, trout breeding and transportation of green eyed ova to the department personnel and farmers. A technical session, chaired by Hon'ble Minister of Fisheries (Govt. of Sikkim) and in presence of the Secretary, was organized by State Fisheries Department. The Hon'ble Minister and Secretary have appreciated the efforts and scientific and technical guidance of Directorate of Coldwater Fisheries Research, Bhimtal to the state. The minister was hopeful for developing 700 more farmers in the coming two years.

Activities related to trout breeding at Sikkim

Uttarakhand

Rainbow trout breeding at State fish farm, Bairangna

- During the period the farm produced 2, 20,000 eyed ova & 1, 50,000 fry with 84% fertilization, 86% hatching. (Incubation period 61 days) at water temperature 4-11°C.
- Breeding performance was better due to high rainfall, better ova house practices and appropriate feeding.
- Good health of the brooder resulted as high fertilization rate, big ova size (4-4.2mm) and healthy hatchlings
- Samples of diseased fishes were collected by scientist DCFR for further analysis.



State trout farm, Bairangna

Ova house

Sampling for disease diagnosis

Himachal Pradesh

An extensive survey of River Ravi and Beas has been conducted for detail study to collect the fish fauna in relation to existing pysico-chemical condition and to explore commercially important fish species. Six sites were selected on different tributaries of River Ravi based on fishery information and altitude viz. 2 sites (Near Village Chandoli & Chaned village) on Chaned Nala, 8 sites (Chaminu Bridge and Saroh) on Sal, Bhakhani Nala at Rakh, Odra near Sultanpur, Dunali nala near Dunali village and Gahra nala near Gahra village. Seven sites were selected on River Beas which is located on different tributaries starting from Pandoh to downstream near Nagrota Siriyan viz. Kamand on Uhl, Mandi near confluence of Suketi with Beas, Tribeni and Chobu on Binwa, Naun Thural, Tripal on Baner, Kotla on Dehar. As

per fishery information of River Ravi only 10 to 12 fish species were collected by fisherman. Further from river Beas about 30 fish species were recorded from different tributaries. Five sites were selected on River Satluj such as Spiti, which joins Satluj at Khab, Nogli Khud that originate from Rohru Hill and join the main river near Nogli bridge, Rampur and main fisheries of this khud is Snow trout. The next is Sainj khud near Sainj, Machyada Khud and Bhadras. But due to heavy rain no fish was caught.

Runoff water harvesting technology for coldwater aquaculture in the hills: The water harvesting model for demonstration to the farmers at Fish Farm, CSKHPKV is under construction and excavation of a check dam has been completed for collection of rain water. One nursery pond of 15x3x1.5 meter has been constructed to rear the new commercially important fish species. In this regard some suitable fish species has been identified and collected to study the biology.

An extensive survey of district Hamirpur has been conducted and two areas have been selected for water harvesting located at Gwardu village near Toni Devi. The water analysis pertaining to the selected sites was done viz. pH 8.63 and 8.52, Dissolved oxygen 7.4 and 7.6mg/l. The water temperature during the first week of March was recorded 15.8^{0}C, which is found suitable for aquaculture. Another survey of district Chamba was conducted during month of March and one site selected near Sihunta where the water from natural water channels can be diverted and stored for aquaculture.

River Ravi: This river originates from Manimahesh glacier of Dhwladhar hills and drains district Chamba of Himachal Pradesh and enters in Punjab near Gurdaspur. The effective length of this river is 108 Km and consists of a number of tributaries out of which six tributaries based on altitude and fisheries information were selected;

1. **Gahra Nalah**: It is snow fed stream, originates from Bhali hills, 15km upstream from village Gahra. The top of hills visible from the site cover with snow cap and stream bed is strewn with big boulders and pebbles. The water colour remains white in the month of October and November as no algae was reported during this period and water temperature varied from 6^{0}C to 12^{o}C. The width of the stream is 8 to 10 meter and depth varies from 45 to 60 cm. The fishery of this stream is nil as in two visits after an hour of fishing no fish was caught as more anthropogenic activity in the area has been observed due to hydel project.
2. **Dunali Nalah**: It is snow fed stream and located 1 and ½ km down from Gahra village. This stream originates from Lamdall hills just 20Km upstream from village Dunali and joins Ravi near this village. The stream bed is strewn with rocks and boulders and due to steep gradients of the stream the water velocity is high as such no alga was observed and water remains transparent. The width of the stream is 15meter and riparian vegetation was negligible. The depth varies from 50 to 60 cm. The fishery information of this stream reveals that the local people were caught mainly *Schizothorax richardsoni* of quite good size (up to 1kg). In month of October after one hour of efforts two specimen of snow trout was caught but in month of November no fish was caught as there was heavy rain just four days before so in scarcity of food fishes migrated downstream.
3. **Sau/Sal:** This is snow fed stream, originates from Sila Ghrat Hills 15 km upstream from the selected site and joins Ravi near village Saroh. Its total length is 20 Km and average width varies from 15 to 20 meters. A good number of riparian vegetations are present on both the sides of the stream. The streambed is strewn with boulders, pebbles, gravels and sand. The watercolour remains light greenish and average depth was 45 to 55cm. The water velocity is high i.e. 0.8 to 1m^{-s}. As per local information good quantity of catch has been observed from this stream but during study period only one snow trout was caught as the mesh size of the cast net was bigger and the fishes are smaller in size. In month of November 4 to 5 pools were seen in the vicinity of selected site, which was full of fries of snow trout.
4. **Bathri stream:** This originates from Kala Top Hills (back side of Dalhousi) and joins Ravi 500meter below the Chamera project 1. A snow fed tributaries and streambed strewn with boulders, pebbles, gravels and sand. The average width of the stream is about 15meter and depth varies from 30 to 50cm. A good amount of riparian vegetation was seen on both the bank of stream. The watercolour remains green. In month of October a good catch has been

procured after one hour of fishing i.e. 18 nos. of snow trout and two number of *Crossochielus latius.*

5. **Chaned stream**: Stream fed stream originates from Kolarhi near Dalhousi and joins river Ravi near Chamera Dam. Its approximate length is 10 Km and selected site is just 2 Km from village Chaned towards upstream. The thick riparian vegetation observed on both the sides of stream and streambed strewn with boulders, pebbles and gravels with sand. The average width of the stream is approximately 20 meters and depth varies from 45 to 55 cm. The site is ideal for fish breeding, the watercolour remains greenish. As per fishery information the people used to caught snow trout from this stream as such in October month only one specimen of snow trout caught with the help of cast net but in November no fish was caught due to big mesh size (2") of cast net. Three specimens of Crossochielus latius were caught near Dam area where it joins the Ravi.

River Beas: It originates from Rohtang glacier in district Kullu and passess through district Mandi and Kangra and finally enters in Punjab. A number of tributaries join the river on its left and right banks and some are selected from fishery point of view.

1. **River Banner**: It originates from Dhawladhar hills near Old Chamunda and passes through Jia, Chamunda and Kangra. River provides irrigation water, building material and faunal wealth (mainly fish) to the people living in the vicinity. It receives a number of tributaries and finally joins Beas at Haripur. There is a hydal project known as Jia hydel project in upper reaches of this river.
2. **Neugal River**: It originates from forest of Kandi and passes through Palampur, Paraur, Thural. River provides irrigation water, building material and faunal wealth (mainly fish) to the people living in the vicinity. It receives a number of tributaries and finally joins Beas at Alampur.
3. **River Binwa**: It originates from Kharali village, which is about 40 Kms from Baijnath. Doond tributary join Binwa at Bakroda village and Nain another tributary join it at Utrala. The fishes do not migrate up due to construction of Utrala Dam. It passes through Baijnath where another tributary Batwali and Sansali join, Chobu, Chadiyar and finally fall in the Beas at Triveni near Sandhol. River provides irrigation water, building material and faunal wealth (mainly fish) to the people living in the vicinity.

Jammu & Kashmir

The work related to the Exploratory Survey of Fish biodiversity in Jammu and Kashmir with special reference to commercially important species was carried during 2010 at Gurez Valley, during 2011 at Jammu (sites J1 – J14) and Kashmir provinces.

A: The Physico-chemical parameters of waters were determined as under:

Parameter	Equipment/Method used
Ambient Temperature	Celsius thermometer
Sp. Conductivity	Digital conductivity meter
pH Digital pH meter	
Chlorides	Titrimetric with AgNO3 (Mackereth *et al.,*1978)
Carbon dioxide	Titrimetric with NaOH (Mackereth *et al.,*1978)
Dissolved oxygen	Winkler modified method (APHA, 1998)
Alkalinity	Titremetric with H_2SO_4 (Mackereth *et al.,*1978)
Hardness	Titremetric with EDTA(Mackereth *et al.,*1978)
NO_3- N	Salicylate method (Mackereth *et al.,*1978)
Phosphate (T.P.P.)	Stannous Chloride method (APHA, 1998)

B: Fishes

Fishes from river Jhelum were collected by using cast net and the catch was recorded as gm/hr, while as in the fast flowing streams of Kashmir and Gurez fishing was done by Electro Fisher and the catch was recorded as gm/half an hour. In Jammu region fishes were collected by the help of cast net and the catch was recorded as gm/hour.

Physico-chemical parameters

Physico-chemical characteristics of various sites are recorded. The water temperature of Gurez during the study period ranged from 6-7.5 °C, while as in Kashmir valley it was between 8-12°C. In Jammu division minimum and maximum water temperature was recorded as 13°C and 23°C respectively. In Gurez the minimum width and depth was recorded at site G 1 being 14.6 and 0.52 mts respectively and maximum width and depth was recorded at site G 4 being 26.6 and 0.78 mts respectively. In Kashmir valley, minimum width and depth (8 and 0.28 mts respectively) was recorded at site K 20 and maximum

width and depth (86 and 2.4 mts respectively) at K 6. In Jammu division the minimum width of 6 m and minimum depth of 0.20m was recorded at site J13 and J 12 respectively while as maximum width of 490 m and maximum depth of 20m was recorded at site J8. The range of variation of DO in the three zones viz., Gurez, Kashmir valley and Jammu division was 8 – 9 mg/l, 7 – 11mg/l and 5 – 9 mg/l respectively, though the mean DO in all the regions was with a mean value of 8 mg/l.

pH in all the three zones was on the alkaline side of neutrality and was present with a mean value of 8.4, 8.6 and 8.3 respectively. The mean conductivity value in Gurez, Kashmir valley and Jammu division was 131 ¼S, 153 ¼S and 167 ¼S respectively. The chloride content in Gurez was present with a mean value of 13 mg/l and in Kashmir valley it was present with a mean value of 12 mg/l while in Jammu division it was present with a mean value of 16 mg/l.

Total alkalinity in Gurez ranged from 52 mg/l (G1) – 64 mg/l (G4) with a mean value of 58 mg/l. In Kashmir valley alkalinity ranged from 20 mg/l (K9) – 69 mg/l (K7) with a mean value of 43 mg/l while in Jammu division it ranged from 71 mg/l (J10) to 290 mg/l (J14) with a mean value of 132 mg/l. The mean Total hardness of the water of sampling areas was of the order of 177 mg/l (Jammu Division) > 93 mg/l (Kashmir valley) > 54 mg/l (Gurez). Calcium and Magnesium followed almost the same trend as that of total hardness in all the sampling sites.

Nutrients like Ammonia, Nitrate and Total Phosphorus in Gurez were present with a mean value of 15 ¼g/l, 560 ¼g/l and 27 ¼g/l respectively. In Kashmir valley Ammonia ranged from 5 ¼g/l (K9) to 57 (K7) with a mean value of 23 ¼g/l. The nitrate concentration in Kashmir varied between 205 ¼g/l (K14) to 410 ¼g/l (K5) with an average value of 269 ¼g/l, while as Total phosphorus ranged between 18 ¼g/l (K20) to 72 ¼g/l (K8). In Jammu Division the Nitrate and Total Phosphorus ranged between 98 ¼g/l (J12) to 368 ¼g/l (J14) and 34 ¼g/l (J5) to 86 ¼g/l (J4) respectively. The mean value of Nitrate and Total Phosphorus in Jammu Division was 218¼g/l and 65¼g/l respectively.

Fishing in the river Jhelum at Baramullah

Electro-fishing in streams of Kashmir valley

Inter-institutional Outreach Activities (Fisheries Division-ICAR)

Project Code	NP-1
Project Title	Outreach Activity-Fish Genetic Stock
Personnel	A. Barat, Prem Kumar, S. Ali, R.S. Haldar

1. Collections of samples (Sites with GPS Coordinates)

- A total of 113 mahseer (Tor putitora) fin and muscle tissue samples were collected from 4 locations during 2011-12. The samples were collected from Beas River near Jogindernagar, H.P, Satluj River near Bhakra, H.P, Chenab River near Anji, J&K and Ravi River near Basoli, J&K.
- Fin tissue samples has been collected and preserved in 70 % ethanol for DNA isolation.

Collection Site	Year	Total No. of Samples	Lat/Long
Himachal Pradesh			
Beas River/ Jogindernagar	2011/May	27	31°24'37"N 76°26'26"E
Satluj River/Bhakra	2011/May	28	31°34'38"N 76°26'25"E
Jammu & Kashmir			
Chenab River/Anji	2011/May	38	33°04'33"N 54°49'62"E
Ravi River/ Basoli	2011/May	30	32°30'14"N 75°48'68"E

Collection site at Bias river

Mahaseer near Jogindernagar

2. Length-weight and condition factor analysis

The total length (TL) of the fish was measured from the tip of the snout to the caudal fin using meter rule calibrated in millimeter. Fishes were measured to the nearest millimeter. Fish weight (W) was measured after blot drying with a piece of clean hand towel. Weighing was done with a tabletop weighing balance to the nearest gram. The statistical relationship between length and weight of the fish was expressed by equation of Pauly, 1983. The L-W relationship shows that the Bhalukpong, A.P & Jogindernagar, H.P population have isometric growth (b=3) while other population shows allometric growth pattern (b≠3). The condition factor of the Bhalukpong, A.P & Jogindernagar, H.P, population have higher values (0.98 & 0.82) showing better condition of the stock as compared to other populations.

3. Genomic DNA Isolation and PCR amplification

Genomic DNA was isolated from 50mg fin tissue sample by the phenol–chloroform procedure (Sambrook et al., 1989). To determine the quality and quantity of genomic DNA was checked through 0.8% agarose gel and UV-Spectrophotometer respectively. The highly purified DNA was used as template to amplify Cytb and ATPase 6/8 gene using respective universal primers. PCR products were sequenced using commercial service (Sci-genome, Kochhi) following Bigdye terminator 3.1 in ABI 3130 genetic analyzer. The raw sequences were trimmed and gene annotations were carried out using CLC workbench software. Further analysis is in progress to estimate genetic diversity and population structure of different population of mahseer.

Microsatellite marker

PCR amplification: A total of thirteen microsatellite loci (isolated from EST derived carp sequences and from partial genomic library of *S. richardsonii* and *Garra gotyla*) were successfully amplified and were found to be polymorphic in four populations of *Tor putitora*. PCR amplification of microsatellite loci was performed in 10 µl reaction mixture containing 50 ng template DNA, 1 µl of 10

X PCR-buffer (100 mM Tris, pH 9.0, 500 mM KCl, 15 mM $MgCl_2$, 0.1 % Gelatin) (Genei, India), 200 µM of each dNTPs (Genei, India), 5 pmol of each primer (Ocimum Biosolutions, India) and 0.5 U Taq DNA Polymerase (Genei, India). One negative control (absence of DNA template) was included for each set of amplification. PCR amplifications of microsatellite loci were carried out in a Thermal Cycler (ABI, USA) by using the following program: initial denaturation at 94 ^{0}C for 3 min, followed by 30 cycles of 94 ^{0}C for 30 sec, annealing temperatures 50- 55 for 90 sec and 72 ^{0}C for 60 sec and final extension of 72 ^{0}C for 7min. Amplified products were concentrated on a vacuum concentrator (Concentrator plus Eppendorf), and mixed with 2µl of gel loading dye and then separated on 2% agarose gel along with standard marker, $x174/Hinf I marker (Fermantas) @ 50 ng/µl.

Microsatellite data analysis: Microsatellite data were scored visually from the photograph of gels, alleles size were determined by comparing with a molecular marker $x174/Hinf I. GDA1.1(Lewis and Zaikin, 2001) was used to calculate the observed and expected heterozygosity and genetic distance between the populations. Arlequin version 3.1 (Excoffier and Schneider, 2005) was used to determine the genetic diversity and Hierarchical analysis of molecular variance to estimate the proportion of genetic differentiations at different levels. Further population structure analysis is in progress.

Project Code	NP-2
Project Title	Outreach Activity- Fish Feed
Personnel	N.N. Pandey, D. Sarma, S.K. Srivastava, Md.M.S. Akhtar, S.K. Gupta

Directorate has developed three fish feed for the coldwater aquaculture practice under the outreach activity- Fish feed.

Formulated microparticulate diet of golden mahseer

Formulated microparticulate diet for the mahseer larvae was developed on the basis of the nutrients requirement and ontogeny of the digestive enzymes of golden mahseer larvae. This diet performed better than the traditional feeding with goat liver and simple formulated larvae feed. On farm testing resulted 500% growth of mahseer fry in 60 days with 94% survival. The production cost of the feed is Rs. 197/ kg. NANHE MAHSEER is an improved efficient larval feed for Golden mahseer.

Growout feed for Chocolate mahseer

As Chocolate mahseer is a slow growing fish in coldwater environment, fish meal is required as protein supplement and spirulina for better growth, which contains all the essential vitamins, minerals, trace elements and carotenoids that are responsible for proper growth, pigmentation and enhances nutrient profile of fish. Artificial feed fortified with *Spirulina* is an effective feed for the growth of Chocolate mahseer. The survival rate was observed better along with the effective consumption of the food with 5% inclusion of *Spirulina platensis.* This 5% *Spirulina* fortified feed was also found to be cost effective when correlated with FCR. Developed Chocolate mahseer feed is nutritious and cost effective feed for the better growth and survival having production cost of Rs. 33/- per kg. Feed of the Rs. 49/- is required for raising 1 kg. fish (FCR-1.43).

Growout trout feed

Dietary protein requirement of trout is in the range of 30-45% on dry basis. Trout has an exclusive requirement of n-3 or w3 PUFA in their diet. 10-14% lipid may be included in the trout diet. Fish meal (Sterilized having >60% protein), solvent extracted soybean meal, mustard oil cake, wheat flour, Starch, fish oil, Brewer's yeast powder, Linseed oil cake and Vit.& min. mixture may be used for formulation of trout diet. Data on growth performance and nutritional value revealed that 50% protein and 14 % lipid for starter feed, 45% protein and 16 % lipid for fingerlings feed and 35% protein and 14 % lipid for growout feed is required for proper growth. For trout, requirement of Arginine (6.427%) is comparatively higher than the other essential amino acids in the diet. Solvent extracted soybean meal (SESM) contain 48% protein with Arginine (3.91% of dry basis), an important amino acid for the trout. 40% fish meal can be replaced by SESM without impairing feed intake, growth and FCR. Protein utilization of the trout diet may be improved by adding papain in the diet of the trout. Papain is the principal and most active enzyme and possesses a very powerful digestive action superior to pepsin and pancreatin. Turmeric powder as anti-biotic, asafetida as appetizer for improving feed intake and Ashwagandha (*Withania somnifera*) as anti stress may be incorporated in the trout diet in little proportion for better feed performation. Hence, a growout trout feed was developed with inclusion of Solvent extracted soybean, papain powder, turmeric powder, and ashwagandha powder with other ingredients. DCFR trout growout feed is environmentally friendly, cost effective, nutritious diet for trout with 35% protein and good FCR.

Project Code	NP-3
Project Title	Outreach Activity-Nutrient Profiling and Evaluation of Fish as a Dietary component
Personnel	Debajit Sarma, N.N.Pandey, Neetu Shahi, Md. S. Akhtar

The nutritional quality of fish in general is, to a great extent, associated with its content of essential fatty acids, essential amino acids, minerals and vitamins. The fatty acids analyzed were grouped as saturated fatty acids (SFAs), monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs). Fatty acid profile showed that total monounsaturated fatty acids (MUFA) were the highest in snow trout (37.14%) and rainbow trout (35.88%) followed by common carp (31.22%) and found to be lowest in chocolate mahseer (23.90%). Golden mahseer recorded to have highest saturated fatty acids (52.91%) followed by common carp (46.13%). The highest polyunsaturated fatty acids

Clinico-epidemiological survey on fish consumption pattern in relation to human health

were noticed in rainbow trout (31.39%) and chocolate mahseer (31.22%). There is the fact that the lipid and fatty acid compositions of fish differ depending on a variety of factors such as the species, maturity period, size and age of the fish, seasonal conditions and geographical location.

Rainbow trout protein had a well-balanced amino acid composition, with high amounts of proline (96.37 mg/g crude protein), aspartic acid (85.23 mg/g crude protein), tyrosine (83.84 mg/g crude protein), glycine (69.87 mg/g crude protein), serine (66.63 mg/g crude protein), arginine (65.26 mg/g crude protein), isoleucine (64.56 mg/g crude protein) and tryptophan (61.63 mg/g crude protein). Except for methionine and lysine, the levels of essential amino acids were similar in snow trout, chocolate mahseer and common carp. The levels of methionine (0.88%) and lysine (1.09%) were found to be lowest in common carp and snow trout and chocolate mahseer recorded similar levels.

Clinico-epidemiological survey was conducted in three different states viz. Assam, Meghalaya and Arunachal Pradesh during June-July 2011. Kalang paur, Mali Bagan, Dung Dang, Bogi Bari, Borbila villages were covered in Assam. Rama Camp, Dirang Basti, Shergaon, Yewang, Dhum Dirang Villages were covered in Arunachal Pradesh. Maw-Punkshaid, Pyllum, Nongsder, Umroi villages were covered in Meghalaya.

Completed Research Projects

Project Code	AQ-6
Project Title	Investigation on coldwater fish pathogens and their environment
Personnel	Amit Pande, N.N.Pandey, S. K. Mallik, D. Thakuria, Ananda Kumar B.S

This project was aimed to enlist the infectious diseases of cold water fish species. In the first instance, we have established laboratories for the diagnosis of bacterial and viral disease in cold water sector and developed procedures for the identification of important fish pathogens. Setting up of cell culture facility for studying the viral pathogens of cold water fish species was also taken up. To enable the research in Diagnostic fish virology, a cell culture facility was developed and cell lines namely BF2 (from bluegill fry), FHM (fat head minnow) and RTG-2 (rainbow trout gonads) have been maintained for over three years. Under this project, 257 samples were obtained from states of Uttarakhand, Sikkim and Arunachal Pradesh during the entire course of the study. Twenty two samples tested positive in cell culture as they showed cytopathic effect. The virus was produced in bulk and hyperimmune serum was raised in rabbits which were used for the serological studies. This hyperimmune serum has shown lines of identity with the referral anti IPNV and IHNV serum, a generous gift from Dr Jim Winton an OIE expert. This hyperimmune serum was subsequently used for screening of field samples. Forty three tested positive in serological tests while none of the two viruses could be detected by RT-PCR which need optimization with the known primers against IHNV and IPNV. Our preliminary studies based on simple serological tests like counter immuno-electrophoresis (CIE) and agar gel immune precipitation tests (AGPT) suggests the possible incidence of two important viral pathogens namely infectious pancreatic necrosis (IPN) and infectious hematopoietic necrosis (IHN). Further studies are urgently required to confirm their incidence and occurrence.

For the identification of the pathogenic bacteria infecting coldwater fish species a Diagnostic Bacteriology Laboratory was set up. Among bacterial pathogens, *Aeromonas hydrophila, Aeromonas sobria, Aeromonas caviae, Pseudomonas luteola,* and *Pseudomonas fluorescence* were isolated from the cases of gill rot, fin rot and dropsy. However, suspicion of diseases like bacterial coldwater disease and columnaris disease has to be ruled out.

Saprolegnia, a secondary pathogen can target fish both in wild and in tank environment through cellular necrosis and other epidermal damage. The infection is characterized by the presence of a cotton wool like growth on fish eggs. Fungal infection remains more prominent in the ponds of stagnant water than the running water raceways. Improper handling and physical injury are the major causes of the disease. It has been observed that temperature has a significant effect on the development of fungal infections. Most epizootics occur when temperatures remains below the optimum. Severity of mycosis was observed at moderate water temperature of 16-24°C. In coldwater fishes, saprolegniosis usually occurs between October and March when water temperature is below 24°C. *Saprolegnia diclina* and *Saprolegnia parasitica* infections remain more common in winter months, whereas *Saprolegnia ferax* occurs predominantly in the spring and autumn.

In the present investigation, the effect of aqueous extract of certain plants preparations was tested for anti-mycotic activity. Preliminary results have demonstrated that herbal extracts of - kaphal (*Myrica esculenta*), tesu (*Butia* sp.), kalmegh (*Andrographis paniculataI*) pine (*Pinus roxberghaii*), marigold (*Targetes erectus*), black musturd (*Brassica nigra) and* lemon grass (*Cymbopogon citratus*) were mycostatic *in vitro*. Further studies are required to establish the dose, tolerance levels in fish for the control of saprolegniasis *in vivo*.

Among fish parasites, M*yxosporidium*, *Costia*, *Ichthyophthirius,* Episylish spp., *Ichthyobodo sp, Dactylogyrus* spp., *Trichodina*, *and* Lernia were observed. The most interesting finding was of the occurrence of *Argulus sps.* in cage culture unit of Bhimtal lake.

The project has set the ball rolling for the identification of important viral and bacterial pathogens and the occurrence of diseases caused by these agents. Moreover, our preliminary observations suggest the occurrence of parasitic diseases. The preventive control measures of which need to be worked out. An intriguing finding of the project was the mycostatic effect of tested herbal extracts. The validation of the said extracts for the control saprolegniasis has to be further explored that might help in the development of new anti-fungal therapeutic agent which may reduce the hazard caused by chemicals/fungicides in the aquatic environment.

Isolation of pathogenic fungi from coldwater fish and their environment

In the water samples from the lake and trout farm Bairangna, no freely flowing primary zoospores were observed and secondary oocystes appeared at the sporangium opening. This is the character of genus *Achlya* and *Aphanomyces*. In the case of lake samples, hyphae was observed much thinner than in the other samples and the zoospores in their zoosporangium were arranged in a single line. These findings reflected the occurrence of *Achlya* spp. in the trout farm Bairangna and occurrence of *Achlya* spp. and *Aphanomyces* spp. in the open water of Bhimtal Lake.

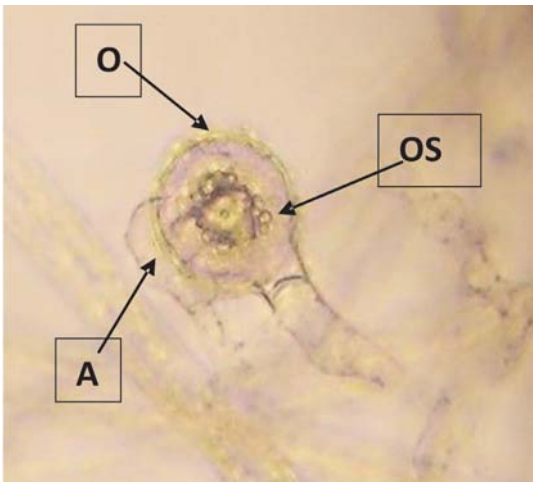
Clinical signs of the fungal infected fish

In the infected fish, fungus was present as an ulcerative mycosis that converted into a deep necrotic lesion involving the muscle. In early infections, skin lesions were gray or white in colour, with a characteristics circular or crescent shape. Finally, it resulted as destruction of the epidermis. In case of carps, affected area was observed on skin or gills. Common carp was found more susceptible among the Chinese carps, may be due to the bottom dwelling habit. Improper handling and physical injury were the major causes of the disease. It was interesting to note that temperature has a significant effect on the development of fungal infections. Most epizootics occur when temperature remains below the optimal temperature range for that species of fish.

Fungal infected Golden Mahseer

Hematological examination of fish

Blood samples of fungal infected fishes were collected from caudal vain using sterilized disposable 2 ml syringe. The red blood corpuscles (RBC) and White blood corpuscles (WBC) were counted by haemocytometer crystalline chamber using diluting fluids. For estimating hemoglobin Sahli's hemoglobinometer was used. The erythrocytic and leucocytic indices (RBCs, WBCs and Hb) were determined according to Schalm (1986) to investigate

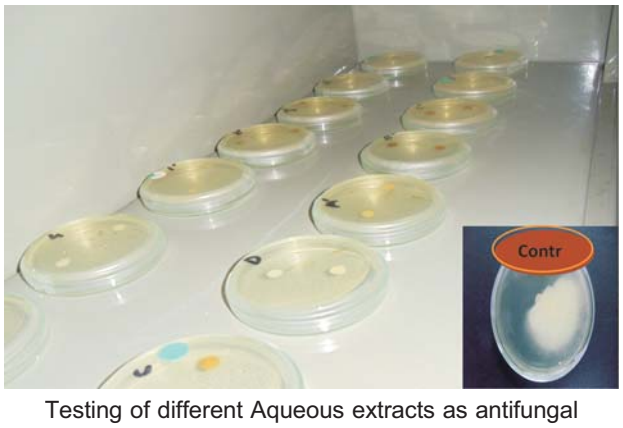


Fertilized oogonia of *Saprolegnia* (20X)
(OS-Oosphere, A-Antheridium, O-Oogonium)

the effect of fungus infection on the Hematological profile of Common carp and found significant difference in the all three parameters of infected and healthy fish. Haemoglobin and TEC were decreased as the infection become prominent in the proceeding weeks. In controversial to this TLC was significantly increased with the virulence of the infection.

In vitro study of aqueous extract of some medicinal plants as antifungal agent

Samples of pathogenic fungi isolated from fish tissue, and grown on SDA plates were taken and tested at 18-20^{0}C for therapeutic properties of different aqueous extracts. Kaphal (*Myrica esculenta*), Tesu (*Butia* sp.), Kalmegh (*Andrographis paniculataI*) Pine (*Pinus roxberghaii*), Marigold (*Targetes erectus*), Black Musturd (*Brassica nigra) and* Lemon grass (*Cymbopogon citratus*) were selected for the present study on the basis of their antifungal and antibiotic properties with least toxic effect to fish. Results observed for the different concentrations and different immersion times for the aqueous extracts of tested plants. Colony diameter of the control was around 38±2 mm for the all immersion time. Black Musturd (*Brassica nigra),* Kaphal (*Myrica esculenta*) and Lemon grass *(Cymbopogon citratus)* showed nil mycelial growth at all concentrations and immersion time. These Indian herbs were found most effective antifungal. Results of Marigold revealed that this herb is effective at the concentration of 8% and 10 % w/v. Kalmegh *(Andrographis paniculata),* Tesu *(Butea sp.)* and *Pine* (*Pinus roxberghaii*) were found effective on 8% w/v with 60 min. immersion time. Analysed data on ANOVA at 5% level of significance reflected that the resulting colonies are significantly different from the control with more effect of exposure time rather than the concentration. Accordingly the minimum inhibitory concentration (MIC) of all the five aqueous extracts was determined. 2% Solution of the bark of Kaphal (*Myrica esculenta*) tree and 3% solution of the marigold leaves (*Calendula officinalis*) were tested (bath treatment of 15 min. for 3 alternate days) in the infected eggs of snow trout and rainbow trout. Harad (*Myrobolus indicus*) is a good source of vitamin C, tannins, alkaloids and essential oil. Extract of Harad was used for fungal infected eggs of trout. Tannin content of the Harad extract performs a biofilm over the trout eggs and protects the entry of fungal spores. This biofilm is persisted for 4-5 days. Micro pile is the main place of fungal attack during incubation of the trout eggs.



Testing of different Aqueous extracts as antifungal

Project Code	AQ-1
Project Title	Evaluation on growth performance in different strains of common carps
Personnel	S.K. Srivastava, N.N.Pandey, Prem Kumar, Amit Pande, S.K. Gupta

Rearing of different strains (Hungarian & existing) separately in field conditions under monoculture and polyculture system

Hungarian strains (Ropsa scaly carp and Felsosomogy mirror carp) and existed local strain of scale carp (Bangkok strain) were reared in six cemented ponds (size-75m^2) under polyculture system with silver carp and grass carp (30:40:30), stocking density was 2.5 fish/ m^3, in double replicates at experimental field centre, Champawat. Monoculture was done in six cemented Nursery ponds (size-30m^2) with stocking density of 2.5 fish/ m^3, in double replicates.

Evaluation of growth performance of each stock in field conditions

Highest growth was recorded in Hungarian mirror carp (352gm) under polyculture system followed by Hugarian scale carp (304gm) and existing strain (187gm.). Overall growth of all strains were inferior in monoculture than in poly culture. Slow growth (17-38gm individual fish) & less feed intake (30% of normal diet) was observed during winter months. Hungarian strains are better than the existing strain for the cold-water aquaculture practice

Rearing of broodstock

Each strain were reared separately and found more than 80% male specimen in imported strains. Onset of early maturity in existing stock may be due to the high degree of inbreeding coefficient.

Breeding of imported strains

Breeding of Ropsa scaly was started from 2nd week of April and ended in 3rd week of May at 16-24°C. Breeding of Felsosomogy mirror carp was started from 1st week of April and ended in 2nd week of May at water temperature 16-22°C. Imported strains required little higher temperature for the maturity and breeding than the existing strain. Ropsa scaly require temperature in higher side than the imported mirror carp for the breeding activities.

Seed distribution for growth evaluation in different geographical locations

Seed (Fry) of both strains was released as Champa-1 and Champa-2 by DDG (Fy) and distributed to Fisheries department Sikkim state, Arunachal Pradesh and NEH, Barapani (Meghalaya). Better growth of yearlings (40-50%) of Hungarian scale carp, mirror carp was observed in field condition over the existing strain. Mirror carp performed better than the scale carp. Growth of F1 progeny was little better than the recorded growth of parental stock, might be due to better acclimatization.

Optimum Water quality parameters for growth and breeding

Lower water temperature (4.2-12°C) during the winter months resulted in less feed intake, negligible growth and minor mortality. Higher level of ammonium was recorded during winter months might be due to the less activity of nitrifying bacteria at low temperature. Other water quality parameters were found optimum for the growth.

Recorded data were analyzed and project was concluded for growth of imported strains in field conditions, growth pattern, morphometric variation (truss), L-W relationship, breeding and fry production, and growth of fingerlings.

Project Code	AQ-2
Project Title	Study on water budgeting and water management for coldwater aquaculture practices
Personnel	S.K. Srivastava, N. N. Pandey, Prem Kumar, S.K. Gupta

One of the most important prerequisite for the successful trout farming is availability of year round uninterrupted supply of clean water which should be free from pollutant and suspended matter with high dissolved oxygen. Quality and quantity of water have a vital role for trout culture. The success or failure of trout production depends on the quality and quantity of water supplied to the farm. The quantity of water is required in a farm is calculated on the basis of the fish held. To hold one ton of fish nearly 3 liters/second of water flow is sufficient at an average temperature of 15°C. This requirement gets further reduced at the lower temperatures. The water flow also varies with the life stages of trout. Some of the estimated water requirement for trout culture is 1.0 l/min/kg of trout without aeration or 0.3 l/min/kg of trout with aeration or 1.0 l/min/age month of every 1000 fry/fingerlings.

On the basis of previous recorded data on water availability, losses and requirement, a design of water recirculatory system has been prepared with the technical advice of experts from IIT Kharagpur. With a target of one ton trout production having the size of 400-450g in two years, 3000 yearlings and 400 kg broodstock for the 1.5 lakh eyed ova, the total calculated water requirement is 164 m^3/day. During normal days about 300 m^3/day water is available from the feeder stream, but in the lean period (April- June) only 72 m^3/day water used to be available. The total drain water from the trout rearing unit will be 147m^3/day after 10% loss in evaporation and seepage. In general, 20-30% fresh water is needed in any RAS unit to maintain the proper water qualities *viz*. temperature, pH and trace elements. A quantity of 40 m^3/day of water out of available 72 m^3/day in the lean period would be used for trout unit and rest 124 m^3/day requirement would be met out by recirculatory water. Hence, 124 m^3/day drain water is to be recirculated for the proper culture operation especially in the lean period to get the targeted trout production.

Recorded data were analyzed and report has been prepared. Project was concluded for water budgeting for polyculture of exotic carps and trout rearing in raceways, water availability, losses and requirement for trout production unit of Champawat Centre, rainwater harvesting and development of low cost Grit Filter for mid hill Aquaculture.

Project Code	DBT
Project Title	Development and Characterization of microsatellite markers in Indian snow trout, *Schizothorax richardsonii*
Personnel	A. Barat

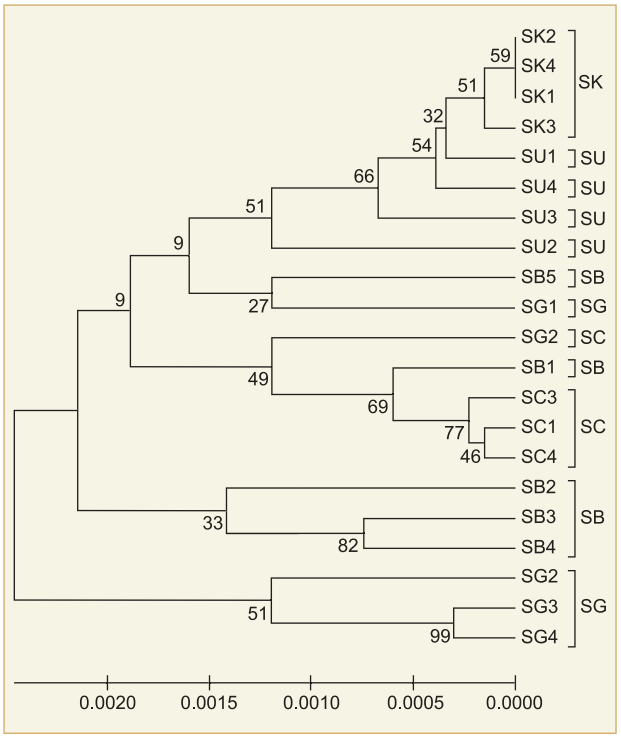
34 Microsatellite markers were developed for Indian snow trout *Schizothorax richardsonii*. For

development of microsatellite markers, initially a partial genomic library containing microsatellite was constructed using 300-600bp RE digested insert DNA of *Schizothorax richardsonii*. RE digested product was cloned in dephosphorylated pUC19 vector. Around 5000 positive clones were obtained in the form of white colonies. The white colonies were screened by colony hybridisation using (CA)n/(GT)n, (GA)n/(CT)n, (GAA)n/(CTT)n and (CCA)n/(GGT)n probes. Out of 5000 colonies, 450 colonies were detected as having positive repeat motifs. Plasmid DNA was isolated from those selected clones and sequenced. Out of 450 sequences, 51 sequences consisted of mono, di, tri and tetranucleotide repeats. Dinucleotide repeats particularly GT/CA repeats (87%) were most abundant in comparison to tri- (8%) and tetra-nucleotide (5%) repeats. All the sequences containing microsatellite markers were submitted in the NCBI GenBank having following accession numbers **(ACC# HM 591233 to HM 591283).** A total of 57 markers developed from partial genomic library using PRIMER3 software. Among 57 markers, 30 microsatellite markers were fluorescent labelled with FAM at 5' end and genotyped by capillary electrophoresis (ABI 3130, USA) using commercial service and rest 27 primer sets were validated using conventional PCR assay and 6% denaturing poly-acrylamide gel electrophoresis (PAGE). Out of 57, 34 were validated with polymorphism rate. Frequency of alleles of above microsatellite loci in all populations and heterozygosity were detected using genetic data analysis software GENEPOP 3.1. The number of alleles, observed (HO) and expected heterozygosity (HE) per locus in fourty individuals ranged from 2 to 30, from 0.20 to 0.90, and from 0.3531 to 0.9547 respectively, in two populations of *S. richardsonii*. All the markers were found to be highly polymorphic in different populations of *S. richardsonii.* These loci will be useful for population genetic analysis of *S. richardsonii* and in some closely related coldwater fishes.

Project Code	DST
Project Title	Genome Scale Mining of *S. richardsonii* fish species for formulation of selective breeding Programme
Personnel	S. Ali, A. Barat

In the present project we were able to provide some useful insights into phylogenetic relationships, genetic identity, and population structure of *S. richardsonii* particularly those from Uttarakhand regions. The population with higher genetic variability could be identified using mtDNA molecular markers. The stock identification using molecular tools are immensely helpful in conservation and its sustainable utilization. The stock with higher genetic variability could be identified and used for aquaculture programme. However, further studies using larger sample sizes per population, samples from other areas of its geographical distribution, sequence data from nuclear DNA (eg. Single locus microsatellites) markers are required to ascertain conservation strategies or breeding programme of *S. richardsonii*.

There are immense aquaculture potential of this species because of its high demand and market preferences. The seed production technology has already been developed by DCFR which is quite helpful in artificial propagation of this species. Efforts are on to bring more area under culture system in the mid hill regions for the socio-economic development of the people. The problem of growth increment needs to be addressed through various means and scientific intervention. The development of low cost feed, suitable modification in culture system and



UPMGA population relationships based on Nei's (1987) net genetic distances among five populations of *S. richardsonii* SK= kosi population; SB= Baiangna population; SC= Champawat population; SG= Gola population; SU= Uttarwahini population

appropriate breeding strategy would be helpful in growth enhancement of this species. Being an indigenous cold water species having wide distributional pattern from western to eastern Himalayas, *S. richardsonii* deserve requisite attention for its conservation and management.

Four mitochondrial genes mainly Cytochrome b, ATPase 6/8, Cytochrome oxidase subunit I and Cytochrome oxidase subunit II were amplified and sequences for the estimation of different genetic parameters such as genetic diversity (nucleotide & haplotype diversity) and genetic differentiations. The five populations studied using mtDNA markers revealed that Bairangna populations have higher genetic variability than other populations. The identification of different populations of snow trout and estimation of genetic variability based on mitochondrial DNA markers has helped immensely to draw some conclusion about the population structures of this species. Based on the genetic parameters estimated for the five populations of *S. richardsonii*, it was concluded that the Bairangna population from Bhilangna river could be used as parental stock for breeding purpose as it shows the highest genetic diversity among all populations studied. The population of kosi having lowest genetic diversity and Bairangna being the highest genetic diversity is being collected and maintained for rearing and raising of broodstock for suitable breeding strategy for genetic improvement programme using this molecular marker.

Externally Funded Projects

Project Code	DBT
Project Title	Molecular characterization and development of a diagnostic test for the identification of a filterable agent isolated from diseased Rainbow trout
Personnel	Amit Pande, N.N. Pandey

In the proposed work plan, samples were collected from identified sites from the Experimental Field Station DCFR, Champawat and State Fish Farm, Bairangana (Chamoli). Infective tissues were obtained after dissecting the fish.

Rainbow trout showing the symptoms of the disease were sampled. The fish that showed darkening of the body, abnormal swimming movements with ataxia were sampled and dissected. Upon postmortem, it was observed that the liver of the infected fish was pale and enlarged, kidney was swollen Figure 1. Samples of anterior kidney, the site of antigen presentation in fish, liver, ovarian fluid along with the eggs were collected. Samples of anterior kidney, liver, brain, ovarian fluid along with eggs, heart and spleen were collected in a medium containing 10% serum, 20% glycerol, and antibiotics and anti-mycotic. The samples were immediately shipped to the laboratory on ice, processed, aliquoted and stored at -80ºC.

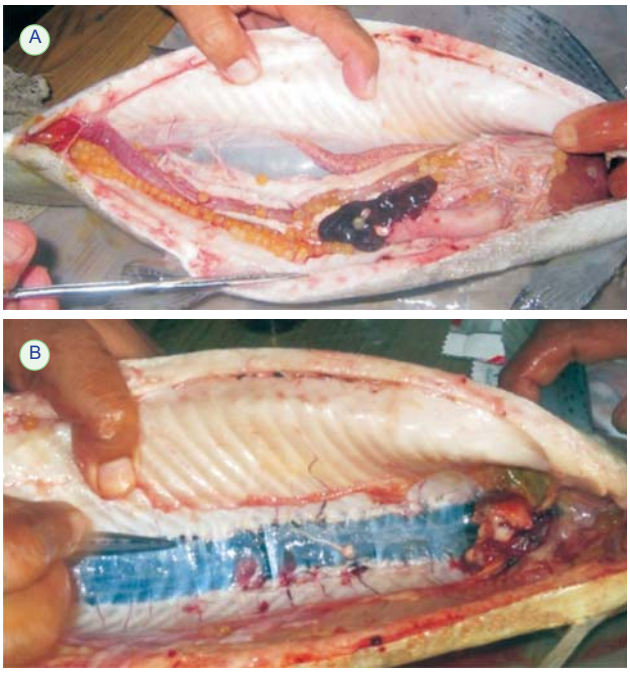


Figure 1: Dissected rainbow trout showing pale liver and enlarged kidney

The supernatant diluted 20 times and 1 ml of infective material was inoculated into overnight grown culture of either BF2 or FHM or RTG-2 cells in a 25cm^2 tissue culture flasks. Likewise, the control flasks were inoculated with 1ml of maintenance medium. The virus was allowed to adsorb at 15ºC for one hour, topped up with maintenance medium and then incubated at 15ºC to observe the cytopathic effect. Cytopathic effect could not be observed in FHM cells and RTG-2 cells. However, in BF2 cells a characteristic cytopathic effect was observed. The infected cells appeared rounded, aggregated and clumped, and, the monolayer got completely eroded upon incubation beyond 72hours post infection (Figure 2).

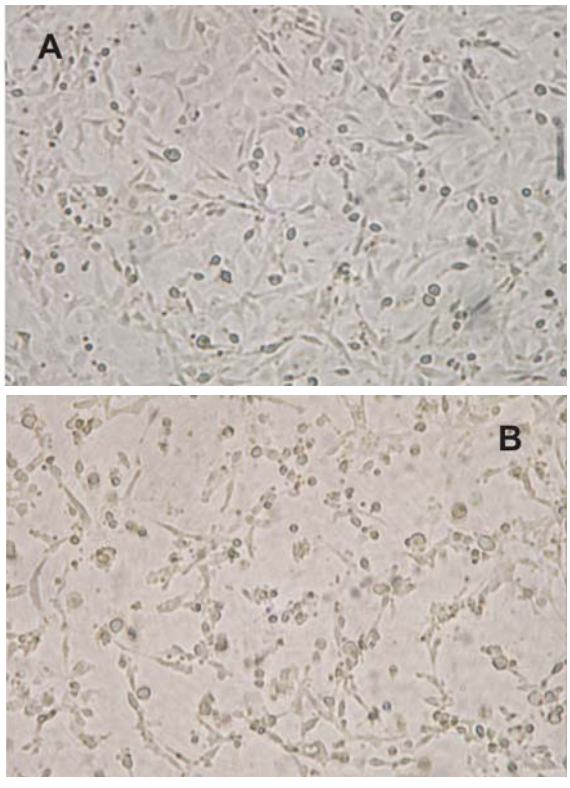


Figure 2: Isolation of a filterable agent from diseased rainbow trout. Triturated tissue samples from rainbow trout were used as inoculums at a dilution of 1:20. BF2 cells were mock infected (A) or infected with the infective material (B) after filtering through 0.22µm filter. As compared to A the cells in B are clumped, degenerated and rounded.

The infected cells that showed cytopathic effect were frozen at -80ºC and after 72hours post infection. After two cycles of freezing and thawing, the cell culture supernatant was clarified by centrifugation at 4000 Xg, aliquoted and stored at -80ºC till further use. Virus was produced in bulk from the aliquots stored at -80 ºC in BF2 and hyperimmune serum was raised in rabbits. After 30 days, the titre of the antibodies has been estimated using double immuno diffusion test before giving the final immunization.

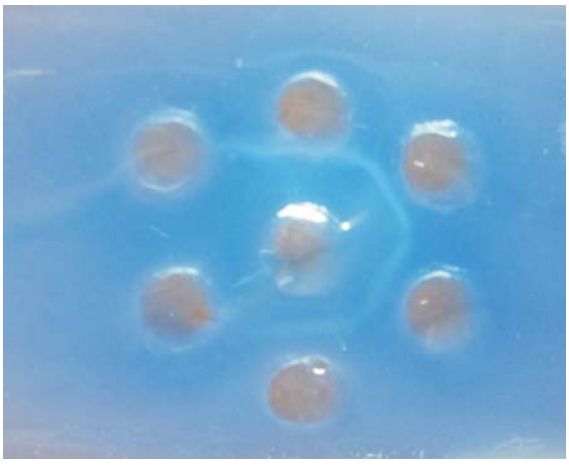


Figure 3: Results of the double immino diffusion test conducted with the hyperimmune serum raised against the concentrated virus. Isolated by our laboratory. The photograph shows the precipitin lines obtained at different dilutions of hyperimmune serum at 2^0, 2^1, 2^2 and 2^4 respectively.

Total RNA from infective material of Rainbow trout was isolated using ribozole RNA extraction reagent according to manufacturer's instructions. 5 ¼g RNA reverse transcribed using 0.2 ¼g random hexamer primer. PCR was standardized to amplify the 524bp fragment within VP2 gene of IPNV using 3¼l of cDNA prepared from infective material as discussed earlier. The primer sequences PrB1 and PrB2 used for the amplification of 524bp fragment were the ones published by Blake *et al.,* 1995. The nucleotide sequences of the primers were PrB1: 5´-CGACATCGTCAACTCC-3´and PrB2 5´-GACAGGATCATCTTGGCATA-3. Amplification was carried out using the cycling conditions, 95ºC for 5 min followed by 30 cycles of denaturation, annealing and extension at 95ºC for 30sec, 53ºC for 30sec and 72ºC for 1min respectively with a final extension at 72ºC for 10 min. The presence of the desired PCR product was confirmed by agarose gel electrophoresis on 1.5% agarose gel in Tris Borate EDTA (TBE) buffer pH8.0. The gel was visualized using a UV-transilluniator (Alpha-imager). A DNA band corresponding to 524bp was observed after agarose gel electrophoresis in 1.5% agarose gel and was visualized using a UV-transilluniator (Figure 5).

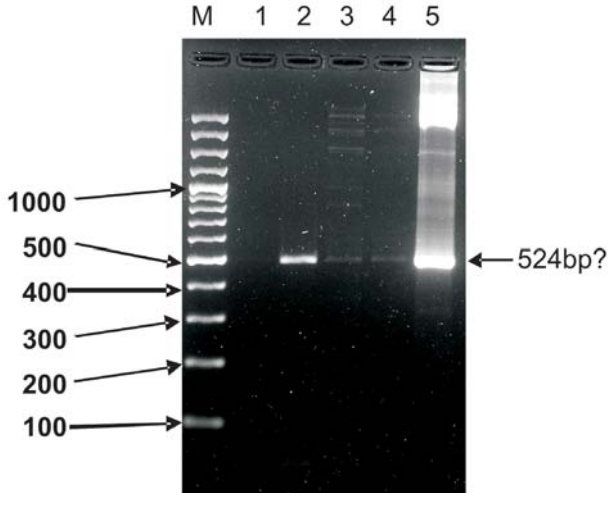


Figure 5: Agarose gel electrophoresis showing the 524 bp fragment amplified using RT-PCR of the RNA extracted from infected cell cultures. Lane M: 100bp DNA ladder, Lane 1: Negative control, Lane2: Concentrated virus (Champawat isolate I), Lane 3 infected BF2 cells with Champawat Isolate I, Lane 4: Bairangana isolate and Lane 5: Champawat isolate II from ovarian fluid of rainbow trout brooder.

The nucleotide sequence of the RT-PCR product obtained did not match with the nucleotide sequence of IPN virus which we suspected in the first instance. However, as the infective material has shown cytopathic effect in cell culture, therefore, the possibility of infection due to other viruses cannot be ignored. To expedite this fact study is under way to test the material using primers specific to viral hemorrhagic septicemia and infectious hematopoietic necrosis.

Project Code	NAIP (Comp-4)
Project Title	Bioprospecting of Gene and allele mining for abiotic stress tolerance
Personnel	A. Barat, S. Ali

Objective 1: Generation of Genomic resource base to facilitate gene prospecting and allele mining

- Live samples were collected from rivers, lakes and streams of different altitudes of Himalayan region. The fish species were *S. richardsonii*, *S. niger*, *S. progastus*, *Oncorhynchus mykiss* and *Salmo trutta*. Location specific species were found under Genus Schizothorax. They inhabit a thermal range of 5-20^{0}C. The fishes were identified morphometrically following conventional protocols of fin counts, length and general body features etc. The three different species of Schizothorax were also showed species specific RAPD profiles.
- Physiological and biochemical parameters were established under different temperatures. One tank was maintained at approximately 5°C by adding ice flakes and other at ambient water temperature (15-20°C). Sampling of blood and other tissues were carried out at an interval of 24 hrs, up to 5th day and final sampling was made on 12th day. Different enzymes activities were studied using colorimetric assay. The enzymatic activity of lactate dehydrogenase and Glucokinase shows Significant increase in their activity under cold stress, whereas, Pyruvate kinase has shown decrease in their activity. The level of Glycerol and glucose also rises significantly. The activity of Alanine amino transferase and Aspartate amino transferase is also increased. Hence, the increased activities of AlaAT and AspAT in the liver samples showed the possible carbon source of glycerol accumulation to depress the cold temperature during the winter months in addition to activities of Glycerol phosphate dehydrogenase through dihydroxy acetone phosphate (DHAP).
- In an attempt, to develop the EST database initially, around 1200 positive clones were screened from a cDNA library of brain tissue. A total of 1031 ESTs were sequenced from which 484 putative gene (consists of 73 contigs and 411 singletons) were identified. BLAST homology analysis indicated that only 9.3% of these ESTs were homologues of known genes while the remaining 90.7% appeared to be novel sequences. Based on sequence similarities, 45 putative genes were identified that encodes stress proteins, enzymes and signal transduction regulators. Our study thus provides both a large collection of novel transcripts and a detailed annotation of genes for an important snow trout species.
- ESTs are resources for the development of useful genetic markers including microsatellite and single nucleotide polymorphism (SNP) markers. Among the 1031 high quality ESTs in this study 24 unique microsatellite containing ESTs were identified. Seven markers were validated in two populations of *S. richardsonii* using 6% denaturing PAGE. The seven markers showed allele numbers 3 to 7 with Observed (Ho) and expected (He) heterozygosity: 0.00-0.41 and 0.50-0.79 respectively. The same markers revealed PIC value 0.49-0.825.Thus, the EST approach offers an efficient opportunity for the development of microsatellite markers.

Objective 2. Prospecting for new genes and alleles for abiotic stress tolerance (adverse temperature)

- Around seventeen primer pairs were designed from the different AFPs submitted in the public database. One primer pair designed from AFP type III gives an amplicon of about 285bp. The amplicon was sequenced and submitted to the Genbank and named hypothetical protein. Since, the protein is rich in alpha helix (49.47%) and strands (23.16%) so; hence, it is presumed to be associated with stress related protein.
- To study the transcripts of GPDH in the tissues of *S. richardsonii* using GPDH (Acc. No. AYO24368) of rainbow smelt, Osmerux mordax, a primer pair was designed and an

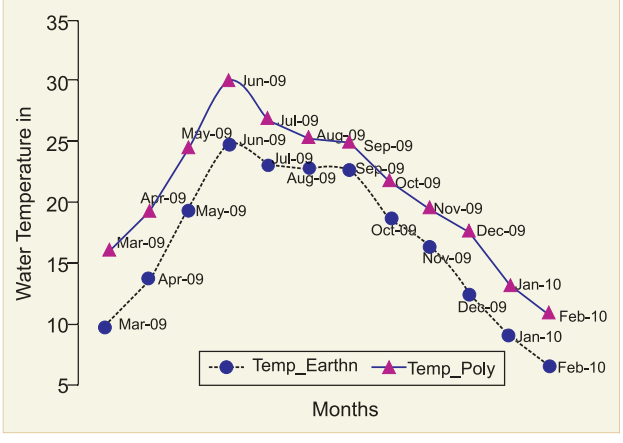
amplicon of about 1096bp was amplified. The same fragment was cloned and sequenced. The nucleotide sequenced was analysed using BLASTx and BLASTn for similarities for GPDH gene. 98% and 97% similarities were observed with GPDH gene of Danio and Osmerux respectively. It is presumed that this NAD linked GPDH gene is responsible for freeze resistance in association with Glycerol accumulation in *S. richardsonii*.

- In order to gain insight into gene expression in relation to function, RT-PCR analysis was conducted using RNA isolated from various tissues of snow trout. The GPDH gene expressed essentially in all the tissues analyzed including muscle, brain, kidney, heart, fin, intestine, liver and spleen. However, it is expressed highly in muscle followed by liver. ²-actin was used as control. The same expression profile was observed using real time PCR analysis. The highest mRNA expression level of GPDH was detected in muscles which was 52.70 fold ($p < 0.05$) than that of fin which was lowest among all the tissues. The expression level in intestine, kidney and spleen were approximately, 1.40, 1.55, and 2.94 respectively.
- It was also observed differential gene expression in relation to downshift of temperature using real time PCR analysis. A significant up regulation of GPDH transcripts in liver was observed (Fig.4) when the fishes were exposed to 4-5^{0}C in comparison to 15^{0}C control group. Low temperature (4-5^{0}C) led to approximately 19 fold ($p < 0.001$) elevated expression of GPDH during 96hrs. There was no significant increase during the initial day (24hrs), though there was little elevation (5 fold) during 48hrs and a fall (2.5fold) during 72hrs in comparison to control.
- In order to study differential Gene expression analysis of possible novel genes of *Schizothorax richardsonii* from the ESTs resources of cDNA library. Initially, 10 primer sets were designed using the Primer 3 software from 512 unclassified ESTs to study the differential gene expression using real time PCR. Out of 10 primer pairs two primer pairs designed from clone no. S-N-23-448 (JK088330) and SM-28-442 (JK088324) are found to be cold stress responsive genes.

Project Code	NAIP (Comp-3)
Project Title	Enhancement of livelihood security through sustainable farming systems and related farm enterprises in North-West Himalaya
Personnel	Prem Kumar

Under the protected agriculture, the primary aim was to construct the pond with polythene lining (Polytank) for harvesting rainwater/low discharge spring water for fishery related activities and overflow water would be used for and other different agricultural activities especially vegetable farming. The depths of the Polytank were maintained as 1.5.m. The deeper ponds would act as buffer stock of water and provides more space to fish stocking. Plastics film lined ponds have been found very suitable for rainwater harvesting in uplands where scarcity of water becomes major bottleneck in agricultural production or diversification from poorly remunerative production to scientifically recommended production considering local climatic and soil advantages. In Himalayan hilly tracts, such ponds are being used for rainwater harvesting or storing the water from low discharge springs which otherwise cannot be directly used for irrigation purposes. This multi-tier model for fish culture was developed for which the poly-cum-irrigation tanks were used for fish culture.

This model was developed in Champawat district, which is one of disadvantaged district of Uttarakhand due to extreme climate and undulating terrains. The area under study suffers from the paradoxical situation of being classed as both 'high



Temperature fluctuations in Earthen and polytanks

potential' and a 'water scarcity'. The high potential arises from production of economic important fish like trout & carps, especially in localized areas; the area is seen as dry in summer months because the unimodal rainfall pattern limits water availability in tributaries & rivulets. The region faces marked water shortage during the summer. This is a paradox based on the description of the physical environment of the area. Nonetheless, there is no comprehensive package of water management options that can be taken up immediately. There is a need to set a research agenda and undertake participatory research which will involve not only indigenous technologies but also exogenous ones, such as water conservation using suitable culture model.

The main reason for higher production of fish yield in Polytank was because of its heat conserving nature which was not happen in cemented/ conventional earthen ponds. Fish are cold blooded or poikilothermic animals. In other words, they cannot maintain a constant and high body temperature like other livestock animals. Instead, their body temperature fluctuates according to the surrounding temperature. In warmer environment, their metabolism accelerates and they grow faster, while in colder environment, the metabolic rate slows down, resulting in a reduced rate of growth. In this way they save energy by not spending it for maintaining a higher and constant body temperature. This is the reason why warm water favors fish growth. The model is being disseminated in other parts of the hill region.

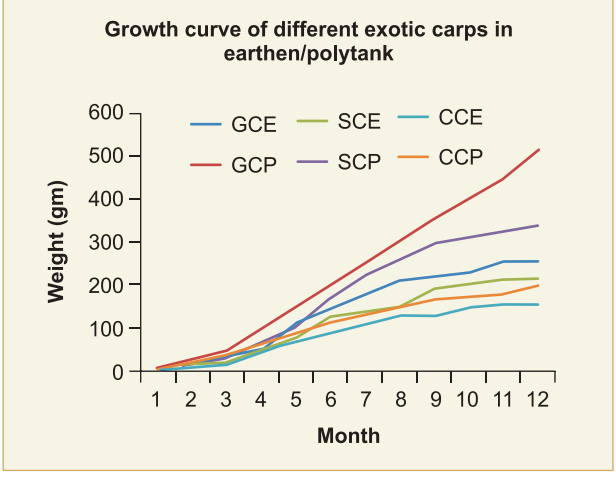


Figure : Growth curve of different exotic carps in Polytank and earthen pond. (GCE-grass carp in earthen pond, GCP-grass carp in Polytank, SCE- silver carp in earthen pond, SCP- silver carp in Polytank, CCE-common carp in earthen pond, CCP- common carp in Polytank)

Project Code	AICRP
Project Title	Enhancement of carp fish production by using polytanks in mid hills
Personnel	N.N. Pandey, Prem Kumar

Farmers of the Doonagiri area have been adopted for this programme. In the two villages of this area, Dudhauli and Todera, about 50 polytanks have been constructed. Fish seed (Fry) of three exotic carps; Silver carp (*Hypophthalmichthys molitrix*), Grass carp (*Ctenopharyngodon idella*) and Common carp (*Cyprinus carpio*) has been stocked in all the tanks @ 3 fish/m^3 during the month of July, 2011. The species ratio was 30:40:30 for Silver carp, Grass carp and Common carp. The average weight at the time of stocking was 1.19-1.50g. Fish were fed with rice polish and mustard oil cake @ 3% of their body weight daily.

Polyculture of exotic carps in polytank at village Todera

Three earthen ponds, three cemented ponds, ten polytanks were selected for the further study. The growth of the exotic carp; silver carp, grass carp and common carp is better in the polytanks followed by earthen pond, might be due to the better plankton production (1.6-1.9 ml/50 lit. in cemented pond, 1.8-2.6 ml/50 lit. in earthen pond and 2.4-3.2 ml/50 lit. in polytanks at water temp. 0.5-20.5°C. In Polytanks, growth of the Silver carp was better 52.3% from the cemented pond and 35.6% from the earthen pond. Similarly, growth of the grass carp was better 129.0% from the cemented pond and 90.8% from the earthen pond. The growth of the common carp was better in polytanks as 67.0% from the cemented pond and 39.0% from the earthen pond. Among the three tested exotic carps, maximum growth was

recorded for grass carp followed by common carp without any mortality. This is due to the advantage of comparatively higher water temperature in the polytanks. Low temperature and the sharp diurnal fluctuation inside the earthen and cemented pond are the major factors of the slow growth of carps in cold climate of the hills.

Carp seed distribution to the adopted farmers of Almora district, Uttarakhand

There is a smooth diurnal fluctuation of temperature inside the poly tanks, which favours the growth of the fish. The availability of the natural fish food organisms, plankton and periphyton is better in the polytanks due to the higher temperature. Some species specific mortality of silver carp fish was noticed during winter as this is a surface feeder fish and surface of the pond affected with frost. In the vertical profile of the tanks of all types, a water temperature difference of the 1-2.5°C was experienced at the surface from the bottom with much fluctuation in the earthen pond. In the horizontal profile of the pond significant difference in the water temperature of the periphery and centre of the pond was not found except in the earthen pond. The qualitative and quantitative analysis of plankton community in production ponds was carried out and 11 phytoplankton and 5 species of zooplankton were recorded. Out of 11 species, 5 species belongs to Chlorophyceae, 3 species belongs to Bacillariophyceae and 3 species were belongs to Cynophyceae. Zooplankton species were recorded as 2 species Rotifera, 1 species from Cladocera and 2 species of Copepoda. Maximum diversity of the plankton was observed in polytanks with comparatively higher population. The total plankton volume varied from 1.6-3.2 ml/50 lit. in different experimental ponds with maximum in polytanks and minimum in cemented tanks. One peak of the plankton population was observed during the period of Sept-Nov.

Mahseer conservation and ranching in Mehao Lake, Arunachal Pradesh by DCFR, Bhimtal

The Mehao Lake is an upland lake (elevation 1656m asl) situated at 28°8² 48.51² ²†N and 95°56² 9.33² ²†E. The lake comprises of two unequal segments, both connected through a 'link-stream' of length around 200m, bigger one flows into smaller. The source of large volume of water in the lake is purely reaped from rainwater, as there is no inlet. The only outlet sweep out from smaller one. The water area of the important lake was studied by importing the toposheets in ILWIS 3.4 GIS platform, and the area was calculated from the digital polygon map. It confirmed that the lake covers water area of 95.27ha, with periphery of 4748.33m. The depth of the lake at a distance of 30m from shoreline was measured to be 10.4m; however, the maximum depth as recorded by the District Fishery Development Office is 65m. The lake water is very much clear, drinkable, and safe for life. During daytime, the light transparency of the water was measured up to 7.0m, which provided the pristine clarity. The upper surface of the lake water is total open and there is no any floating vegetation in the lake. The lake is also a dwelling ground for many aquatic local and migratory birds.

Considering all the characteristics the lake is suitable for ranching of mahseer and a stock of mahseer has been stocked in the lake in collaboration with Department of Fisheries, Govt. of Arunachal Pradesh. The mahseer has survived and growing well and it is expected the mahseer fishery will be established in the lake in near future.

Brood banking of Ornamental fishes at DCFR, Bhimtal

Initiated the new activities for ornamental fish brood banking. The main objectives of the activities are to make a brood bank of ornamental fishes for future breeding trials, explore the potential ornamental species of the region, Intervention of ornamental fish culture in mid hill region and lively hood security through generating income and finally conservation and rehabilitation of indigenous species' through culture in polylining tanks and cement tank . Under this initiative a pond of 26 Sqm was prepared in unusable seepage land available within the campus and polylined by Silpauline plastics. This pond was fed by good agricultural soil for 1 feet and pond was managed according to carp culture norms. In the same time fishes were stocked in the cement pond for comparative observation. The pond was regularly oxygenated with aerator. Fish stocking was @ of 4nos/C^3 and 20 % fish was comprised of exotics and rest with indigenous fishes like, *Barilius sp, Tor chelynoides, Gara sps, Noemacheilus sps* collected from various rivers and streams of Uttrakhand. Regular monitoring with proper feed and other management practices are being carried out for future breeding trial.

Polylining pond at DCFR campus

Collection of ornamental fishes from rivers

Farm Activities

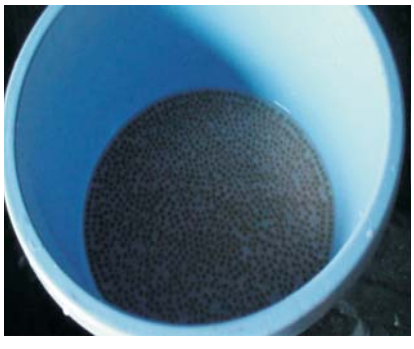
Rearing and breeding of Rainbow trout at Chhirapani Fish Farm, Champawat

Healthy brooders of Rainbow trout (*Oncorhynchus mykiss*) were segregated from the rearing tank (150m^{-2}) and kept in smaller tank (30 m^{-2}) for breeding purpose. Female of average weight (620 gm) having average size of (325mm) and healthy male of average (470 gm) with average size of (310 mm) were selected for breeding purpose. Both male and female selected were 3 years old. Total number of 54 Females and 74 males were stripped individually. Eggs were collected in cleaned and dry plastic container (2 lt.) and milt was dropped over the eggs for fertilization. Out of 54 female, one did not release the eggs after pressing the abdomen with hand. The egg and milt was mixed thoroughly using bird feather in dry and dark condition. After 12 minutes, they were washed to remove the unfertilized and dead eggs from the plastic container to prevent

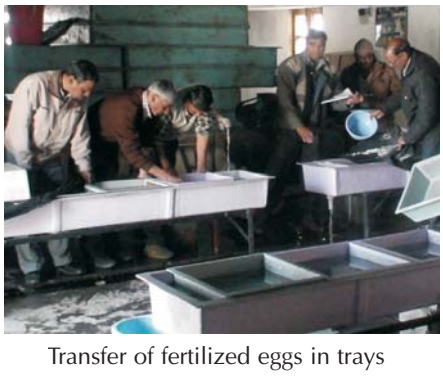
the fungal infection. Washed eggs were gently transferred to hatching tray, kept under running water conditions in the troughs. The total number of fertilized egg was approximately 45,315 (Forty five thousand three hundred fifteen) and average fecundity recorded were 1370 eggs per kg body weight of the female.

Stripping of brooders

Stripped eggs of rainbow trout



Mixing of eggs with milt



Transfer of fertilized eggs in trays

Incubation of eggs in trays

Advanced fry of rainbow trout

Induced breeding of Hungarian strain of common carp, Champ-1 and champ-2 and old Bangkok strain

Breeding trails Champa-1 Champa-2 and Bangkok strain were conducted in the mid May month at water temperature ranging between 17.5 – 22 ^{0}C. For the adhesive eggs of common carp dry and green needles of pine tree were used as substrate for egg attachment which was placed in the center of hapas. The latency period was observed to be 10-12 hrs at water temperature of 17.5± 2^{0}C in all the three strains. Similarly the average fertilization rate was 65%, 80% and 95% in Champa-1, Champa-2 and existing Bangkok strain. Total numbers of 15,000 advanced fry were produced at center. The seeds were distributed to the farmers and other stake holders for culture purposes and field demonstration. The seed were also distributed to the scientists for feeding trials.

Brooder of Champa-1 and Champa-2

Induced breeding with hormonal injection

Pine substrate for adhesion of eggs in the hapa

Fry of champ-1 and champa-2

Study on breeding performance of two age group of Grass Carp

With an objective to observe the breeding performance of grass carps brooders at mid Himalayan altitude with lower thermal regime, two age group grass carp *i.e.* 3+ year (Group1) with weight range of 0.7-0.9 kg and 6+year (Group2) with 1.25-1.6 kg were used for induced breeding in the month of August, 2011. Ovatide hormone in single

and two split doses @ 0.6-1.8 ml/kg under different permutations tried in 6 breeding trials employing total 14 female fish from 3rd August, 2011 to 11th August, 2011. Air and water temperature till hatching of eggs ranged between 22± 3.5^{0}C and 21.5± 3.5^{0}C respectively. Although Group 2 brooders partially responded to two equal higher split doses (0.8ml/kg) of hormone but the eggs were uneven in sizes and spawn recovery was almost nil. Group1 fishes did not responded in single dose of hormone, however, responded well in two doses of 0.8ml/kg each. Fertilization rate was 92.4%. Approximate 1000 number of fry was produced. The present breeding observation reveals that with limitation of optimum temperature prevalence in higher altitudes coupled with lower intake of feed, and frequent occurrence of gill parasites in grass carps, proper development of eggs is affected and the effects more prominent in bigger size grass carps.

Farmer's interest group organized for the farmers of Shahjahanpur and Pithoragarh district under ATMA project.

Demonstration to the Students of GIC Khetikhan of Champawat District

Demonstration of growth of champa-1 & Champa-2 at farmers Pond during Field day at Village-Bheti, Karnaarayat, Champawat

Frontline demonstration in farmer's pond at village Khark bagar champawat

Infrastructure development at Champawat Field Centre

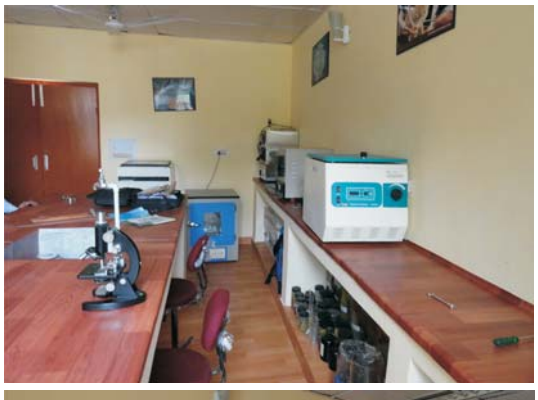
Newly constructed Office cum farmers training Hall at Champawat center

Residential Block Type-1 quarters

Farm workers changing room

Up gradation of laboratory facilities at Champawat center

The laboratories of Champawat Center were upgraded with scientific equipments like electronic balance, centrifuge, water bath, hot air oven etc. for conducting experiments and analysis of samples.



Seed production of Golden Mahseer at Mahseer hatchery, Bhimtal

The DCFR, Bhimtal has done tremendous achievements in seed production of golden mahseer during this year. One Lakh advance fry of golden mahseer was produced in the hatchery complex. 50,000 nos. was sold to Fisheries Federation, Bhopal; 10,000 nos. sold to College of Fisheries, Pantnagar, 5000 nos. was sold to lake authority of Deoria Taal. Apart from earning revenue from the hatchery, the seed produced in the hatchery were ranched in the different water bodies of Kumaun and Northeastern region for conservation and rehabilitation. The seed produced also used for conducting experiment in the DCFR, Cage unit.

Fry of Mahseer

Packaging of Mahseer seed

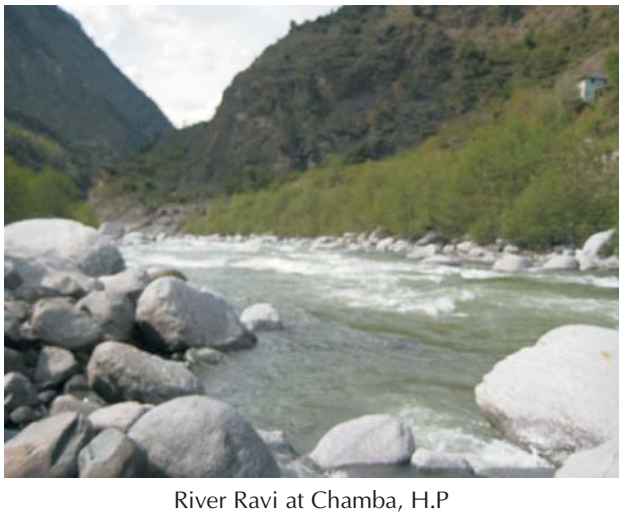
Consultancy

Investigation of fish fauna in River Ravi falling under Kutehr Hydroelectric Project, District Chamba, Himachal Pradesh

Dr. N. N. Pandey and Dr. S. Ali

A survey on the occurrence of important fish fauna in the River Ravi was conducted by a team of Scientists from Directorate of Coldwater Fisheries Research (DCFR). The proposed Kutehr Hydroelectric Project using the water of River Ravi is located in the District Chamba**,** Himachal Pradesh. The investigation was conducted to ascertain the presence or absence of important fish fauna in the stretch of River Ravi falling under the proposed project. A detailed survey was made along the stretch of the river between the intake and discharge point as well as the area above intake point and below discharge point.

River Ravi and its morphology: The Ravi River originates in the Himalayas in the Chamba district of Himachal Pradesh, India. It follows a north-westerly course and is a perennial river. It is the smallest of the five Punjab Rivers that rises from glacier fields at an elevation of 14,000 feet (4,300 m), on the southern side of the mid Himalayas. Town Chamba is situated on the right bank of the river Ravi. It flows nearly 130 km in Chamba region, before leaving it finally at Kheri. The Ravi River forms the biggest sub-micro region of Chamba district. The Ravi River merges with the Chenab in Pakistan. The total length of river Ravi is 720 km. The river drains a total catchment area of 14,442 sq km (5,576 sq miles) in India after flowing for a length of 720 kilometers. The Ravi's waters are used for irrigating large areas of land along its course. The river Ravi has torrent water flow (2-3 m sec^{-1}) with frequent rapids and cascade habitats. The substratum of river is dominated with small to large boulders and rocks impregnated with fine sand. Cobbles and gravels were observed in lesser amount. The temperature, flow rate, and volume of water decrease during winter and the temperature of the river was observed in the range of 7^0C to 12^0 C, clearly indicating cold water flowing zone. Cold water climate in general supports the coldwater species like indigenous trout. However, distribution of endemic fishery is highly fragmented in this region.



River Ravi at Chamba, H.P

Catch of S. richardsonii from River Ravi at Chamba, H.P.

Education and Training

Training program for Tribal Fish Farmers in Tirap, Arunachal Pradesh (26-27 September, 2011)

Fish Production in mid Himalaya was confined to inland waters including ponds, lakes, reservoir and rivers. Aquaculture production is concentrated to Terai region where Chinese carps and Indian Major Carps are cultivated. The remote hilly area of the region is virtually untouched since the region is

promising for coldwater fisheries development. Keeping in view the squeezing land and burgeoning human ratio, mountain fish resource base is of great relevance and development of such areas becomes matter of national concern, which needs different technological approach and support services. From large number of experimental trails conducted by the institute, a technology suitable for water temperature range of 5-29° C in hills has been developed, which is based on three species combination of these carps maintaining stocking in the density range of 3-4 fishes m2 with recommended supplementary diet. So that, there is a need of introduction of large scale farming for enhancement of Livelihood Security through Sustainable Farming Systems for the tribal population of these extreme border area. It may be mentioned here that the integrated fish farming with live stock and paddy is very much successful in N-E region as well as in other upland areas with active support and technical guidance from this Directorate. Keeping this in mind the training program for 20 rural tribal fish farmers was conducted by DCFR, Bhimtal during 26-27 September 2011 in collaboration with KVK, Deomali, Tirap, Arunachal Pradesh.

Participants of the training program on Integrated Fish Farming in Hills at KVK, Tirap

Training programme on "Surveillance of Diseases in Coldwater Aquaculture"

A training programme on "Surveillance of Diseases in Coldwater Aquaculture" was conducted by the Directorate of Coldwater Fisheries Research (DCFR), Bhimtal at Regional Centre of the ICAR Research Complex for NEH Region, Tadong,

Inaugural speech by Dr. Tika Lucksom, Director, Department of Animal Husbandry & Veterinary Services, Govt. of Sikkim

Gangtok (Sikkim) during 14th-18th Feb., 2012. The training programme was sponsored by National Fisheries Development Board (NFDB), Hyderabad and organized by DCFR to address the fish health issues of coldwater sector. The programme was inaugurated by Dr. Tika Lucksom, Director, Department of Animal Husbandry & Veterinary Services, Govt. of Sikkim and the Chief Guest of the inaugural session. Illustrative talks were delivered by Dr. Amit Pande, Dr. N.N. Pandey and Dr. D. Thakuria on important diseases of coldwater fishes and coldwater fish farming. To familiarize the participants with the sampling techniques used in the diagnosis of fish diseases, a practical demonstration for the collection of samples from diseased fish was also conducted.

Trainees along with the Scientists and Resource persons


Practical demonstration of sampling procedures

Training progarmme on "Practical orientation on intensive grow out practices for Golden and Chocolate mahseer"

A training programme on "Practical orientation on intensive grow out practices for Golden and Chocolate mahseer" was organized by Directorate of cold water fisheries (DCFR), Bhimtal at NRC, Mithun, Nagaland from 27th February to 2nd March 2012 for the State Govt. officials of north east region of India. The programme was attended by the participants (State fisheries officers, Farmers, Students and Media persons) from Nagaland, Sikkim and Arunachal Pradesh. The objective of the programme was to develop trained manpower to carry out activities in respect to breeding and culture of Golden and Chocolate mahseer the hill states of north east India. Chocalate mahseer has good prospects for culture potential in the Nagaland region. Choacalate mahseers, (*Neolissochilus hexagonolepis*) declared as the "state fish" of the Nagaland and its propagation through scientific aquaculture practices would enable to elevate the livelihood and nutritional security of the poor farmers. He also emphasized about the construction and setting up of hatchery complex for the seed production of mahseer after surveying the suitable site in the state. Deputy Director, Gov. of Nagaland, appreciated the role of DCFR for taking keen interest in organizing the training progarmme for technical official and encouraged the participants to utilize the golden opportunity and take maximum benefit from the training programme. He also stressed upon the untapped rich resources of coldwater fisheries which has great potential to harness fish production. Besides, integrated paddy-cum fish farming can be adopted for large success in different district of the Nagaland due to hilly terrain to avoid the water scarcity problem.

Dr. Chandan Rashkhowa, Director, NRC Mithun informed that overall coldwater aquaculture is unexpanded in the state. Rivers, dams and reservoir having great prospects for fisheries development which needs to be explored. The technology of the scientific farming needs to be propagated to the primary stakeholders. He advised the scientists to take up any possibility of integration of Mithun with the fish farming system in the days to come. Dr. Anamika Sarma, Joint director Incharge ICAR complex for NEH region Nagaland brought to light about the integrated fish farming with pig or poultry as one of the component.

Director of fisheries, Govt. of Nagaland graced the occasion as the chief guest of the function. He emphasized upon the commercial importance of the mahseer both as food fish and game fish. Since mahseer has good consumer preference and longer shelf life, so could be candidate species for aquaculture in the Nagaland. To utilize the resources

Inauguration of training programme

Training on Nutrition and feeding strategies of mahseers

Training on water quality management at State fish farm, Kohima

Certificate distribution by Director, NRC

community awareness, feeling of belongingness and motivating people for fish farming is very essential for fisheries development in the state. Since Naga communities are non vegetarian so demand for fish is very high thus aquaculture has to play a pivotal role to fulfill the gap between demand and supply.

A group of scientists from DCFR, Dr. D. Sarma, Mr. S.K. Mallik and Dr. S.K. Gupta delivered lectures and explained technical knowhow on different aspects of mahseer farming, nutrition and disease management. Deputy Director of the fisheries Nagaland Govt. highlighted the overall fisheries development and ongoing schemes. He laid emphasis on the various schemes implemented, such as state plan scheme, centrally sponsored schemes as well as state earmarked programme (SEP).The percentage of area utilized for ponds/tanks culture is only 9.24% while for integrated fish culture only 3.50% area have been utilized till to date and in the inland capture sector, there is huge potential to develop fisheries in the lakes, reservoirs, rivers streams and swamps, informed by the deputy director.

A field visit to state fish farm at Kohima was organized on 28th Feb, where participants were given hands on practical demonstration about the pond preparation method as well as importance of water quality management for aquaculture. Incidence of disease outbreak in coldwater fisheries sector is major constraints.

Field visit to State fish farm, Kohima

Trainees along with the scientists and resource persons

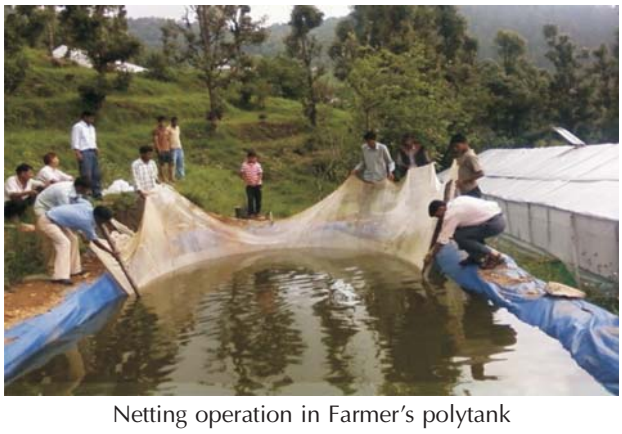
A success story of Golden and Chocalate Mahseer breeding was displayed through a film in the seminar hall of the institute. A lecture on ecotourism and sport fisheries development through endogenous tourism in PPP Mode was delivered by the Dr. Atul Borgohain, Professor, Assam Veterinary College Khanaparra.

Lectures were delivered by the resource persons from Assam Agricultural University (AAU) on Mahseer hatchery technology and quality seed production by Sangipran Baishya and Dr. Bipul phukan respectively. Special talk on "Recent trend in aquaculture practices in hilly regime of north east india" was deliberated by Dr. Deepjyoti Baruah from livestock research station (AAU), Assam. Prof. Sharif U Ahmed from Dept. of Zoology, Nagaland University called attention towards integrated fish-livestock farming in Nagaland. Dr. D. Sarma, Principal scientist delivered a lecture on "Rearing of chocolate Mahseer, *Neolissochilus hexagonolepis* (McClelland)-A new candidate species for hill aquaculture.

On Farm training on Fish Farming and Fish seed Distribution

Under the Transfer of technology activity of the Institute, a two days on- farm training on fish farming and fish seed distribution programme was organized at selected promising site, Doonagiri area of the Almora district (Uttarakhand) during 2-3rd July, 2011.The purpose of this programme was to create the awareness and promoting the farmers for fish farming in the polytanks. Directorate has refined the technology of the composite carp culture in the polytanks. This technology has to be disseminated to the farmers of hills. In this connection, farmers of the Doonagiri area have been adopted for this programme under the All India coordinated Research project on APA with collaboration of VPKAS, Almora. In the two villages of this area, Dudhauli and Todera, about 50 polytanks and 15 poly house have been constructed with the technical guidance of VPKAS, Almora for the purpose of water conservation and its use for the fish production and vegetable production. DCFR, Bhimtal has taken the initiative to start the fish farming in these poly tanks. Growth of the exotic carps, silver carp, grass carp and common carp is better in the polytanks rather than in earthen and cemented tanks. This is due to the advantage of comparatively higher water temperature in the polytanks. Low temperature and the sharp diurnal fluctuation inside the earthen and cemented pond are the major factors of the slow growth of carps in cold climate of the hills. There is a smooth diurnal fluctuation of temperature inside the poly tanks, which favours the growth of the fish. The availability of the natural fish food organisms, plankton and periphyton is better in the polytanks due to the higher temperature. In the winter season, fish remain in the hibernation without taking food and gaining growth and even some time looses the weight. In the case of polytank fish culture, this hibernation or no growth period can be minimized by taking the advantage of higher temperature in polytanks.


Director, DCFR delivering a talk on composite carp culture in polytanks


Netting operation in Farmer's polytank

Fish seed distribution to the farmers

Director, DCFR and the team of the Scientists of DCFR and VPKAS, Almora visited the ponds of the farmers and distributed the seed of the Silver carp and Grass carp to the 18 farmers having 30 ponds.

Other training/demonstration/Extension programme organized

- Technical knowledge about Mahseer culture and breeding and demonstration of carp seed packing to the fish farmers of the Lakhimpur Khiri District (UP) during their Institute visit on 30th July to 1st August 2011.
- Farmers' interest group was organized for farmers of Pithoragarh under ATMA project on 28th September 2011 at Champawat Field Center (Dr. S.K. Srivastava and Dr. S.K. Gupta).
- Front line demonstration (FLD) arranged by Dr. S.K. Srivastava, Dr. Suresh Chandra and Dr. S.K. Gupta for farmers of Champawat District to demonstrate them breeding and culture technology of imported Hungarian strain of CHAMPA-1 and CHAMPA-2 as candidate species for hill aquaculture during November 2011.
- Farmer field school organized at Champawat Field Center by Dr. S.K. Srivastava, Dr. Suresh Chandra and Dr. S.K. Gupta on 27th December 2011.
- Farm Advisory Service to 13 farmers of Almora district for Polyculture of exotic carps in polytanks.
- Technical guidance to the state fisheries department, Sikkim for establishment of circular carp hatchery was provided.
- A Television presentation was delivered for ETV (Uttar Pradesh/Uttarakhand) on 1st March, 2012 at Champawat Field Center on the topic of breeding, rearing and culture of trout and carps (Dr. S.K. Srivastava and Dr. S.K. Gupta).

Radio Talk

- Radio talk given by Dr. S. Ali, Scientist at All India Radio, Aakashwani kendra Almora on the topic "मत्स्यसंवर्धन हेतु पानी की गुणवत्ता" broadcasted on 30th June, 2011.
- Radio talk given by Dr. S. Ali, Scientist at All India Radio, Aakashwani kendra Almora on the topic "शीतकाल में मत्स्य पोषण एवं तालाबों की देखभाल" broadcasted on 23rd Dec, 2011.
- Radio talk delivered by Dr. S. Chandra, Senior scientist on Common Coldwater Fish Diseases and their Control in Hindi, FM Radio programme "Janvani" at G.B. Pant University of Agriculture & Technology Pantnagar on 13th October, 2011.
- Radio talk delivered by Dr. S. Chandra, Senior scientist on Fish Pond Management in in Hindi, FM Radio programme "Janvani" at G.B. Pant University of Agriculture & Technology Pantnagar on 14th October, 2011.
- Radio talk given by Dr. R.S. Patiyal, Senior Scientist at All India Radio, Aakashwani kendra Almora on the topic "*Parvateey shetro mai matsya aakhet ki sambhawnaaye*" broadcasted on 8th March, 2012.

Dissertation/Ph.D. Thesis work

- Under the Co-Supervision of Dr. N.N. Pandey, Senior Scientist two PhD students of Kumaon University, Nainital completed their research work on "Temporal analysis of river Kosi through thematic map based on GIS tools and its impact on ecology and ichthyofaunal diversity" and "Integrated Poultry-Cum- Fish culture in Kumaon hills with special reference to pond productivity and fish production".
- Under the Co-Supervision of Dr. N.N. Pandey, Senior Scientist three students of M.F.Sc, for their dissertation work on "*In vitro* study of aqueous extract of some medicinal plants as antifungal agent for the control of pathogenic fungi in fish", "Use of Papain and Ashwagandha (*Withania somnifera*) in Aqua-feed for growth performance of Common carp (*Cyprinus carpio*) under semi-temperate climatic condition of

Uttarakhand" and "Isolation of pathogenic fungi from infected Golden Mahseer (*Tor putitora*).

- Under the supervision of Dr. Neetu Shahi, Scientist M.Sc. Biotechnology student Ms. Anshu Kumari from Department of Biotechnology, Kumaon University, Nainital, has completed her dissertation work on the topic Amplification of growth hormone gene of economically important coldwater fishes: *Tor putitora* by 3' Race.
- Under the supervision of Dr. A. Barat, Principal Scientist, Ms. Sugandha Gupta, student of M.Sc (Biotech) of Department of Biotechnology, Kumaon University, Nainital, has completed her dissertation work on the topic entitled "Genetic characterization of different species of sub-family Schizothoracinae by using RAPD marker.
- Under the supervision of S.K. Mallik, Scientist Ramandeep Kaur Dhillon, M.Sc (Microbiology) of Department of Biotechnology, Kumaon University, Nainital Uttarakhand has completed the M.Sc dissertation work on the topic entitled, 'Study on in-vitro screening of local medicinal plants for antimicrobial activity using disc diffusion method.

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Awards & Recognitions

- Dr. Prem Kumar has undergone a one year course entitled "Post Graduate Diploma" in Technology Management in Agriculture for the year 2011-12 organized by NAARM and University of Hyderabad.
- Dr. Prem Kumar, Senior Scientist and Dr. D. Sarma, Principal Scientist has been conferred Gold medal by Academy Environmental Biology (AEB) for meritorious service 2011 during 30st Annual session and National Symposium on National Consultation on Biodiversity of High Altitude Aquatic Resources, Conservation and Utilization during 31st Session of Academy of Environmental Biology & National Symposium on "Sustainable Development: Socio Economic Challenges" during 14-16 October, 2011 at Bundelkhand University, Jhansi, U.P.

Dr. Prem Kumar, Senior Scientist and Dr. D. Sarma, Principal Scientist has been conferred Gold medal by Academy Environmental Biology (AEB)

Dr. A. Barat, Principal Scientist, DCFR felicitated by Dr. M.L. Madan, Ex DDG (Animal Science) during International Conference at DIHAR, Leh-Ladakh

- Dr. S. Chandra, Senior scientist as a team member of the NAIP-SRL sponsored programme received **Krushk Bandhu Team Award** on World Food Day for distinct contribution in livelihood development in three districts of Odisha.

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Bulletins

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Participation in Conferences/Meetings/ Symposia/Seminars/Workshops/Trainings

Conferences/Meetings/Seminars/Symposia/Workshops	Participants
Attended a Workshop on 'Mountain Agriculture in Himalaya Region:Status, Constraints and potentials" on April 2-3 2011 orgonised by Central Soil and water Conservation Research and Training Institute, Dehradun. Dimmentions and application" on 22nd may 2011 orgonized by Department of biotechnology, Devasthaly Vidhyapeeth,Lalpur Rudrapur,Uttrakhand	Dr. P. C. Mahanta Dr. R.S. Patiyal
Review committee meeting on Annual progress of Fish Genetic Stock-Outreach Activity during. 5-6 April, 2011.	Dr. A. Barat
Attended NAIP sponsored National Training Programme on "Molecular markers for genetic diversity assessment and tools for genome resource conservation" organized by NBFGR, Lucknow during 21st April- 4th May, 2011.	Dr. S.K. Gupta
Exhibition in an expert consultation on "Revitalizing Indian Fisheries Education to meet the 21th century aspirations organized by Fisheries College and Research Institute Tamilnadu Veterinary and Animal Science University, Thoothukudi (TN) during 8-10 May 2011.	Dr. N.N. Pandey Dr. Neetu Shahi
Participated in the seminar on "Emerging Issues in Asian Aquaculture" organized by NACA and CMFRI at CMFRI Cochin on 12th May 2011.	Dr. Amit Pande
Participated as resource person in Biotechnology Workshop at Devasthali Vidyapith, Rudrapur on 22nd May, 2011	Dr. A. Barat Dr. R.S. Patiyal
Participated in ICAR Industry meet 2011 at New Delhi as SMD (Fisheries) selected "Livelihood Security through Fish Culture in Polytank" as promising technology developed by the Institute on 23rd May, 2011.	Dr. Prem Kumar
Participated in two days interface meeting of KVKs and other stakeholders organized by DCFR at Bhimtal during 6-7th June 2011.	Dr. R.S. Patiyal
Participated in two days on farm training to the fish farmers and fish seed distribution at Village Dudhauli (Doonagiri), Dist. Almora (Uttarakhand) during 2-3 July, 2011.	Dr. P. C. Mahanta Dr. Prem Kumar Dr. N.N. Pandey Dr. R.S. Patiyal Dr. S. Ali Sh. Y.S. Dhanik Sh. B.C. Pandey
ZPD sponsored training program for KVK, SMS (Fy.) on 6th July.2011 at CIFRI Regional Centre, Guwahati.	Dr. D. Sarma
National workshop on "Strategies on enhancement of productivity of IMC and species diversification in North Eastern States" at Guwahati, organized by NFDB, Hyderabad during 8-9 July, 2011.	Dr. D. Sarma
Participated in the National Fish Farmers day organized by college of Fisheries, G. B. Pant University of Ag. & Tech. Pantnagar on 10th July 2011.	Dr. N.N. Pandey

Conferences/Meetings/Seminars/Symposia/Workshops	Participants
State level angling competition" at "JASINGFFA Aqua Tourism Centre", Assam on 10th July 2011.	Dr. D. Sarma
National Workshop on Portable FRP Carp Hatchery Technology, at Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha during 11-13 July, 2011.	Dr S. Chandra
Participated in ICAR Director's Conference and ICAR Annual Day Celebration & Award ceremony during 15-16 July 2011.	Dr. P. C. Mahanta
Attended DPC meeting at CSWCR&TI, Dehradun on 19th July 2011.	Dr. P. C. Mahanta
Participated and presented the completion report of DBT funded project to DBT task force at CIFE, Mumbai during 19-20 August, 2011.	Dr. A. Barat
Participated in the 4th Task force meeting on held at CIFE Mumbai during 19-20 August, 2011.	Dr. Amit Pande
Brainstorming session on Fish Stock certification and ecolabelling in fisheries organized by the National Academy of Agricultural Sciences at NASC, New Delhi on 27th August, 2011.	Dr. P. C. Mahanta
Participated in the exhibition in 15th National exhibition organized by Central Calcutta Science & culture organization for Youth at Kolkata during 7-11 September, 2011.	Dr. N.N. Pandey
Participated in National Workshop on Bioflock Technology: An Eco-Friendly Technology for Intensive Production of Fish and Prawn at Department of Zoology, University of Delhi, Delhi. During 13-16 September, 2011	Dr S. Chandra
21 days ICAR sponsored Summer School on " Advances in Aquaculture Nutrition and Feed processing Technology" conducted by Central Institute of Brackishwater Aquaculture, Chennai during 15th September-5th October, 2011.	Mr. M. S. Akhtar
Participated in National consultation on "Species prioritization for Ex-situ Conservation and Freshwater Aquaculture" at NBFGR, Lucknow, during 17-18 September, 2011.	Dr. P. C. Mahanta Dr. D. Sarma Dr. S. Chandra
Attended collaborative programme with M/s SAP Labs India, Bangaluru on ChariTra (Charitable Transformation) for NGO's in NE region organized at Guwahati, Assam during 25-28 September, 2011.	Dr. P. C. Mahanta
Participated and delivered a paper in International Conference at DIHAR, Leh-Ladakh during 22-24 September, 2011.	Dr. A. Barat Dr. (Mrs.) P.K. Sahoo, Dr. S. Ali
15th Scientific Advisory committee meeting of KVK Lohaghat, Champawat on 22nd September 2011	Dr. S.K. Gupta
Participated in the training programme on "MDP Workshop on Policy and Prioritization, Monitoring and Evaluation (PME) Support to Consortia based research in Agriculture" held at NAARM Hyderabad from 22-27 September, 2011.	Dr. Amit Pande
Participated Genomics Platform meet at NBFGR, Lucknow on 25 September, 2011.	Dr. A. Barat
Visited DCFR Field Centre Champawat on 3rd October, 2011.	Dr. P. C. Mahanta
Participated in the exhibition in 90th "All India Farmer's fair & Agro Industrial Exhibition" organized by G. B. Pant University of Ag. & Tech. Pantnagar, during 12-15 October, 2011.	Dr. N.N. Pandey Dr. S. Chandra
NAIP Sponsored Training on "Computational tools for genome resources data analysis in fisheries domain" at NBFGR, Lucknow during 12-22 October, 2011.	Dr. S.K. Srivastava

Conferences/Meetings/Seminars/Symposia/Workshops	Participants
31st Session of Academy of Environmental Biology & National Symposium on "Sustainable Development: Socio Economic Challenges" during 14-16 October, 2011 at Bundelkhand University, Jhansi, U.P.	Dr. P.C. Mahanta Dr. D. Sarma Dr. Prem Kumar
Participated in the National Consultation on Water: Research Prioritization, presented proposal for 12th five year plan. Programme was organized by NFDB, Lucknow under the chairmanship of DDG (Fy) on 18th October, 2011.	Dr. N.N. Pandey
Participated in the International Seminar on "Bioresources & Human Substances" organized by Department of Zoology, Cotton College, Guwahati during 20-22 October, 2011.	Dr. P.C. Mahanta
Attended annual review meeting for Outreach activity-Fish Genetic Stock, NBFGR, Lucknow, during 20-22 October, 2011	Dr. A. Barat
Workshop / Installation Training for SAS" organized by IVRI, Izatnagar, Bareilly during 28-29 October, 2011.	Mr. M. S. Akhtar
Participated in the National Workshop & Stakeholders Meet on Fish Feeds and presented progress report, submitted interim report of the project and proposal for 12th five year plan. The workshop was organized by CIFA, Bhubneswar during 1-2 November, 2011.	Dr. N.N. Pandey Dr. S.K. Gupta
Participated CAC meeting under NAIP, NRCPB, New Delhi during 2-4 November, 2011.	Dr. A. Barat
Participated Scientist interaction meet with Hon'ble Agricultural Minister, Govt. of India at NASC, New Delhi on 8th November 2011.	Dr. A. Barat
Participated in 6th Uttarakhand State Science and Technology congress organized by Uttarakhand state council for science and Technology at Almora on 14-16 November, 2011.	Dr. P.C. Mahanta Dr. N.N. Pandey Dr. S. Ali
Participated in NAIP sponsored training programme on "Genetic dissection of complex traits with reference to GIN in goats" held at CIRG Makdoom during 15-28 November, 2011.	Dr. Anand Kumar B.S
Participated in group discussion and delivered a lecture to ADOs and extension officer of department of Agriculture, District Nainital during one day training organized by CDO, Nainital on 16th November 2011	Dr. R.S. Patiyal Dr. N.N. Pandey
Attended the DBT review committee meeting at Gopalpara and inspection of the progress of work of collaborative fisheries programme at ICAR Research Complex for NE region, Barapani during 22-24 November, 2011.	Dr. P.C. Mahanta
Participated in the exhibition in "Kisan mela" organized by VPKAS, Almora at Hawalbagh on 24th Nov. 2011.	Dr. N.N. Pandey
Attended the Consultative meeting organized by NFDB, Hyderabad on 29th November, 2011	Sh. S.K. Mallik Dr. R.S. Haldar
Attended stakeholders meeting and Foundation Day Celebration of NBFGR, Lucknow on 12th December, 2011.	Dr. P.C. Mahanta
Participated in the brain storming meeting on "Network Project on Fish Health" held at CIBA Chennai on 12th December, 2011.	Dr. Amit Pande
Participated in National Seminar on Preparation for the Success of 2nd Green Revolution in Indian Agriculture held at NBSS&LUP, Nagpur on 16th Dec 2011.	Dr. Anand Kumar B.S
Attended Conference on "Agri-Biotech" organized at IARI, New Delhi during 19-20 December, 2011.	Dr. A. Barat

Conferences/Meetings/Seminars/Symposia/Workshops	Participants
9th Indian Fisheries Forum" organized by Asian Fisheries society at Chennai during 19-23 December, 2011.	Dr. P.C. Mahanta Dr. D. Sarma Dr. N.N. Pandey Dr. Prem Kumar Sh. S.K. Mallik Dr. S.K. Gupta Sh. M.S. Akhter
Participated in the XX Annual Conference of the Indian Virological Society, VIROCON "Managing Emerging and Re-emerging Plant, Animal, Human and Aquatic Viral Diseases: One Health Perspective" held at National Research Centre on Equines, Hisar during 29-31 December, 2011.	Dr. Amit Pande Dr. D. Thakuria Dr. Anand Kumar B.S
21 days training programme in diagnostic in fish health management at CIFE, Mumbai during 10-30 January, 2012.	Dr. Neetu Shahi
Participated in the seminar and exhibition in Fish festival Bhopal organized by Directorate of Fisheries, M.P Govt. during 4-6 February, 2012.	Dr. N.N. Pandey Dr. D. Sarma
Participated in the exhibition in National conference on "New vistas in Indian aquaculture' organized by CIBA at Channai during 23-24 February, 2012.	Dr. N.N. Pandey
NAIP Sponsored Training on "Allele mining in natural genetic resources for targeted trait improvement and their conservation" at NBFGR, Lucknow 25th February-9th March, 2012	Dr. S.K. Srivastava
Participated and represented DCFR in meeting for cumulative environmental Impact assessment studies of Satluj basin, organized by ICFRE at Dehradun on 27th February, 2012.	Dr. N.N. Pandey
Participated in exhibition in "Pusa Krishi Vigyan Mela organized by IARI (ICAR) at New Delhi during 1-3 March, 2012.	Dr. N.N. Pandey
Global Conference on 'Women in Agriculture' organized by Indian Council of Agricultural Research and Asia-Pacific Association of Agricultural Research Institution at New Delhi during 13-15 March, 2012	Dr. (Mrs.) P.K. Sahoo
Participated in the exhibition in 91th "All India Farmer's fair & Agro Industrial Exhibition" organized by G.B. Pant University of Ag. & Tech. Pantnagar, during 15-18 March, 2012.	Dr. R.S. Patiyal Dr. N.N. Pandey Mr. Santosh Kumar
National Conference on 'Aquaculture: Fish for Billion' in commemoration of Silver Jubilee year celebration of CIFA, Bhubaneswar during 16-17 March, 2012	Dr. (Mrs.) P.K. Sahoo Dr. N.N. Pandey
National workshop on "Sustainable utilization of mountain fishery resources of North East region" at Guwahati organized by DCFR during24-25, March, 2012	Dr. P.C. Mahanta Dr. D. Sarma Dr. (Mrs.) P.K. Sahoo Dr. S.K. Srivastava Dr. R.S. Patiyal Dr. S. Ali Dr. Ananda Kumar B.S

Meetings Organized

Institute Management Committee Meeting (IMC)

27th April, 2011

Institute Management Committee Meeting (IMC) was held on 27th April, 2011 under the chairmanship of Dr. P.C. Mahanta, Director, DCFR, Bhimtal. Among the IMC members, Dr A.K. Sahu, Pr. Scientist, CIFA Bhubaneswar, Dr A. K. Srivastava, Ex-Pr. Scientist, VPKAS Almora, Dr S. A. Ali, Pr. Scientist CIBA Chennai and Sri Harish Ram, Member Secretary and AAO, DCFR were present. Besides the IMC members invited scientists of the institute along with Shri Y.S. Dhanik, Administrative Officer and Prof. A. Dutta, member RAC were also present. During the meeting the proceedings of previous IMC meeting held on 7th May, 2010 was approved. Various agenda items pertaining to store purchase and other infrastructure facilities were discussed during the meeting.

Interaction during IMC meeting

17th March, 2012

Institute Management Committee Meeting (IMC) was held on 17th March, 2012 under the chairmanship of Dr. P.C. Mahanta, Director, DCFR, Bhimtal. The newly constituted management committee members discussed the various development and management issues of the directorate. During the meeting the proceedings of previous IMC meeting held on 27th April, 2011 was approved. Various agenda items pertaining to store purchase and other infrastructure facilities were discussed during the meeting.

Interaction during IMC meeting

Research Advisory Committee Meeting (RAC)

28-30 April, 2011

The 2nd Research Advisory Committee Meeting (RAC) was held on 28-30 April, 2011 under the Chairmanship of Dr. K.K.Vass, Former Director, CIFRI, Barrackpore. The other RAC members Prof. A. Dutta, Dr. S.D. Singh, ADG (I.Fy), were also present during the meeting. Dr. A. Barat, Senior Scientist & Member Secretary, RAC presented the Action Taken Report on the recommendations of the previous RAC meeting. The Principal Investigator of the different projects presented the progress of the project before the RAC. Some of the new proposals

were also discussed. The RAC Chairman and other members expressed their satisfaction over the ongoing research activities and appreciated the new initiatives taken by the institute. The RAC also suggested certain modification in the on going projects to make it more pragmatic and result oriented. The RAC also visited the Champawat Field centre for reviewing the on going progress.

16th March, 2012

The 3rd meeting of the Research Advisory Committee (RAC) of DCFR was held on 16th March 2012 at the Directorate, Bhimtal under the chairmanship of Dr. K.K.Vass, former Director, Central Inland Fisheries Research Institute, Barrackpore, and other members viz., Prof. R.S. Chauhan, Fisheries College, GB Pant University of Agriculture & Technology; Dr Krishna Gopal, Toxicological Research Institute, Lukhnow; Prof. Amalesh Datta, Guwahati University, Assam; Dr D.N. Das, Central University, Arunachal Pradesh; Dr. P.C. Mahanta (Director DCFR).

Dr. P.C. Mahanta, Director, DCFR welcomed all participants to this meeting, which he mentioned was specially called for seeking advice of RAC on the draft XII plan proposals of the Directorate. Dr A.Barat, Principal Scientist & Member Secretary, RAC presented the action taken report on the recommendations of the last RAC meeting held on April 28-30, 2011. The RAC expressed their overall satisfaction on the progress presented in the action taken report on the recommendations. The RAC expressed its satisfaction on the action decided by DCFR in consultation with SMD to monitor the progress of Network Project with States and SAU.

Official language Hindi

Quarterly meeting of official language Hindi was conducted under the Chairmanship of Director and review was done on the work going on in official language. The Director encouraged all the staff members to carry out day to day work in the official language Hindi for better understanding and smooth functioning. Directorate also celebrated Official Language Week "Hindi Saptah Samaroh" during September 14-20, 2011. On this occasion various types of competition such as easy writing, translation, administrative vocabulary and official noting and drafting were organized. All the scientists and other staffs particularly from non Hindi states participated and winner of different events were awarded with various prizes.

Prize distribution during the Hindi week

Review Meeting cum Workshop on Nutrient Profiling and Data Analysis at DCFR, Bhimtal

A review meeting cum workshop on Nutrient Profiling and Data Analysis was held at DCFR, Bhimtal, during 18-19 October, 2011. Dr. S.D. Singh, ADG (I.Fy) ICAR, Dr. B.P. Mohanty, Coordinator and PI of outreach project: Nutrient profiling and evaluation of fish as a dietry component along with other PIs and Co-PIs of the project Dr. B.N. Paul, CIFA, Dr. J. Syama Dyal, CIBA, Dr. Suseela Mathew, CIFT, Dr. K. Chakraborty, CMFRI, Dr. G. Venkateshwarulu, CIFE, Dr. D. Sarma, Dr. N. Shahi,

Review meeting on nutrient profiling and data analysis

Mr. M.S. Akhter, DCFR and other scientists of the Directorate participated in the workshop. Dr. B. P. Mohanty briefed the house on the present status of the project. The proposal for the XII plan was also discussed during the meeting. Dr. S.D. Singh, emphasized that the data should be compiled in an accurate way as the dietary recommendation of fish intake is for human consumption. Fish being an excellent food due to its easily digestible protein and w-3 fatty acid should be popularized for nutritional fulfilment and for better health.

Visit to the cage at Bhimtal Lake

Stakeholders Meet

The Directorate organized a stakeholder's meet on 30th November, 2011 to prepare the XII Plan EFC document. The meeting was graced by Sh. A. K. Roy, IAS, Secretary to Govt. of Assam, Department of Fisheries. Dr. S.D. Singh, ADG (I.Fy) ICAR, Dr. Krishna Gopal, member RAC, DCFR were also present during the meeting. Farmers from Himachal Pradesh, Uttarakhand, Arunachal Pradesh along with representative of State Fisheries Department also participated in the meeting. Some of the representatives from private organizations, feed manufacturers and NGOs also participated in the discussion. The major problems faced by the hill farmers in terms of input supply and delivery mechanisms were highlighted. Dr. S.D. Singh stressed upon the implementation of ICAR policy of

Stakeholders meet at DCFR, Bhimtal

Farmer's first while devising the research programmes of the institute. The benefit of research should reach to its ultimate user in an effective manner. The concerns of farmers were taken into consideration while formulating the EFC proposals. Sh. A. K. Roy, IAS, appreciated the progress made by the Directorate and also emphasized to work for the welfare of fish farmers.

Other Events Organized

Workshop on Intellectual Property Rights (IPR)

Directorate of Coldwater Fisheries Research, Bhimtal organised "**One Day Workshop**", on the occasion of **World Intellectual Property Day** on **26th April 2011**. In this occasion more than fifty delegates from different Institutes, other than DCFR, Bhimtal, such as IVRI (Bareilly & Mukteshwar), CIBA (Chennai), CIFA (Bhubaneswar), Regional Centre NBPGR (Bhowali), VPKAS (Almora) and Guwahati University were participated in the workshop. The workshop was focused on the emerging issues on IPRs and more than fifty participants were got benefited. The workshop provided an excellent opportunity for the scientists to know these emerging issues and got benefitted from their expertise.

The delegates and participants were welcomed by Dr. Prem Kumar, Incharge, ITMU and key note addressed by Dr. P.C. Mahanta, Director, DCFR. On the occasion, Dr. Mahanta also focused on the WTO, TRIPs, Copyrights, Trademarks, Patens and other IP issues. The procedure while filing application for patent, copyright and trademark were underlined by Dr. S.A. Ali, Principal Scientist, CIBA, while Dr. M. Shankar, Scientist, IVRI highlighted on TRIPs. Dr. Mona Singh, IVRI, Bareilly delivered a valuable talk on IPR with special emphasis on patents. Dr. Shahnawaz. Ali, Scientist, DCFR, Bhimtal gave prominence to the Material Transfer Agreement (MTA). Dr. Laxmikant, Principal Scientist given a lecture on the importance of commercialization of technologies. Dr. A. Barat, Principal Scientist, DCFR, Bhimtal expressed vote of thanks. The full day workshop proved to be fruitful event to the scientists and organization.

KVK-DCFR Interface Meet

The directorate conducted a KVK-DCFR Interface meet during 6-7th June 2011. The fundamental thought after transformation of NRCCWF to DCFR is to spread out the activities in the entire Himalayan region utilizing the recourses and manpower of various state fisheries departments and institutes located in the hilly region. In this direction, definite programs on partnership mode has been conceded in the XI five year plan with the different state fisheries departments, universities and institutes in J&K, Himachal Pradesh, Sikkim, Arunachal Pradesh and Uttarakhand with immense success and encouragement. However, it was felt that, the KVK in the hill region could be a partner to intensify the fisheries activities in the hill region. Therefore, to cater the need of tribal population for the development of coldwater fisheries sector in the

Inaugration of meet by lighting of lamp by Shri Harish Rawat Ji, the Hon'ble Union Minister of State

hill region through partnership approach in the XII five year plan, an interface meeting was organized with the involvement of KVKs and other stakeholders focusing on the following themes:

- Exploratory research on coldwater fish biodiversity.
- Expansion of Rainbow trout breeding and farming in potential coldwater areas
- Expansion of new and economically viable fish farming system suitable for mid altitude areas.
- Development of broodbank and seed production of important coldwater fish species.
- Surveillance of disease in coldwater aquaculture
- Prospective areas in different states for developing Aqua-tourism.

More than 200 delegates including the Directors of different ICAR institutes, scientists, KVKs and progressive farmers participated in the INTERFACE MEETING which was inauagrated by Shri Harish Rawat Ji, the Hon'ble Union Minister of State for Agriculture and Food Processing Industry, Govt. of India. He emphasized on the participation of different stakeholders for the overall development of coldwater fisheries and sustainable utilization of hill resources for the socioeconomic development and nutritional security. Dr. B. Meenakumari, DDG (Fy.), ICAR highlighted the major issues to be discussed in the Interface meeting. Dr. K.D. Kokate, DDG (Agricultural Extension) stressed upon the utilization of resources in effective manner to increase the productivity of the coldwater fish sector. Dr. J.C. Bhatt, Director, VPKAS, Almora, Dr. J.K. Jena, Director, NBFGR, Lucknow were also present mong other dignitaries.

Address by Shri Harish Rawat Ji, the Hon'ble Union Minister of State

Inauguration of newly develoed infrastructures by Shri Harish Rawat Ji, the Hon'ble Union Minister of State

KVKs from different states such as Arunachal Pradesh, Manipur, Uttarakhand, Himachal Pradesh, Jammu and Kashmir (Srinagar and Leh) and Meghalya actively participated in the deliberation. After a deliberation and interactive discussion of two days, different strategies and key points emerged as action plans for consideration and implementation during XII Five Year Plan. On this occasion the Shri Harish Rawat Ji, the Hon'ble Union Minister of State for Agriculture and Food Processing Industry, Govt.

Visit to the hatchery facility at DCFR, Bhimtal

Felicitation of farmer by Shri Harish Rawat Ji, the Hon'ble Union Minister of State

of India inaugurated the newly developed infrastructures Fish ponds and model fish hatchery complex as well as annexe of guest house. Progressive farmers from different coldwater regions of India were also felicitated by the Hon'ble Union Minister of State.

Review Workshop on Sustainable Utilization of Mountain Fishery Resources

A two days workshop was organized during 25-26 July 2011 in the directorate on sustainable development of mountain fishery resources of the country. Dr. B. Meenakumari, DDG (Fy) ICAR, Dr. S.D. Singh, ADG (I.Fy) ICAR, DR. P.C. Mahanta, Director, DCFR along with other scientific staff and representatives from State Fisheries Department & SAUs participated in the workshop. A review was made on the ongoing work in partnership with hill states. During the meeting the constraints were also discussed and proposals were also made for XII Five Year Plan. It was emphasized that mountain fishery resources should be utilized in a sustainable manner and the benefit should percolate to the underprivileged communities for their socio-economic developments. Eco-tourism should also be developed for the conservation and resource utilization. An area specific model may be developed for the implementation of the programme.

Workshop on Sustainable Utilization of Mountain Fishery Resources attended by DDG (Fy) & ADG (I.Fy)

Workshop on "Sustainable Utilization of Mountain Fishery Resources of NEH Region" at IIBM, Guwahati

Directorate of Coldwater Fisheries Research, Bhimtal organized a national workshop on "**Sustainable Utilization of Mountain Fishery Resources of North East Region**" during 24-25 March, 2012 at IIBM, Guwahati. Over 150 eminent scientists, academicians, students, govt. officials, KVKs, farmers, entrepreneurs and other stakeholders from Northeastern region and other parts of India participated in the workshop and deliberated in a common platform.

Sri Basanta Das, Hon'ble Minister of Fishery and Public Relations, Govt. of Assam inaugurated the workshop. Dr. K.M. Bujarbruah, Vice Chancellor, AAU, Jorhat, Assam; Mr. A. K. Roy, IAS, Secretary to Govt. of Assam, Department of Fisheries; Dr. S. V. Ngchan, Director, ICAR Research Complex for NEH Region, Barapani, Shillong, Meghalaya graced the inaugural function. During the deliberations, the minister as well as other eminent dignitaries urged DCFR to act as a Centre of Excellence for the development of coldwater fisheries sector in the entire region.

Inaugural speech by Hon'ble Minister of Fisheries, Govt. of Assam Shri Basanta Das

Key note address by Dr. P.C. Mahanta Director, DCFR

The workshop was organised in order to give emphasis for the sustainable development of coldwater fisheries sector in Northeastern region and aimed to address the specific issues on resource assessment, upland aquaculture, human resource development & livelihood security, fish

based eco-tourism, fish nutrition, disease and biotechnology and other relevant aspects and also in fulfilling the same informed Dr. P.C. Mahanta, Director.

Dr. Debajit Sarma, Principal Scientist and Organizer of the workshop presented the theme presentation and emphasized the scope and potential of coldwater fiat culture in NEH region.

Release of Souvenir by the Dignitaries

The progressive farmers and NGOs from different North Eastern states *viz*. Nagaland, Sikkim, Assam, Arunachal Pradesh and Meghalaya were felicitated on the occasion for their significant achievements in fish production. The Institute also organised an 'Exhibition cum Aquarium Show' where products, publications and technologies were showcased.

Felicitation of progressive farmer of Manipur and Nagaland

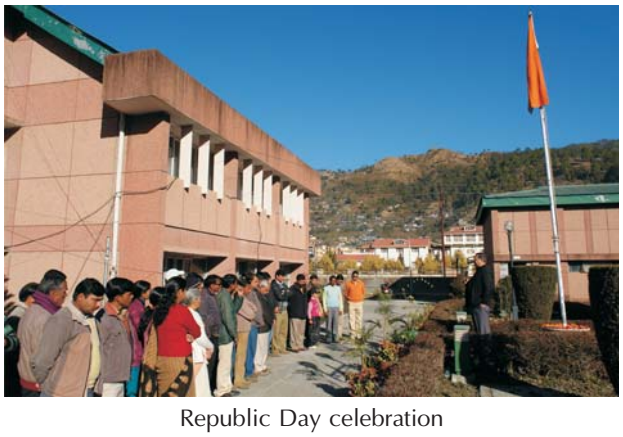
Delegates present in the workshop

'Charitra' programme by SAP, Bangalore at Bhimtal and Guwahati

SAP lab, a software company from Bangalore in collaboration with DCFR organized Charitable Transformation (Charitra) programme at Bhimtal and Guwahati during September 2011. The programme was attended by NGOs and other beneficiaries.

Independence and Republic Day Celebration

Institute celebrated Independence and Republic Day on 15th August and 26th January with full devotion. On these occasions, Director hoisted the National Flag and addressed the gathering of the staff members. He emphasized to work in cohesion for achieving the goals of the institute and to contribute for the development of coldwater sector of the country.



Republic Day celebration

Personnel

List of staff (As on March 31, 2012)

Research Management

Dr. P.C. Mahanta, Director

Scientific

1.	Dr. Ashoktaru Barat, Principal Scientist	Animal/Fish Genetics & Breeding
2.	Dr. Debajit Sarma, Principal Scientist	Fish & Fishery Science
3.	Dr. Amit Pande, Senior Scientist	Biotechnology (Animal science)
4.	Dr. Nityanand Pandey, Senior Scientist	Aquaculture
5.	Dr. Prem Kumar, Senior Scientist	Fish & Fishery Science
6.	Dr. (Mrs.) P. K. Sahoo, Senior Scientist	Fish & Fishery Science (Joined on 12.07.2011)
7.	Dr. S.K. Srivastava, Senior Scientist	Fish & Fishery Science
8.	Dr. Suresh Chandra, Senior Scientist	Fish Pathology
9.	Dr. R. S. Patiyal, Senior Scientist	Animal/Fish Genetics & Breeding
10.	Sh. Sumanta Kumar Mallik, Scientist	Aquaculture
11.	Dr. Shahnawaz Ali, Scientist	Aquaculture
12.	Dr. Neetu Shahi, Scientist	Biotechnology (Animal Science)
13.	Md. Shahbaz Akhtar, Scientist	Fish & Fishery Science
14.	Dr. Dimpal Thakuria, Scientist	Biochemistry (Animal science)
15.	Dr. Ananda Kumar B.S., Scientist	Veterinary Microbiology
16.	Dr. Sanjay Kumar Gupta, Scientist	Fish & Fishery Science

Technical

1.	Sh. R.S. Haldar	T-6 (Farm Manager)
2.	Sh. A.K. Joshi	T-5 (Hindi Translator)
3.	Sh. Baldev Singh	T-5 (Librarian)
4.	Sh. Santosh Kumar	T-4
5.	Sh. Ravinder Kumar	T-4
6.	Sh. Vijoy Kumar Singh	T-3
7.	Sh. Amit Kumar Saxena	T-3
8.	Sh. Hansa Dutt	T-3
9.	Sh. Gopal	T-3
10.	Sh. T.M. Sharma	T-3
11.	Sh. R.K. Arya	T-3
12.	Sh. Manoj Kumar Yadav	T-1 (Driver)
13.	Sh. Partha Das	T-1 (Probation cleared & Confirmation w.e.f 19.07.11)

Administrative

1.	Sh. Y.S. Dhanik	Admn. Officer (Joined on 11.04.2011)
2.	Sh. Harish Ram	Asstt. Admn. Officer
3..	Sh. B.C. Pandey	Asstt. Fin. & Acc. Officer
4.	Smt. Khilawati Rawat	Asstt. Admn. Officer
5.	Smt. Susheela Tewari	Private Secretary
6.	Sh. P.C. Tewari	Assistant
7.	Sh. J.C. Bhandari	UDC
8.	Sh. Pratap Singh	LDC
9.	Smt. Munni Bhakt	LDC
10.	Sh. Hyat Singh Chauhan	LDC
11.	Sh. Hansa Singh Bhandari	LDC

Skilled Supporting Staff

1.	Sh. Ravinder Kumar	Skilled Supporting Staff
2.	Sh. Om raj	-do-
3.	Sh. Sunder Lal	-do-
4.	Sh. Prakash Akela	-do-
5.	Sh. Pooran Chandra	-do-
6.	Sh. Manoj Kumar	-do-
7.	Sh. Kulfeep Kumar	-do-
8.	Sh. Bhola Dutt Mouni	-do-
9.	Sh. Dharam Singh	-do-
10.	Smt. Basanti Devi	-do-
11.	Sh. Mangla Prasad	-do-
12.	Sh. Sushil Kumar	-do- (Probation cleared & Confirmation w.e.f 14.07.11)

Farewell to Dr. A.K. Nayak, Scientist (SS) on 16 March 2012

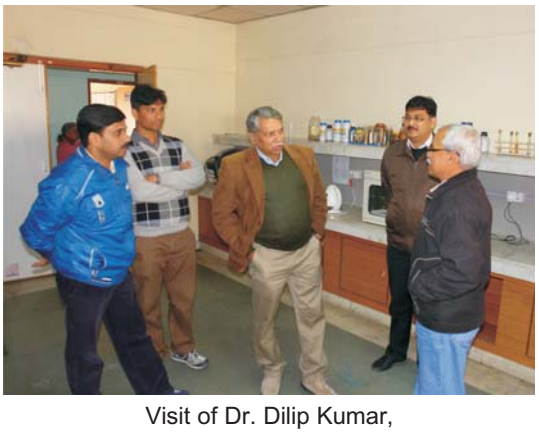
OBITUARY

The Director and all the Staff of DCFR express their condolence and deepest sympathies on the sad demise of **Dr. Shyam Sundar**, Principal Scientist (Rtd.) who has left for heavenly abode on 18th May, 2011. May his soul rest in peace and Almighty God give strength to his bereaved family.

The Director and all the Staff of DCFR express their condolence and deepest sympathies on the sad demise of **Sh. Chandra Shekhar**, SSG who has left for heavenly abode on 20th October, 2011. May his soul rest in peace and Almighty God give strength to his bereaved family.

Distinguished Visitors

- Shri Harish Rawat, Hon'ble Minister Union Minister of State, Agriculture and Food Processing Industries
- Dr. B. Meenakumari, DDG (Fisheries), ICAR, New Delhi
- Dr. A.K. Roy, Secy. Fisheries, Govt. of Assam
- Dr. T.P. Trivedi, Director, DIPA, ICAR, New Delhi
- Dr. A.T. Sherikar, Add. Secretary (Finance), ICAR, New Delhi
- Students along with faculty members from College of Fisheries, Andhra Pradesh, Udgir, Maharashtra.
- Two trout farmers from USA, Seatle visited the institute and interacted with Scientist.
- Prof. Rina Chakraborti, Delhi University
- Dr. Dilip Kumar, Former Director, CIFE, Mumbai.
- Visit of Sh. Pradeep Tamata Hon'ble MP at Champawat Field Center
- Dr. K.D. Kokate, DDG (Extension)
- Dr. K.K. Vass, Former Director, CIFRI, Barrackpore
- Dr. S.D. Singh, ADG (Fisheries), ICAR, New Delhi
- Prof. A. Dutta, Professor, Dept. of Zoology, Guwahati University, Assam
- Dr. Krishna Gopal, Deputy Director IITR
- Dr. B.S. Bisht, Vice Chancellor, GBPUAT
- Mr. Chaman Kumar, FA, DARE
- Mrs. Veena Ghanekar, IAS, MD, Fisheries Federation of India, Bhopal, M.P.



Visit of Dr. Dilip Kumar,
Former Director, CIFE, Mumbai

Visit of Sh. Pradeep Tamata
Hon'ble MP at Champawat Field Center

Visit of Students from Fisheries College

Visit of Dr. T.P. Trivedi, Director, DIPA, ICAR, New Delhi

Important Committees

Institute Management Committee

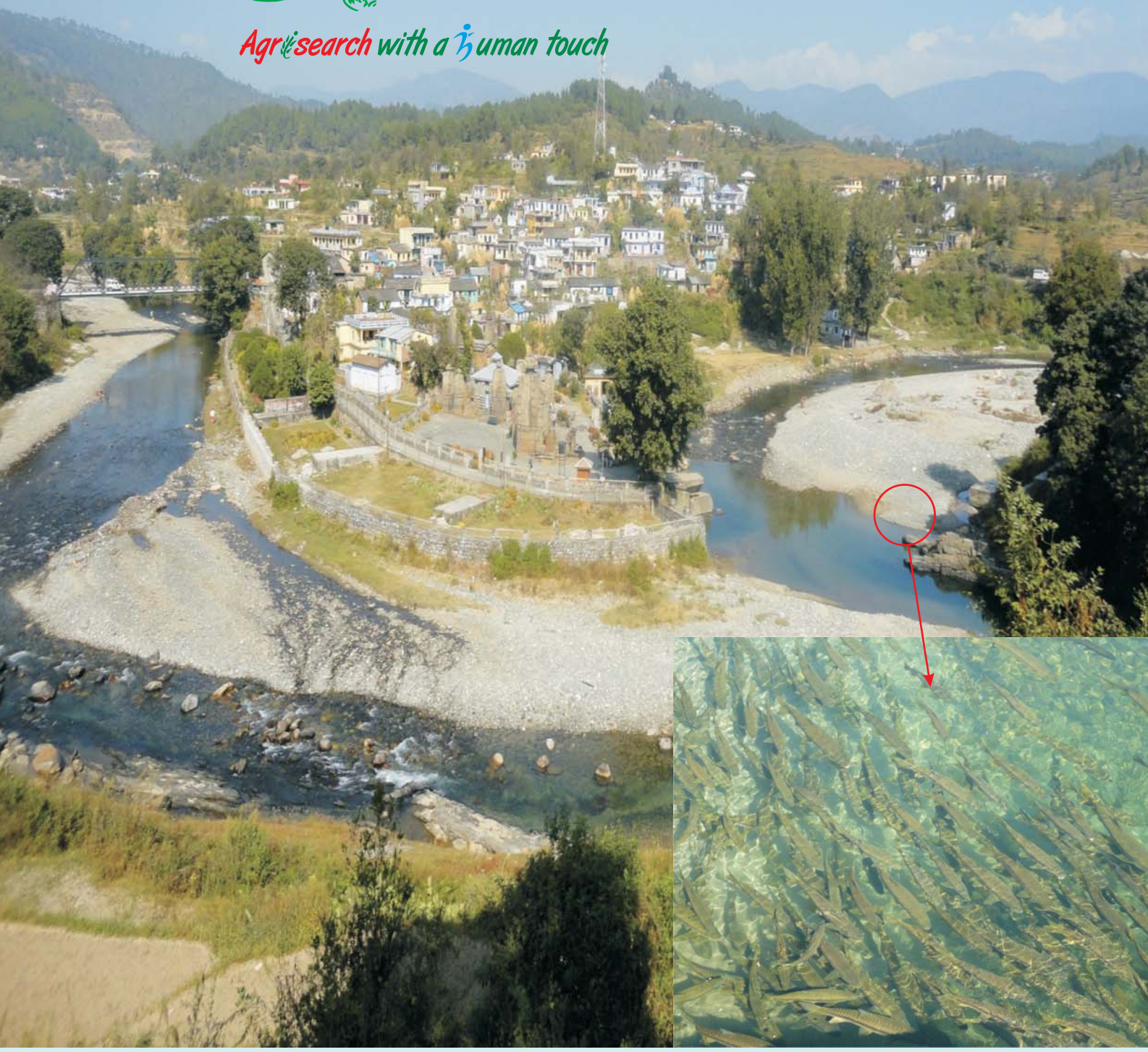
Dr. P.C. Mahanta Director, DCFR, Bhimtal	Chairman
Dr. S. D. Singh Asstt. Director General (I. Fy.), ICAR, KAB II, New Delhi	Member
Dr. A.K. Srivastava Ex-Principal Scientist Vivekanand Parvatiya Krishi Anusandhan Sansthan, Almora, Uttarakhand	Member
Dr. A.K. Sahu Principal Scientist, Central Institute of Freshwater Aquaculture, Bhubaneswar, Orissa	Member
Dr. S.A. Ali Principal Scientist, Central Institute of Brackishwater Aquaculture, Chennai	Member
Dr. M.K. Das Principal Scientist Central Inland Fisheries Research Institute, Barrackpore, West Bengal	Member
Shri Harish Ram AAO, DCFR, Bhimtal	Member Secretary

Research Advisory Committee

Dr. K.K. VassFormer Director, CIFRI, Barrackpore	Chairman
Dr. S.D. SinghADG (Inland Fy.), ICAR, New Delhi	Member
Dr. P.C. Mahanta, Director, DCFR	Member
Dr. Krishna GopalHead, Toxicology Division, IITR (CSIR), Lucknow	Member
Dr. R. S. ChauhanProfessor, College of Fisheries, GBPUA&T, Pantnagar	Member
Dr. D.N. DasProfessor, Rajiv Gandhi University, Itanagar, Arunachal Pradesh	Member
Dr. P.C.JoshiAssociate Professor, Gurkul Kangri University, Haridwar	Member
Dr. A. Barat, Principal Scientist, DCFR	Member Secretary

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch



शीतजल मात्स्यिकी अनुसंधान निदेशालय
(भारतीय कृषि अनुसंधान परिषद)
भीमताल, नैनीताल, उत्तराखण्ड, भारत

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