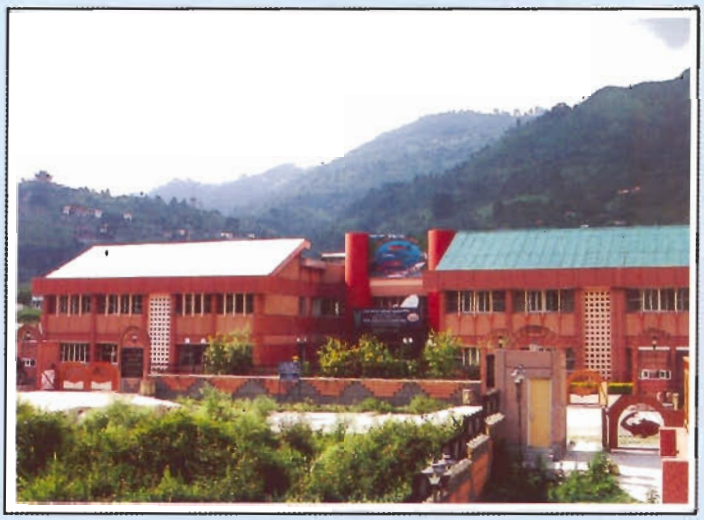
ANNUAL REPORT 2004-2005

वार्षिक प्रतिवेदन



राष्ट्रीय शीतजल मात्स्यिकी अनुसंधान केन्द्र

(भारतीय कृषि अनुसंधान परिषद)

भीमताल-263 136, जिला-नैनीताल (उत्तरांचल)

National Research Centre on Coldwater Fisheries

(Indian Council of Agricultural Research)

Bhimtal-263 136, Distt: Nainital (Uttaranchal)

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भीमताल-२६३१३६, जिला-नैनीताल (उत्तरांचल)

NATIONAL RESEARCH CENTRE ON COLDWATER FISHERIES

(Indian Council of Agricultural Research)

BHIMTAL - 263136, District - Nainital (Uttaranchal)

NRCCWF Annual Report 2004 – 2005

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Printed at
Yugantar Prakashan Pvt. Ltd.
WH-23, Mayapuri Industrial Area, Phase-I, New Delhi – 110 064
Phone: 28115949, 28116018.

- The activities and achievements reflected in this report covers the period from April 2004 to March 2005.

- The material in this report contains the semi-processed and analyzed data of different projects, which will form the basis for the publications of the Centre. Therefore, material may not be used for any publication without written permission of the Centre.

- NRCCWF Annual Report is not a priced publication. Recipients of complimentary copies should use it for scientific purposes only.

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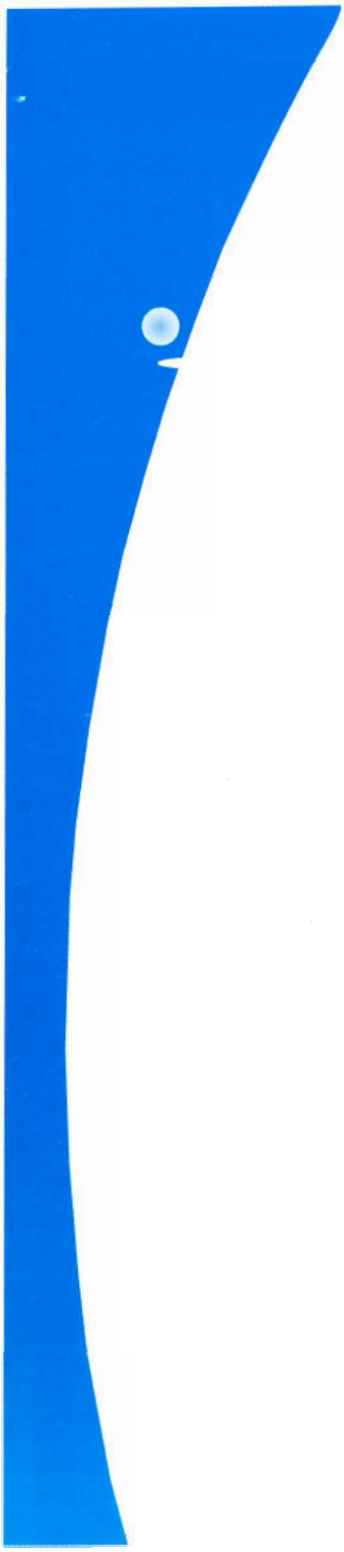

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PREFACE

PREFACE

It is my proud privilege to present the Annual Report of National Research Centre on Coldwater Fisheries (NRCCWF) for the year 2004-05. This embodies results of research and an account of other institutional activities carried out at this National Research Centre through the previous financial year. This Centre is mandated to address the issues related to coldwater fisheries both openwater as well as coldwater aquaculture and finally Transfer of Technology. During 2004-05, this center carried out investigations on eight research projects apart from two adhoc scheme and a NATP project for which this Institute was a nodal center.

Coldwater sector is surging ahead and gaining momemtum. The concept of integrated agriculture is gaining attention in hill region in which fish as important component of animal protein is going to add not only variety in production but much needed additional income to poverty ridden and meager land holding families of remote and hilly terrain. This Institute has taken up research programmes which will help in fish production enhancement.

There are several freshwater and saline lakes of different sizes situated at high altitudes in Himalayas, located between 3000-5000 m also at different latitudes. In spite of their unique nature, there had been very few investigations depicting their bio-ecological status. For generating baseline data, in the first phase survey of these lakes has been initiated wherein four lakes located in north of Sikkim were studied.

Infrastructural development has been a mission oriented activity of this National Research Centre. The construction of Phase-II of the NRCCWF complex which will serve as Administrative Block and its own Guest House is nearing completion. National Research Centre being the nodal research institution wherein various areas of coldwater fisheries research are addressed, shall be able to extend this national facility to other user organization after its completion. Few more equipments have been added in laboratories to make them more sophisticated which is now offered to research workers and research students.

This National Research Centre is extending all possible co-operation to Hill States Fisheries Departments. The designing and establishment of golden mahseer hatchery for seed production at Koteshwar in Tehri district of Uttaranchal through Tehri Hydro Development Corporation and one more near Pookote lake in Waynad district Kerala for Deccan mahseer and the third in Roying District of Arunachal Pradesh were about to be completed for their operations. The center has expanded its activities in North Eastern States through survey of its aquatic resources and transfer of technology for fish production. Training programmes have been arranged for officials of various State Fisheries Departments and other departments such as Tehri Hydro Development Corporation.

I take this opportunity to express my profound gratitude to Dr. Mangala Rai ji, Secretary DARE and Director General ICAR for his keen interest and support for development of this Centre. I am extremely grateful to Dr. S. Ayyappan, Deputy Director General (Fisheries), ICAR for his valuable guidance and suggestions at every stage of all the research and institutional activities of the Centre. I am thankful to Dr. V.R. Chitranshi, ADG (Inland Fisheries) for his ever available help and cooperation rendered for successful and smooth functioning of this institution.

The basic material for the report was provided by the Principal Investigators and associated scientists. Most of the photographs included in the report were provided by the research project investigators. Dr. Yasmeen Basade, Scientist (Senior Scale) and new Incharge of PIM Section gathered information for preparing the basic draft of this report and Shri Amit Joshi, Hindi Translator for his assistance in Hindi translation and my other colleagues for helping in preparation of this report are thankfully acknowledged.

Madan Mohan

Bhimtal (Nainital)
August, 2005

Madan Mohan
Acting Director

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EXECUTIVE SUMMARY

The National Research Centre on Coldwater Fisheries (NRCCWF) was established in September 1987 by Indian Council of Agricultural Research (ICAR) entrusting the responsibilities of conducting and promoting research on coldwater fisheries, aquaculture and aquatic resource management in the hill regions of the country. The Centre is located at Bhimtal, district Nainital in the State of Uttaranchal. The Centre at present has ten scientists, eleven technicians, nine administrative and thirteen supporting personnel. The Institute had a total budget of Rs. 249.81 lakhs for the year 2004-2005.

The Institute veered its research priorities as per the guidelines of the high level Research Advisory Committee (RAC) comprising mostly of eminent professionals from the field of fisheries and keeping in view vision 2020 and recommendations of QRT. The Centre also has a Management Committee. A number of internal committees such as Staff Research Council, Institute Joint Staff Council, Official Language Committee, Consultancy Processing Cell, etc. are in place and contributed in Institute's management activities through periodic meetings and decisions taken.

Since its inception, NRCCWF, in spite of limited scientific and technical manpower and meager facilities has made significant contribution for proper appraisal of coldwater fishery resources and evolved suitable technologies to propagate important coldwater fish species in hills. Continuing its efforts, the Institute during the year focussed its attention on overall performance which involved research, transfer of technology, human resource development, public awareness programmes, establishment of linkages and institutional building activities.

The research programmes are designed with major thrust on Openwater Fisheries, Aquaculture and Transfer of Technology. During the year the Institute worked on eight research programmes apart from two adhoc scheme and a NATP project for which this institute was a nodal centre.

The limnology and fishery of high altitude lakes in NE regions was studied and it was observed that there are large number of freshwater and saline lakes of various sizes situated at high altitudes in Himalayas, located between 3,500-5,000 m asl at different latitudes. The lakes in Ladakh *viz.* Tso Morari and Pangong are huge like inland seas. The Tsomgo, Memencho, Kupup Tso and Manju lake situated above 3,500 m asl in North Eastern region of Sikkim are important. Except Manju lake, other lakes are very large and deep and very important in this area from religious and tourist point of view. These natural systems are oligotrophic to ultra-oligotrophic and normally remain ice-bound for 4-5 months in a year. In spite of their unique character, there are very few ecological studies on these lakes mainly due to difficult approach. To generate baseline data a survey was conducted on four lakes located in North of Sikkim, particularly to investigate summer limnology and fishery of these lakes in the phase manner, as round the year investigations are not possible due to their difficult accessibility and short ice-free period.

Majority of the lakes offers excellent natural food for fish species feeding on zooplankton. In these lakes brown trout (*Salmo trutta fairo L.*) has been stocked for sport purpose, where in some lakes (Memencho lake) a self-sustaining population has got established. However, no indigenous fish fauna is recorded from these lakes, a remarkable feature of these systems.

Under NEH activities Arunachal Pradesh has been selected as the target state for the running year to generate more reliable and complete information on the use of aquatic resources by stratified multistage sampling method. Preliminary survey has been initiated. The state has abundant water bodies about 7000 ha of still water and 2000 km of running water surface suitable for development of fisheries. A rich fish fauna with more than 150 species, of which about 20% are coldwater, inhabit these water bodies.

A collaborative project between NRCCWF and Department of Fisheries, Government of Arunachal Pradesh was launched in July 2003 on 'Artificial Propagation and Seed Raising of Chocolate Mahseer, *Neolissocheilus hexagonolepis* in Arunachal Pradesh'. The project is located in the Dibang valley, Roying District of Arunachal Pradesh and supported by ICAR. Detail survey of different rivers/streams/lakes in this area were undertaken to assess the fish diversity, potential sites for collection of seed and brood stock of chocolate mahseer. Experiments on rearing of juveniles of chocolate mahseer to fingerlings were initiated at Iduli Fish Farm, Roying. Trials were conducted to evaluate the growth behavior of chocolate mahseer under pond environment.

Coldwater fishery resources of Uttaranchal were characterized using GIS. Based on satellite imageries he perimeter and area of open water bodies of Kumaon region, including Bhimtal, Nainital, Sattal, Naukuchiatal and Garurtal were ascertained. The above lakes have an area of 45.13, 54.29, 48.9 and 5.7 ha, respectively with the perimeter of 4.3, 4.6, 6.2, 3.1 and 1.3, respectively.

To formulate feeds for various growth stages of golden mahseer trials were conducted to ascertain the influence of a conventional, a commercial and a formulated practical feed on growth, feed efficiency, survival and body composition. Further, experiments were conducted to study the effect of feeding frequency on food consumption and growth and the use of a polycarboxylic organic acid as feeding stimulant for age-0 Himalayan golden mahseer. The amino acid profile of egg, fry, fingerling and adult were also analyzed.

Experiments were carried out to ascertain impact of fry density, feeding rate and feeding frequency on the growth and survival of rainbow trout under the ad hoc scheme, 'Development of Pilot Scale Feed for Culture of Rainbow Trout (*Onchorhynchus mykiss*) in Kumaon Himalayan Region of Uttaranchal'.

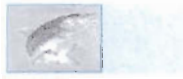
Efforts were made to rear snow-trout below 10°C up to 3°C. It was observed that fish could survive for three weeks under this low temperature conditions. The variations in protein profiles of liver and muscle issues of test fish due to cold (<10°C) exposure were analysed with SDS-PAGE. Many variations in the expression and presence of 50-55 kD, 21-35KD and 14.0 kD proteins have been recorded due to cold exposure.

The NATP programme with three co-operating centres located at Srinagar (Jammu and Kashmir), Palampur (Himachal Pradesh and Pantnagar (Uttaranchal) was functioning as per schedule and has generated information on resources of mahseer and developed technology for its culture under different agro-climatic regions.

In information technology computerized database on coldwater fishes of India is being generated . The generation of database on the biological wealth of various ecosystems of this state would ultimately help in developing strategies for the proper management and conservation of upland fish germplasm.

A goshthi of fishermen and local residents of Bhimtal was organized at Bhimtal under NATP programme during September, 2004 under the chairmanship of the Director of the Institute. The Chairperson, Town Area Bhimtal was the chief guest. In this awareness camp, main emphasis was given on the conservation of fish and its environment. The people were appraised with many conservation strategies such as avoiding elicit poaching, use of dynamities, fish poisons, small sized nets and removal of building material from river beds, etc.

The staff members of the Institute both scientific and technical including administrative staff were deputed for various training programmes to enlighten them about the new developments in their respective fields. Scientists of the Institute also participated in the various seminars, symposia, workshops and conferences and presented their scientific



achievements. The Institute in turn imparted training to participants from Tehri Hydro Development Corporation. Ltd., Tehri—Garhwal, fish farmers of the Uttaranchal state and NEH personnel on the different aspects of coldwater fisheries resources, coldwater fish culture, breeding, disease management, the crafts and gears used in coldwater fisheries, etc. In the mass awareness programme of the Institute the scientists appraised the local masses, visiting students, dignitaries, etc. about the different aspects of coldwater fish and fisheries.

The meetings of the various committees of the Institute viz., Research Advisory Committee, Staff Research Council, Official Language and Institute Joint Staff Council were held as per schedule. The respective committees discussed the various agenda items and provide guidelines for the proper management and smooth functioning of the Institute and the research activities.

The NRCCWF family is representative of the diverse cultures of the country and each member participated in celebration of various national days, events with genuine spirit of communal and cultural harmony.

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INTRODUCTION

Establishment and growth

Indian Council of Agricultural Research (ICAR) established the National Research Centre on Coldwater Fisheries (NRCCWF) on September 24, 1987. The main objective of its establishment was to strengthen fishery research in Coldwater sector, encompassing the Himalayan and Penninsular parts of the country. The Centre till September 2003 operated from three rented buildings in Bhimtal, located in the state of Uttaranchal. But shifted to its campus at Bhimtal Industrial Area w.e.f. September 05, 2003. The Institute has a field centre located in Chirapani in the district Champawat of Uttaranchal state which is operating from January, 1992.

Mandate

- Evaluate and assess the coldwater fisher resources in upland regions.
- Develop strategies for their conservation and management.
- Conduct research leading to development of suitable technology for farming of indigenous and exotic fish species in uplands.
- Study the impact of environmental changes on the aquatic bio-diversity in upland openwaters.
- Undertake transfer of technology through training, education and extension programmes.
- Consultancy services in different areas like coldwater fisheries development, aquatic ecology and environment impact assessment.

Location

The headquarters of NRCCWF is located at Bhimtal at an altitude of 1470 m asl in the district of Nainital of Uttaranchal 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 Indra Gandhi International Airport, New Delhi. The experimental field station of the Institute at Chirapani in Champawat district of Uttaranchal State is about 150 km from Bhimtal.

Faculty

The Institute has ten scientists. There are five Principal Scientists (two as per sanctioned cadre and three from career advancement scheme), two Scientist (Senior Scale) and three Scientists. More than 50% of the sanctioned scientist's posts are vacant.

Management

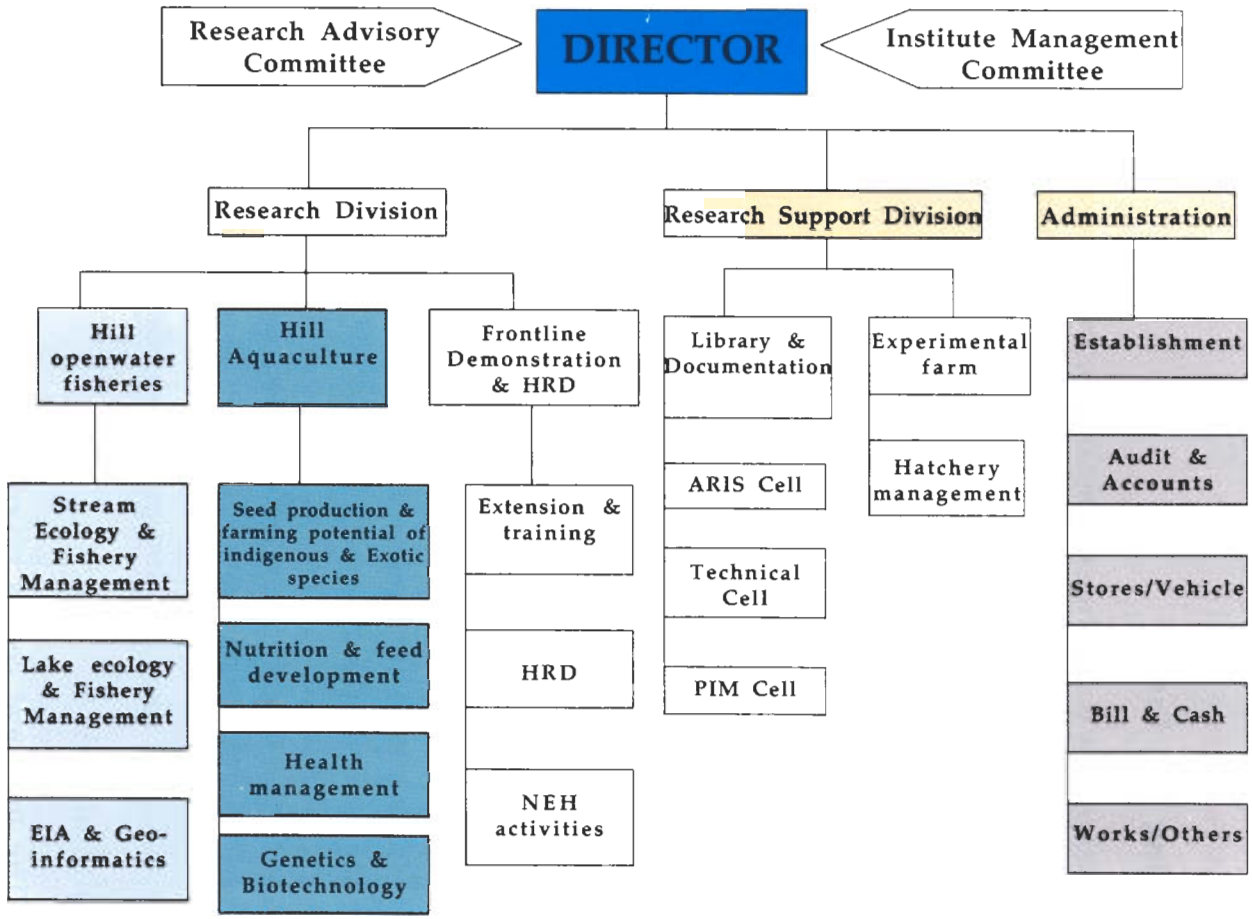
A high-powered Research Advisory Committee (RAC) guides the Centre on planning research thrust areas and new initiatives. The RAC also evaluates and monitors the progress of research activities.

The Management Committee (MC) constituted and mandated by the Indian Council of Agricultural Research under the chairmanship of the Director supervises the Centre. A number of internal committees, such as Staff Research Council, Official Language Committee, Institute Joint Staff Council are in place for decentralized management.

Organogram

The organogram of the Centre is given.

ORGANOGRAM



NATIONAL RESEARCH CENTRE ON COLDWATER FISHERIES

Research Support Facilities

Infrastructure

Building and Farm

The Institute is now functioning from its own new complex constructed at the Bhimtal Industrial Area. A pilot scale mahseer seed production unit is also operating at Bhimtal on the land belonging to the State Fisheries Department, which in addition to the mahseer hatchery houses a laboratory which provides backup facilities to seed production activities of the Centre. The Centre has an experiment fish farm facility at Chirapani in Champawat district of Uttaranchal 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.

Support Services

Project Implementation and Monitoring Cell

A separate cell called the Project Implementation and Monitoring Cell monitors the implementation and progress of research project programmes being conducted by the Centre. This cell annually organizes the meeting of Staff Research Council (SRC) 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 SRC 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, besides compilation of annual report and newsletter of the Institute.

Technical Cell

The technical cell is given the responsibilities of dealing with all technical matters within and outside the ICAR system. This cell takes

care of the training programmes, deputation, participation of scientists in seminars, symposia, workshops, meetings, etc., and organizing of conferences.

Library Section

The library of the Centre during the year subscribed six foreign and eight Indian journals. About sixty seven scientific books both Indian and foreign were also procured. The current holding of the library includes 1504 books, 1500 foreign journals, 600 Indian journals and 2200 other publications. The library provides services to the scientists and other staff members of the Institute apart from scholars, researchers, students and other persons from local organizations interested in scientific literature on coldwater fisheries and allied subjects. The library section has now upgraded CD ROM facilities on aquaculture, fisheries and aquatic science

Fig. 1. A view of NRCCWF library at Bhimtal

by procuring CD ROM for the years from 1971 to 2003. The library section is further continuing its efforts in collection, processing and disseminating scientific/technical information to the potential users.

Documentation Section

This section is entrusted with the responsibility of publication of scientific bulletins, brochures and pamphlets. During the current year this section published ten pamphlets and one book during the period under report.

ARIS Cell

The computer related facilities are provided to the scientists and other staff members of the Institute by this cell. This cell has taken initiative in developing formats to computerize the on-going research

Fig. 2. ARIS Cell of the Institute

project achievements. This cell also shoulders the responsibilities of providing Internet facilities and basic and advanced computer training to the staff members of the Institute. Total LAN system and internet through V-Sat has been installed in the new complex.

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.

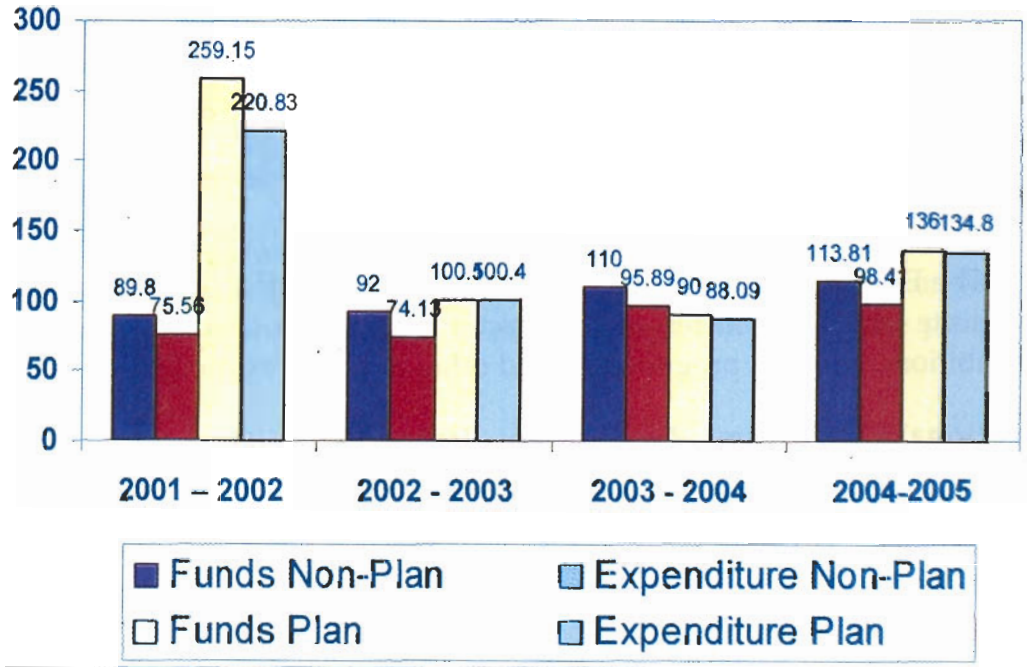
NationalAgricultural Technology Project

A National Agricultural Technology Projection on Aquaculture Management in Coldwaters was under operation (up to November 30, 2004) at the Institute as a lead centre covering the Kumaon Himalayan region for assessing the mahseer fishery potentials and culture possibilities. Implementation of the approved technical programme of the project and monitoring the progress made by the other cooperating centre in different Himalayan regions was the responsibility of the lead centre.

Financial Statement

Abstract (Rupees in Lakhs)

Year	Funds Non-Plan	Expenditure Non-Plan	Funds Plan	Expenditure Plan
2001-2002	89.80	75.56	259.15	220.83
2002-2003	92.00	74.13	100.50	100.40
2003-2004	110.00	95.89	90.00	88.09
2004-2005	113.81	98.41	136.00	134.80



Budget Statement for the Year 2004-2005

Code	Head of Account	Budget (R.E.) Plan	Budget (R.E.) Non-Plan	Expenditure Plan	Expenditure Non-Plan
02	Pay & Allowances	-	84.80	-	72.95
10	T.A.	4.00	1.20	4.00	1.17
15	Other Charges Including Equipment's	70.00	17.21	69.43	13.69
18	Information Technology	4.00	-	3.98	-
20	Works & Land	50.00	10.30	50.00	10.30
25	Other items Fellowship/ Scholarship/Awards	3.00	0.30	2.39	00.30
28	NEH	5.0	-	5.00	-
	Grand Total	136.00	113.81	134.80	98.41

Staff Position as on 31-03-2005

S.No.	Category	Post Sanctioned	In Position
1.	Director (RMP)	01	-
2.	Scientific	20	10
3.	Technical	14	11
4.	Administrative	14	09
5.	Supporting	67	44
	Total	67	44

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RESEARCH ACHIEVEMENTS

Research achievements during the year under major programme areas of NRCCWF are given below.

Open Water Fisheries

High mountain lake ecology and fishery diversity

There are large number of freshwater and saline lakes of various sizes situated at high altitudes in Himalayas, located between 3,500-5,000 m als at different latitudes. The lakes in Ladakh *viz.* Tso Morari and Pangong are the huge like inland seas. The Tsomgo, Memencho, Kupup Tso, Manju lake situated above 3,500 m als located in North Eastern region of Sikkim area important. Except Manju lake, other lakes are very large and deep lakes and very important in this area from religious and tourist point of view. These natural systems are oligotrophic to ultra-oligotrophic

Fig. 3. Kupup Tso-A high mountain lake in Sikkim

Fig. 4. Memencho lake in Eastern district of Sikkim

and normally remain ice-bound for 4-5 months in a year. In spite of their unique character, there are very few ecological studies on these lakes mainly due to difficult approach. To generate baseline data a survey was conducted on four lakes located in North of Sikkim, particularly to investigate summer limnology and fishery of these lakes in the phase manner, as round the year investigations are not possible due to their difficult accessibility and short ice-free period. The main findings of the lake are as under:

Physico-chemical characteristics

The data generated on water quality in summer period revealed that it ranged between depth 2.0 m (Manju lake) to 55.0 m (Memencho lake); Secchi 1.1-2.0m; water temperature 11.0-13.5°C; pH 6.8-7.12; dissolved oxygen 7.6 - 8.7 mg/l; free carbondixode nil-0.2 mg/l; chlorides 6.0-13.0

Fig. 5. Water quality parameters are being analysed in the laboratory

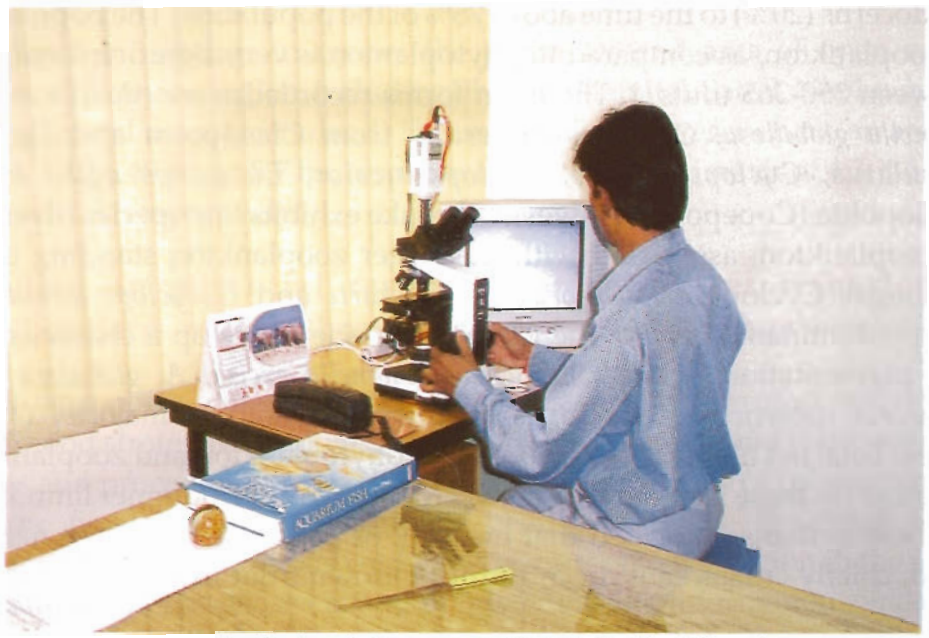


Fig. 6. Analysis of biotic parameters in the laboratory

mg/l; DOM 16.0-38.0 mg/l; TDS 8.9-18.8 mg/l; total alkalinity 6.0-13.0 mg/l; specific conductivity 17.7-28.0 micro mhos at 25°C; total hardness 6.8-8.2 mg/l; calcium 0.80-1.65 mg/l; magnesium 0.57-1.39 mg/l; nitrite 0.01-0.3 mg/l; nitrate 1.5-9.0 mg/l; ammonium nil-0.15 mg/l; phosphate nil-0.05 mg/l; silicates 0.3-1.8 mg/l; sulphide nil-0.01 mg/l; copper 0.01-0.05 mg/l; iron nil-0.01 mg/l; and manganese 0.04-0.16 mg/l.

Biotic communities

Freshwater lakes in this region hold low population of phytoplankton contributing marginally towards carbon fixing at various levels, while zooplankton have a sizeable population on almost all the lakes. The bacillariophyceae is the main group contributing above 80% of the phytoplankton population of approx. 510-750 units/l. Main dominant forms recorded in the group are *Tabelarria fenestrata, Syndra ulna, Diatoma vulgaris, Fragilaria capucina* etc. Zooplankton, mainly contributed by the community of crustacean Copepods (75%) and Cladocerns (20%) to the tune above 75% of the population. The population of zooplankton, as compared to phytoplanton is very significant ranging between 350-365 units/l. The main forms recorded were *Alonella excisa, Alonella globulosa, Chydorus sphaericus* from Clasdocera and *Cyclops serrulatus, Cyclops vividis, Cyclops bicolor, Eucyclops agilis* from Cyclopoida (Copepoda). However, the lake exhibits low species diversity of zooplankton, associated with the larger zooplankton standing crop. Amongst Cyclopoids, *Mesocyclops leuckarti* and *Eucyclops serrulatus* are predominant species. The Copepod species develop a characteristic red pigmentation, while Cladocerns (*Alonella excisa, A. globulosa* and *Chydorus sphaericus*) develop dark brownish colour in majority of the lakes. Total net biomass (wet biomass of phytoplankton and zooplankton together) in these lakes ranged between 4.0-15.0 mg/l. Summer limnology of these systems, indicated that majority of lakes offer excellent natural food, chiefly crustaceans for introduced brown trout fish.

Fish and fisheries

Majority of the lakes offers excellent natural food for fish species feeding on zooplankton. In these lakes brown trout (*Salmo trutta fario L.*) has been stocked for sport purpose, where in some lakes (Memencho lake) a self-sustaining population has got established. However, no indigenous fish fauna is recorded from these lakes, a remarkable feature of these systems. These systems as the data revealed are the unique and can be utilized to raise trout fish stocks in the area to promote angling cum tourist industry. However, presently these lakes are important from religious and tourist point of view. Besides, eco-tourism, these systems have the potential value for providing fish to poor people of this region, where the diet is deficient in protein and particularly to para military personnel posted in these remote areas.

Characterization of coldwater fishery resources of Uttaranchal using GIS

Based on satellite imageries the perimeter and area of open water bodies of Kumaon region, including Bhimtal, Nainital, Sattal, Naukuchiatal and Garurtal were ascertained. The above lakes at present have an area of 45.13, 54.29, 48.9 and 5.7 ha, respectively with the perimeter of 4.3, 4.6, 6.2, 3.1 and 1.3, respectively.

Studies on potential resources of coldwater fisheries in northeastern region through stratified multistage sampling

In the north-eastern region, fishery is one of the most important livelihood strategies employed by the rural households and if appropriate plans and procedures are applied for the developments of fisheries in the region, no doubt maximum of the people would be benefited. Even though there are enormous coldwater resources in the region in the form of natural lake/beels, rivers and ponds but as the information available, they have not properly been harnessed for fish production on scientific

lines. To get more reliable and complete information on the use of these aquatic resources, a thorough survey is required which ultimately would reflect their present status, current use and fishery potential. Moreover, the investigation would also highlight the future expansion prospect, if any for multiple uses of these water bodies including the fisheries. Keeping in view of the above points, present study is taken up to collect detail information on potential resources for developing aquaculture so that it will lead to an appropriate planning of success.

Arunachal Pradesh has been selected as the target state for the running year. Preliminary survey is essentially required to get the basic information on availability of coldwater bodies in the state in terms of area / length to make a list of all the coldwater bodies in the state. Arunachal Pradesh has a rich fish fauna with more than 150 species with 20% coldwater and about 80% admixture of cold water and warm water species. The majority area of Arunachal Pradesh falls under high altitude i.e., above 1200 m asl, the favorable habitat for coldwater fishes. The lentic and lotic water-sheds for coldwater fisheries are available in almost all the districts. The major coldwater fish species of this state are: *Schizothorax richardsonii, Schizopyge progastus, S. esocinus, Scizopygopsis stoliczkae, Garra* spp., *Glyptothorax* spp., *Noemacheilus* spp., *Euchiloglanis* spp., *Pseudecheneis sulcatus, Labeo pangusia, Labeo dero, Semiplotus semiplotus* and mahseer. Among these *Schizothorax richardsonii, Schizopyge progastus, S. esocinus, Scizopygopsis stoliczkae* species constitute the principal coldwater fishes of this state.

The rivers of Arunachal Pradesh (Kameng, Dikrong, Ranga, Subansiri, Siang, Dihang, Dibang, Lohit, Noadihing and Tirap) are steep and turbulent, often passing through deep gorges. Upper reaches of the rivers in this state are suitable for cold water fishery. Arunachal Pradesh has 2500 ha of beels / lakes, important ones of which are located in Lower Subansiri, Chhanglang, Lohit and Tirap districts. Many high altitude lakes are also available in these states which are suitable for stocking coldwater fish species.

Almost all the people of this state consume fish in their everyday meals in different forms. Thus, fish forms an important constituent of the diet of majority people of the state. Even though the potentials of fisheries development in the state are immense and above all, the level of exploitation and utilization of the resources for fishery purpose is very low (only about 30% of the total available resources in the state are utilized). This may be because of fishery development remained a comparatively neglected area in the developmental plans of the state as evidence that the state is investing a meager amount of below 1% of the total budget in fishery sector over state plan. Moreover, no single aquaculture practice can be emphasized in Arunachal Pradesh in view of the much diversified climatic conditions ranging from tropical climate of the foot hills through sub-tropical/temperate to the alpine conditions. The conventional aquaculture techniques developed elsewhere in the country could however, be extended with necessary modifications by incorporating the locally available species of fish prevailing in the agro-climatic conditions of the varies locations.

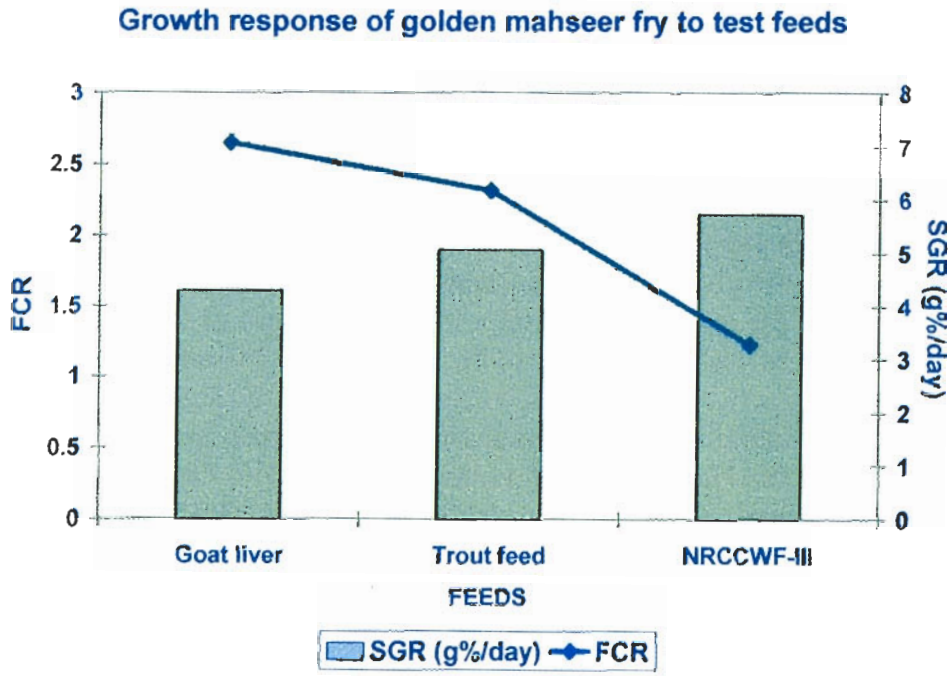
Aquaculture

Formulation of improved feeds for various growth stages of Himalayan mahseer

Experiments were conducted to ascertain the influence of a conventional feed, commercial feed and a formulated practical feed on growth, feed efficiency, survival and body composition; effect of feeding frequency on food consumption and growth and the use of a polycarboxylic organic acid as feeding stimulant for age-0 Himalayan golden mahseer.

Impact of a conventional feed, a commercial feed and a formulated practical feed on growth, feed efficiency, survival and body composition of age-0 Himalayan golden mahseer

Himalayan golden mahseer fry were fed with a conventional feed, a commercial feed and a formulated practical feed viz., goat liver, trout



feed (obtained from Himachal Pradesh State Fisheries Department) and NRCCWF-III feed (developed by NRCCWF, Bhimtal), respectively. In fish fed with the NRCCWF-III feed net weight gain was 30% more than the fish fed with trout feed and about 85% higher than the fish fed with the goat liver. Similarly percent weight gain and SGR were higher in fish fed with the NRCCWF-III feed compared to fish fed with the trout feed and the goat liver. Feed conversion ratio and feed conversion efficiency were better in fish fed with the NRCCWF-III feed was about 85% mare than that for fish fed with the trout feed and the FCE of fish fed with the NRCCWF-III feed than the fish fed with the trout fed and the goat liver. FCE of fish fed with trout feed in turn was higher than that for fish fed with goat liver by about 15%. Survival rate was highest (94%) in fish fed with NRCCWF feed compared to fish fed with the trout feed (88.28%) and goat liver (81.99%). On conclusion of the trial the body composition of the test fish fed with all the three diets was more or less similar except for the lipid content which was higher in fish receiving NRCCWF-III diet by

about 29% and 40% than the fish fed with the trout feed and the goat liver, respectively.

Feeding trials with the test diets-NRCCWF-III, trout feed and goat liver on growth performance, feed efficiency, survival and body composition of age-0 Himalayan golden mahseer revealed that net weight gain, percent weight gain, specific growth rate, feed efficiency and survival were higher in fish fed with the NRCCWF-III diet compared to fish fed with all other diets, namely, trout feed and the goat liver. The trial infers that NRCCWF-III feed is beneficial for the growth of age-0 Himalayan golden mahseer in hatchery.

Feeding frequency influences the food consumption and growth of age-0 Himalayan golden mahseer

The importance of feeding frequency on growth, feed efficiency and meal size was examined by feeding age-0 Himalayan golden mahseer four times a day, three times a day, two times a day and once a day. Fish fed three times a day attained higher net weight gain, percent weight gain and specific growth rate than for the fish fed once and twice per day. With increasing feeding frequency from one time per day to three times per day there was an increase in weight gain, percent weight gain about 60% and SGR by about 43%. Further the net weight gain, percent weight gain and SGR in groups fed once and twice daily were consistently lower than in the groups fed three and four times daily. Feed conversion ratio and feed conversion efficiency did not differ much among the four treatment groups; however, they were better by about 16% in fish fed three times per day compared to fish fed once and twice per daily. Feeding rate and absorption rate increased with increasing feeding frequency. Feeding rate increased from the groups fed once to that fed three times a day by about 33% and decreased by about 7% in groups fed four times a day. Similarly, absorption rate increased from fish fed once per day to fish fed thrice per day by about 38% and with further increase in feeding frequency to four times per day it decreased by about 9%. However, the absorption

efficiency did not differ to a greater extent among the treatment groups. Meal size increased with increasing feeding frequency from one feeding per day to three feedings per day by about 17% and with further increase in feeding frequency to four times a day it decreased by about 5%.

Hence, feeding frequency had a significant effect on food consumption and growth in mahseer. Both food consumption and growth increased with increase in the number of meals per day up to three meals, further increase in feeding frequency did not result in greater growth. Since, the food consumption and growth were not significantly enhanced by increasing the number of meals from three to four.

Use of a polycarboxylic organic acid as feeding stimulant for age-0 Himalayan golden mahseer

An experiment was undertaken to assess the potential of a plycarboxylic organic acid, citric acid as a feed stimulant in culture of age-0 Himalayan golden mahseer. Fish fed with the diet containing 0.04 M ctric acid exhibited better growth performance in terms of net weight gain, percent weight gain and SGR compared to fish fed with the control diet and diets containing 0.02 M and 0.06 M citric acid. With increase in concentration of citric acid in feed from 0.0M to 0.04M there was an increase in net weight gain, percent weight gain and SGR by about more than four times. But with further increase in concentration of citric acid in feed up to 0.06M, the values for net weight gain, percent weight gain and SGR decreased than those for fish fed with the 0.04M feed, however, these values were higher than that for fish fed with 0.0M and 0.02M citric acid containing diets. Feed conversion ratio and feed conversion efficiency were better in fish fed diets containing citric acid compared to fish fed control diet. Fish receiving 0.04M citric acid displayed higher feed efficiency by about 28-44% than those of fish fed with 0.0M, 0.02M and 0.06M citric acid. Survival percentage was found to be more or less similar for all the treatments and was found to range from 95-99%.

Citric acid, an organic acid found in citrus group of fruits can safely be used as feed stimulant in aquaculture of age-0 mahseer as it is not a chemical which may remain as residue in fish tissue and pose hazards to them and also to the consumers. This safe and cheap ingredient offers immense potential for increase in production.

Screening of growth related biochemical parameters in mahseer

The total DNA content and total carcass protein showed a increasing trend in 90 days of feeding trial with maximum levels on feeding diets having 38.7% protein as compared to feeds with 20.9% and 31.9% protein levels. Digestive enzymes amylase and alkaline protease exhibited increasing trends up to 45 days of feeding trials with growth followed by a decrease to a constant levels on subsequent feeding regime up to 90 days irrespective of level of proteins given in feeds. Other biochemical

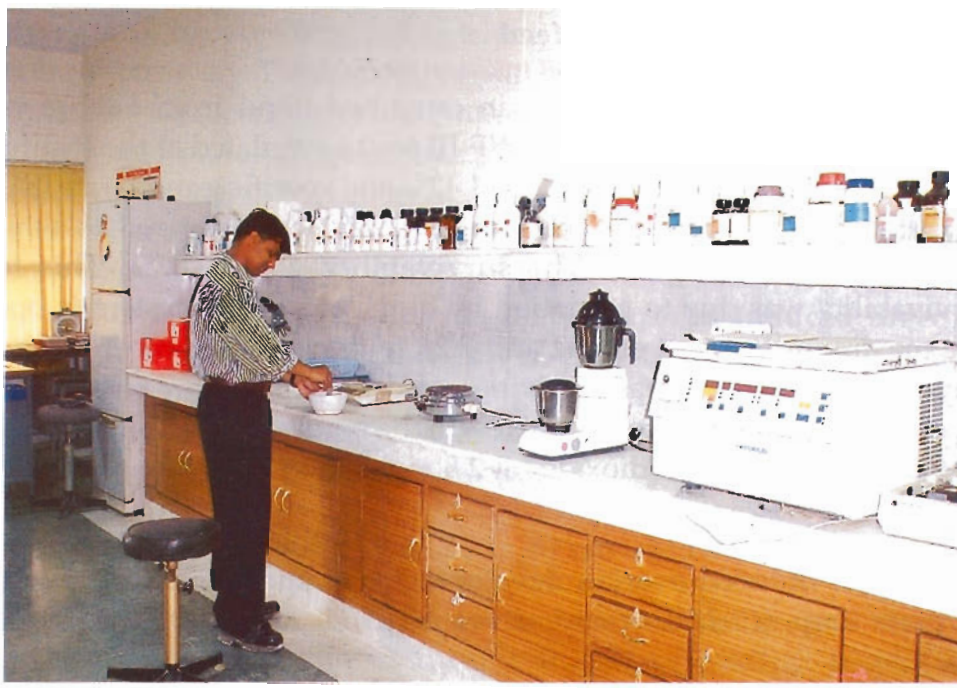


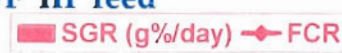
Fig. 7. Proximate composition of feed being analysed

identities tested such as lactate dehydrogenase and transaminase did not exhibited any trends with growth of fish.

Amino-acid profile of different life stages of Himalayan golden mahseer

The amino acid profile of egg, fry, fingerling and adult indicated that essential amino acids namely isoleucine, leucine, phenylalanine, valine, and threonine decreased by 1.69, 2.95, 0.98 , 2.21 and 0.78%, respectively from egg stage to fingerling stage of 52-65 mm size. But other essential amino-acids namely lysine, methionine, histidine and arginine increased by 1.42, 0.16, 0.50 and 1.24%, respectively. When amino acid profile of fingerlings of 52-65 mm size was compared with adult fish of 220-250 mm size, the variations were not much significant except glycine which increased by 1.69% and lysine decreased by 1.05% in the whole fish.

Field trial of NRCCWF III feed



Golden mahseer were reared in cemented pond from February to October 2004 and fed with NRCCWF-III feed formulated at the Institute. The percent weight gain was 833.04±1.42% and specific growth rate (SGR) appeared better in summer days (1.06%/day) as compared to winter months (0.20±0.04%/day). The survivability was 56.57%. This low survivability was due to predation by birds, etc. as the system is open. The maximum increase of 6.02 and 2.26 folds were also recorded in β-amylase and total protease activities of digestive enzymes during the experiment. Water quality parameters in the pond were dissolved oxygen 5.0-9.0 mg^{-1}; free carbon dioxide nil-2.8 mgl^{-1}; total alkalinity 60-80 mgl^{-1}; temperature 3.0-23.6°C and pH 7.1-7.7.

Studies on induced ovarian development, maturation and spawning of grass carp (*C. idella*) and silver carp (*H. molitrix*) in coldwater

Studies have revealed that fishes grow, mature and breed according to the water temperature which exhibit variations at different altitudes. The

induced breeding technique developed for silver carp and grass carp reared in tropical waters was found ineffective in coldwaters. Therefore,the project **Studies on Induced ovarian development, maturation and spawning of grass carp *(Ctn. idella)* and silver carp *(H. molitrix)* in Coldwater** was initiated in the year 2000 to investigate maturation, spawning, hatching and other related issues. Study has been completed in October 2004 and all the targets assigned have been achieved. The species under study exhibited different growth, maturation and spawning behavior in coldwater at high altitudes (1620 m asl) in comparison to their behavior in tropical waters. The fishes grow slow (0.7-0.9 9 Im) at 4.5-27.0°C), female mature at the age of 7 years and male at 6 years, fecundity reduced to 0.9 lakh against normal fecundity of 1.2 lakh/kg, require 3-4 times higher doses (1.3-1.8 mI/kg in 2-3 injections in 14-18 hrs) of spawning agent (OvaprimeIOvatide) and need long spawning and hatching period. In all experiments low fertilization (31.7-63 .0 %)was recorded. The critical temperatures for breeding and hatching was found 19-24 Oc and above 21.5 Oc respectively. The stocking density of brood biomass found inversely correlated with fecundity & maturation i.e. higher density leading to low fecundity and morel irregular time for maturation. Water temperature is a critical parameter influencing entire process of maturation and breeding. The use of sex hormones with/ without manipulation in environmental factors was found effective in reducing the maturation period from 1-2 years. After a series of experiments, a standardized **Induced Breeding Technique of Grass carp and Silver carp in Coldwater** has been developed to produce their seed in large quantity in hills. The technique and *mode operendie* are sim le, eas to ado t but differ from the breeding technique applied for them in warm waters.

Demonstration of exotic carp farming in coldwater

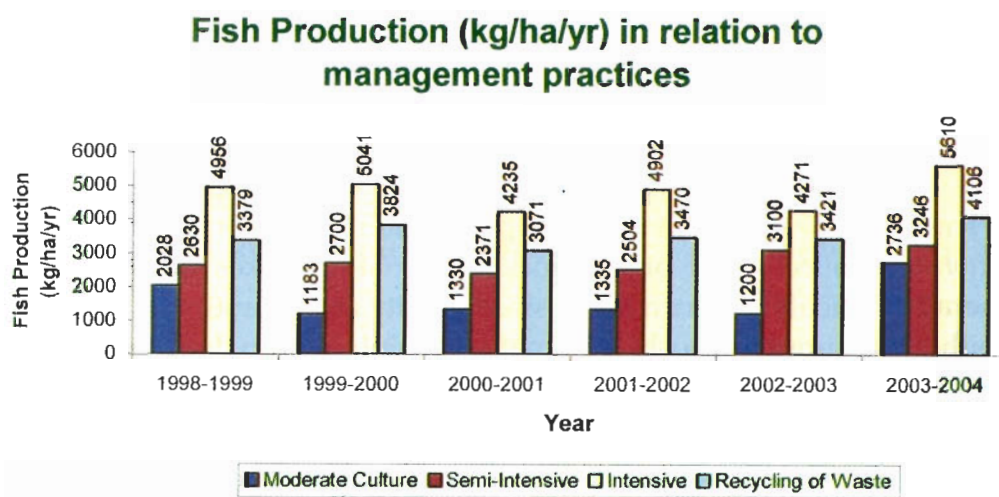
Based on the results under the previous project Culture and breeding of Exotic Chinese carps in Coldwater, the above research project was formulated and initiated in 1998 to assess the growth, survival, and production of these carps and economic viability of the carp culture

Composite carp farming technology and it's variants suitable for different hill regions (based on data for 1994-2004 at NRCCWF)

Particulars	CFCV-1	CFCV-2	CFCV-3	T -1
Arae of application (MASL)	260-800	800-1300	1300-1800	>1800
Operational period	March-Nov.	March-Oct.	April-Oct. the year	Round
Temp. Range (°C)	15.0-31.0	9.1-29.5	4.5-27.6	3.0-18.0
Nature of pond	Earthen	Earthen/RCC	Earthen>RCC	RCC
Size (m^2) & Shape	>1000, rect-angular	400-1000, rect-angular	150-400, any shape	150-200 rec-tangular
Pond depth (m)	1.8-3.0	1.8-2.0	1.5-2.0	1.0-1.5
Source of water	Rains, canal, tube well	Rains.stream	Rains/stream	Stream
Fish species**	C, R, M, Gc, Sc.Cc	R, Gc, Sc.Cc, Ma/katli	Gc, Sc.Cc	Rainbow trout
No./(m^2)	0.6-1.0	2.0-3.0	3.0-4.0	10-15
Per cent of species	10, 10,10,25, 25,20	10,35,20,25, 10	50,20,30	100
Size of fish seed (mm)	25-30	25-30	30 -40	40-50
Feed				
(i)% of body weight	1.5-3.0	2-3	2-3	5-8
(ii)@kg in 1000/ha	14-19	12-15	9-11	As per requirements
(iii) Frequency	Daily	Daily	Daily	Daily
(iv) Items***	OC+RB+WB	OC+RB+WB +FM	OC+RB+WB +SBM	Formulated
(v) Grass	Daily15% of weigh or as required	Daily10% of weight or as required	Daily10% of weight or as required	Nil
Fertilizers: every 10th day in mixture of (kg/ha/yr)				
(i) Raw cattle dung	15000	8000	5000	Nil
(ii) Urea	250	50	–	
(iii) S. phosphate	300	100	–	
(iv) Oil cake	100	50	50	
Liming every 10th day (kg/ha/yr)	250	300	300	Nil
Monitoring growth, health, water quality	Every month	Every month	Every month	Every week
Harvest	Early Dec.	Mid Nov.	Early Nov.	On attaining marketable size
Expected harvest (kg/m^2)	1.0-1.2	0.6-0.8	0.4-0.6	
Range of fish wt. (kg)	0.8-2.1	0.5-1.0	0.4-0.9	0.6-0.8
Expected net profit: Rs./kg	23.00	30.00	47.00	*

* * = at a, =ro u, =mnga , c= grass carp, c= SI ver carp, c=common carp, Ma =rnahseer ,
***OC= oilcake, WB=wheat bran, RP= rice polish, FM=fish meal, SBM=soybean meal

system in Himalayan region at different altitudes under varied operative systems. The project has been completed with great success in October 2004. The cultivable species, their size and combination, growth period, feed and fertilizer requirements, different husbandry practices, impact of water and climatic cues have been identified and assessed their role to get a sustainable higher fish production at low cost. In entire hill region about 15-33% area falls under mid hills where exotic trouts and Indian Major Carps cannot be cultured because of adverse. water temperature. After conducting more then 107 experiments in the field (800-1740 m asl) a new Carp Farming System has been developed wherein three Chinese carp namely Common carp (25-35%), grass carp (30-45%), silver carp (20-25% and mahseer (5-8%) can be reared @ 2-4 fish/m2 during April to OctoberlNovember with the provision of feeds developed from local items like-ricebran/wheatbran/oilcake, soyabeerlflour or kitchen/ livestock/field waste @ 1.5- 3.0% and fertilizers like RCDlcompost at nomirfal rate with out disturbing aquatic environment enabled us to get fish production @ 0.59-0.69 kgl m^2 with moderate practices and 0.926-0.9861 m2 with intensive care at the cost of Rs. 17.50-22.0/ kg.). A standardized **Composite Carp Farming Technology** most suitable for Mid Himalayan region of the country has been developed. The technology is simple to adopt, economical viable and is capable to recycle the kitchen/



farm/agriculture wastes. Large-scale adoption of it, as demonstrated in Pati and Champawat area of the Uttranchal not only help in food production in hilly region but help in conservation and management of aquatic resources by as well. The report is finalized and being published as **Success Story**. Summaries details of the technology and its tested variants are given in table and figure.

Brood stock development and induced maturation in snow-trout

The project was initiated in November 2004 to evaluate the feasibility of maturation of natural brood stock of snow-trout and its artificial fecundation under captivity for mass scale seed production. Specimens of *Schizothorax richardsonii* of various age groups collected were stocked in cemented raceways at Champawat fish farm. Artificial diet comprising wheat bran and mustard oil cake (1:1) fortified with mineral and vitamin pre-mix was given to the fish stock @ 6-8% of body weight depending mainly on the water temperature. Regular sampling was conducted to monitor the fish health, growth, survival and maturity stages. During the winter months as the water temperature dips below 8°C, the fish growth was recorded insignificant coupled with low feed acceptability, however, in the month of March, with the increase in thermal regime, the fish has started accepting full quota of feed and slight growth (2-3g) has been observed.

Studies on induced maturation and breeding of Himalayan mahseer in pond environment

The usual practice for the seed production of golden mahseer (*Tor putitora*) is collection of brood stock from natural lakes till now. It is generally difficult to obtain the desired quality and quantity of brooders of either sex simultaneously from nature mainly due to depleted stocks, which creates a snag in carrying a regular and required seed production programme. To solve this problem, controlled maturation and breeding

of golden mahseer in captivity appears to be the only appropriate solution. The brood stock collection and their rearing in ponds is in progress.

Biotechnology

Biochemical mechanism of cold-tolerance in snow-trout

Efforts were made to rear snow-trout below 10°C up to 3°C. It was observed that fish could survive for three weeks under this low temperature conditions. The variation in protein profiles of liver and muscle tissues of test fish due to cold (<10°C) exposure were analysed with SDS-PAGE. Many variations in the expression and presence of 50-55 kD, 21-35kD and 14.0 kD proteins have been recorded due to cold exposure.

In another trial to determine the temperature tolerance limits of snow-trout, fish were maintained at 3°C, 10°C, 20°C, 25°C and 30°C temperatures. The fishes kept at 25°C swam very rapidly with increased opercula movements and lashing movements of tail. 83.34% fish survived during 96hrs of experiment at this temperature. On the other hand 100% mortality was recorded at 30°C of temperature within six hours of experiments and before death they exhibited violent behavior and try to jump out of water followed by unconsciousness. Fishes kept at 3°C settled down at the bottom with reduced opercula movements and 91.7% survivability was observed during the experiment up to seven days.

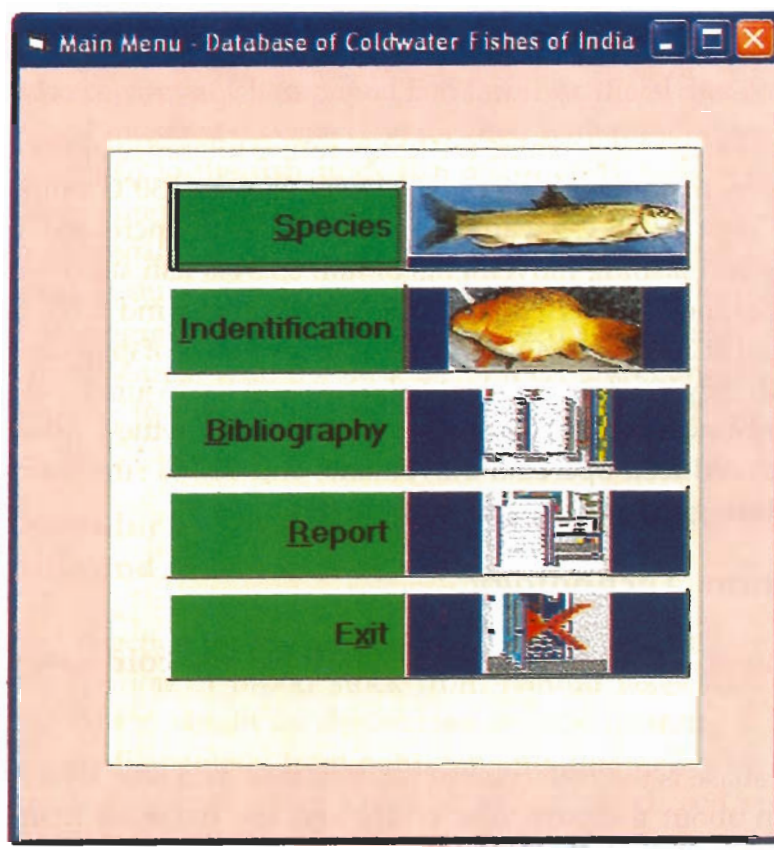
Information Technology

Development of computerized database on coldwater fishes of India

The database is the collection of inter-related data sets, which contain information about the particular entity and the database management system is a collection of interrelated files and set of programma to allow

user to add, access and modify the data. The database is efficient in retrieving and storing information. The data on coldwater fishes are available in this Institute but it is not structured to meet the user requirement. An attempt has been made to store all the coldwater fishes, which are available in Indian uplands and programme has been developed with various structural databases. Microsoft Visual Basic 6.0 software has been used in developing the forms as front-end tool and Microsoft Access 2000 for tables as back-end tool.

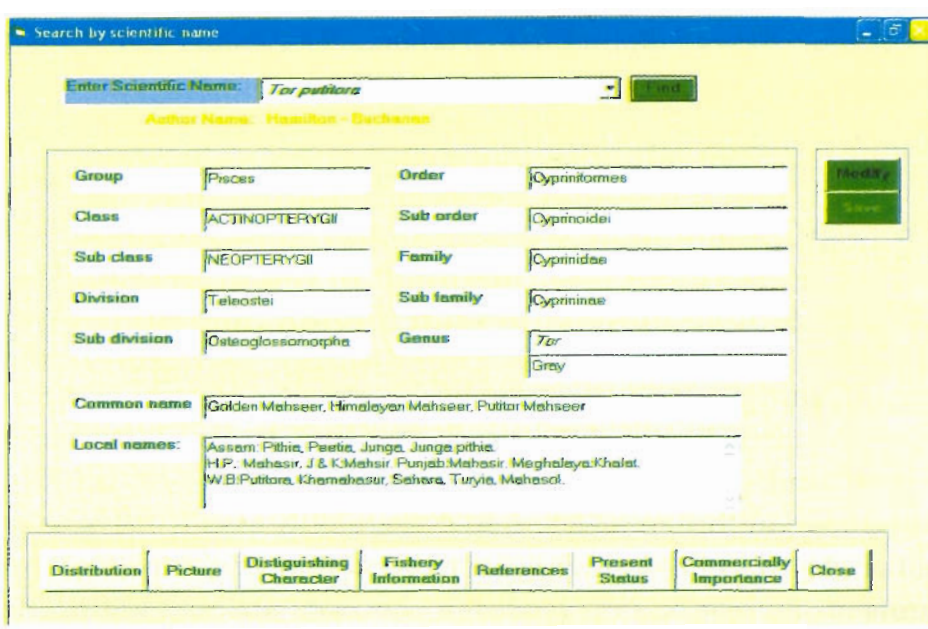
Many scientists/taxonomists have published number of literatures /books regarding the ichthyofauna of India which are in scattered



Main menu of the database

information. Hence, it was decided to make a comprehensive information regarding fishes available in India with their scientific name, local name, classification, habitat, distinguishing characters, fisheries importance, etc.

The database in consolidated from is based on the secondary available data. The database contains different modules *viz.* classification, morphological characters, habitat, distribution, biological features, breeding period and behaviour, present status, economic importance, etc. Brief morphometric and meristic characters of each fish have also been given in the modules. In this database, an attempt has also been made to compile the wealth of fishes of Upland Himalayas and make available to the readers, researchers, anglers, alongwith details of principal game fishes, role of sport fishery in development of tourism and principal fishing sites in different riverine ecosystems. The generation of database on the biological wealth of various ecosystems of this state would



Form for searching fish species by specific name

ultimately help in developing strategies for the proper management and conservation of upland fish germplasm.

The classification module contains the field names like scientific name, group, order, sub-order, class, sub-class, sub-division, family, sub-family, common names and local names, etc. The distinguishing character model contains field names likes fin formula, character of mouth, body shape, presence of barbel, shape / size of head, snout position, eye diameter, scale, color of fish, etc. The module also contains the present research effort being carried out, commercial importance of the particular species, etc.

Data on forty five species belonging to different sub-families like Cyprinianae (*Carassius, Ctenopharyngodon, Cyprinus, Labeo, Neolissochilus, Puntius, Tor*); Cultrinae (*Chela, Salmostoma*); Rasnoriane (*Barilius, Brachydanio, Danio, Raiamas, Rasbora*); Schizothoracinae (*Diptychus, Gymnocypris, Schizothorax, Schizothoraichthys*); Garriane (*Crossocheilus, Garra*); Balitotinae (*Balitora, Bhavania*); Nemacheilinae (*Nemacheilus, Triplophysa*); Botinae (*Botia*); Sisordidae (*Bagarius, Exostoma, Glyptosternum*); Salmonidae (*Onchorhynchus, Salmo trutta*) has been computerized in the form of database.

ICAR Adhoc Scheme

Artificial propagation and seed production of chocolate mahseer-*Neolissochelius hexagonolepis* (McClelland) in Arunachal Pradesh

Under work plan of the scheme detail survey of different rivers/ streams/lakes in this area were undertaken to assess the fish diversity, potential sites for collection of seed and brood stock of chocolate mahseer; experiments on rearing of juveniles of chocolate mahseer to fingerlings were initiated at Iduli Fish Farm, Roing; trials were conducted to evaluate

Fig. 8. Chocolate mahseer being reared in fish pond at Roing, Arunachal Pradesh

the growth behavior of chocolate mahseer under pond environment, a record growth range of 110.0-150.0 g/month was achieved during the summer period; the growth analyses of adult fishes of chocolate mahseer reared in earthen ponds (10m × 50m area) for about 250 days (October to July months) revealed that specific growth rate was highest (0.366) in October and low in June (0.124) within the temperature range of 12.0-32°C. However, in winter (November and December) the growth was not significant, due to low water temperature. The experiments further revealed that fishes attained a weight of 207.06 g (av. length 300 mm) after 250 days from the initial weight of 81.5 g (av. length 180 m) with a net increment of 125.56 g (length of 92.0 mm). The weight gain in relation to length of the fishes was found to be linear throughout the year, except a short fall in winter. The fishes during the experiment period were regularly fed on the supplementary conventional feed. Further rearing trials on

adult fishes of this species are in progress. Adult fishes of chocolate mahseer were reared in earthen ponds for raising brood stock of this species for undertaking artificial fecundation under captivity. A modern flow-through hatchery alongwith stock raising facilities is being established at Iduli Farm of the State Arunachal Pradesh, Roing through Rural Works Division Construction Agency of A.P. This will help in raising brood stock and producing seed of this species in captivity for culture and ranching to conserve the stocks in wild waters and the other neighbouring NE States.

Fig. 9. Broodstock harvesting at Iduli fish farm, Roing, Arunachal Pradesh

Development of pilot scale feed for culture of rainbow trout (*Onchorhynchus mykiss*) in Kumaon region of Uttaranchal

About 20,000 eyed-ova which were 18 days old were received on 16th January 2005 at Champawat Fish Farm from Trout Fish Farming Project, Kokarnag in Kashmir. After initial acclimatization the eyed-ova were

placed in hatching trays (2400 eggs/tray). After 3 days hatching began at 4.5-10°C water temperature and hatching was completed on 18th February 2005. The length of the hatchling ranged from 10-15 mm with an average of 12mm and weight ranged from of 0.1 to 0.2 g with an average of 0.15 g. The rate of survival from eyed-ova to hatchling was 90.14%. When about three forth of the yolk-sac was absorbed, the fry were fed with emulsified hen's egg yolk, finely minced goat liver and powdered trout feed. After about a fortnight, fry were fed with formulated dry feed got prepared at Department of Fisheries, Himachal Pradesh, Patlikuhl. The fry grew 15-30 mm with an average of 20mm in length and 0.2-0.4g with an average of 0.32 g in weight after one month. The rate of survival from hatchling to fry was 96.10%. The fry grew 30-40mm with an average of 35 mm in length and 0.4-0.6g with an average of 0.5 g in weight in three months. The rate of survival during third month was 96.20%. The rate of survival from eyed-ova to advanced fry up to 31st March 2005 was about 83.34%. The mortality (about 10%) during first month was due to handling during transportation of eyed-ova from Srinagar to Delhi by Flight and from Delhi to Champawat by road. Water quality parameters during incubation period were dissolved oxygen 6.8-12.8 mg/l; free carbon dioxide 0.6-2.2 mgl^{-1}; total alkalinity 16.0-24.0 mgl^{-1}; temperature 4.5-18.5°C and pH 6.8-7.1.

An experiment was carried out to ascertain the impact of fry density, feeding rate and feeding frequency on the growth and survival of rainbow trout. Rainbow trout fry were stocked at varying densities and the feeding rate was adjusted to 12%, 10% and 5% and feeding frequency to four times a day, three times a day and two times a day in tanks holding 25, 50 and 75 number of fry, respectively. From the initial length of 38-72mm and initial average weight of 1.00-1.67 g, the fry grew to 39-95mm in length and 3.2-8.10 g in weight. The weight gain, specific growth rate and feed efficiency were found to be better in tank holding 25 fish, where fish were fed 12% of their body weight and four times in a day. Water quality parameters during the experimental period were dissolved oxygen 6.4-6.7 mgl^{-1}; free carbon dioxide 1.0-1.2 mgl^{-1}; total alkalinity 19.4-19.6 mgl^{-1}; temperature 19.0-19.4°C and pH 7.0-7.2.

National Agriculture Technology Project (NATP)

Aquaculture management in coldwaters: Evaluation of mahseer fishery potential and its farming feasibility for conservation in Himalayan region

As a Lead Centre of National Agriculture Technology Project, various aspects of mahseer fisheries in Himalayan region were studied and analyzed during the period under report.

Restoration of mahseer fishery in Shyamlatal lake-a conservation strategy

Despite their abundance at one time, the golden mahseer stocks have declined very rapidly in number and size in most of the Himalayan resources. Hence a strategy was formulated to regenerate the fishery of golden mahseer in such a water body, which was completely devoid of

Fig. 10. Golden mahseer catches from Shyamlatal lake

mahseeer and can serve as model for conservation of fish germplasm. The Shyamlatal lake in Kumaon region was selected for stock building of golden mahseer to conserve its germplasm and further to propagate the species with mass production of its seed. After initial stocking of 7000 golden mahseer fingerlings (35-90 mm in length and 1-6 g in weight) during October-March 2000-2001, its growth and establishment was maintained regularly. The final netting operation carried out during August, 2004 revealed that the mahseer has established well in this lake with 86.0% recovery in the operational fishing. The size of the fish netted out ranged 335-590 mm in length and 310-2170 g in weight. Hence the results are indicative of establishment of sustainable fishery of golden mahseer in this lake and the stocks build up in the lake ensure the availability of brood fishes for propagation purposes.

Seed production of golden mahseer at Bhimtal

Due to non-availability of mature spawners of golden mahseer in the streams, the breeding trials were made at Bhimtal in cooperation with the hatchery staff of NRCCWF, Bhimtal during 2004-2005. It has been observed that the production of the ripe eggs in the first spurt of mahseer varies greatly irrespective of their size. As against its fecundity 8218-39850 eggs kg^{-1} body weight, the average egg production ranged 300-9000 eggs kg^{-1} body weight. The survival rate for the eggs achieved was as high as 92.4% during present study. The fry production in Bhimtal hatchery is in the tune of 50000 to 100000 per year in accordance with the production of eggs from the wild spawners collected from Bhimtal lake.

Raising of mahseer seed in newly fabricated coldwater fish seed hatchery

The experiment conducted on raising of stocking material of golden mahseer in newly fabricated coldwater fish seed hatchery at Chirapani Fish Farm, Champawat revealed better growth performance and survival of mahseer fry collected from nearby streams. In all 850 fingerlings of

Fig. 11. Golden mahseer hatchery at NRCCWF, Champawat

golden mahseer (60-90 mm in length and av.wt. 2g) stocked during mid August, 2004 and after rearing for 45 days 598 Nos. of the size 72-130 mm in total length and 3.8 g in av.wt. were recovered in the first week of October, 204 and released in Shyamlatal lake. During present observations

Fig. 12. Raising of golden mahseer seeds (fry) in the hatchery troughs at Champawat

the water temperature of rearing trough in the hatchery ranged 18.6-25.2°C whereas in the ponds outside the hatchery it was 13.5-21.6°C.

NEH Activities

Fisheries research and development activities in NEH region

The North East region (Lat. 21.57° -29.300 N; Long. 88° -97.30° E) comprise the states of Arunachal Pradesh, Assam, Manipur, Mizoram, Megllalyaa, Nagaland, Sikkim and Tripura covering all area of 2.62 lakh sq. km. The North East India is mostly hilly and only about 30% area is plain on both sides of the river Brahamputra and Barak. Mountain and hills cover most of Arunachal Pradesh, Mizoram, Meghalyaa, Nagaland and Sikkim. Some part of Assam, Manipur and Tripura also are hilly. The topography of the region varies from few meters from sea level to Snow Line Mountains and has different kinds of agro climatic zones. This area receive highest rainfall during prolong rainy season from March to October. As a result aquatic resources in form of rivers, stream, lakes, reservoirs, bheels, swamps and ponds are vast and varied. Icthyofauna is rich and more then 267 fish species have been reported. Commercially important group of fishes are Mahseer, *Schizothorax spp.*, *Barils* and Carps.

The coldwater fisheries occupy a prominent position especially in Arunachal Pradesh, Meghalya, Nagaland, Sikkim, Manipur, part of Assam and Mizoram. National Research Center on Coldwater Fisheries, Bhimtal recently has stepped in NE region and doing hard efforts to collect more and more information on coldwater fisheries, developing close liaison with the agencies, authorities and the locals who have common interest and stake in cold water sector development. The aim is to prepare a blueprint for coldwater fisheries development for the region. To achieve these objectives NRC on coldwater fisheries Bhimtal has initiated fisheries research and development activities in the region giving priorities to the state of Arunachal Predesh and Sikkim.

Survey of fisheries resources

To manage the fish and fisheries in NEH region on scientific line a collaborative programme, Rapid Survey of Fisheries Resources in Arunachal Predesh is in progress. The qualified and trained students from Zoology Departlnent, Rajiv Gandhi University, Ronohill, Itanagar have been engaged to cover all the 14 districts of the state. The data pertain to morphology and bioecoology of all aquatic bodies and fish biodiversity therein is being recorded. In addition, this ground survey work will be validated through GIS.

Fish biodiversity in Arunanchal Pradesh

The rivers/ stream namely Deopani, Epipani, Diha, Enjupani, Dibang were surveyed and recorded 26 fish species dominated by *T putitora T progenies, Neolissochilus hexagonolepis, N. hexastichu~', Schizothorax richardsoni, Schizothoraichthys progastus, Labeo t{vocheilus,* . Among the surveyed streams the Deopani was found having abundant stock of Katli. Shally, a closed lake having an area of 2.0 ha and famous for mahseer angling exhibit good stock of Ka~li and minor carps. The introduced IMC and Chinese carps figure well in catch. Good spawner in wild is available. It is an ideal place for setting up a mahseer hatchery for seed production.

Aquaculture development in Sikkim

A site for demonstrating Composite carp fanning involving Chinese carps and Chocolate Mahseer with the provision of feed plus fertilizers has been identified at ICAR Complex Tadong near Gangtok. The pre-stocking management programme is completed and stocking of seed is to be done. The farmers of the region will be involved at every step to demonstrate them each and all aspect of the technology.

Aquaculture development in Arunanchal Predesh

In total 14 sites have been identified with the help of Arunanchal University / State Fisheries Department to demonstrate Coldwater Aquaculture programme in the state. The identified ponds are:

All the ponds have been stocked with fish seed of grass carp, silver carp, common carp, rohu / mahseer @ 5-6 fish / m2 in a judicious combination according to productivity of the pond. The drawn schedule of feeding and fertilization is being followed. The farmers have been given all information

S. No.	No. of pond	Location	Name of owner
1.	2	Vill. Suluya, Zero District	Mrs Shanti Devi
2.	1	Vill. Rari , Zero	Mr. Rage Tago
3.	1	Vill Siro, Zero	Mr.Rage Dollo
4.	1	Vill Tazang, Zero	Mr.Millo Tade
5.	2	Vill. Dozji, Along, W.Siangi	Mr. Gum ken Bagra
6.	1	Vill. Dozji, Along, W.Siangi	Mr. Gedo Doji
7.	2	Vill. Dozji, Along W. Siang	Mr. K. Bagra
7.	1	Vill. Dozji, Along, W.Siangi	Mr. Darik Doji
8	2	Vill Liru, Likabali, Siang	Mr.Nei Taripodia
9	1	University Campus	Mr.Nangram Taglik

regarding composite carp farming system, Two students of AP university Itanagar, trained at NRC on Coldwater Fisheries Bhimtal will coordinate the fish culture activities. All the recurring expenditure on fishery inputs involved during demonstration program is being borne by NRCCWF.

5

TECHNOLOGY ASSESSED AND TRANSFERRED

TRANSFER OF TECHNOLOGY

- The newly developed technology "**Composite Carp Farming Technology**" is being transferred to the farmers of Kumaon region Uttaranchal. More then 102 fish farmers have adopted it and doing fish culture successfully and economically. These farmers have been organized in SELF HELP GROUP and getting fish production @ 0.59-0.69 kg m^3 with moderate practices and 0.926-0.986/m^3 with intensive system at the cost of Rs. 17.50-22.0/kg. The technology is ready to take off in the rural area of Arunachal Pradesh too.

EVENTS

- NRC's work profile/achievements and various conservation strategies were displayed in coldwater fisheries stalls in the exhibition organized by Indian Society of Fisheries Professionals, Mumbai at IARI Auditorium, Pusa, New Delhi during 4-6 November, 2004.

- NATP's findings on mahseer fisheries sub-project were displayed in the exhibition organized at CSWCR&TI, Dehradun during August 10-11, 2004.

- Matter relating to conservation of mahseer and its resources was displayed at Dadupur, Yamunagar, Haryana during Angling Competition in West Yamuna canal organized by State Fisheries Department, Haryana on October 10, 2004.

6

EDUCATION AND TRAINING

Training

- Training on 'Mahseer Breeding and Culture' was imparted to the participants from Tehri Hydro Development Corporation. Ltd., Tehri—Garhwal during August 19-20, 2004 organized by NRCCWF, Bhimtal.

- A training programme on *'Parvatiya Shetraon Mai Matysa Palan Avam Utapadan'* was imparted to the fish farmers of the Uttaranchal state. The training was organized by Jan Shikshan Sansthan, Bhimtal in collaboration with NRCCWF, Bhimtal during October 11-16, 2004.

- A training programme on 'Emerging Trends in Coldwater Fisheries Research and Development' was organised by NRCCWF in collaboration with CIFRI at Gwahati for NEH personnel during December 6-10, 2004.

- Shri, N.O. Singh, Scientist successfully completed the 78th FOCARS training programme at NAARM, Hyderabad during August 10 to December 7, 2004.

- An in-house training programme on 'Usage of Internet/Email' was organized for the scientist of this Institute. The training was conducted during January 6-7, 2005.

- Shri A.K. Nayak, Scientist attended a Summer School on 'GIS Based Decision Support System for Sustainable Agriculture' at National Academy of Agricultural Research Management, Hyderabad from July 1-21, 2004.

- Shri A.K. Nayak, Scientist attended a training programme for Nodal Officers on 'Personnel Management Information System Network in ICAR (PERMISnet)' at Indian Agricultural Statistics Research Institute, New Delhi from August 17-18, 2004.

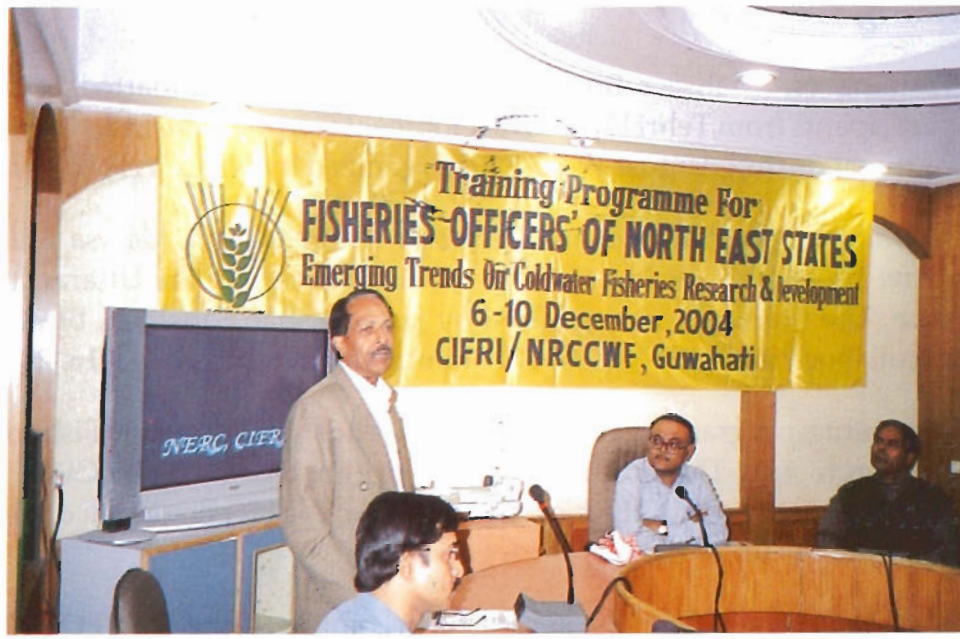


Fig. 13. Dr. B.C. Tyagi, Principal Scientist and Nodal Officer NEH region addressing the fisheries officers of NE states of Guwahati

- Dr. Rajeev Kapila, Scientist (Senior Scale) attended the Winter School on 'Production and Purification of Recombinant Proteins in Heterologous Host Systems' at Molecular Virology Laboratory, Indian Veternary Research Institute, Bangalore during November 4-24, 2004.

- Dr. Rajeev Kapila, Scientist (Senior Scale) and Shri Prem Kumar, Scientist attended training programme on 'Genotoxic Assays in Fishes' held at NBFGR, Lucknow during February 22-28, 2005.

7

AWARDS AND RECOGNITION

- Dr. Madan Mohan, Director was conferred with "Scientist of the Year" Award-2004 by the National Enviornmental Science Academy, New Delhi.

8

LINKAGES AND COLLABORATIONS

Linkage with North-East

A collaborative project between NRCCWF and Department of Fisheries, Government of Arunachal Pradesh on 'Artificial Propagation and Seed Production of Chocolate Mahseer, *Neolissochelius hexagonolepis* (McClelland)' has been initiated in July 2003. The project is located in Lower Dibang valley, Roying District of Arunachal Pradesh and is supported by ICAR. In view of the importance on northeastern Himalayan region and particularly for this fish species, the Institute realized to explore possibilities on artificial propagation of this species for producing its seed for planting in wild waters in upland regions of different states in NE region to rehabilitate/restore their stocks and improve subsistence fishery to the local fishermen and offer sport to the anglers. This will be indirect help to the income of marginal and small-scale farmers, living along the vicinity of streams and rivers of NE region.

State Agriculture Universities

The project on "Aquaculture in Coldwaters—Evaluation of Mahseer Fishery Potential and its Farming Feasibility for Conservation in Himalayan Region" funded by the World Bank under NATP approved by the Council with NRCCWF as a lead centre. The project aims at evaluation of mahseer fishery potential in the different Himalayan zones i.e. Kumaon, Garhwal, Himachal Pradesh and Jammu and Kashmir Himalayas with an integrated approach to generate reliable database on its status. The collaborating institutions—G.B. Pant University of Agriculture and Technology, Pantnagar (Uttaranchal), H.P. Krishi Vishwavidyalaya, Palampur (Himachal Pradesh) and S.K. University of Agricultural Sciences and Technology, Srinagar (Jammu and Kashmir) beared the responsibilities to enumerate the data on ecology and fishery of various mahseer waters in the respective regions. In addition, the culture technology was evolved in each of the Himalayan region for conservation of this prized germplasm and to rejuvenate mahseer fishery in the depleted waters in Himalayas.

Sister Institutes and Outside ICAR

- The Institute has linkages with other sister Institutes—CIFA, Bhubaneswar and CMFRI, Kochi.

- The Institute has developed linkages with the States Fisheries Department of Uttaranchal, Himachal Pradesh, Haryana, Gujarat, Kerala and Arunachal Pradesh for various research and development activities.

- The NRCCWF has developed a very strong linkage with the Lake Development Authorities, Government of Uttaranchal, Nainital. The Institute is very strongly involved in the implementation and monitoring of the project activities in the entire Kumaon lake District. We are very strongly involved in the programme of establishing State of Art Aquarium at the Bhimtal Island.

- The Institute has strong linkages with regards to transfer of technology programme for aquaculture in hills with—Sainik School, Ghorakhal; Birla Institute, Bhimtal; District Development Department, Champawat; Village Panchayats in Pati and Bhimtal Block and NGO's (Girideep, Bhimtal and HOPE, Pilkholi, Ranikhet).

- The Institute established linkages for the usage of watershed programmes in development of coldwater fisheries with CSWCR & TI, Dehradun.

9

PUBLICATIONS

Research Articles

- **Yasmeen Basade** and Kohli, M.P.S. 2004. Influence of dietary cholecalciferol levels on its digestibility in deccan mahseer, *Tor khudree* (Sykes), *Indian Journal of Fisheries*, 51(2): 123-131.

Departmental Publications

Books

- Proceedings National Seminar on Aquatic Resource Management in Hills. 2005. Edited by K.K. Vass, S.A.H. Abidi and Late V.P. Agrawal. Published by National Research Centre on Coldwater Fisheries (ICAR), Bhimtal and Society of Biosciences, Muzaffarnagar.

Training Manual

- Parvatiya Shetraon Mai Matysa Palan Avam Utapadan.2004. Edited by K.K. Pandey, B.C. Tyagi, Smita Nariyal and A.K. Joshi. Published by Rashtriya Sheetjal Matysaki Anusandhan Kendra, Bhimtal and Jan Shikshan Sansthan, Bhimtal. 77 pp.

Pamphlets

- Joshi, C.B. 2005. Flow-Through Hatchery for Mahseer. NRCCWF Publ. No.21.
- Joshi, C.B. 2005. Breeding Techniques of Golden Mahseer. NRCCWF Publ. No.28.
- Joshi, C.B. 2005. Trout Fisheries in India. NRCCWF Publ. No.29.
- Kapila, S. and Shyam Sunder. 2005. Streams ofKumaon. NRCCWF Publ. No.24.

- Shyam Sunder. 2005. Himalayan Environment and Fishery. NRCCWF Publ. No.25.
- Shyam Sunder. 2005. Coldwater Fish Diets. NRCCWF Publ. No.26.
- Shyam Sunder. 2005. Snow-TroutFishery in Himalayas. NRCCWF Publ. No.27.
- Tyagi, B.C. 2005. Extension Services. NRCCWF Publ. No.23.
- Vass, K.K. 2005. NRCCWF- a Profile. NRCCWF Publ. No., 30.
- Yasmeen Basade. 2005. Wetlands of Kumaon. NRCCWF Publ. No.22.

10

LIST OF ON-GOING PROJECTS

Title of the Projects	Project Leaders & Associates	Year of Start	Likely year of termination
Institutional Projects			
1. Fishery limnology of high altitude lakes in Uttaranchal, Laddakh and NEH regions.	Dr. H.B. Singh Dr. K.K. Vass Dr. C.B. Joshi	2004	2006
2. Characterization of cold-water fish and fishery resources of India using geo-informatics.	Sh. Prem Kumar Sh. A.K. Nayak	2004	2007
3. Formulation of improved feeds for various growth stages of Himalayan mahseer (*Tor putitora*)	Dr. M. Mohan Dr. R. Kapila Dr. Y. Basade	2004	2007
4. Brood stock development and induced maturation in snow-trout. *Schizothorax richardsonii*	Dr. Shyam Sunder Dr. B.C. Tyagi	2004	2007
5. Studies on induced maturation and breeding of Himalayan mahseer, *Tor putitora* in pond environment.	Dr. B.C. Tyagi Dr. Shyam Sunder	2004	2007
6. Studies on bio-chemical mechanism of cold tolerance in coldwater fish, *Shizothorax richardsonii.*	Dr. R. Kapila	2004	2007
7. Development of computerized databse on coldwater fishes of India	Sh. A.K. Nayak Dr. H.B. Singh	2004	2006

Title of the Projects	Project Leaders & Associates	Year of Start	Likely year of termination
8. Studies on potential resources of coldwater fisheries in NEH region through stratified multistage sampling.	Sh. N.O. Singh	2004	2007
Externally Funded Projects			
NATP			
1. Aquaculture management in coldwaters-Evaluation of mahseer fishery potential and its farming feasibilities for conservation in Himalayan region.	Dr. C.B. Joshi Dr. Shyam Sunder Shri A.U. Khan Shri P. Sanga	1999	2004
Cess Fund Project			
1. Artificial propagation and seed raising of chocolate mahseer, *Neolissocheilus hexagonolepis* in Arunachal Pradesh	Dr. H.S. Raina Shri B.M. Laskar Shri Azen Pujen	2003	2006
2. Development of pilot scale feed for culture of rainbow trout (*Onchorhynchus mykiss*) in Kumaon region of Uttaranchal.	Dr. K.K. Vass Dr. M. Mohan Shri. K.S. Negi Mrs. S. Singh	2002	2005

11

CONSULTANCY

The Institute is rendering consultancy services as per guidelines of the ICAR to various organizations.

"Designing of hatchery of Himalayan mahseer *Tor putitora* (Ham.) for seed production" at Tehri, Garhwal Uttaranchal a layout design of a mahseer hatchery, farm and other components/facilities has been prepared and submitted to the authorities of Tehri Hydro-Development Corporation Ltd., Tehri for implementation.

For establishment of mahseer hatchery and small farm at Pookote lake, Wyanand, Kerala, a consultancy proposal has been prepared and submitted to State Fisheries Management Society (FIRMA), Kerala which has been accepted and the work has been initiated.

For establishment of mahseer hatchery and assessing other relevant mahseer related development activities in the State of Gujarat a consultancy programme has been initiated up with the Government of Gujarat and under this programme survey of various sites has been carried out.

12

RAC, MC, SRC, QRT MEETINGS

Staff Research Council (SRC)

Annual Staff Research Council meeting of the Institute was held on June 14, 2004 at Bhimtal under the Chairmanship of Dr. K.K. Vass, the Director. In the meeting the progress of each on-going research project during the year 2003-2004 was critically discussed and evaluated. The work programme for the year 2004-2005 was finalized based on the priorities of X Plan.

Bio-manipulation project under Kumaon lake conservation

Meeting in connection with the proposed Bio-manipulation project under Kumaon lake conservation programme was held on Sept. 4, 2004 at NRCCWF, Bhimtal. Following dignitaries participated:

Dr. P.V. Dehadrai	Former Deputy Director General (Fisheries), ICAR, New Delhi
Prof. Brij Gopal	Professor and Head School of Environmental Sciences, Jawaharlal Nehru University, New Delhi
Prof. D.P. Zutshi	Former Director Centre for Research and Development, Kashmir University
Dr. K.K. Vass	Director NRRCWF, Bhimtal
Dr. K.K. Pandey	Director Birla Institute, Bhimtal
Shri Shailesh Bagoli (IAS)	SDM, Nainital & Secretary, Lake Development Authority, Nainital
Shri D.C. Pandey	Executive Engineer Irrigation Department, Nainital
Shri C.M. Shah	Project Engineer Lake Development Authority, Nainital

The meeting was held under the Chairmanship of Dr. P.V. Dehadrai, Former DDG (Fy), ICAR. The basic frame work of the proposed Bio-manipulation programme was presented before the committee by Dr. K.K. Vass, Director, NRC on Coldwater Fisheries, Bhimtal. Dr. Vass highlighted the concept of Bio-manipulation that can be implemented especially in the Nainital lake and with implications for other Kumaon lakes. Based on the interaction and responses on the presentation from various experts the technical concept of the project as proposed by the NRCCWF was appreciated by the committee and it was agreed that in consultation with the authority they should develop a proposal for submission to the lake development authority for funding. The meeting ended with a vote of thanks to the Chair.

Vision 2020 Meeting

For preparation of the revised Vision 2020 document of the Institute, as per Council's directives, a discussion meeting with the following experts was convened on September, 13-14, 2004 at the Institute. Following experts attended the meeting:

Dr. M.Y. Kamal	**Former Vice Chancellor SKUAST, Srinagar (J&K)**
Dr. K.L. Sehgal	**Former Director NRCCWF, Bhimtal**
Dr. Kuldip Kumar	**Ex-Director of Fisheries Govt. of H.P. & Advisor-cum-CEO, Govt. of H.P.**

They proposed to assess the existing coldwater fisheries resources of open and confined waters in Indian Himalayas and Western Ghats, to estimate carrying capacity of typical coldwater streams, lakes, reservoirs to obtain MSY and study impact of natural and human interference on

fragile Hmalayan water bodies and its effect on fish stocks. Further they advised to continue research relating to development and improvement in the existing culture technologies of major coldwater fishes with particular reference to trouts, Schizothoracids, mahseers and common carp leading to large scale production of stocking material and table fish. Also they emphasized on genetical, physiological, behavioural and nutritional studies on trout and mahseer, habitat restoration of selected stretches of hill streams for revival of sport fishery and to conduct education and training programmes for the personnel from Himalayan, southern upland states and adjoining South-East Asian countries.

Research Advisory Committee (RAC)

The meeting of the newly constituted Institute's Research Advisory Committee was convened during November 29-30, 2004 at Bhimtal. The committee comprised of following members:

Dr. Brij Gopal	Professor and Head School of Environmental Sciences, Jawaharlal Nehru University, Delhi	Chairman
Dr. Sarvesh Kumar	Professor and Head Department of Zoology, Kumaon University, Nainital	Member
Shri N.A. Quareshi	Director Fisheries Government of J&K, Srinagar	Member
Dr. D.N. Das	Senior Lecturer Aquaculture Unit, Department of Zoology, Arunachal Pradesh University, Itanagar	Member
Dr. V.R. Chitranshi	ADG (Inland Fisheries) ICAR, New Delhi	Member
Dr. K.K. Vass	Director NRCCWF, Bhimtal	Member
Dr. Yasmeen Basade	Scientist (Senior Scale) NRCCWF, Bhimtal	Member Secretary

At the onset the Director welcomed the Chairman and all the Members of the newly constituted RAC. After the introductory remarks by the committee members and presentation of the Action Taken Report by the Member Secretary, the progress made under each of the research projects for the year 2003-2004 and the new programmes to be taken up for the year 2004-2005 were discussed in detail. The Chairman and the Member of the committee gave recommendations for improvement of the research activities to be taken up. The meeting ended with vote of thanks proposed by the Member Secretary, Dr. Yasmeen Basade.

Fig. 14. RAC meeting in progress

Interactive meeting with RAC on Vision 2020

An interaction meeting with the RAC to discuss the vision 2020 document of NRCCWF was held on 26th February, 2005. The following RAC Members were present in this meeting.

Dr. Brij Gopal	Professor and Head School of Environmental Sciences, Jawaharlal Nehru University, Delhi	Chairman
Dr. Sarvesh Kumar	Professor and Head Department of Zoology, Kumaon University, Nainital	Member
Dr. Madan Mohan	Director NRCCWF, Bhimtal	Member
Dr. Yasmeen Basade	Scientist (Senior Scale) NRCCWF, Bhimtal	Member Secretary

The RAC recommended changes/modifications in the document with reference to Preamble, Organogram and suggested inclusion of a brief executive summary in the vision document. They also felt that the existing scientific strength is grossly inadequate to meet the objective of the Institute and its requirement to cover the entire Himalayan and Peninsular hill regions as projected in the Vision document and non-availability of land for experimental demonstration farm is a major bottleneck in the development of aquaculture programme undertaken by the Institute.

Rajbhasha Committee

The regular quarterly meetings of the Hindi cell of the Institute were convened in June, September and December months under the Chairmanship of the Director. In these meetings proposals were discussed and approved to improve the use of Hindi language in day-to-day activities of the Institute by the scientific, technical and the administrative members of staff. The Committee members include the following:

Dr. K.K. Vass	Director	Chairman (upto 27.01.05)
Dr. Madan Mohan	Acting Director	Chairman (after 28.01.05)
Dr. B.C. Tyagi	Principal Scientist	Member Secretary
Shri A.K. Nayak	Scientist	Member
Smt. Susheela Tewari	Stenographer	Member
Shri Harish Ram	Assistant	Member
Shri Amit Kumar Joshi	Hindi Translator	Member
Shri Ravinder Kumar	T-3	Member

Joint Staff Council (IJSC)

The Institute's Joint Staff Council's elections were held in April and September 2004 in respect of Administrative, Technical and Supporting staff and in October 2004 the new IJSC was constituted for a period of three years. The Institute's Joint Staff Council's meeting was held regularly at quarterly intervals under the Chairmanship of the Director and was attended by all the members from official and staff side. In the meetings action taken on previous agenda items were reviewed and various new agenda items regarding welfare of the staff were discussed. IJSC comprised of the following members:

Official side	Staff side
Dr. K.K. Vass, Director & Chairman (upto 27.01.05)	Shri T.M. Sharma, T-2 & Secretary
Dr. Madan Mohan, Acting Director (after 28.01.05)	Shri Santosh Kumar, T-3 & Member
Dr. H.B. Singh, Principal Scientist	Shri Pratap Singh, LDC & Member CJSC
Dr. Yasmeen Basade, Scientist (SS)	Shri J.C. Bhandari, LDC & Member
Dr. Prem Kumar, Scientist	Shri Ravinder Kumar, SSG-III & Member
Shri R.L. Raina, AAO & Member Secretary	Shri Prakash Akela, SSG-I & Member

13

PARTICIPATION IN CONFERENCES, SEMINARS, MEETINGS AND WORKSHOPS

Conferences/Meetings/Symposiums/ Seminars/Workshops	Participants
Round Table meeting on Impact of Inter River Basin linkages on Fisheries at NAAS, NASC Complex, New Delhi during May 21-22, 2004	Dr. K.K. Vass Dr. H.B. Singh Dr. Shyam Sunder
Workshop on Rainbow Trout Farming in Hill States with Special Reference to Trout Health and Hygiene, a NORAD sponsored workshop organized by Department of Fisheries, Government of Himachal Pradesh during May 24-25, 2004	Dr. K.K. Vass Dr. Madan Mohan Dr. Shyam Sunder
Midterm Appraisal Meeting, ICAR Regional Committee-II at Guwhati on June 8-9, 2004	Dr. B.C. Tyagi
Second meeting of Uttaranchal State Fish Farmers Development Agency chaired by the Hon'ble Minister, Fisheries and A.H. at Uttaranchal Secretariat, Dehradun on June 21, 2004	Dr. K.K. Vass
Directors' Conference and Fisheries Divisional Meeting at Delhi from July 14-16, 2004	Dr. K.K. Vass
INTECOL International Conference on Wetlands at the Netherlands organized by CGIAR Challenge Programme on Water and Food during July 25-3, 2004	Dr. K.K. Vass
Meeting of Directors' of Fisheries Institutes to discuss priority areas and the revised	Dr. K.K. Vass

Conferences/Meetings/Symposiums/ Seminars/Workshops	Participants
ASRB meeting on September 8, 2004	Dr. K.K. Vass
National symposium on Enhancing productivity sustainability in Hill and Mountain Agro-Ecosystem' organized by CSWCR&TI, Dehradun during August 10-11, 2004	Dr. C.B. Joshi
National Seminar on Official Languages-Culture and Capture Fisheries organised by Central Institute Fisheries Technology at Vishakhapatnam, on September 10, 2004	Dr. Shyam Sunder
Vision 2020 meeting of CIFRI on September 23-24, 2004 and First Interface Meeting on Aquaculture at CIFA, Bhubaneshwar on 27 & 28 September, 2004	Dr. K.K. Vass
8th meeting of National Committee on Exotics at Krishi Bhavan, New Delhi on September 30, 2004	Dr. K.K. Vass
Workshop meeting for Networking Research on Water Productivity organized by ICAR Research Complex for Eastern Region at NASC Complex, Pusa, New Delhi on October 14, 2004.	Dr. K.K. Vass
National Workshop on Integrated Aquafarming for Rural Development held at College of Fisheries, GBPUAT, Pantnagar (Uttaranchal) during October 14-15, 2004	Dr. Madan Mohan Dr. C.B. Joshi Dr. Shyam Sunder Dr. B.C. Tyagi Dr. Rajeev Kapila Dr. Yasmeen Basade

Conferences/Meetings/Symposiums/ Seminars/Workshops	Participants
15th All India Congress of Zoology and National Symposium on Status of Coldwater Fisheries with Reference to Fragile Himalayan Ecosystems organised by Department of Zoology, University of Jammu, Jammu, J&K during October 29-31, 2004	Dr. Shyam Sunder
Third Indian Fisheries Science Congress held at IARI Auditorium, Pusa, New Delhi organized by Indian Society of Fisheries Professionals, Mumbai during November 4-6, 2004	Dr. C.B. Joshi Shri T.M. Sharma
Board of Management Meeting of CIFE at Mumbai on November 17, 2004	Dr. K.K. Vass
Vision 2020 presentation at ICAR, New Delhi during December 16-19, 2004	Dr. K.K. Vass
Meeting of the committee to suggest organizational and procedural changes in ICAR under the chairmanship of Dr. R.A. Mashelkar, Secretary, DSIR at Delhi on December 29, 2004	Dr. K.K. Vass
Workshop on Enhancement of Fish Producting in Pong Wet land at Pong reservoir organised by H.P. Fisheries Department, H.P. February 19, 2005	Dr. Shyam Sunder
9th Meeting of National Committee on Exotics at Krishi bhavan, New Delhi during February 2005	Dr. Madan Mohan
Workshop on Implementation of Personnel Management Information System Network in	Shri A.K. Nayak

Conferences/Meetings/Symposiums/ Seminars/Workshops	Participants
ICAR (PERMISnet) organized at Indian Agricultural Statistics Research Institute, New Delhi on March 9, 2005	
National Seminar on Organic Farming in India organized by National Center for Organic Farming (Ministry of Ag. & Cop) at Ghaziabad on March 10-11,2005	Dr. B.C. Tyagi

14

WORKSHOP, SEMINAR ORGANIZED

Independence Day

At the new complex, the NRCCWF family celebrated the Independence Day with great enthusiasm and happiness. On this occasion the Director unfurled the National Flag and impressed upon the staff members that with the creation of more facilities it becomes the duty of all members to redictate themselves for the betterment of the Institute to achieve the objective and targets set by ICAR. Some of the members recited the songs dedicated to Nation.

Fig. 15. Independence Day being celebrated at the Institute

Hindi week

Hindi Week Celebrations were organized by the Institute at Bhimtal during 04-20, September 2004. For the efficient use of Rajbhasha among the Institute staff and provide encouragement to them in its use, competitive events were held during the period. A large number of members of staff participated in different event viz., essay writing, noting,

Fig. 16. Essay competition organized during Hindi week celebrations

drafting, Hindi translation, computer typing in Hindi and vocabulary test.

Farmers meet

A goshthi of fishermen and local residents of Bhimtal was organized at Bhimtal during September, 2004 under the chairmanship of the Director of the Institute. The Chairperson, Town Area Bhimtal was the chief guest. In this awareness camp, main emphasis was given on the conservation of fish and its environment. The people were appraised with many conversation strategies such as avoiding elicit poaching, use of dynamites, fish poisons, small sized nets and removal of building material from river beds etc.

Fig. 17. Mass awareness programme for conservation of golden mahseer at Bhimtal

National science day

National Science Day was celebrated on 28th February 2005 at the new complex of NRCCWF, Bhimtal. As the theme for this year was Physics, it was planned to involve local schools and community representatives. Science Models were prepared and presented by the students. Essay and debate competitions were also organized on this ocassion of National Science Day. The Chairman of Nagar Palika Committee Bhimtal was invited as Chief Guest to grace this occasion. Various other local dignitaries, teachers and students participated in this function.

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DISTINGUISHED VISITORS

Following distinguished dignitaries visited the Institute during the year 2004-2005.

Dr. S. Ayyappan, Deputy Director General (Fisheries), ICAR, New Delhi.

Dr. M.Y. Kamal, Former Vice Chancellor, SKUAST, Srinagar (J&K).

Dr. K.L. Sehgal, Former Director, NRCCWF.

Dr. Brij Gopal, Professor, Jawaharlal Nehru University, Delhi.

Dr. P.V. Dehadrai, Former Deputy Director General (Fisheries), ICAR, New Delhi.

Prof. D.P. Zutshi, Former Director, Centre for Research and Development, Kashmir University.

Dr. Sarvesh Kumar, Professor and Head, Department of Zoology, Kumaon University, Nainital.

Shri N.A. Quareshi, Director of Fisheries, Government of J&K, Srinagar.

Dr. D.N. Das, Senior Lecturer, Aquaculture Unit, Department of Zoology, Arunachal Pradesh University, Itanagar.

Dr. V.R. Chitranshi, ADG (Inland Fisheries), ICAR, New Delhi.

Dr. R.S. Tolia, Chief Secretary, Government of Uttaranchal.

Shri Rakesh Kumar, IAS, Commissioner Kumaon Region, Uttaranchal.

Shri Amit Kumar Ghosh, District Magistrate, Nainital, Uttaranchal.

Shri D.S. Garbyal, Chief Development Officer, Nainital, Uttaranchal.

Dr. H.S. Gupta, Director, Vivekananda Parvatiya Krishi Anusandhan Shala, Almora, Uttaranchal.

Dr. O. Dhar Director, G.B. Pant Institute of Environment, Kosi, Almora, Uttaranchal.

Dr. Kuldeep Kumar, Advisor Fisheries & CEO Government of Himachal Pradesh, Bilaspur.

Dr. K.K. Pandey, Director, Birla Institute, Bhimtal.

Shri Shailesh Bagoli, IAS, SDM, Nainital & Secretary, Lake Development Authority, Nainital.

Shri D.C. Pandey, Executive Engineer, Irrigation Department, Nainital.

Shri C.M. Shah, Project Engineer, Lake Development Authority, Nainital.

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PERSONNEL

LIST OF STAFF (AS ON MARCH 31, 2005

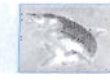
(This is not a Seniority List)

SCIENTIFIC

1. Dr. K.K. Vass, Director (Transferred to CICFRI w.e.f. 27-01-2005).
2. Dr. Madan Mohan (Acting Director w.e.f. 28-01-2005).
3. Dr. H.S. Raina, Principal Scientist.
4. Dr. C.B. Joshi, Principal Scientist.
5. Dr. Shyam Sunder, Principal Scientist.
6. Dr. B.C. Tyagi, Principal Scientist.
7. Dr. Yasmeen Basade, Scientist (Senior Scale).
8. Dr. Rajeev Kapila, Scientist (Senior Scale).
9. Shri A.K. Nayak, Scientist.
10. Shri N.O. Singh, Scientist.
11. Shri Prem Kumar, Scientist (Joined w.e.f. 21-07-2004).

ADMINISTRATIVE

1. Shri R.L. Raina, AAO.
2. Shri Harish Ram, Asstt.
3. Shri Manni Lal, Asstt.
4. Smt. Susheela Tewari, Stenographer.
5. Smt. Khilawati Rawat, Senior Clerk.
6. Shri P.C. Tewari, Junior Clerk.
7. Shri Pratap Singh, Junior Clerk.
8. Shri J.C. Bhandari, Junior Clerk.
9. Smt. Munni Bhakt, Junior Clerk.



TECHNICAL

1. Shri R.S. Haldar, T-5.
2. Shri Amit Kumar Joshi, T-4 (Hindi Translator).
3. Shri Baldev Singh, T-3.
4. Shri Santosh Kumar, T-3.
5. Shri Ravinder Kumar, T-I-3.
6. Shri Gopal, T-2.
7. Shri R.K. Arya, T-2.
8. Shri Hansa Dutt, T-2.
9. Shri T.M. Sharma, T-2.
10. Shri Bakshi Ram, Driver (T-2).
11. Shri Bhagwan Singh, Driver (T-2).

SUPPORTING

1. Shri Sant Ram, SSGr IV.
2. Shri Ravinder Kumar, SSGr IV.
3. Shri Om Raj, SSGr III.
4. Shri H.S. Chauhan, SSGr III.
5. Shri H.S. Bhandri, SSGr III.
6. Shri Dharam Singh, SSGr II.
7. Shri Sunder Lal, SSGr II.
8. Shri Manoj Kumar, SSGr II.
9. Shri Pooran Chandra, SSGr II.
10. Shri Kuldeep Kumar, SSGr I.
11. Shri Bhola Dutt, SSGr I.
12. Shri Chandra Shekhar, SSGr I.
13. Shri. Prakash Akela, SSGr II.
14. Smt. Basanti Devi, SSGr I.

CASUAL LABOUR WITH TEMPORARY STATUS

1. Shri Mangala Prasad.

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SPECIAL INFRASTRUCTURAL DEVELOPMENT

Construction of Phase -II of NRCCWF Complex

The construction of NRCCWF Complex Phase -II which includes Administrative Block, Auditorium and Guest House of the Centre is in progress. While construction of Guest House and Administrative Block are in final stage, Auditorium may take some more time to be completed. The progress of work is being regularly monitored by CPWD Officials as well as by the NRCCWF Officials.

Fig. 18. NRCCWF Complex at Bhimtal

Fig. 19. NRCCWF guest house at Bhimtal

New work awarded to CPWD at Champawat

The work item for construction of circular hatchery at coldwater fish farm at Chirapani has been awarded to CPWD. The construction of culvert on the adjacent stream flowing between the two pockets of farm complex has been completed.