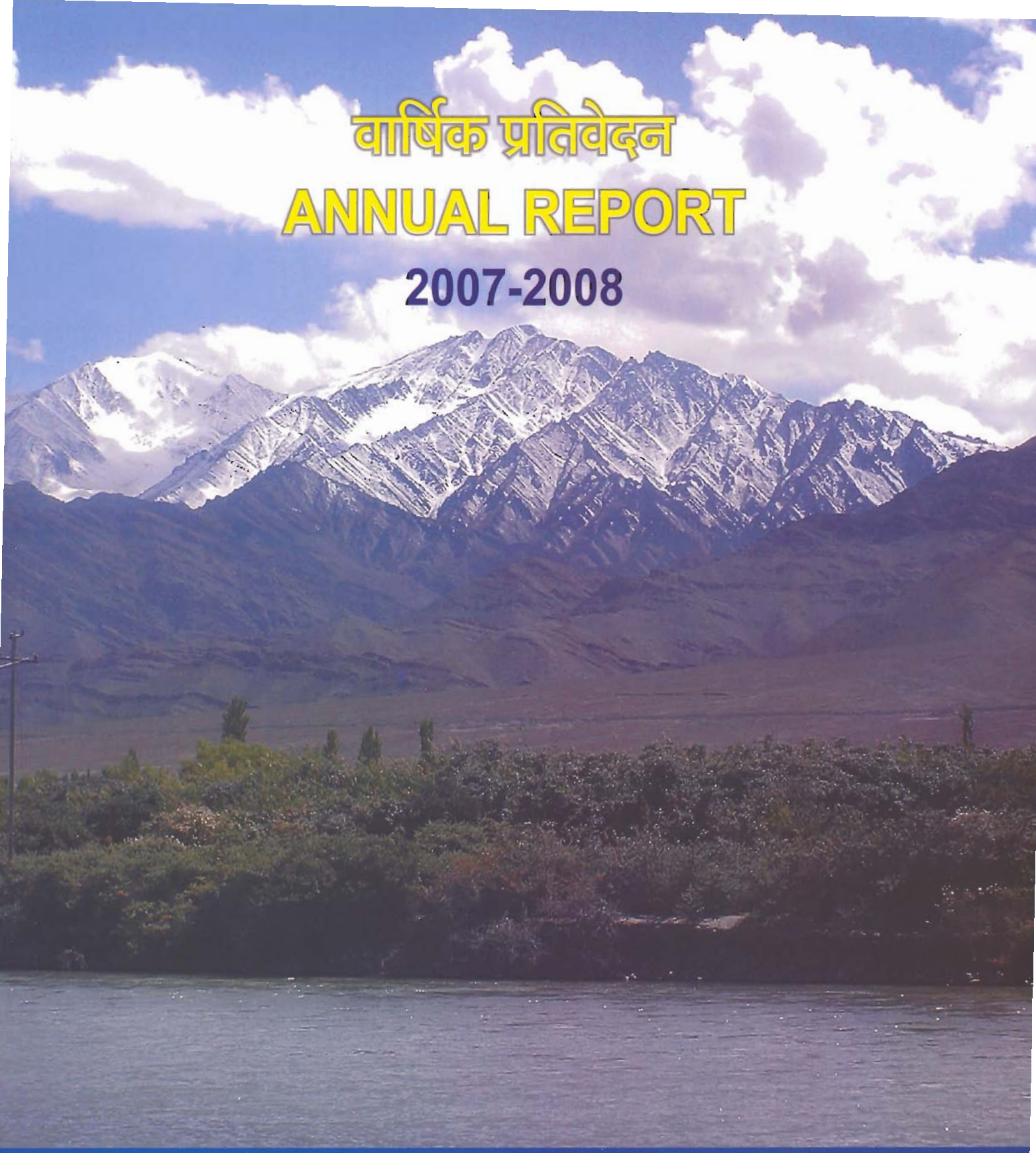

वार्षिक प्रतिवेदन

ANNUAL REPORT

2007-2008

भाकृअनुप
ICAR

NATIONAL RESEARCH CENTRE ON COLDWATER FISHERIES
(Indian Council of Agricultural Research)
Bhimtal - 263 136, District - Nainital (Uttarakhand)

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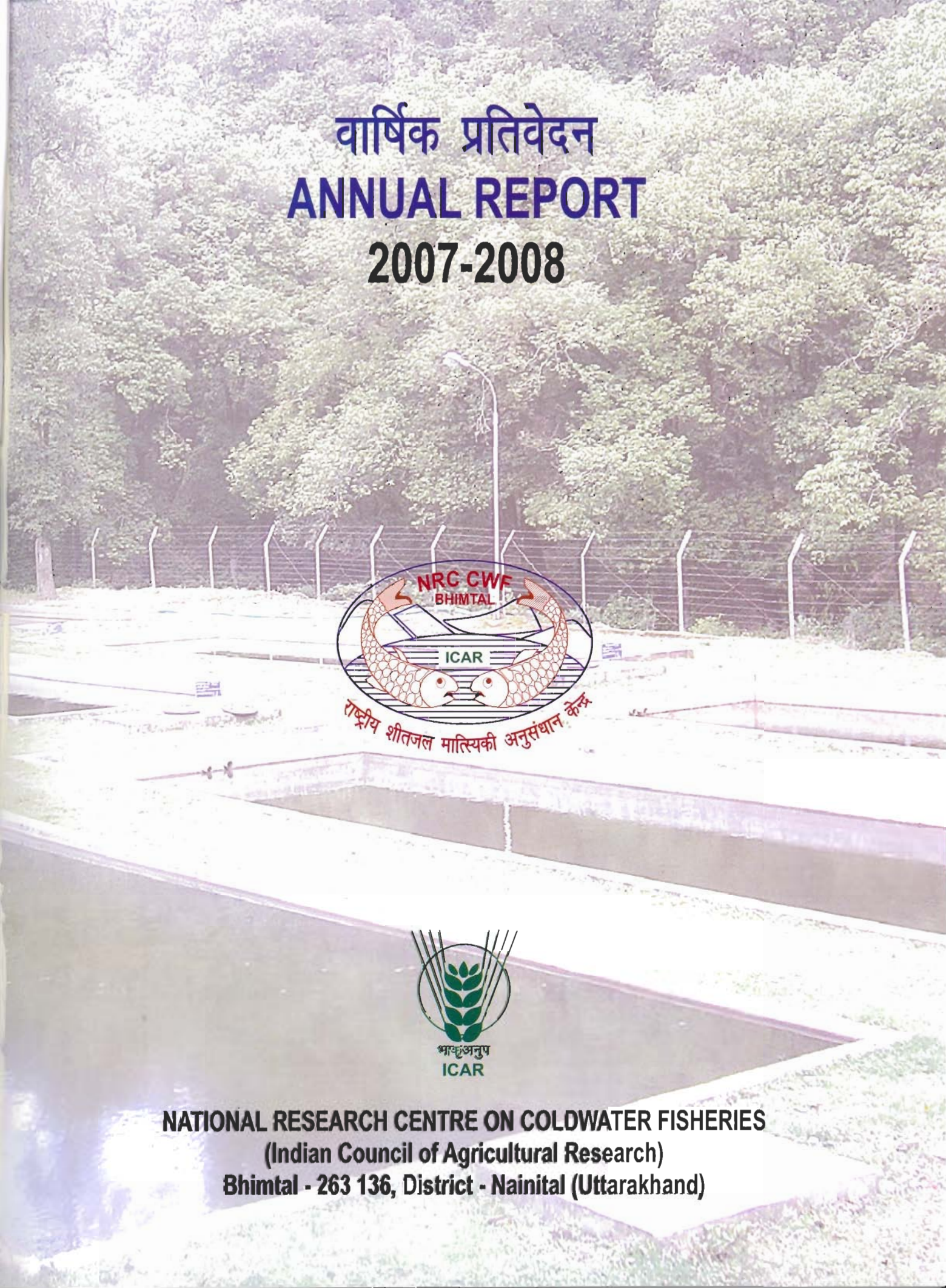

NATIONAL RESEARCH CENTRE ON COLDWATER FISHERIES
(Indian Council of Agricultural Research)
Bhimtal - 263 136, District - Nainital (Uttarakhand)

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River Indus at Sindhu Ghat, Leh-Ladakh

Back Cover
View of Leh-Ladakh region

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PREFACE

It was the first year of 11th five-year plan where we projected more prospects in National and International fisheries sector particularly related to the development of coldwater zones. As well as a great milestone was achieved in the history of NRCCWF while approving the XI plan EFC for changing it to Directorate mode. We targeted an outlay of budget three times more than 10th five year plan with an aim to fulfill the increased research activities mandated for the Institute.

During the year for the first time we explored a difficult climate zone of Leh-Ladakh for the fisheries possibilities to the benefit of local inhabitants and the army people. We also developed and transferred some technologies like mahseer hatcheries and carp farming suitable in the hill areas. As conservation measures, released mahseer seeds in the Kosi River under fish seed ranching programme. We also completed successfully some research projects during the year. We identified some common issues, for the overall change in coldwater fisheries sector, to work in a partnership approach with five coldwater states namely Arunachal Pradesh, Sikkim, Himachal Pradesh, Jammu & Kashmir and Uttarakhand. In addition to that in the coming years we will also participate in some national issues of fish nutrition, feed development and identification of some Genetic stocks. According to the recent issues and Institutes mandate we redefined our research projects after inclusion of some specialized scientists during the year. These projects were approved through Research Advisory Committee (RAC) and in-house Scientific Research Council (SRC).

During the year we organized ICAR Mega seed workshop under the Chairmanship of Hon'ble DDG (Fy). We also successfully arranged several training programme for the scientists, officers and farmers. Our scientists participated in several national and international training, workshop, seminars and own several awards and honors. It was the constant efforts of scientists and all staff of this Institute that made it possible for such progress and achievements. The continuous support, guidance and encouragement received from Dr. Mangala Rai, Secretary DARE & Director General, ICAR, Dr. S. Ayyappan, Dy. Director General (Fisheries) and Dr. V.V. Sugunan, ADG (Inland Fisheries) is recorded with sincere thanks and gratitude.

Thanks are also due to Drs. R. Kapila, A. Barat, Senior Scientists and Mr. A. Nayak, Scientist, SS in bringing out the Annual Report. The efforts made by Mr. Amit Joshi, T-4, for Hindi version of the report and assistance rendered by Dr. G. K. Sivaraman, Scientist, Mr. Vijay K. Singh, T-3 and Mr. Amit K. Saxena, T-3, Mrs. Susheela Tewari, PA to Director, is also recorded with appreciation.

P.C. Mahanta
DIRECTOR

CONTENTS

विशिष्ट सारांश

देश के पर्वतीय क्षेत्रों में जल संसाधन प्रबन्धन एवं अनुसंधान कार्यों को बढ़ावा देने के लिए भारतीय कृषि अनुसंधान परिषद् द्वारा वर्ष 1987 में राष्ट्रीय शीत जल मात्स्यिकी अनुसंधान केन्द्र की स्थापना की गई। संस्थान के अधिदेश के अन्तर्गत शिकारमाही तथा सतत् मत्स्य उत्पादन की प्राप्ति हेतु परिस्थितिकी योजना का निर्माण तथा देश के उच्च स्थली क्षेत्रों में पर्वतीय मात्स्यिकी संस्थान के मूल्यांकन को सम्मिलित किया गया है। इसके अतिरिक्त संस्थान के अधिदेश में प्रमुख शीतजल मत्स्य प्रजातियां मुख्यतः विभिन्न ऊंचाई वाले क्षेत्रों में पायी जाने वाली ट्राउट, महासीर, स्नो ट्राउट व काप के लिए मत्स्य पालन की तकनीकी के विकास को सम्मिलित किया गया है। संस्थान अन्य संस्थाओं के साथ मिलकर पर्वतीय मत्स्य पालन तथा जल संसाधन प्रबन्धन पर प्रशिक्षण व इससे सम्बन्धित प्रदर्शन कार्यक्रमों को भी आयोजित करता है।

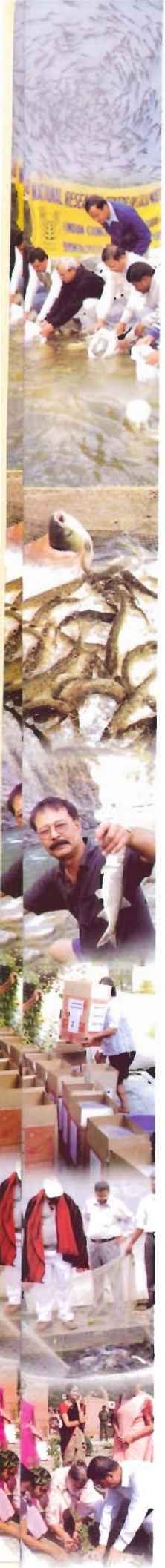
इस वर्ष एक आई. सी. ए. आर. मैगा सीड परियोजना सहित ग्यारह अन्य परियोजनाओं पर अनुसंधान कार्य किए गए।

प्राकृतिक स्रोतों में मात्स्यिकी:–

इसके अन्तर्गत उत्तराखण्ड के शीतजल मात्स्यिकी संसाधनों को जी. आई. एस. प्रयोग के आधार पर वर्गीकृत किया गया है। उपग्रह से प्राप्त चित्रों के आधार पर जल स्रोतों के क्षेत्रफल व परिधि का पता लगाया गया। इस वर्ष उत्तराखण्ड राज्य की नदियों और जल स्रोतों का फील्ड सर्वेक्षण कर जी. पी. एस. प्रणाली के द्वारा उनका विश्लेषण भी किया गया। तराई क्षेत्र के प्रमुख जल स्रोत–तुमड़िया, हरिपुरा, बौर, बैगुल, धौरा, रामगंगा, सागर (कालागढ़ जलाशय) एवं नानक सागर हैं। इनमें से अधिकांश जलस्रोत इस राज्य के तराई व भावर क्षेत्र में स्थित हैं। दूर संवेदी आंकड़ों से 22 प्रमुख नदियों की पहचान की गई तथा उनको प्रांगुलित किया गया। इनकी कुल लम्बाई की गणना 6105 कि.मी. की गई। जबकि इनकी प्रभावकारी लम्बाई केवल 1219 कि. मी. ही है। इसके अतिरिक्त शारदा सागर जलाशय के मात्स्यिकी संसाधनों के त्रिविमीय आंकड़ों पर भी विस्तृत अध्ययन किये गये तथा इन आंकड़ों को झील के भू-रासायनिक पैरामीटर्स के साथ सह-सम्बन्धित किया गया ताकि जलाशयों के पौषणिक उत्पादिक क्षेत्रों के विश्लेषण में सहायता मिल सके। सर्वेक्षण द्वारा शारदा सागर की मत्स्य सम्पदा की भी पहचान की गई तथा लगभग 15 परिवार की मत्स्य प्रजातियां पायी गयीं, जिनमें क्लूपेडी, बैगरीडेई, सिलुराइडी, ओफिसीफैलिडी, साइप्रिनिडी तथा विलोनाईडी की प्रमुखता थी। उपग्रह (आई. आर. एस. एल. आई. एस. एस.III) से वांछित आंकड़े भी प्राप्त हुए हैं तथा जलाशय में अवसाद के एकत्र होने की दर पर अध्ययन कार्य प्रगति पर है। साथ ही विभिन्न परिवारों से सम्बन्धित प्रजातियों के आंकड़ों को भी कम्प्यूटरीकृत किया गया है।

दिनांक 12–19 दिसम्बर, 2007, को वैज्ञानिकों के एक दल ने लेह-लद्धाख क्षेत्र के मत्स्य एवं मात्स्यिकी संसाधनों पर अन्वेषणात्मक सर्वेक्षण किया। उनके द्वारा विभिन्न मत्स्य प्रक्षेत्रों, सिन्धु नदी के स्थलों का सर्वेक्षण किया गया। साथ ही इन क्षेत्रों में पाये जाने वाले जन्तु प्लवकों की प्रजातियों, जल के भू-रासायनिक मानकों व उनमें मत्स्य विभिन्नत सम्बन्धी आंकड़े एकत्र किए गये। पारम्परिक व अण्विक विधियों के प्रयोग से प्रजातियों के वर्गीकरण हेतु मछलियों के नमूने भी एकत्र किए गए।

बहुआयामी सांख्यिकी विश्लेषण के अन्तर्गत जल की गुणवत्ता, घटकों एवं सामूहिक विश्लेषण को उत्तराखण्ड की गौला नदी से प्राप्त जल की



गुणवत्ता सम्बन्धी द्वैतीयक आंकड़ों के साथ समाहित किया गया। जिससे पता चला के प्रदूषण के कारणों के मूल्यांकन में ताथ्यिक विश्लेषण बहुत लाभकारी है तथा ये जल संसाधनों के प्रभावकारी प्रबन्धन में भी सहायक हैं। इसके अतिरिक्त यह सांख्यिकी तकनीक जल की गुणवत्ता के महत्वपूर्ण स्रोतों की पहचान करने के लिए भी उचित सिद्ध हो चुकी हैं गौला नदी में प्रदूषण का मुख्य स्रोत जानवरों के अपशिष्ट तथा गंदे पानी का बहाव है। सैम्पलिंग के समय क्लस्टर ऐनालिसेज़ के परिणाम 3 सम्भावित संयोजनों द्वारा चित्रित किये जाते हैं। यद्यपि इस नदी-तंत्र के जल की गुणवत्ता पर मौसम का कोई स्पष्ट प्रभाव नही दिखायी दिया। अंततः यह निष्कर्ष निकला कि दो चयनित स्थलों के जल की गुणवत्ता लगभग एक समान थी, जबकि तीसरे सैम्पलिंग स्थल में स्पष्टतः भिन्न विशेषताऐं थीं। अतएव गौला नदी के जल की गुणवत्ता में त्रिविमी व अस्थायी विभिन्नता देखी गयी।

मत्स्य पालनः–

सुनहरी महासीर सहित देशी मत्स्य प्रजातियों के लिए यथोचित मूल्य पर आहार निर्माण का कार्य किया गया। इस अवधि में स्थानीय रूप से उपलब्ध प्रोटीन-वनस्पति का भी मूल्यांकन किया गया। इसके लिए कच्चे तथा तैयार घोड़े के खाने वाले चने व काली सोयाबीन का भी प्रयोग किया गया और देखा गया कि सुनहरी महासीर के आहार में कमशः 10 प्रतिशत व 30 प्रतिशत घोड़े के खाने वाले चने व काली सोयाबीन को सम्मिलित किया जा सकता है।

देशी शीतजल मत्स्य प्रजातियों (टौर पुटिटोरा) को दो तालाबों जिनका क्षेत्रफल 95 व 104 वर्ग मीटर था में 1 मछली/मीटर 2 की दर से संचालित किया गया। इन मछलियों का भार संचयन के समय कमशः सामान्यतः 50 ग्राम व 183 ग्राम था। इनके प्रतिपूरक आहार में मार्च, 2008 से मिटाएल टैस्टोस्ट्रोम नामक हारमोन भी मिलाया गया। निरन्तर अवलोकन के पश्चात् यह देखा गया कि जिन मछलियों ने मई से जून, 2008 तक बढ़िया वृद्धि प्राप्त की उनसे अण्डे प्राप्त किये जा सकते हैं। इसी प्रकार वर्ष 2008से चम्पावत में तीन नर्सरी तालाबों (15 मी 2) में स्नो ट्राउट मछलियों को क्रमशः 8 (18 ग्राम), 11.3 (57 ग्राम) व 5.3 (85 ग्राम) मछली/मीटर 2 की दर से पाला गया। 3 वर्ष के पश्चात् इन तालाबों में मछलियों के भार में क्रमशः 47,93 व 118 ग्राम की वृद्धि हुई। मछलियों की आयु में तीन वर्ष की वृद्धि उनकी परिपक्वता का सूचक है और उनसे आगामी ऋतु में अण्डे प्राप्त किये जा सकते हैं। 4.4–4.9 ग्राम/म्यू वाले तालाबों में मछलियां अच्छी वृद्धि प्राप्त करती हैं। दूसरी ओर कोसी नदी से 75–133 ग्राम भार वाली परिपक्व मादा साइजोथोरैक्स रिचार्डसोनी (टी.एल. 240–255 मी.) के लीवर–नमूने भी प्राप्त किये गये। मत्स्य पालन के अन्तर्गत सुनहरी महासीर व स्नो ट्राउट मछलियों को भीमताल झील में तैरते हुए लकड़ी के पौलीथीन आवरण युक्त केजों में पाला गया और महसीर व स्नोट्राउट पर प्रशिक्षण किऐ गए। शीतजल की इन दो प्रजातियों को अलग-अलग 2–4 केजों में रखा गया जहां उनके लम्बाई के हिसाब से दो वर्गों में बांटा गया। एक केज में आहर नहीं दिया गया जबकि शेष केजों में संस्थान द्वारा तैयार किया गया कृत्रिम आहार दिया गया। तीन माह के प्रयोग के पश्चात् मत्स्य समूह में कुल भार वृद्धि 1029 ग्राम प्राप्त की गई। जिनमें प्रत्येक मछली की भार वृद्धि 6.1–7.5 ग्राम पायी गई। केजों में छोटे आकार की मछलियां भी रखी गई। एक अन्य प्रयोग में छोटे-बड़े आकार की 5.8–6 ग्राम (6.1ग्रा.) भार वाली सुनहरी महासीर को 350 मत्स्य प्रति केज की दर से रखा गया। इन मत्स्य समूहों का कुल भार 2135 ग्राम था। जब इन मछलियों का आकार बड़ा हो गया तो इन मछलियों की उत्तरजीवितता दर प्रथम केज में 49.7 प्रतिशत तथा दूसरे केजों में 67.1 प्रतिशत थी। नियन्त्रित

केज में मछलियों का कुल भार 1810 ग्राम तथा उनका प्रत्येक का भार 8.3–11.9 ग्रा. (औसत 10.4 ग्रा.) एवं अन्य केजों में 4536 ग्रा. व उनका प्रत्येक का भार 18.2–21.3 ग्रा.(औसत 19.3 ग्रा.) पाया गया। इसी प्रकार अन्य प्रयोग में, स्नो ट्राउट (साइजोथोरैक्स रिचार्डसोनी) के दो आकार वर्ग प्रयोग में लाये गये। छोटे स्नो ट्राउट का भार 2.7–3.8 ग्रा. जिसका कुल भार 11.20 ग्रा./केज था, को तीन माह तक पाला गया और 0.20 ग्रा. की मासिक वृद्धि व उत्तरजीविता 51.7 प्रतिशत पायी गई। जबकि दूसरे केजों में 0.57 ग्रा./माह के साथ 69 प्रतिशत उत्तरजीविता पायी गई बड़े आकार की मछलियों में परिणाम और अच्छे पाये गये।

आनुवांशिकी एवं जैव-प्रौद्योगिकी :–

संस्थान के जैव-प्रौद्योगिकी कार्यक्रम के अन्तर्गत दो अनुसंधान परियोजनाऐं चालू की गयीं। शीतजल मत्स्य प्रजातियों में शीत सहन करने की क्षमता सम्बन्धी जैव-रासायनिक प्रक्रिया को समझने के लिए मछलियों के रक्त प्लाज़्मा में ओसमालेट्स (ग्लूकोज, यूरिया, ग्लाइकोजन, लैक्टिक ऐसिड) का परीक्षण किया गया। इसके अतिरिक्त HSP–70 (हीट स्ट्रौक प्रोटीन) के मापन के लिए ELISA का मानकीकरण तथा इस प्रोटीन पर शाइजोथोरैक्स रिचार्डसोनी के पेशीय उत्तकों में पड़ने वाले ठंड के प्रभाव का भी अध्ययन भी किया गया।

हिमालय के प्राकृतिक जल स्रोतों से चार शीतजलीय मत्स्य प्रजातियों नामतः टौर पुटिटोरा, शाइजोथोरैक्स रिचार्डसोनी, राइमस बेला व गारा को ग्यारह यादृच्छिक प्राइमर्सों द्वारा आर. ए. पी. डी. मारकर्स के चयन हेतु विश्लेषित किया गया। प्राप्त आंकड़ों को हिमालय की विभिन्न मत्स्य प्रजातियों के बीच आनुवांशिक सम्बन्धों की स्थापना के लिए जातिवृत्तिय वृक्ष (Phylogenic Tree) के निर्माण हेतु प्रयोग में लाया जा सकता है।

बृहद् बीज परियोजना:–

भारतीय कृषि अनुसंधान परिषद् के अन्तर्गत वर्ष 2006-07 में 25000 महासीर बीजों की तुलना में 2007-08 में 75000 महासीर बीजों का उत्पादन किया गया। वर्ष 2006-07 में कामन कार्प के 3 लाख जीरा तथा 10 लाख अंगुलिकाओं की तुलना में वर्ष 2007-08 में 5 लाख जीरा तथा 15 लाख अंगुलिकाओं का उत्पादन किया गया तथा मध्य ऊंचाई वाले क्षेत्रों में अपेक्षाकृत कुछ कम गर्म जल स्रोतों में रेन्बो ट्राउट का प्रजनन कार्य भी किया गया।

साझेदारी एवं अनुबन्ध :–

यह केन्द्र देश के उन विश्वविद्यालयों, राज्य मत्स्य विभागों, ऐजेन्सियों, संस्थाओं तथा उत्तर-पूर्वी पर्वतीय क्षेत्रों के स्थानीय मत्स्य पालकों के साथ निकट सम्बन्ध स्थापित करने के लिए प्रयत्नशील है जो अपने-अपने क्षेत्रों में शीतजल मात्स्यिकी के विकास हेतु इच्छुक है।

मानव संसाधन एवं तकनीकी हस्तान्तरण:–

संस्थान के वैज्ञानिकों एवं तकनीकी तथा प्रशासनिक वर्ग के सदस्यों को अपने सम्बन्धित क्षेत्रों में दक्षता प्राप्त करने हेतु विदेश सहित विभिन्न प्रशिक्षण कार्यक्रमों में भाग लेने के लिए भेजा गया। इस संस्थान के वैज्ञानिकों ने विभिन्न सम्मेलनों, कार्यशालाओं, संगोष्ठियों आदि में भाग लिया तथा उनमें अपनी उपलब्धियों को प्रस्तुत किया। संस्थान द्वारा उत्तरांचल व उत्तर-पूर्वी राज्यों के मत्स्य पालकों के लिए शीतजल मात्स्यिकी की विभिन्न सम्भावनाओं, शीतजल मत्स्य पालन, प्रजनन, रोग प्रबन्धन, तथा शीतजल मात्स्यिकी में उपकरणों के प्रयोग आदि विभिन्न विषयों पर प्रशिक्षण कार्यक्रम भी आयोजित किये गये। अपने जन-जागृति कार्यक्रम के अन्तर्गत संस्थान के वैज्ञानिकों द्वारा शीतजल मत्स्य एवं

मात्स्यिकी की विभिन्न सम्भावनाओं के सम्बन्ध में स्थानीय जनों, भ्रमणकारी छात्र-छात्राओं, गणमान्यों आदि को जानकारी दी गयी।

संस्थान की विभिन्न समितियों जैसे–अनुसंधान सलाहकार समिति, कर्मचारी अनुसंधान परिषद्, राजभाषा समिति तथा संयुक्त कर्मचारी परिषद् की बैठकें निर्धारित समय पर आयोजित की गयी। सम्बन्धित समितियों में विभिन्न कार्यसूचियों पर चर्चा की गयी तथा संस्थान व अनुसंधान गतिविधियों को सुचारू रूप से संचालित करने के लिए दिशा-निर्देश जारी किए गये।

राष्ट्रीय शीत जल मात्स्यिकी अनुसंधान केन्द्र के प्रत्येक सदस्य ने देश की सांस्कृतिक एकता व अखण्डता को बनाए रखने के लिए विभिन्न राष्ट्रीय दिवसों, घटनाओं आदि में साम्प्रदायिक सौहार्द की भावना से भाग लिया।

EXECUTIVE SUMMARY

The National Research Centre on Coldwater Fisheries (NRCCWF) was established in 1987 by the Indian Council of Agricultural Research (ICAR) for providing research inputs towards aquaculture and aquatic resource management in the hill regions of the country. The mandate of the Institute includes assessment of the hill fishery resources in Indian upland regions for formulating ecological management plans to achieve sustainable fish production, including sport fishery. Besides, the Centre is also mandated to develop aquaculture technologies for major coldwater fish species with particular reference to trouts, mahseers, snow trouts and carps specific to different altitudinal zones. The institute is also involved in conducting frontline demonstration programmes and educational training in hill aquaculture and aquatic resource management in co-ordination with other organizations. During the year under report, the research was conducted through eleven institutional projects including one ICAR-Mega seed project.

Openwater Fisheries

In open water fisheries, coldwater fishery resources of Uttarakhand were characterized using GIS and remote sensing. Based on satellite imageries the perimeter and area of reservoirs were ascertained. This year rivers and reservoirs of Uttarakhand state were analyzed by field surveys as well through GPS or digitization from the related topomaps. The important reservoirs of the Tarai region are Tumuria, Haripura, Baur, Baigul, Dhaura, Ramganga Sagar (Kalagarh Dam) and Nanak Sagar. Most of them are located in Bhabar and Tarai belts of the State. On the other hand, 22 major rivers have been identified from the remote sensing data and are digitized. Their total length is calculated as 6105 kilometers while the effective length is only 2219 kilometers. Moreover, detailed studies on spatial database on fisheries resources of Sarda Sagar reservoir were also conducted and attempts were made to link the physicochemical parameters of reservoir with the respective satellite images that would be useful in analyses of the productive/nutritive zone of the reservoir. Fish fauna of Sarda Sagar was also identified by ground survey and about 15 families of fish were recorded of which Clupedae, Bagridae, Siluridae, Ophicephalidae, Cyprinidae and Belonidae were dominating. Required satellite data (IRS LISS III) have also procured and studied to analyze sedimentation rate of the reservoir. Data on species belonging to different

Line fishing in Sarda Sagar

A catches from Sarda Sagar

families were also computerized in the form of database.

A group of scientists also conducted an exploratory survey on fish and fishery resources in Leh-Ladakh region during 12-19 December 2007. Various fish farms, Sindhu river sites were surveyed and their fish composition, physico-chemical parameters of water and dominant species of phytoplankton were recorded. Fish samples were also collected for species characterization using conventional and molecular approaches.

Recording of water temp. at Sindhu river

Collection of tissue samples at Leh

Under multivariate statistical analysis of water quality data, factor and cluster analysis have been applied to data set of water quality parameters obtained from secondary data of Gaula river of Uttarakhand. It reflected the usefulness of factor analysis for evaluation of pollution sources and helped in interpretation of large complex water quality data set for effective management of water resources. Further, this statistical technique proved suitable for identifying the significant sources of water quality inputs at the cross section of the river. Animal waste discharges and wastewater discharges are probably the important sources of pollution to Gaula river. The cluster analysis results on sampling times depicted three possible associations though seasonal effect on water quality was not clearly seen in this river system. Further, it was concluded that the water qualities at two of the selected sites were almost similar while the third sampling site had distinctly different characteristics. Thus, spatial and temporal variations were seen in water quality of Gaula river.

Aquaculture

With the aim to develop cost-effective feeds for indigenous upland fishes dietary protein, lipid and carbohydrate requirements of Himalayan golden mahseer were determined. Evaluation of the inclusion levels of the locally available indigenous plant protein sources in feed of golden mahseer was also carried out during this period. For this purpose, effect of raw and processed horse gram and black soybean were visualized. Further, it was observed that horse gram and black soybean can be incorporated in the golden mahseer diets up to 10% and 30% levels respectively. However, it is advantageous to use heat-treated components over the raw forms as heat treatment denatures the anti-nutrients present in them.

Under induced maturation programme of indigenous coldwater fish species, *Tor putitora* were stocked @ 1 fish/m² in two ponds having an area of 95 and 104 sq. m. with an average weight of 50g (Av. T.L 171mm) and 183 g (Av. T.L.280 mm) respectively. The hormone namely methyl testosterone (MT) was also added in

Maturity confirmation of mahseer brooders

formulated feed from March 2008 for the stock having age above 3 and 4 years. Regular observations indicated that fishes were maturing which would attain prime maturation in May to June 08 and could be induced for spawning. Similarly the fish stock of snow-trout was being reared in 3 nursery ponds (15m²) at Champawat @ 8 (18 g), 11.3(57 g) and 5.3 (85 g) fishes/ m² respectively since October 2005. After 3 years, fishes have attained average weight of 47, 93 and 118 g respectively in these ponds. The fishes having 3+ years age indicating maturity and would be induced to spawn in coming season. Fishes were growing well in ponds @ 4.4–4.9 g/month. On the other hand, liver samples from matured *Schizothorax richardsonii* (T.L.240-255mm) females weighing 75-133g were obtained from river Kosi. Their gonadosomatic index was calculated and vitellogenin (Vtg) levels were determined after standardizing ELISA technique using antibodies raised against carp vitellogenin in rabbit. The sensitivity of ELISA was observed from 10-100ng Vtg.

Under aquaculture, cage culture of fishes (golden mahseer and snow trout) were carried in floating raft type wooden frame cages having high density poly ethylene webbing in subtropical Himalayan lake of Bhimtal. Experiments were carried out on mahseer and snow trout. These two species of coldwater were stocked in four cages separately wherein two length groups were reared separately. One cage was treated as control for each group and fish in rest of the cages were provided with artificial diets prepared at this Institute. About 350 fish were stocked in each cage @ about 40 fish per cubic metre area. These experiments were carried out for three months. After three months of experiment, 1029g of final fish biomass was harvested with individual fish weight as 6.1-7.5g (av. 6.9g), in cages stocked with smaller sized fish. For other experiment, slightly bigger size golden mahseer was stocked in size ranging

Cleaning of cages installed at Bhimtal Lake

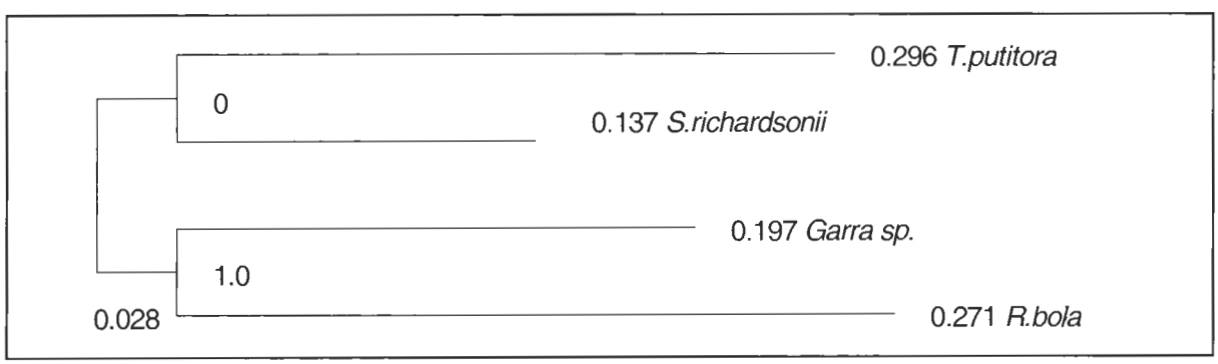
5.8-6.5g (av. 6.1g) at the rate of 350 fish per cage with initial total fish biomass of 2135g. Since these fish were bigger in size, the rate of survival was better in control (49.7%) as well as in treated cages (67.1%). The values for total final fish biomass as 1810g with individual fish weight as 8.3-11.9g (av. 10.4g) in control group while in treated cages final fish biomass was recorded as 4536 g with individual fish weight, 18.2-21.3g (av. 19.3g) respectively. Similarly, in another experiments two size groups of snow trout *Schizothorax richardsonii* were reared. Smaller size snow trout with weight range 2.7-3.8g (av. 3.2g) with total biomass of about 1120g were reared for three months. It was observed that fish in control cages grew from 3.20g to 3.80g showing monthly growth of 0.20g with survival of 51.70% while their growth was better in treated cages being 0.57g per month with improved survival of 69.00%. The experiments conducted with bigger size fish (individual weight ranged 4.8-6.7g) grew to 6.4-7.8g (av. 7.1g) in control cages and 7.8-9.7g (av. 8.9g) in treated cages after three months.

Genetics & Biotechnology

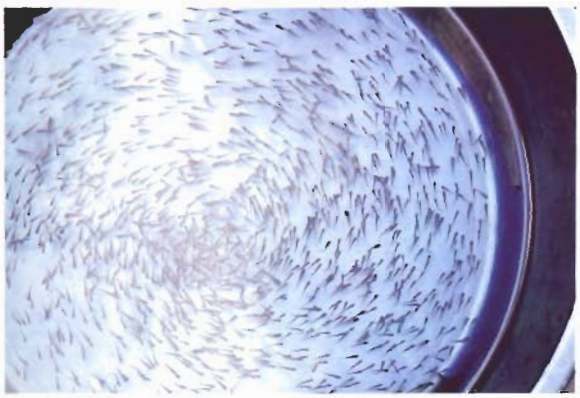
Under biotechnology programme of the Institute, two research projects have been executed. In order to understand the biochemical mechanism of cold tolerance in a coldwater fish, measurement of organic osmolytes (glucose, urea, glycogen, lactic acid) in blood plasma of test fish were carried out. Moreover, standardization of ELISA for measurement of HSP-70 (Heat Shock Protein) and the impact of cold on this protein in muscle tissue of *S. richardsonii* were also studied. Genomic DNA from this prized fish of Himalaya was isolated and PCR amplification of anti-freeze gene was attempted using primers based on winter flounder anti-freeze sequence. In second programme, eleven random primers were employed to screen RAPD markers in the four commonly available coldwater fish species viz., *Tor putitora*, *Schizothorax richardsonii*, *Raiamas bola* and *Garra gotyla* from the natural water bodies of the Himalayan region. The data generated can be utilized for construction of phylogenic tree between the various Himalayan fish species to establish the genetic relationship among them.

Mega Seed Project

Under the ICAR mega seed project seed production of mahseer in 2007-08 was 75000 compared to 25000 in 2006-07. Seed production of common carp 15 lakh spawn and 5 lakh fry in 2007-08 compared to 10 lakh spawn and three lakh fry in 2006-07 respectively. Breeding of rainbow trout in comparatively warmer waters of mid- altitude region has also been attempted.



Construction of Phylogenetic tree (TDRAW V1.14)



Mahseer seed

Partnership & Linkages

The center is doing its best efforts for developing close liaison with the Universities, State Fisheries Departments, agencies, authorities and the locals in North Eastern Hill (NEH) region of the country, who have common interest and stake in coldwater sector development with aim to prepare a blue print for coldwater fisheries development activities in this area. The "Composite Carp Farming Technology" involving three exotic Chinese Carps namely grass carp, silver carp, common carp @ 3-4 fishes/m² in a combination of 40-45%, 20-25% & 35-40% with 10% either Rohu/Chocolate Mahseer respectively providing supplementary feed @ 2-3% of body weight of fish on daily basis and fertilization with lime and only organic fertilizers @ 9000 kg/ha is presently being demonstrated in NEH region.

HRD & Technology Transfer

The staff members of the Institute both scientific and technical including administrative staff were deputed for various training programmes within the country as well abroad to enlighten them about the new developments in their respective fields. Scientists of the Institute also participated in various seminars, symposia, workshops and conferences and presented their scientific achievements. The Institute also imparted training to fish farmers of the Uttarakhand state and NEH personnel on the different aspects of

Integrated fish farming at farmer's pond

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 provided guidelines for the proper management and smooth functioning of the institute and 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 and genuine spirit of communal and cultural harmony.

Training to farmers of NEH region

A group of trainees from NEH region

INTRODUCTION

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 Peninsular parts of the country. The Centre was shifted to its own campus at Bhimtal Industrial area w.e.f. September 05, 2003 from the rented buildings. The Institute has a field centre located at Chhirapani in the district Champawat of Uttarakhand state which is operating from January, 1992.

Main campus building

Location

The headquarters of NRCCWF is located at Bhimtal at an altitude of 1470 msl in the district of Nainital of Uttarakhand State. It is about 25 km away from the famous tourist place of Nainital. The nearest railway station is Kathgodam, which is about 280 km from Delhi. The nearest airport is Indira Gandhi International Airport, New Delhi. The experimental field station of the Institute at Chhirapani in Champawat district of Uttarakhand State is about 150 km from Bhimtal.

Faculty

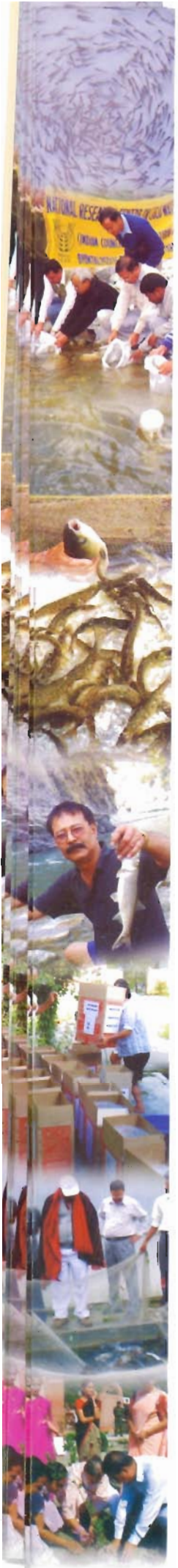
The Institute has thirteen scientists. There are three Principal Scientists (one as per sanctioned cadre and two from career advancement scheme), six Senior Scientists, two Scientists (Senior Scale) and two Scientists. More than 50% of the sanctioned scientist's posts are vacant.

Management

A high-powered Research Advisory Committee (RAC) guides the Centre on planning research in thrust areas and on 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, and Institute Joint Staff Council are in place for decentralized management.

Mandate

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



The organizational set-up

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 back-up facilities to seed production activities of the Centre. The Centre has an experimental fish farm facility at Chhirapani in Champawat district of Uttarakhand State which has trout hatchery, cemented raceways for nursery and brood stock rearing and few circular iron tanks for conducting yard trials on various culture aspects of the indigenous and exotic fish species.

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.

The technical cell has 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.

The library of the Centre during the year subscribed about 25 National and International journals. The current holding of the library includes 1751 books, 1792 foreign journals, 381 Indian journals and 3000 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 by procuring CD ROM. The library section is further continuing its efforts in collection, processing and disseminating scientific/ technical information to the potential users. The library automation has also been completed. Four online foreign journals have also been subscribed by this institute for the year 2007-08.

The institute publication section is entrusted with the responsibility of publication of scientific bulletins, brochures and pamphlets. During the current year this section published two bulletins

Book display for library subscriptions

in addition to annual report and newsletters of the Institute.

The ARIS Cell of the institute is established in its new complex at Bhimtal. The Cell is now providing the VSAT Internet/email, scanning, printing facilities for official use of scientist/staff of this institute. The Internet facilities were provided to all scientists, AAO, AF&AO, Library and Director Cell for its efficient use. The LAN connectivity has also been established for information sharing in the new complex of the Institute. The institute is also well equipped with modern plasma display/LCD projection facilities required for the meetings.

The website of this institute has been upgraded regularly by ARIS Cell. It contains relevant information about the Institute, photographs of the Institute's complex, various laboratories, experimental fish farm/ hatchery at Bhimtal and field station Champawat, the mandate of the institute with organizational structure and manpower. The website also contains the information about the institutional projects and externally aided projects and their achievements. The major achievements of the Centre, the technology generated, consultancy services and angling information is also being incorporated in the site. Further, the ongoing and forthcoming training programmes, seminar / symposia conducted by the institute, recruitments, tender notice has also been reflected in the website. The NRCCWF's website finds a place in the Indian Council of Agricultural Research (ICAR) website with the address: http:// www.icar.org.in/nrccf

The Institute has well equipped Biochemistry & Biotechnology, Fish Nutrition and Transfer of Technology Laboratories. In addition to these laboratories Institute houses one Wet laboratory equipped with flow through troughs for installing physiological experiments and nutrition trials. There is one trout feed mill also installed at main campus of Institute at Bhimtal to meet routine requirements of fish feeds.

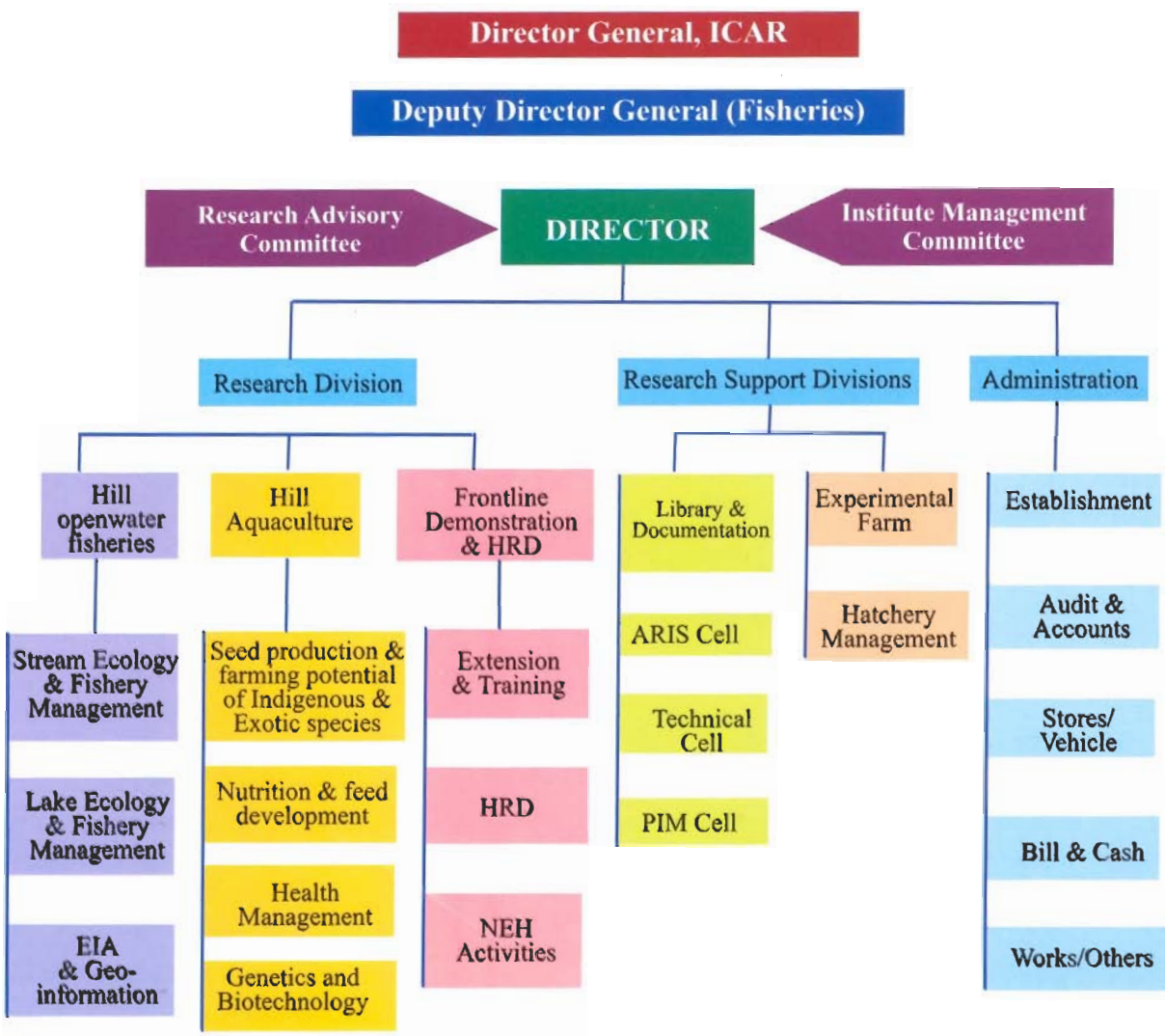
The Extension wing carries out the various extension activities of the Institute such as transfer of technology programmes, organizing the exhibitions, training programmes and other activities related to farmers.

The Institute has recently initiated IPR (Intellectual Property Rights) cell. The cell is responsible for providing information about ICAR guidelines on IPR issues. Trainings to the concerned scientists have also been given regarding IPR issues. The ITMC has also been constituted under the chairmanship of Director for dealing with patents and other intellectual property rights to recognize technologies developed at the Institute and their safe transfer.

Display of ARIS Cell activities

Staff strength as on 31.03.2008			
Category	**Sanctioned**	**Filled**	**Vacant**
Director (RMP)	01	01	-
Scientific	30	13	17
Technical	14	13	1
Administrative	11	11	-
Supporting	14	13	1
Total	70	51	19

ORGANOGRAM



BUDGET 2007-2008

Financial Statement Abstract				
	(Rupees in Lakhs)			
Year	Funds Non-Plan	Expenditure Non-Plan	Funds Plan	Expenditure Plan
2004 - 2005	113.81	98.41	136.00	134.80
2005 – 2006	124.03	117.68	235.98	235.90
2006-2007	124.50	116.21	192.91	186.26
2007-2008	146.00	142.40	208.00	207.65

Budget Statement for the Year 2007-2008

(Rupees in Lakhs)

Head of Account	Budget (R.E)		Expenditure	
	Plan	Non-Plan	Plan	Non-Plan
Pay & Allowances	0	106.10	0	103.21
Traveling Allowances	10.00	2.00	9.98	2.00
Other Charges Including Equipments	185.00	17.20	184.69	16.75
Information Technology	10.00	0	9.99	0
(a) Major Works	0	0	0	0
(b) Repair & Maintenance	0	20.70	0	20.44
Other items Fellowship/ Scholarship/ Awards	0	0	0	0
NEH	0.00	0.00	0.00	0.00
Grand Total	208.00	146.00	207.65	142.40

RESEARCH ACHIEVEMENTS

Open Water Fisheries

PROJECT CODE	RAEM/B/0018
PROJECT TITLE	Characterization of Coldwater Fishery Resources of Uttaranchal through Geoinformatics and Development of Computerized Database on Coldwater Fishes of India
SCIENTISTS	Prem Kumar, Ashok Kumar Nayak, N. Okendro Singh

Remote sensing satellite images of different dates of IRS-1C LISS III for the year 1997 and IRS-P6 LISS III for the year 2004 were procured in order to characterize the water resources of the Uttarakhand State.

Lakes of Kumaon Region

Bhimtal, Garudtal, Khurpatal, Nainital, Naukuchiyatal, Sattal, Shyamlatal and Hanumantal are the major lakes found in the Kumaon region. The total water spread area covered by these lakes was observed as 197 hectares in 1997 and 185 hectares in 2004.

Lakes of Garhwal Region

Arwatal, Bajwarital, Gandhi Sarovar, Hemkund, Kashnital, Kholiyatal, Lamatal (comprised of five small lakes), Nandikund, Panyatal and Sastrutal (comprised of seven small lakes) are the major lakes in Garhwal region. The lakes available in this region are numerous but they are not as bigger as lakes of Kumaon region and it is difficult to assess their depiction on the LISS III image. Therefore, field truths have been collected for some of the lakes located in Garhwal region. The area of the lakes is either analyzed through Global Positioning System (GPS) or digitization from the related topomap. The total water spread area of the lakes was observed as 58 hectares.

Reservoirs of the Uttarakhand State

The important reservoirs of the Tarai region are Tumuria, Haripura, Baur, Baigul, Dhaura, Ramganga Sagar (Kalagarh Dam) and Nanak Sagar. Most of them are located in Bhabar and Tarai belts of the State. Apart from these, Sarda Sagar is another important reservoir that falls in Uttarakhand and Uttar Pradesh (UP). Major portion of the reservoir falls in UP. The total water spread area of the reservoirs including Sarda Sagar was 18139 hectares in 1997 and 17875 hectares in 2004. Sarda Sagar was 5628 hectares in 1997 and 4856 hectares in 2004. However, water spread area of Sarda Sagar falls in Uttarakhand was only about 724 hectares in 1997 and 719 hectares in 2004.

Rivers of the Uttarakhand State

There are 22 major rivers, which have been identified from the remote sensing data and are digitized. Their total length was calculated as 6105 kilometers while the effective length was only 2219 kilometers.

Creation of Computerized Database

The database on coldwater fishes of India was developed in Visual Basic 6.0 and MS Access 2000 software. The database contains information about all 258 coldwater fishes of Indian uplands.

The database has different modules for coldwater fishes such as general classification, distribution, picture of fish species, distinguishing characters, fisheries information, references, present status and commercially importance. Another module was developed which contained information about persons/groups working on the particular species. Searching of species through its scientific name, common name or through family/group is now possible through this database.

Database updating is an ongoing process, therefore the software is designed in such a way to modify, add the new information on the fish species as and when available. The database is being updated regularly with the information of the fish species from literature/primary/secondary sources.

The CD on database of coldwater fishes of India along with details of principal game fishes, role of sport fishery in development of tourism and principal fishing sites in different riverine ecosystems will be made available to the readers, researchers, anglers and other Government agencies.

Spatial database was made on Fish and Fisheries of Sarda Sagar Reservoir in Terai Region of UP and Uttarakhand.

Fish fauna of Sarda Sagar belong to 15 families of which Clupedae, Bagridae, Siluridae, Ophicephalidae, Cyprinidae and Belonidae are dominating.

Required satellite data (IRS LISS III) were procured and study is in progress to analyze sedimentation rate of the reservoir. Water samples were also collected monthly for analyzing physico-chemical parameters.

Exploratory survey on fishery resources of Leh region

A team of Scientists namely Dr. Rajeev Kapila, Dr. A. Barat and Shri Prem Kumar were deputed to conduct an exploratory survey on Fish and Fisheries Resources of the Leh Region during December 2007. The scientist could visit to only some important places due to extreme cold climate during the period.

Leh, the headquarters of the Leh district, stands at an altitude of 11,500 ft, certainly one of the highest inhabited spots in the world. The district is ringed round and criss-crossed by high mountain walls which intercept the moisture laden clouds striking against them from various directions and divest them of the bulk of their wealth of watery vapor as they travel inward over concentric rings. According to Cunningham the dry season of the region is due to elevation and radiation of heat from the bare soil whereas the most striking feature in the physical aspect of Ladakh is the parallelism of its mountain ranges.

Classified Image October 2006

Classified Image May 2007

Water Sampling from the Mighty River "Indus"

Confluence of Indus and Zhanskar rivers

Glaciers of perennial snow shimmering green and giving birth to innumerable rivulets and torrents on numerous mountain sides while the low valleys remain uncommonly dry, the rainfall in the region hardly ever exceeding in the year. The great rivers which carve deep gorges far below their steep banks are useless for watering the fields lying mostly in terrace-like formations one above the other on mountain slopes and it is generally the mountain torrents issuing from glaciers which are channeled and trained to irrigate the cultivated lands.

Existed Fish Farms in the Region

Shey Fish Farm of Leh District

A small fish farm with a total area of 1 ha. and water area of 0.5 ha, situated in the marshes/ wetland of Shey village consisting of five ponds has been established at Shey. The farm is located at an altitude of 11500 ft above mean sea level. This farm is not only utilized for rearing exotic fish species but has played an important role in developing the fisheries in Ladakh. Apart from this, it has also served as an acclimatization station for the fish seeds being brought in from Kashmir Valley before it is supplied further for stocking purpose. Experimental breeding of the exotic fish species like Rainbow trout and carps had been successfully carried out under local condition. Thus, showing encouraging result to carry out construction of a full fledge hatchery with the latest available technology.

Trout Fish Farm at Sindhu Ghat

The farm is located near Sindhu Ghat and the farm is made in the channel about 10' wide and 1000' long and the channel is covered with the thick mesh wire. The intercepted with the help of nets that make number of small ponds. The ponds were stoked with Rainbow trout and growing well to 80-100 gms in 6 months.

Scientists at Trout Fish Farm at Sindhu Ghat

Trout Fish Farm, Nubra

Situated in the valley of Diskit, Nubra this farm is one of its kinds in Leh district where for the first time Trout Raceways were developed to rear rainbow trout brought in from Kashmir. Apart

Water Sampling at Shey Fish Farm

from the 06 raceways a hut was also constructed at the site for the proper watch and ward of the farm. The first batch of live Trout fish seeds brought in from Srinagar has been successfully reared under local condition.

Physico-chemical Parameters of Water

S. No.	Location Lat/Long	Place Name	Elevation (m)	Date	Temp.		pH	DO ppm	CO_2 ppm	Alkalinity ppm	NO_3	PO_4	Silicate (ppm)
					Air °C	Water °C							
1.	34°05'06" N 77°36'30"E	Indus River (Sindhu Ghat)	3215	13. 12. 2007	-6.0	0.5	8.8	12.0	nil	72	Nil	0.53	Nil
2.	34°05'6.5" N 77°36'35"E	Shey Trout Farm (Sindhu Ghat)	3247	14.12. 2007	-2.0	2.0	8.5	9.2	nil	54	Nil	0.66	Nil
3.	34°05'11" N 77°36'0.0"E	Shey Fish Farm	3262	14.12. 2007	-1.5	1.7	8.7	9.6	nil	64	Nil	0.74	Nil
4.	34°09'53" N 77°19'59"E	Sangam (Sindhu& Jhanskar	3075	15.12. 2007	-4.6	-0.6	8.2	9.2	nil	70	Nil	0.64	Nil
5.	34°09'53" N 77°19'59"E	Nimboo Bazgo (Alchi) HEP*	3070	17.12. 2007	-5.2	-0.4	8.1	9.6	nil	68	Nil	0.52	Nil

* Hydro-electric Project

Dominant species of phytoplankton recorded at Shey Fish Farm

Chlorophyceae

Ankistrodesmus convolutes, Ankistrodesmus falcatus, Chlamydomonas cingulata, C. globosa, C. Microspherea, Volvox aureus, Chlorella conglomerata, Chlorella vulgaris, C. Pyrenoidosa, Closterium acerosum, Closterium microporum, Closterium simansis, Closteriopsis longissima, Chlorococcum humicola, Desmidium spp., *Pandorina granulosa, Pediastrum duplex, Pediastrum simplex, Selenastrum gracile, Hydrodiction reticulam, Chaetophora elegans, Oedogonium spp., Cladophora spp., and Spirigyra communis*

Bacillariophyceae

Fragilaria cupucina, Fragilleria pinnata, Navicula sublinearis, N. Viridula, N. cryptocyphala, Pinnularia microstatum, Amphora ovalis, Asterionella formosa, Cymbella ltinceolata, Diatoma vulgare, Pinnularia nobilis, Rhopalodia gibba, Synedra ulna

Fish species

The two varieties of trout's cultured are the Rainbow trout (*Oncorhynchus mykiss*) and

Brown Trout (*Salmo trutta fario).* Among the common carp, Leather Carp (*Cyprinus carpio* var *nudus*), Mirror carp (*Cyprinus carpio var specularis*), and Scale Carp (*Cyprinus carpio var communis*) are important.

PROJECT CODE	RAEM/B/0022
PROJECT TITLE	**Multivariate Statistical Analysis of Water Quality Data**
SCIENTISTS	N. Okendro Singh

Water quality data observed for physico-chemical examination from three different sampling sites at monthly interval from the Gaula River has been used in this study (see Sunder *et al.*, 1991 for further details of data collection). The three sampling sites selected were first at the proposed Jamrani dam site, second at 2 km upstream of the HMT factory and third at 3 km downstream of the HMT factory. The data set was analyzed by SPSS 12.0 version available at NRC on Coldwater Fisheries, Bhimtal.

Principal axis factoring (PAF) and principal component analysis (PCA) are the most commonly used extraction methods for factor analysis. Moreover, PCA and PAF lead to similar substantive conclusions for most of the datasets. For the present data, PAF failed to give factor solutions. Thus, factor analysis was carried out using PCA of extraction method. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.507 indicating that the present data was merely fulfilled the criteria for conducting factor analysis. However, Bartlett's test of shpericity was highly significant ($p<0.001$), indicating sufficient correlation between the variables to proceed with the analysis because the extracted communalities were reasonably high (say, >0.5) and acceptable. The first five components in the solution depicted in Table (1) have an eigenvalues >1 that accounts for about 81% of observed variation in water quality observations and the rest being neglected. According to Kaiser criterion, only the first five components should be used because subsequent eigenvalues were <1. Similarly, Scree plot shown in Figure (1) was also observed as a useful tool to decide number of components.

On the other hand, cluster analysis was used to group the collected water quality data, where each cluster indicated the water of a particular quality. Figure (3) clearly depicted the cluster analysis result on sampling times. Broadly, three associations are evident – the first association included January through June except March; the second included March and August; the third included July through December except August month. Figure (4) represents the results of cluster analysis for water quality monitoring data from different sampling sites of the Gaula River. Two associations were evident. The sampling sites 1 and 2 can be clubbed together, that is significantly different from the sampling site 3 chosen near HMT Factory, Ranibagh. This could be enrichment of water quality due to chances of effluents from HMT Watch Factory; residential habitats in and around the factory site; burning of corpses at the cremation ground near the selected site etc. Thus cluster analysis result on sampling times showed three possible associations although seasonal affect on water quality is not clearly seen.

An interpretation of the rotated five components in Table (2) is made by examining the components noting the relationship to the original variables. Further, it was justified with the component loadings plot shown in Fig. (2). The first component explains about 20% of the total variance (Table 1) with strong positive loadings of the air temperature and water temperature and also, strong negative loading of pH. Thus, it basically represented the physical parameters group. Temperature affected the physical, chemical and biological processes in water bodies, and therefore, had an important role in determining the concentration of various water quality

Table 1 : Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.691	28.388	28.388	3.691	28.388	28.388	2.608	20.061	20.061
2	3.048	23.443	51.832	3.048	23.443	51.832	2.445	18.809	38.870
3	1.466	11.277	63.109	1.466	11.277	63.109	2.437	18.748	57.618
4	1.230	9.463	72.572	1.230	9.463	72.572	1.730	13.304	70.922
5	1.056	8.124	80.696	1.056	8.124	80.696	1.271	9.775	80.696
6	.775	5.960	86.656						
7	.607	4.667	91.323						
8	.379	2.912	94.235						
9	.307	2.365	96.600						
10	.267	2.056	98.656						
11	.110	.845	99.501						
12	.048	.367	99.868						
13	.017	.132	100.000						

Extraction Method: Principal Component Analysis.

variables. Thus, water temperature could be considered as an indicator variable of this component. The second component that explains about 19% of the total variance (Table 1) has strong positive loading on chloride and moderate loading on magnesium and calcium. High chloride content of water is an index of pollution from animal origin. Magnesium and calcium are generally found high when chloride concentrations are high. Chloride could be considered as an indicator variable of this component. The third component incorporates those water quality variables that are characteristics of wastewater discharges into the river since it explaines about 19% of the total variance (Table 1) with strong positive loadings of specific conductance, total dissolved solids and total alkalinity. Total dissolved solids may be considered as an indicator variable of this component. The fourth component had strong negative loading on dissolved oxygen and moderate positive loading on flow of water. This component explaines about 13% of the total variance. In general, negative loading on flow of water similar to dissolved oxygen is expected because, high speed of flow of water, in usual case, does not decrease the level of dissolved oxygen. However, oxygen depletion often resulted during high speed of flow of water exceptionally in this river. The water flow of this river was quite high especially during the rainy season wherein organic matters from various sources were added to the river water, resulting in depletion of dissolved oxygen level. After the monsoon months, flow of water was gradually reduced from month to month and dissolved oxygen content approaches to a stable level based on the volume of water. Dissolved oxygen content, which played a vital role in supporting aquatic life in running waters could be considered as the key parameter of this component. The fifth component has strong loading on free carbon dioxide alone that explained about 10% of the total variance. This component could be neglected because free carbon dioxide was not detected during most of the period at various sampling sites of this river system.

Table : Rotated Component Matrix (a)

Variables	Component				
	1	2	3	4	5
Air Temperature	.920	.059	.171	.107	.211
Water Temperature	.784	-.128	.132	.398	.268
pH	-.750	.194	.186	-.054	.410
Chlorides	.049	.820	.160	-.147	.021
Magnesium	-.473	.699	.071	.137	.122
Calcium	-.004	.696	.191	.085	-.251
Depth	.438	-.515	.003	.489	-.294
Specific Conductance	-.091	.243	.910	.248	-.016
Total Dissolved Solids	-.039	.191	.895	.281	.008
Total Alkalinity	.315	-.035	.791	-.282	.040
Dissolved Oxygen	-.193	-.116	-.170	-.763	-.129
Flow of Water	.106	-.602	.067	.682	-.130
Free Carbon Dioxide	.095	-.065	-.004	.046	.887

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 6 iterations.

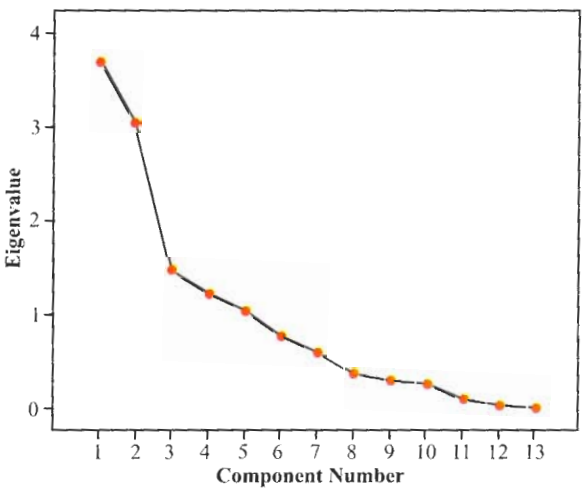


Fig. (1) Component plot in rotated space

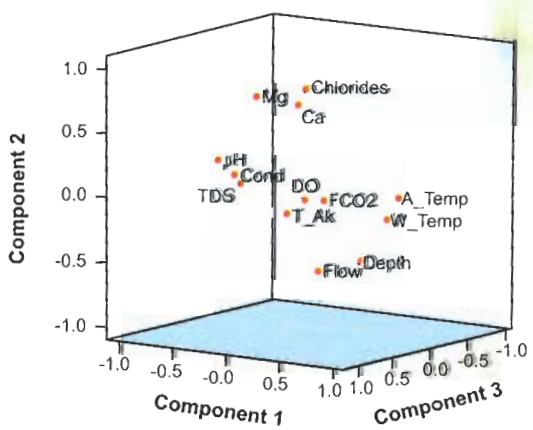


Fig. (2) Scree plot of the eigenvalues

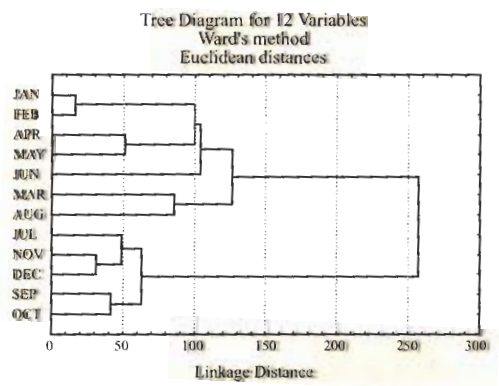


Fig. (3) Dendrogram showing sampling time clusters on Gaula River

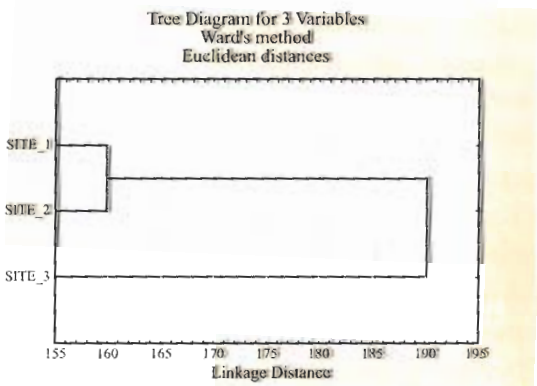


Fig. (4) Dendrogram showing sampling site clusters on Gaula River

PROJECT CODE	
PROJECT TITLE	Development of GIS based decision support system for aquaculture in selected coldwater region
SCIENTISTS	Ashok K. Nayak, Prem Kumar & P.C. Mahanta

The spatial decision support system is the conjunctive application of geographical information systems (GIS) and decision support system technologies, aiming to assist in development of aquaculture in coldwater region. Coldwater fisheries occupy an important place in the Himalayan region having abundant aquatic resources in terms of natural lakes, rivers, streams and ponds, which hold large population of both indigenous and exotic fish species. The combination of computer programming and GIS can be used as an integrated decision support system to assess the fisheries resources to derive strategies for integrated management of the region. The study would entail use of emerging technologies *viz*. GIS and modeling to optimize the use of resources, production system there in and post harvest programmes, activities for planning and rational development of the resources.

Uttarakhand state comprises two major regions namely Kumaon and Garhwal having total 13 districts. The Nainital district has significant aquatic resources in terms of rivers, streams, natural lakes and ponds. Among these available resources the region has number of natural lakes, which constitute a valuable resources for development of aquaculture fisheries. The major lakes in this district are Nainital, Bhimtal, Naukuchiyatal, Sattal, Garudtal, Khurpatal and Hanumantal.

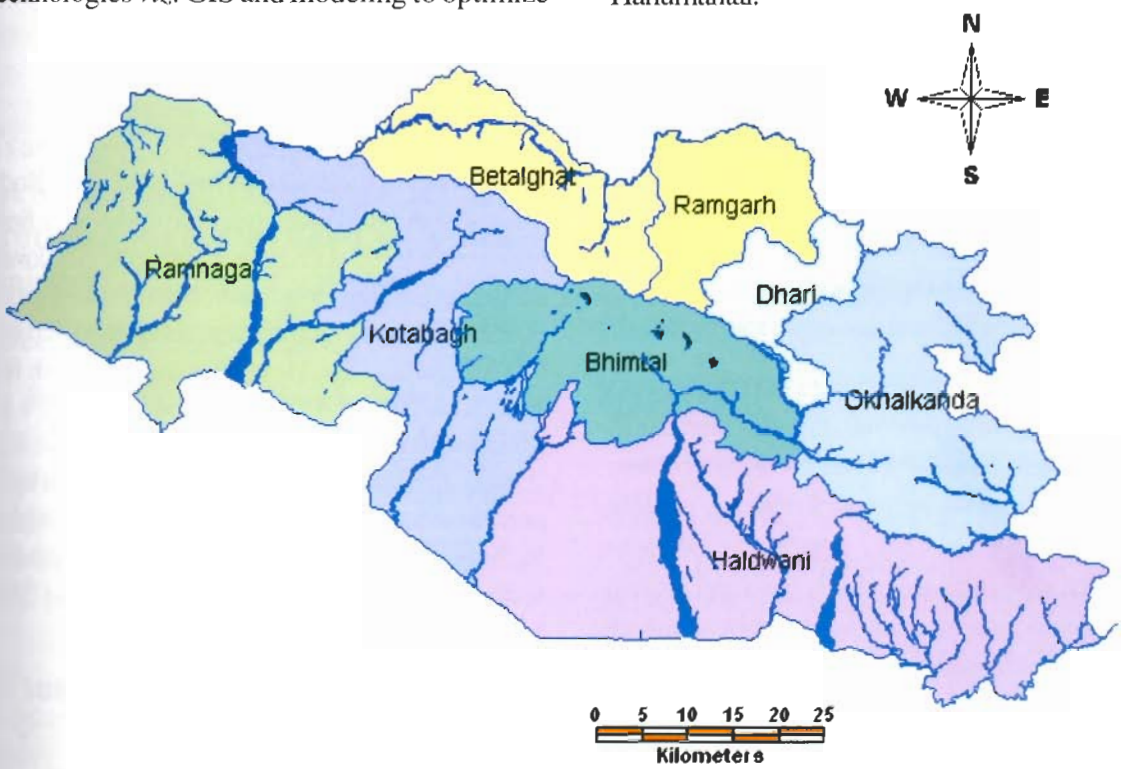


Fig. 1 : Rivers and streams of Nainital district

Under the project the IRS-1C LISS III satellite images of Nainital district having Path and Row of 98 & 50 were analyzed. The images then geo rectified with respective toposheet of Survey of India and global positioning system. A subset of study area from remote sensing imagery was prepared. Toposheets of the study area were scanned and geo-rectified and were mosaiked as one scene. A subset of study area was prepared from the mosaiked toposheet. The subset of toposheet was digitized to block level for water resources and infrastructure of the study area. In this process ERDAS Imagine and Geomedia professional software were used. The lakes and rivers/streams are digitized and the area of lake and length of each river/streams were calculated. The road network along with fish market, fish hatchery were digitized on block level.

AQUACULTURE

PROJECT CODE	AFE/B/0019
PROJECT TITLE	Evaluation of indigenous ingredients and feed supplements for feed formulation of indigenous upland fishes of Kumaon region
SCIENTISTS	Yasmeen Basade, Madan Mohan

Evaluation of dietary requirements for key nutrients

Dietary protein requirement of Himalayan golden mahseer

The carcass protein and lipid content increased significantly (P<0.05) with increase in dietary protein up to 40% level. Body ash content also increased with increase in dietary protein concentration to 45%. Moisture content decreased with increase in body lipid and protein levels. Crude protein, crude lipid and gross energy efficiency increased significantly (P<0.05) with increase in dietary protein level up to 40%. However, with further increase in dietary protein level to 45% the values for nutrient and gross energy efficiency decreased significantly (P<0.05). ADC of crude protein, crude lipid and gross energy was significantly (P<0.05) higher in fish fed diet containing 40% protein compared to fish fed in all other diets.

Dietary lipid requirement of Himalayan golden mahseer

With increase in dietary lipid content body lipid increased significantly (P<0.05) up to 15% lipid level. But with further increase in dietary lipid, body lipid content decreased significantly (P<0.05) in fish fed with 25% lipid. Body protein also exhibited similar trend being significantly (P<0.05) higher in fish fed 15% dietary lipid and with further increase in dietary lipid body protein level decreased significantly (P<0.05) for 25% lipid diet. Body moisture content showed inverse relation to body lipid as well as protein content, being lower in fish fed with 15% lipid level. Body ash also exhibited inverse profile to the body lipid and protein levels with significantly (P<0.05) lower value in fish fed 15% lipid. Nutrient and gross energy efficiency increased significantly (P<0.05) at 15% dietary lipid level compared to fish fed with lower level 5% and higher level 25% of dietary lipid. In fish fed with increasing levels of dietary lipid ADC of crude protein, crude lipid and gross energy was significantly (P<0.05) higher in fish fed 15% lipid level compared to fish fed with lower 5 and 10% and higher 20 and 25% levels of lipid.

Dietary carbohydrate requirement of Himalayan golden mahseer

Body moisture content decreased significantly (P<0.05) with increase in dietary carbohydrate

level to 25%. Protein and lipid content increased significantly (P<0.05) with increase in dietary carbohydrate level up to 25%. With further increase in carbohydrate level to 30% body protein and lipid content decreased significantly (P<0.05). Ash content was lower in fish fed 25% carbohydrate diet. With increase in dietary carbohydrate level from 10% to 30%, crude protein, crude lipid and gross energy efficiency were significantly higher (P<0.05) in fish fed 25% dietary carbohydrate. With further increase in dietary carbohydrate to 30% level these values decreased. In fish fed with 25% dietary carbohydrate the ADC of crude protein, crude lipid and gross energy was significantly (P<0.05) higher compared to fish fed with all other levels of carbohydrate.

Based on the results obtained so far and the biochemical composition of carcass, nutrient and gross energy efficiency and ADC of nutrients and gross energy it can be concluded that the dietary requirements of Himalayan golden mahseer are 40% protein, 15% lipid and 25% carbohydrate.

Evaluation of the inclusion levels of the locally available indigenous plant protein sources in feed of golden mahseer

Effect of raw horse gram

Body protein and lipid content were significantly higher (P<0.05) in fish fed with diet having 10% raw horse gram. Moisture content was inversely proportional to the lipid and protein contents being lowest in fish fed 10% dietary raw horse gram. Ash content decreased significantly (P<0.05) with increase in raw horse gram level in diets from 0 to 20%. Crude protein, crude lipid and gross energy efficiency were significantly (P<0.05) higher in fish fed with 10% raw horse gram feed compared to those fed with 0, 5, 15 and 20% levels. ADC of crude protein, crude

Discussion of CIFT scientist with Incharge Nutrition Lab.

lipid and gross energy increased significantly (P<0.05) with increase in raw horse gram content in the diet from 0% to 10%. But with further increase in raw horse gram levels to 15% and 20% the ADC values decreased.

Effect of heat-treated horse gram

Biochemical composition in terms of body protein and lipid content of fish fed with 10%

Demonstration of feed mill to visitors

heat-treated horse gram was significantly (P<0.05) higher. While the values of body protein and lipid content were less in fish fed with lower, 0 and 5% and higher, 15 and 20% levels of heat-treated horse gram. Moisture content was found to decrease with increase in body lipid and protein content hence it was lower in fish fed with 10% heat-treated horse gram. Ash content decreased with increase in levels of heat-treated horse gram

in the diets being lowest in fish fed with 25% heat-treated horse gram. Nutrient and gross energy efficiency increased significantly (P<0.05) in fish fed with 10% heat-treated horse gram compared to fish fed with all other levels of heat-treated horse gram. Heat-treated horse gram when fed at 10% level gave significantly better (P<0.05) values for ADC of crude protein, crude lipid and gross energy than the fish fed with higher and lower levels of heat-treated horse gram.

The horse gram can be incorporated in the golden mahseer diets up to 10% level. However, it is advantageous to use heat-treated horse gram over the raw forms as heat treatment denatures the anti-nutrients present in them.

Effect of raw black soybean

The biochemical composition of fish exhibited variations corresponding to the level of raw black soybean added to their diets. Body protein and lipid contents were significantly higher (P<0.05) and moisture content lower in fish fed with 30% of raw black soybean compared to those fed all other concentrations. Carcass ash content decreased with increase in level of dietary black soybean. Crude protein, crude lipid and gross energy efficiency increased significantly (P<0.05) with increase in dietary raw black soybean levels up to 30%. However, with further increase in dietary raw black soybean level to 40% these values decreased. ADC of crude protein, crude lipid and gross energy was significantly better (P<0.05) in fish fed with diet having 30% raw black soybean compared to fish fed with 0, 10, 20 and 40% of dietary raw black soybean.

Effect of heat-treated black soybean

Carcass protein and lipid contents increased to significantly maximum (P<0.05) levels with increase in level of dietary heat-treated black soybean from 0% to 30%. But with further increase in dietary heat-treated black soybean level these values decreased. Body moisture content was inversely related to body lipid and protein content being lowest in fish fed with 30% level of heat-treated black soybean. Ash content decreased with increase in level of dietary heat-treated black soybean. Nutrient and gross energy efficiency was significantly higher (P<0.05) for crude protein, crude lipid and gross energy in fish fed with 30% level of dietary heat-treated black soybean compared to those fed with 0, 10, 20 and 40% levels. ADC of nutrients and gross energy was fond to increase with increasing levels of dietary heat-treated black soybean being significantly greater (P<0.05) in fish fed with 30% levels. However, with further increase in level of dietary heat-treated black soybean these values were found to decline.

The black soybean can be incorporated in the golden mahseer diets up to 30% level. However, it is advantageous to use heat-treated black soybean over the raw forms as heat treatment denatures the antinutrients present.

Analysis of the suitability of the locally available indigenous carbohydrate sources in feeds of golden mahseer

Body protein, lipid contents were significantly better (P<0.05) in fish fed wheat flour compared to those fed with mandua, ramdana and ugal. Consequently, moisture and ash contents were lower in fish fed with wheat flour. Crude protein, crude lipid and gross energy efficiency were significantly more (P<0.05) in fish fed with wheat flour than those fed with all other carbohydrate sources. In fish fed diets having wheat flour as carbohydrate source the ADC of crude protein, crude lipid and gross energy was significantly higher (P<0.05), as measured for other carbohydrate sources.

The various locally available indigenous carbohydrate sources assessed indicated that the

control diet having wheat flour as carbohydrate source gave better performance. Hence, wheat flour is advantageous over mandua, ramdana and ugal.

Effect of available dietary probiotic and immunostimulants on golden mahseer

With the increasing level of dietary probiotic and immunostimulant the carcass protein and lipid content increased with significantly higher ($P<0.05$) values at 0.15% level. With further increase in level of dietary probiotic and immunostimulant body protein and lipid content did not exhibit an increase in these values, however, a decline was observed at 0.20 and 0.25% levels. Moisture content showed inverse relation to body protein and lipid contents. Ash content was also less in fish fed with 0.15% level of probiotic and immunostimulant compared to those fed all other levels. Crude protein, crude lipid and gross energy efficiency were significantly better ($P<0.05$) in fish fed with 0.15% level of probiotic and immunostimulant compared to those fed with all other levels. ADC of crude protein, crude lipid and gross energy increased with increasing levels of dietary probiotic and immunostimulant being significantly greater ($P<0.05$) in fish fed with 0.15% level. While in fish fed with higher levels of 0.20 and 0.25% and lower levels of 0.05 and 0.10% probiotic and immunostimulant as well as in control diet the ADC of nutrients and gross energy was less.

For probiotics and immunostimulants a commercially available product was used as this product contains both the probiotics as well as immunostimulants. The results indicated that this product when incorporated at 0.15% level gave better performance in Himalayan golden mahseer fingerlings.

PROJECT CODE	AFE/B/0020
PROJECT TITLE	Studies on induced maturation and seed production of Himalayan Mahseer, *Tor putitora* and *Schizothorax richardsonii* in pond Environment
SCIENTISTS	B.C. Tyagi, S.Sunder, R. Kapila & P.Kumar

The fish stocks of S. *richardsonii* and *Tor putitora* of different age group initially collected from wild were being reared in pond environment at Chherapani Fish Farm Champawat (1620 m asl) and in 2 hired ponds at Bhimtal (1200m asl) since October 2005. The species, *Tor putitora was stocked* @ 1 fish / m^2 in two ponds having an area of 95 and 104 sq. m respectively with an average weight of 50g (Av. TL171 mm) and 183 g (Av. TL280 mm). Fishes are growing well in ponds @ 4.4 –4.8 g/mo. (Table 1)

Table 1 : Stocking & growth details of Mahseer brood stock

Mahseer Species	Pond 1	Pond 2
AREA (m^2)	100	100
DENSITY (FISH/M^2)	1	1
No & Av. wt. (gm) (Oct 2005)	100	100
	50.0	183
No.& Av.Wt. (gm) (Feb2006)	67 ,55.7	72 ,190
No.& Av.Wt (gm) (Feb2007)	89,102.8	68, 248
Survival (%)	89	68
Growth / mo (G)	4.4	4.8

Maturating mahseer brooders under pond conditions at Bhimtal

No growth was recorded during winter months (December-March) owing to low temperature (6.7-16.8°C). Some bacterial and fungal infection was noticed and controlled. The hormones namely methyl testosterone MT was added in formulated feed from March 2008 for the stock having age above 3 and 4 years. Regular observations indicated that fishes were maturing, and would attain prime maturation in May to June 08, which could be induced to spawn. Water temperature ranged 6.7- 26.4 °C, DO_2, pH, CO_2, Alkalinity were within normal ranges.

Similarly the fish stock of snow-trout is being reared in 3 nursery ponds (15m²) at Champawat @ 8 (18 g), 11.3(57 g) and 5.3 (85 g) fishes/ m² since October 2005. After 3 years, fishes have attained 47, 93 and 118 g weight respectively. The fishes having 3+ years age indicated maturity and would be induced to spawn in coming season. The fishes were fed on a formulated diet having important gradients necessary for growth and maturation. Ponds were also being fertilized with organic manures to maintain plankton population. Water quality was being monitored to keep the quality at optimum. Growth of fishes was being recorded at monthly intervals and results were quite encouraging at this stage of rearing.

Quantification of vitellogenin in *S. richardsonii* brooders with ELISA

ELISA was standardized using polystyrene microtitre plates coated with known concentrations of purified vitellogenin (Vtg) of carp as antigen (25ng/ul) in PBS. The antigen was allowed to stick to plastic plates in 0.06M carbonate buffer (pH 9.6) at 5°C for overnight. After antigen binding the wells were washed 3 times with PBS/T followed by blocking of wells with BSA to avoid errors in reading due to non specific binding of antibodies to plastic surface. After 2 hrs of incubation with blocking reagent it was removed and replaced with primary antibodies raised against carp vitellogenin in rabbit. Dilution of primary antibodies was standardized to be 500 times for proper antigen-antibody reaction for measuring vitellogenin levels in liver and blood of fish during maturity. Plates were incubated for 1 hr at 37°C with primary antibody then washed thrice with PBS/T and followed by addition of secondary antibody (anti rabbit goat antibody) conjugated with peroxidase enzyme. Dilution of second antibody was standardized to be 1000 times for proper reaction. Finally substrate for peroxidase (TMB/H_2O_2) was added to get the colored product whose intensity was measured at 450nm by ELISA reader. A straight line curve was obtained for measuring vitellogenin from 10 to 100ng.

Liver samples from *Schizothorax richardsonii* (T.L.240-255mm) females weighing 75-133g were obtained from river Kosi. Their gonadosomatic index has been calculated and attempts have been made to measure of Vtg levels.

PROJECT CODE	AFE/A/0021
PROJECT TITLE	Cage culture of fishes in floating cages in subtropical Himalayan lake-Bhimtal
SCIENTISTS	Madan Mohan, Shyam Sunder, B.C. Tyagi, Yasmeen Basade

To build up technology for cage culture in open waters, lay out design for the cages was prepared and got fabricated. Each unit comprise of four cages (3 m x 3 m x 3 m each) made of HDPE net (4-15 mm mesh size) fitted with a wooden frames suspended with angle iron poles at suitable site in lake Bhimtal. All the sides of cages have been provided with working wooden platform.

The fingerlings of golden mahseer were collected from natural riverine ecosystem at Ramnagar portion of Kosi river and snow trout from Garam Pani area for stocking them in cages. Mahseer and snow trout were stocked in four cages separately wherein two length groups were reared separately. One cage was treated as control for each group and in treated ones artificial diet prepared by this Institute was provided. About 350 fish were stocked in each cage @ about 40 fish per cubic metre area. These experiments were carried out for three months. The initial weight of golden mahseer, *Tor putitora* ranged from 3.1 to 3.9g (ave. 3.5g) during second week of August. The artificial feed was given in treated cages @ 5-10% of fish body weight. After three months of experiment with smaller size of fishes, the survival rate in control cages was recorded as 43.4% as compared to 61.1%. in cages given artificial feed. The final fish biomass recorded as 1029g having 6.1-7.5g weight (av. 6.9g) of individual fish with daily growth of 0.04g in control cages. However, these values were 2953g, 12.4-16.1 (av. 13.8g) and 0.11g for treated cages. For other experiment, slightly bigger size golden mahseer were stocked size ranging 5.8-6.5g (6.1g) at the rate of 350 fish per cage with initial total fish biomass of 2135g. Fish in treated cages were fed with artificial diet. Since these fish were bigger in size, the rate of survival was better in control (49.7%) as well as in treated cages (67.1%). The values for total final fish biomass as 1810g, individual fish weight as 8.3-11.9g (av. 10.4g), weight increase per fish 4.3g and daily growth as 0.05g in treated cages while 4536g, 18.2-21.3g (19.3g), 13.2g and 0.14g respectively in treated cages.

The fish rearing experiments were also carried out with two size groups of snow trout *Schizothorax richardsonii* by stocking 350 fishes in each cage. Smaller size snow trout with weight range 2.7-3.8g (av. 3.2g) with total biomass of about 1120g were reared for three months. Similar to mahseer, fish in treated cages were given artificial feed twice in a day at the rate of 5-10% of fish body weight. After three months of rearing period, fish in control cages grew from 3.20g to 3.80g showing monthly growth of 0.20g with survival of 51.70% while their growth was better in treated cages being 0.57g per month and improved survival of 69.00%. These experiments were also carried out with bigger size ranging 4.8-6.7g (av. 5.3g). All other parameters except size of fish were similar. After three months, fish

Spawn rearing in cages

grew 6.4-7.8g (av. 7.1g) in control cages and 7.8-9.7g (av. 8.9g) in treated cages with daily growth of 0.02g with 53.70% survival: while in fish fed with artificial diets grew 7.8-9.7g (av. 8.9g) with daily growth of 0.04g and survival of 70.30%.

Parameters	Inside cages	Outside cages
Water temp. (^{0}C)	21.2-26.4	20.1-26.2
Transparency	1.71-2.24	1.71-2.00
pH	6.9-8.7	6.5-8.7
Dissolved oxygen mg/l	5.2-7.6	5.20-7.2
Free carbon dioxide mg/l	0.9-2.10	0.9-3.12
Alkalinity	69-116	69-109
Conductivity umhos	251-342	251-378

The artificial diet provided to fishes had 40.65% protein, 16.84% lipid, 6.97% crude fibre, 25.14% NFE, and 10.40% ash. The feed was well accepted by both the fish species.

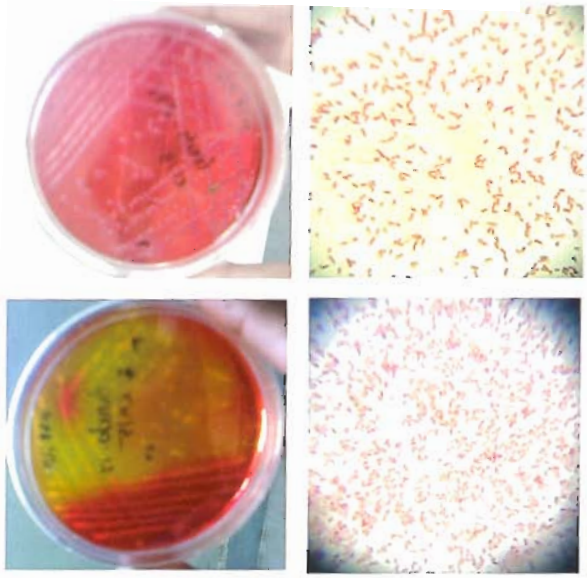
The abiotic and biotic parameters such as water quality and plankton were recorded and analysed inside and outside the cages. The water quality parameters inside and outside as recorded are given below:

Total plankton counts ranged 2.7-7.2 x 10^4 units per liter inside cages and 2.6-6.8 x 10^4 units per litter outside cages. Phytoplankton formed the bulk and comprised of diatoms 28.11-40.02% (av. 33.76%), Dinophyceae 21.78-31.47% (av. 25.91%), Chlorophyceae 29.12-42.97% (av. 36.34%) and blue green algae 1.99-6.38% (av. 3.99%). The important genera included

Fragillaria, Synedra, Navicula, Cymbella and *Amphora* in diatoms; *Ceratium hirudinella* in Dinophyceae; Spirogyra, *Ulothrix, Zygnema, Closterium* among green algae; *Oscillatoria* and *Rivularia* among blue greens. In zooplanktons, *Arcella, Daphnia, Keratella, Monostyla* and *Cyclops* were dominant genera

PROJECT CODE	
PROJECT TITLE	Cold water fish health management
SCIENTISTS	A. Pande, N.N. Pandey, Y. Basade

Methods for the isolation of pathogenic bacteria of fish are being standardized and pure cultures have been obtained from water, post mortem samples and sacrificed fish. The pure cultures obtained were stored and catalogued in order to have a microbial repository.



***Pseudomonas* species recovered from infected tissue**

GENETICS & BIOTECHNOLOGY

PROJECT CODE	AFE/B/0015
PROJECT TITLE	Studies on biochemical mechanism of cold tolerance of coldwater fish *Schizothorax richardsonii* (Gray)
SCIENTISTS	Rajeev Kapila

Measurement of organic osmolytes glucose, urea & lactic acid in blood plasma

During the period under report test specimens of *Schizothorax richardsonii* were reared for 96hrs at 5°C and 20°C respectively in glass aquarium. Blood samples were collected from heart using heparin as anticoagulant. Blood plasma was separated by centrifugation at 3000 rpm for

Schizothorax richardsonii in experimental aquarium

10 minutes. Level of plasma glucose was observed to increase significantly by 2.4 fold (4.37 mM) after 12 hrs of cold exposure and further was maintained between 2.68 to 2.8 mM respectively in samples collected at 24, 48, 72 and 96 hrs. On the other hand plasma lactate concentration was observed to increase by 4.6 fold after 12 hrs of cold treatment as compared to control, which returned to almost same values of control (2.8- 3.1 mM) after 24 hrs of rearing of fish at 5°C. 2.67- 3.28 mM plasma urea were also detected from 12 to 24 hrs reared samples as compared to control values of 1.56mM.

Impact of Cold on HSP-70 levels in muscle tissue of *S. richardsonii.*

ELISA was standardized using polystyrene microtitre plates coated with antigen (fish muscle tissues) extracted in 0.06M carbonate buffer (pH 9.6). The antigen was allowed to bind plastic surface at 37°C for 3 hrs. After antigen binding the wells were washed 3 times with PBS/T followed by blocking of wells with BSA to avoid errors in reading due to non specific binding of antibodies to plastic surface. After 2 hrs of incubation with blocking reagent it was removed and replaced with primary antibodies raised against Hsp-70 of carp fish in goat. Dilution of primary antibodies was standardized to be 10 times for proper antigen-antibody reaction for measuring Hsp levels due to cold stress of fish. Plates were incubated for 1 hr at 37°C with primary antibody then washed thrice with PBS/T and followed by addition of secondary antibody (anti goat rabbit antibody) conjugated with peroxidase enzyme. Dilution of second antibody was standardized to be 1000 times for proper reaction. Finally substrate for peroxidase (TMB/ H_2O_2) was added to get the colored product whose intensity was measured at 450nm by ELISA reader.

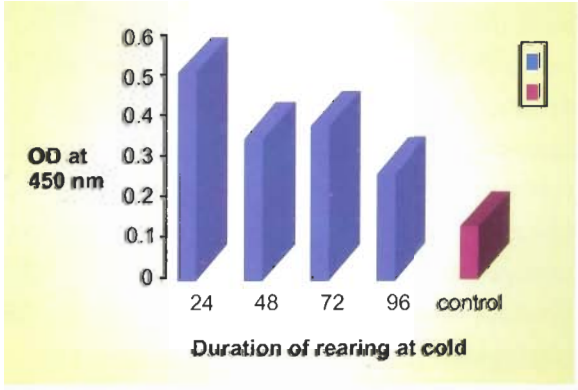


Figure 1: Impact of cold on muscle HSP-70 of *S.richardsonii*

Test fish (*Schizothorax richardsonii*) exposed to cold temperature of 5°C exhibited higher levels of Hsp-70. It has been observed that Hsp-70 production was increased by 296.56,171.75, 195.93 and 106.10% respectively at 24, 48,72 and 96 hrs exposure at 5°C as compared to control; maintained for 96hrs at 20°C.

Isolation of genomic DNA and PCR Amplification of Anti-freeze gene using specific primers from *S. richardsonii*

DNA was extracted from fish muscle tissues. The Quality of isolated DNA was checked on 1% agarose gel electrophoresis in 1X TAE buffer.

Three pair of forward and reverse primers were selected out of fourteen primers designed using 'DNAman software' of primer designing, considering DNA sequence of winter flounder (*Pseudopleuronectes americanus)* as reference (accession no. : L00138) .

On preliminary screening for PCR amplification at annealing temperature of 55^{0}C, first two primers exhibited the amplification while no amplification product was visible with third pair of primer on 2%agarose gel. To further confirm the amplification product, gradient PCR with mean annealing temperature of 60 ^{0}C (G = 55-65^{0}C) and 65^{0}C (G=60-70^{0}C) were also set. A PCR product <300bp were observed with optimal intensity at 63^{0}C whose intensity decreased on further increase of annealing temperature. At lower annealing temperature of 55^{0}C some nonspecific products were also visible. The product obtained needs to be sequenced for confirmation of anti-freeze gene.

PROJECT CODE	
PROJECT TITLE	Genetic Characterization of Important Snow Trout Fish Species
SCIENTISTS	G.K.Sivaraman, A. Barat and Rajeev Kapila

Eleven random primers were employed to screen for RAPD markers in the four commonly available coldwater fish species viz., *Tor putitora, Schizothorax richadrsonii*, *Raiamas bola* and *Garra gotyla* from the natural water bodies of the Himalayan region. Genomic DNA was isolated from muscle tissue (150mg) of each species using phenol:chloroform: isoamylalcohol method and subsequently subjected to RAPD- PCR amplification after confirming their quality on Agrose gel electrophoresis. The PCR products ranged from 200 to 5000 bp in all the fish species were only considered for analysis. Total 188 bands were scored with the eleven primers employed, out of which 39, 57, 40 and 52 bands were scored in the *Tor putitora*, *Schizothorax richadrsonii*, *Raiamas bola* and *Garra gotyla* species respectively. The average numbers of bands scored were 3.54 ± 0.72, 5.18 ± 0.69, 3.64 ±0.58 and 4.73 ± 0.78 in *Tor putitora*, *Schizothorax richadrsonii*, *Raiamas bola* and *Garra gotyla* respectively. The maximum numbers of scorable bands were obtained with primer OPA- 03 in *Tor putitora* (08 ± 0.71), *Schizothorax richadrsonii* (08± 0.71), *Raiamas bola* (07± 0.71) and *Garra gotyla* (07±0.71) among all the primers. The minimum numbers (1 to 4) of amplified fragments were observed with primer OPF- 17 in all the fish species. The average number of scorable bands ranged from 1 to 8, 2 to 8, 1 to 7 and 1 to 8 in all the four species respectively. This data can be utilized for construction of phylogenic tree between various Himalayan fish species to establish the genetic relationship among them.

Table 1: Estimation of Genetic Distances Between Fish Species Using RAPD

	T. putitora	S.richar-dsonii	R.bola	Garra sp
Tor putitora	-	0.43	0.60	0.52
S.richardsonii	-	-	0.44	0.36
R.bola	-	-	-	0.46
Garra sp.	-	-	-	-

Fig. 1: RAPD-PCR amplification patterns in pooled DNA samples of Coldwater Fish Species with primers BG 53, BG 54 and BG 56.

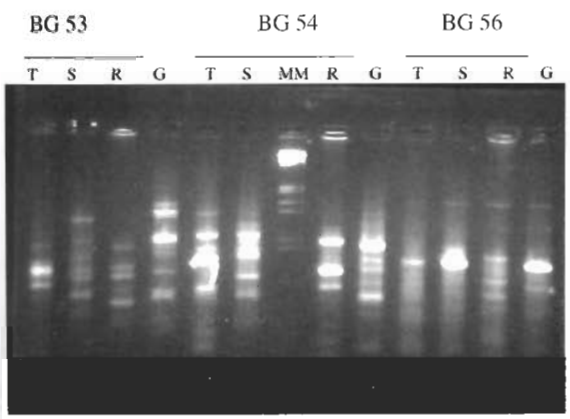
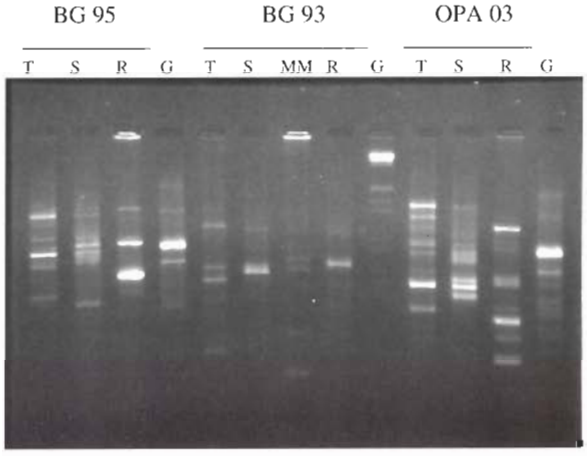


Fig. 2: RAPD-PCR amplification patterns in pooled DNA samples of Coldwater Fish Species with primers BG 95, BG 93 and OPA 03.



T, S, R and G represent the DNA samples from *Tor putitora*, *Schizothorax richardsonii*, *Raiamas bola* and *Garra species* respectively; MM: ë-DNA *Ecor* I *Hind* III double digest marker

Fig. 3: RAPD-PCR amplification patterns in pooled DNA samples of Coldwater Fish Species with primers BG 98, BG 54 and OPA 05.

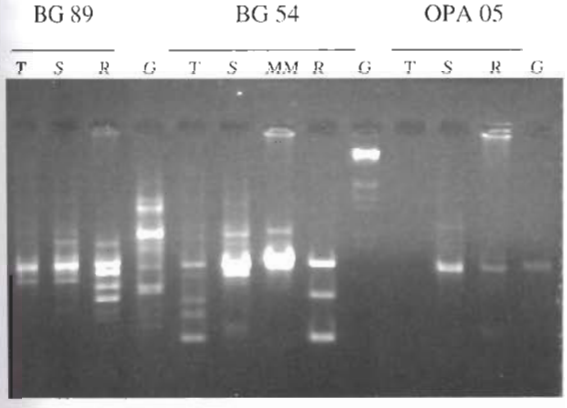
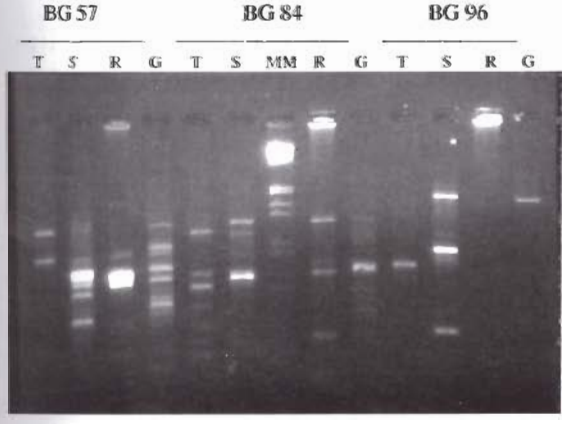


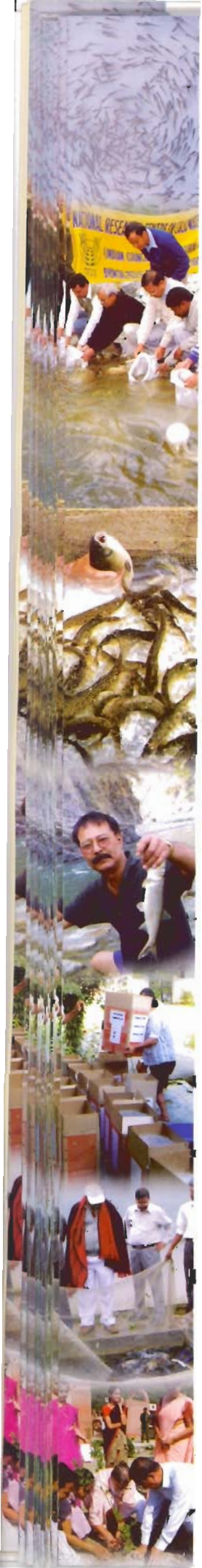
Fig. 4: RAPD-PCR amplification patterns in pooled DNA samples of Coldwater Fish Species with primers BG 57, BG 94 and BG 96.



PROJECT CODE	ICAR-Mega Seed Project
PROJECT TITLE	Seed production in agricultural crops and fisheries
SCIENTISTS	Madan Mohan, Prem Kumar

The seed production technology for coldwater fishes is quite different from carp seed technology used in hills. However, there is an urgent need of fish seeds in hills for growing fish for consumption and ranching in rivers and lakes for sport fishery etc. Under this programme hatchery at Bhimtal has been renovated and used for seed production of mahseer as well as common carp. On the other hand, the institute is providing initial help to fish farmers in the form of fish seed and technical knowledge for rainbow trout culture.

- Seed production of mahseer in 2007-08 was 75000 compared to 25000 in 2006-07.



- Seed production of common carp 15 lakh spawn and 5 lakh fry in 2007-08 compared to 10 lakh spawn and three lakh fry in 2006-07.
- Breeding of rainbow trout in comparatively warmer waters of mid- altitude region.

Infrastructure development

The necessary components procured & installed at Bhimtal & Champawat for renovation of hatchery for mahseer, rainbow trout and common carp by replacing existing hatching and rearing facilities at Bhimtal and Champawat.

Rearing of mahseer and common carp brooders

About 75500 seed of endangered golden mahseer was produced by using newly created hatchery facilities and stocked in Bhimtal lake. About twenty nos. of golden mahseer and fifty numbers of common carp brooders are being reared at the mahseer hatchery complex in 12x5m size earthen pond. About 125 number of brood stock of common carp measuring 250-350 mm in length and 250-900 gm in weight and about 280 nos. yearlings measuring 80-110mm in length and 30-100 gm in weight are being reared at Champawat fish farm that would be used as brood stock for seed production in forthcoming breeding season. The brood stock is likely to breed in April 2008.

Seed production of Golden Mahseer

During this year 2007-08, 22 female brooders of golden mahseer (T.L 350-500 mm and 400-1200 g in weight) were collected using gill nets in Bhimtal lake. The ripe eggs (103,200 nos.) were stripped and fertilized with oozing milt from male specimen (T.L 280-510 mm and 300-1100 g in weight) by "dry method". The rate of fertilization varied between 86.5-92.0%. The fertilized eggs were kept in hatching trays having flow-through facilities (water flow of 2-3 l/min) for incubation. The incubation period ranged between 118-120 hours depending upon the water temperature fluctuating between 16.5-24.5^{0}C and the yolk-sac absorption was completed within 10-12 days at the water temperature of 17.5-25.0^{0}C. The hatching rate was 85.0-92.0% and about 82000 nos. swim up fry were produced.

Distribution of fish seed

30,000 seed of golden mahseer produced under this project at NRCCWF sold for Rs. 30,000/- to Deputy Director, Department of Fisheries, Siliguri, West Bengal. About 20,000 seed was released and stocked in Bhimtal lake by Secretary, ICAR New Delhi. About 15,000 seed of mahseer used for ranching at Kosi river Garampani. About 10,000 seed was provided to GBPUAT, Pantnagar for experimental purposes. 500 seed provided to a fish farmer at Hawalbagh near Almora.

Seed production of common carp

About 18 nos. of females of common carp were bred in the first and second week of March 2008. About 15 lakh spawn from which about 5 lakh fry have been produced at Bhimtal by using mahseer hatchery facilities.

Broodstock rearing and breeding of Rainbow Trout

Rearing of rainbow trout at a comparatively lower altitudes and higher temperature regimes of Kumaon region is a very important recent phenomenon. The fast growing rainbow trout stock was brought by NRC on Coldwater Fisheries from Kokernag Fish Farm of Department of Fisheries, Jammu and Kashmir to

raise brood stock at its fish farm for seed production. Now the brood stock is about three years old. Rainbow trout normally starts breeding at 2 + year age but good quantity eggs were expected from three years old females. The good brooders of rainbow trout were available during second week of January 2008 for breeding. Three year old matured female with weight range of 0.80- 1.250 kg and males in weight group of 0.60- 0.90 kg were used. Brooders were given good and proper diet. They were not been fed 2 days prior to breeding. For the first time, Rainbow trout breeding was carried out 7th to 9th January and about 12,700 eggs were produced out of which 2600 eggs were found non viable. The number of ripe eggs ranged 600-1000 though 2600 all non-viable eggs were stripped from one female. Rate of fertilization was estimated as 84.56%. From third day onwards, some mortality was observed. Eyed ova stage in these fertilized eggs was appearing and survival up to this stage is about 40.6%. Second attempt for breeding made produced about 4000 viable eggs in March 2008.

PROJECT CODE	NEH
PROJECT TITLE	Fisheries Research and Development in NEH region
SCIENTIST	B.C. Tyagi, D. Sarma

Aquaculture Development through Demonstration on carp farming system

The "Composite Carp Farming Technology" involving three exotic Chinese Carps namely grass carp, silver carp, common carp @ 3-4 fishes/m² in a combination of 40-45%, 20-25% & 35-40% respectively plus 10% Rohu/Chocolate Mahseer with the provision of supplementary feed @ 2-3% of body weight of fish on daily basis and fertilization with lime and only organic fertilizers

The VC, RGU University with Director DCFR

@ 9000 kg/ha is presently being demonstrated in NEH region.

Arunachal Pradesh

The15 farmers of Ziro and Along area of Arunachal having 15 ponds covering an area of 1.4 ha and selected in 2005-06 under this programme are growing fishes @ 0.6-0.7 kg/m² at a price of Rs. 20- 26/kg. Other farmers of this area are following the methodology. The technical guidance and part financial assistance are being given to all of them with the help of the staff of RG University, Itanagar. Encouraged by the progress achieved in Ziro and Along area, the state Fisheries Department of Arunachal selected 2 farmers in each district of the State, being total

Visit of Institute scientist at fish pond in NEH

22, and adopted the carp farming technology. All the 22 farmers have stocked their fishponds with Chinese carps as suggested by us and growing fish based on supplementary feed and organic fertilizers. As the water is acidic in nature regular liming is being done. The fish loss is estimated minimal ranging 10-15%. After a period of 8 months the production has been estimated @ 0.31- 0.42 kg/m². In addition to these farmers, 14 farmers of Chug village in Dirang block of Bomdilla Districts have also adopted carp farming technology. The technical aspects and financial assistance is being looked after by NRCCWF. Fish production has been reported higher than 0.56 kg/m².

Manipur State

In 2006-07, the hill area of Ukhrul districts in Manipur was selected for demonstration of carp farming technology. Initially seven farmers joined the programme and later 4 new farmers also joined it. All the ponds are stocked with Chinese carps slightly in varied ratio and density owing to availability of fish fingerlings. Farmers are fertilizing their ponds and feeding fish irregularly. Few ponds have been harvested and fish production @ 0.48-0.67 kg/m² was achieved. The demonstration programme is a grand success in the area and more farmers are adopting it. The State Fisheries Department is helping us, however; the technical and financial help in form of cost of fisheries inputs is being born by NRC on Coldwater Fisheries. On request of ICAR Research Complex, Imphal, Manipur, the composite carp farming system programme has been extended to 4 new district of Manipur namely Senapati, Tamenglong, Chandel and Churachandpur by adopting 2 farmers in each district. All the ponds have been stocked and progressing very well. The subject specialist posted under KVK, Chandel has been trained to implement the programme.

Paddy-cum-fish culture in Arunachal & Manipur

In Arunachal Predesh, Attapani tribals in Ziro district do a community-based paddy-cum-fish culture in traditional way. The system though is quite innovative and successful but has scope to enhance productivity by scientific interventions. Two plots of over 0.6 ha were selected, prepared fields were planted with paddy of local variety and common carp fry were released later @ 20000 / ha. Regular fertilization was in practice but feeding could not be done. The fish of 14-16 g at stocking time grew 70-90 g with 60 % survival. After 8 months fish and paddy were harvested @ 150-180 g fish/m² plus 1.5-1.7 t paddy/ha. The fish of this size fetch price @ Rs. 100-120 / kg.

Exchange of scientific knowledge with employees of KVK Manipur

In Manipur, 2 fields of over 0.4 ha size were selected in Ukhrul District for paddy-cum-fish culture demonstration. The entire operation was carried out by the fishery scientist of the ICAR Research Complex, Imphal with technical guidance and financial support of NRCCWF. The fry of Common carp having av. wt of 15-18 g were released in paddy, which attain 90 g weight after 8 months without feeding provisions. Fish production was calculated @ 320-330 g / m² and 2.1 t kg paddy /ha.

Culture and breeding of indigenous fish species in NEH

Chocolate mahseer (N. *hexagonolepsis*)

In the State of Arunachal Pradesh, the studies on ecological habitats, seed availability, culture, growth, survival and maturity of Chocolate Mahseer in pond environment are in progress. It is very important food fish. It is benthoplegic omnivorous but also accept supplementary feed. Fecundity has been recorded 12-13000 eggs/kg in nature and found migrating to breed and laying eggs on gravel/pebbles field during June to August. It grew @ 104 g/year in pond environment. The fish did not exhibit growth at temperature below 14°C and above 31.2°. The brood stock of 3+ ages were examined and found matured. Attempts to spawn them through hormone injection were made with limited success. A portable Flow-through Mahseer Hatchery has been established at Iduli Fish Farm, Roing Dibang Valley District of Arunachal having the capacity of 2.0-lakh seed production.

Medium carp (*Osteobrama belangeri*)

The species commonly known as Pengba is an important indigenous food fish of Manipur. It is in high demand and fetch very high prices. The population of it in natural water is declining at alarming rate. Its aquaculture and breeding in captivity seems the only way to save and rehabilitate the species. Under this project, complete biology, feeding ecology, growth and survival pattern in ponds under mono and polyculture, compatibility with other cultivable carps, maturity, fecundity, spawning and seed production in pond environment are the issues to be thrashed out. The species seed was collected from rivers and has been stocked in ponds @ 6000/ha under monoculture and with Indian & Chinese major carps. Supplementary feed is being provided. Water quality is also being recorded periodically. The growth is varied in relation to density, stocking ratio and feeding schedule. Hope to develop culture and breeding technology of the species in next two years. NRCCWF and ICAR Research Complex are conducting this programme jointly.

Conservation of Himalayan Mahseer (*Tor putitora*) in NEH region

The population of Himalayan mahseer is declining sharply in NEH waters. Its conservation through aquaculture and seed production in captivity is a major step to save it. The technology "Flow through Hatchery for Mahseer Seed Production" is a new technology. The Government of Assam and Sikkim joined hands with NRCCWF, Bhimtal and surveyed sites for establishing Mahseer hatchery. Two mahseer hatchery are being established at Bagua Fish Farm, South Sikkim and Eco Camp Nameri, Tejpur in collaboration with State Fisheries Department of Sikkim and Assam Angler Association, Tejpur, with the financial assistance of Rs. 10 lakh for each hatchery by NRCCWF. Both the hatcheries may be functional in next breeding season.

Documentation and bioprospecting of bacterial micro flora from gastro intestinal tracts of selected coldwater food fishes from Arunachal

Some probiotic can be added in feed to accelerate the growth and production of cultivable cold-water fish species. Himalayan and Chocolate mahseer are indigenous food and sport fish species of economic importance of Arunachal Pradesh .As their population in natural waters is declining with the time, culture practices on scientific lines may help us to produce them for food rehabilitation in natural waters. The studies on food and feeding habits are complete but presence of microflora in their gut is not very well known. A project in collaboration with RG University Itanagar has been initiated in March 2008. The project may facilitate to know the bacterial flora availability in their intestinal tracts so that efficient FCR may be obtained by using certain probiotics.

Bioecological status and fish production potentials of selected lakes in Arunachal Pradesh

The Institute has completed survey of Fisheries Resources of Arunachal Pradesh. Based on the data collected, two lakes of Arunachal Pradesh have been selected representing two Geoecological locations i.e. one at lower altitude near Itanagar namely Ganga Lake (650 m asl; 2.5 ha and influenced by human activities) and one at higher altitude (1560 m asl; 20 ha totally undisturbed in Meheo Wild Life Sanctuary) namely Meheo lake. The two years investigations on their bioecological and Fisheries status will help to develop bioecological models for the development of lake fisheries in Arunachal Pradesh. The research work is already initiated in March 2008 in colloboration with RG University Itanagar.

Project Code	Network Project on Fish Germplasm Exploration, Cataloguing and Conservation
Project Title	Fish Germplasm Exploration in Middle and Upper stretches of Kosi River system in Kumaon Himalayas
Scientist	P.C.Mahanta, A.K. Nayak

The middle and upper stretches of Kosi River system were surveyed for exploration of fish germplasm in the river at different sites. A global positing system is used to find out the altitude, latitude and longitude of each station. The survey was conducted at different stations mainly at Garampani/Khairna (877 masl) having latitude/ longitude as N 29^0 29.76' and E 079^0 28.71'. In cast netting of 5 times the species obtained are as Schizothorax of 20 Nos. having average size of 7 cm and 4gm each; *Garra gotyla gotyla* of one sample of 15 cm having weight of 45 g and

Sampling for germplasm exploration in Kosi river

Barilius of 4 Nos of 6-8 cm having average weight of 5 g.

Another station at Suyalbadi (1002 masl, N 29^0 32.33' and E 079^0 33.99') was surveyed for the fish germplasm. In the survey *Garra gotyla gotyla* of 6 Nos. having 12-16 cm length and average weight of 40g; one mahseer of 100g and five Barilius have been recorded. The water quality parameters like temp, pH, DO, CO_2, chloride, silicate, calcium, magnesium etc. of above stations have also been calculated.

The Kosi river system has been digitized through GIS software Geomedia professional by using toposheets available from Survey of India and images. In the software the stations have been identified and has an option to find out the fish and fisheries resources available at that station. A database will be developed depending on the fish and fishery resources available at different stretches to find out the present biodiversity of Kosi river system.

TECHNOLOGY ASSESSED & TRANSFERRED

Technology Assessed & Transferred

Institute's ITMC identified following two technologies for transfer to the stakeholders.

- Construction/Installation of Mahseer Hatchery
- Carp Farming Technology in Hills

These technologies are suitable for hill and foothill areas. The Institute has signed MOUs with Assam Bhoreli Angling & Conservation Association, Nameri, Tejpur and Department of Fisheries, Govt. of Sikkim to establish mahseer hatchery at Nameri and Bagua fish farm (Sikkim) and also with Teesta stage VI H.E. project (LANCO Energy Pvt. Ltd) for construction and installation of mahseer hatchery.

Extension Activities

- The innovation and adoption of "**Composite Carp Farming**" in Uttarakhand has spread to various districts and more than 150 farmers are engaged in further demonstration. The same technology has been transferred in 5 districts of Manipur State and in 11 districts of Arunachal Pradesh involving 74 demonstration sites through State fisheries Department and KVK in respective States.
- Mixed fish culture in the hills was extended as and when required to the fish farmers and government officials across the hill region.
- Scientists of Institute discussed technique of polyculture of exotic carps in hills with farmers during the training programme organized by *Paryavaran Sanrakshan Samitee*, Pati, Champawat.

On farm Training

- Scientist of the institute participated in 11th National Expo organized by Central Calcutta Scientific Culture organization for youth at Kolkata during 7-14 September, 2007.

Training conducted at Ritha Saahib

Director explaining the activities of coldwater fisheries to visitors

Visitors at Institute's stall at National expo at Kolkata

- Scientific and technical staff of Institute participated in exhibition on coldwater fisheries at CIFRI Barrakpore, and G.B.Pant University of Ag. & Tech. Pantnagar during Diamond Jubilee celebration on 14-16 December 2007 and Kisan mela, October 2007 respectively.
- Scientists of the center delivered Radio talks on topics "Parvatiye kshetro me machhili palan" and "Parvatiye kshetro ki machhiliyo me payi jane bali bimariyan evam niyantran"time to time at All India Radio, Almora, to educate more number of farmers about cold water fisheries.

Mahseer seed ranching in river Kosi

Scientist delivering a lecture to trainees

Trainees at mahseer breeding hatchery

A group of trainees in classroom

SPECIAL INFRASTRUCTURE DEVELOPMENT

Major Civil Works

During the period four Type -III residential quarters have been handed over to Institute by CPWD after completion of construction at Chhirapani Fish Farm, Champawat.

Residential Quarters at Champawat

Under major repairs at Chhirapani Fish Farm, Champawat, in past cleaning and repair of fish ponds and water reservoir were carried out and handed over to institute authorities.

Construction work of circular hatchery was completed and handed over to institute for carrying out carp breeding experiments at Champawat.

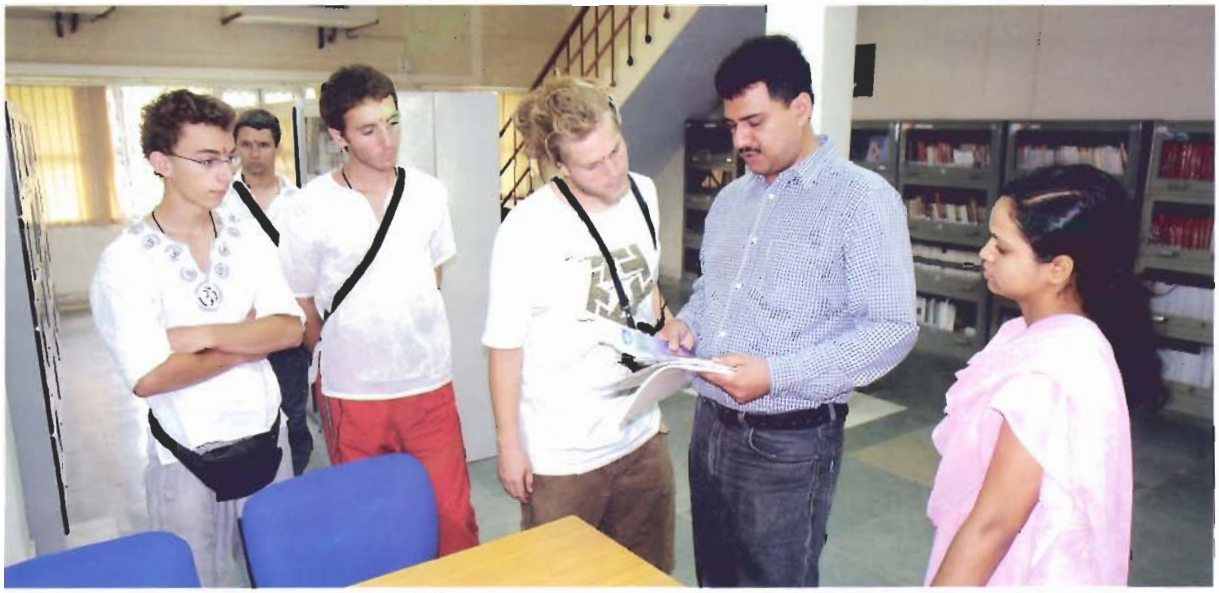
Ten new fish ponds of size 15X5X1.5 meters was also made functional during this period of report.

Establishment of Mahseer Hatchery

The hatchery for breeding of Chocolate Mahseer already established at Iduli Fish Farm, Roing, Arunachal Pradesh during the year made functional with rearing of brood stocks and trial breeding is being successfully carried out in collaboration with the Department of Fisheries, Arunachal Pradesh.

In Assam setting up of one Mahseer Hatchery at Nameri National Park under Assam Bhorelli Angling and Conservation Association (ABACA) is taken up. Initiated the establishment work, released necessary funds and necessary MOU signed.

New Fish Ponds at Cheerapani Fish Farm



French student delegation consulting literatures in institute library

Also initiated for setting up the Mahseer Hatchery in Sikkim at Baguwa Fish Farm in West Sikkim. Necessary funds released to Dept. of Fisheries, Govt. of Sikkim and MOU signed.

Medical Facilities created

Two Authorized Medical attendants, one each at Champawat and Bhimtal were appointed and medical treatment being provided to staff members.

Upgradation of Institute's Library

During the year, library holding of books increased to 1751, issues of foreign Journals to 1792 and issues of Indian Journals to 381. Present holding of library is 3924 including bound journals. 153 more books were also added during the financial year and the whole library is well computerized. A total of Rs. 24.63 lakhs had been utilized for achieving this library facility.

Strengthening of Laboratories

Laboratories facilities were also strengthened by purchase of new equipments *viz.* fluorescent microscope, inverted microscope, water purification system, fluorometer, -80^{0}C deep freezer, laminar flow, Fish finder and spectrophotometer etc.

Aquaculture and Fish Health Laboratory is being set up at the Institute to probe into the causes of diseases in cold-water fishes. The laboratory is being equipped with necessary glassware, plasticware chemicals and equipments. The design of the laboratory has planned to take up additional work on fish cell culture and fish virology.

Newly established fish health management laboratory

EDUCATION & TRAINING

Farm/ Field Trainings Imparted

- Two 7-day (2-9 July 2007 and 16-24 September 2007) training programme entitled "**Intensive Aquaculture in hills**" were organized at Bhimtal for 8 officers of Fisheries Department and 55 farmers of the Sikkim State.

Honorable Secretary, Mr. A.K. Upadhyay, IAS, ICAR and Director interacting with trainees (Sikkim)

- NRCCWF organized a training programme on **Intensive Aquaculture in Ponds & Tanks in Hill Region** at Bhimtal, during 3-8 July 2007.
- A training programme on **Mahseer–an Icon of Coldwater Bodies** was organized at NRC on Coldwater Fisheries, ICAR, Bhimtal, during 13-18 August 2007.
- Institute organized a training programme on "**Fish culture in Himalayan uplands**" from 17-22 Sept. 2007 at Institute's campus at Bhimtal.
- Another programme on "**Recent techniques to enhance fish production in hill ponds"** was organized for farmers and State Fisheries Officers at Imphal, Manipur on 17 January 2008. The Programme was inaugurated by Dr S.V. Nagchan, Director

Interaction of IPS officer trainees with Director and scientists of the Institute

ICAR Research complex, Umiam Meghalya and attended by Prof W.Vishvanath, Shri Sarat Kumar Singh, Director Fisheries, District Fisheries Officers, Farmers, Specialist from KVK, Chandel Manipur.

A group photograph of trainees

- The Institute organized a training on 22 January 2008 at Midpui village near Itanagar on which Shri Autem Welly, Hon'ble Minister of Fisheries inaugurated the training programme. Mr. Bandano Deori, Secretary Fisheries; Director, Dy Directors, District Fisheries Offices of all the districts, subject specialists of KVKs working in Arunachal and more than 60 farmers and guests attended

the programme. Prof. K.C. Belleapa, Vice Chancellor, RG University delivered keynote address. Faculty of the University and research scholars also attended the function.

- Fish conservation and management awareness programmes were conducted at Pati, district Champawat and at Bhimtal.
- A training programme entitled "**Culture and breeding of important cold water fish species**" was organized 28 Feb-5 March 2008 at NRCCWF, ICAR, Bhimtal.
- "**Fisheries Scientists, Development Officers and Farmers meet**" organized in collaboration with ICAR Research Complex, Imphal, Manipur on 17 January 2008.
- "**Fisheries Scientists, Development Officers and Farmers meet**" organized in collaboration with Dept. of Fisheries, Arunachal Paradesh and RGU, Itanagar on 21 January 2008 at Itanagar.
- A two-day training programme was conducted in seed production rainbow trout at Coldwater Fish Farm at Champawat for Fisheries Officials of Jammu and Kashmir who were at NRCCWF for their training in Coldwater Fisheries during 25th February to 5th March 2008. The trout breeding was demonstrated to these trainees and details for seed rearing was imparted to them. This will help in transfer of seed production technology to the farmer's level by these officials

Laboratory Trainings Imparted to University Students

Summer trainings were imparted to number of students from Department of Zoology and Biotechnology, H.N.B. Garhwal University, Srinagar, (Garhwal) from June20- July 4, 2007 on the topic " **Isolation of genomic DNA from muscle, fins and scales of coldwater fish**", Department of Zoology, CCS University , Meerut from July 25- August 10, 2007 on the topic " **Hands on training on Bio-analytical techniques and DNA isolation from fish tissues**" and Bangalore University, Bangalore from November 28 2007- January 31,2008 on the topic **" Standardization of PCR for RAPD and amplification of specific gene from fish genomic DNA".**

Students being trained in Biochemistry Laboratory

Dr. A. Barat, Senior Scientist was deputed to CIFA, Bhubaneswar, as resource person for the training programme on " Application of molecular genetics in Inland fisheries and aquaculture management" organized by NACA-CIFA-FAO, during 27 Nov-4 Dec,2007.

Trainings Attended (Abroad)

Shri Prem Kumar, Scientist (SS) attended a two months training programme for Asia-Pacific on Aquaculture at Freshwater Fisheries Research Centre (FFRC), Wuxi, China from 25 May to 24 June 2007. The course is organized in order to promote aquaculture development in Asia-Pacific region and enhance the economic and trade cooperation between China and the recipient countries in the areas of fisheries. The objective of the course is to transfer the techniques and experience of Chinese aquaculture, to endow the

Institute Scientist getting training at China

participants with specialized knowledge of relevant subjects and practical techniques used in field through theoretical studies and practical training during the course.

Institute technical officer undergoing training at National Fisheries University Japan

Shri R.S. Haldar, Technical Officer (T-5) attended a group training course on **Prevention of Cultured Fish Disease and Fish-Borne Disease** organized by **JICA Chugoku International Centre, Hiroshima Prefecture and National Fisheries University, Yamaguchi Prefecture, Japan** during September 4 to November 23, 2007.

Trainings Attended (In India)

Dr. Rajeev Kapila, Dr. N.N. Pandey and Sr. Scientists participated in **NACA training** programme on **"Application of molecular genetics in Inland fisheries and aquaculture management"** held at CIFA, Bhubaneswar during 27 Nov-5 Dec 2007 organized by NACA, Bangkok, Thailand.

Shri A.K. Nayak, Scientist (SS) and Shri Amit Kumar Saxena, T-3 attended the Second Training Program on **Intelligent Reporting System (IRS)** at Indian Agricultural Statistical Research Institute, New Delhi from 10-11 Sep., 2007.

Dr. G.K. Sivaraman attended short term training course on Molecular Techniques for Production of Recombinant Cytokines and Genome Analysis in Poultry (18th Aug - 7th Sep, 2007) Sponsored by DBT, Min. of S/T, GOI

organized by Avian Genetics & Breeding, CARI, Izatnagar, UP- 243 122.

Dr. G.K. Sivaraman participated in the winter school on "Pesticides and veterinary drug residues in foods of animal origin" sponsored by ICAR and organized by the dept. of Veterinary Public Health at the College of Veterinary & Animal Sciences, GBPUAT, Pantnagar (Uttarakhand) during Feb 24 to Mar 15, 2008 (21 days).

Sh. R.S. Haldar was deputed for three days training programme on "**Purchase Procedure for ICAR"** at Institute of Secretariat Training and Management (Department of Personnel & Training), New Delhi from 14-16 May 2007.

Sh. R.S. Haldar attended five days NIH-CSMRS Training Course on **"Water Quality and its Management"** at Central Soil and Materials Research Station, New Delhi from 16-20 July 2007. This training programme was organized by the National Institute of Hydrology, Roorkee and Central Soil and Materials Research Station, New Delhi.

AWARDS & RECOGNITION

- Institute's exhibition stall won special award during Kiasn Mela at G.B.Pant University of Ag. & Tech. Pantnagar, during October 2007.
- Institute's exhibition stall won award during 11th National Expo Kisan Mela from 7th-15th September 2007 at Kolkata .
- Institute won special Award at All India Farmers Fair & Agro Industries Exhibition 01-04 March,2008 at G.B. Pant University of Agriculture and Technology, Pantnagar.

Scientist was honored by D.M. Champawat on Matsya Divas

Institute won Award 11th National Expo at Kolkata

PUBLICATIONS

Papers Published

- Kapila, R., S. Kapila, and Y. Basade. (2007). Impact of water pH on haematology and serum enzyme activities in Schizothorax richardsonii (Gray) Indian J. Fish., 54 (2): 227-233.
- Singh, N. Okendro, A.K. Paul and Md. Wasi Alam (2007). Non-linear Models to Describe Growth Pattern of *Tor putitora* (Hamilton) Under Monoculture and Polyculture Systems. *Indian Journal of Animal Sciences*, **77**(12): 1346-1348.
- Singh, N. Okendro, Surinder Kumar and P.C. Mahanta (2007). Multivariate Statistical Analysis of Water Quality Data in Narmada River. *Journal of Ecophysiology and Occupational Health*, **7(1 & 2)**: 45-53.
- Singh, N. Okendro, Surinder Kumar, P.C. Mahanta, M.K. Pande and N. Gopimohan Singh (2007). Evaluation of Water Quality from Gaula River by Factor Analysis. *Journal of Ecophysiology and Occupational Health*, **7(3 & 4)**: 165-169.

Technical Articles/ Popular Articles

- Tyagi, B.C. and N.Okendro Singh.(2007). Coldwater Fisheries Research and Development in North East States of India (Hindi). *In Jalchari*. CIFE, Mumbai: 14: 20-29.
- Tyagi,,B. C. B.A.Laskar and Goken Ete.(2007)..Studies on culture and Seed production of Chocolate Mahseer (*N. hexagonolepsis*) in ponds in Arunachal. In Proc. Recent advances & rebuilding of Fish & Fisheries in North East India. Depart. Of Zoology, St Anthony College Shillong: 1-6 .
- Singh, N. Okendro (2007). Factor Analysis on Parameters of Water Quality. *The SPSS Analyst*, April – June Issue: pp 19-23.
- Singh, N. Okendro and A.K. Nayak. (2007). Analysis of Covariance (ANCOVA) on Evaluation of Sex and Seasonal Differences in Length-Weight Relationship of a Fish Species. *The SPSS Analyst*, October – December Issue: pp 1-12.
- Kapila, R., R. Pant, and P.C. Mahanta. (2007) Biochemical and physiological mechanisms of cold tolerance in fishes. Fishing Chimes 27(4) 42-45.
- Singh, A.K. and R. Kapila.. (2007). Sex control in endangered upland golden mahseer *Tor putitora* (Hamilton 1822) for reproductive management. The seventh Asaian Fisheries Forum Proceedings Eds. Vasudevappa, C., Basavaraju, Y., Sennappa, D., Ayyappan, S. and Reddy, S.R. Published by AFSI Mangalore, ICAR, UAS (B). 165-172.
- Shyam Sunder (2007). Snow-trout fishery: state of art and conservation needs in SAARC Countries. Fishing Chimes. 27 (6): 8-15.

Technical Bulletins

- Singh, N. Okendro (2008). Evaluation of Water Quality by Factor Analysis. *Bulletin No. II*, NRC on Coldwater Fisheries, ICAR, Bhimtal, pp 1-19.
- Kapila, R. (2007). Biotechnological approaches to promote potentials of coldwater fisheries Bulletin No.10. NRCCWF, Bhimtal 28p.

Books Edited

- Basade, Y., R. Kapila, and P. Kumar. (2007) National Workshop on " Parvitya Matsyaki Paridrish: Vikas, Parbandhan avem sarakshan" 96pp.

Book Chapters

- Chauhan, D.P.S., R. S. Chauhan , P.V. Dehadrai., Kuldip Kumar, Madan Mohan, P.C.Mahanta. and D.N Sarangi. (2007).Conservation and management of mahseer. Chapter in resource book ," Art and Science of Mahseer ,Conservation and Management " published by CIFE & Indian Fisheries Association, Mumbai ,June 2006 (released in June 29007), pp. 5-30.
- Keshavnath, P., Madan Mohan and Yasmeen Basade (2007) Nutrition and feeding of mahseer. Chapter in resource book ," Art and Science of Mahseer ,Conservation and Management " published by CIFE & Indian Fisheries Association, Mumbai ,June 2006 (released in June 2007), pp. 79-94.
- Shyam Sunder. 2007. Wular lake a Ramsar site in J & K state needs fisheries restoration. In Ecology & Fisheries of Wetland lakes (Ed. M.P. Singh Kohli). Indian Society of Fisheries Professionals, Mumbai: 151-158.
- Shyam Sunder 2006. Sheetjal matisyaki vikas evam anusandhan ki aawshaktayen. Jaldhi, CIFT, Cochi: 17-24

Training Manuals

- Mahanta, P.C., Debajit Sharma, Amit Pande and N. Okendro Singh (2007). Mahseer – an icon of coldwater bodies. A training manual: NRC on Coldwater Fisheries, ICAR, Bhimtal, pp 1-69.
- Tyagi, B.C., Y. Basade and N. Okendro Singh (2007). Intensive aquaculture in ponds and tanks in hill region. A training manual: NRC on Coldwater Fisheries, ICAR, Bhimtal, pp 1-123.

Abstracts

- Madan Mohan (2007). Impact of available suitable technologies on coldwater fisheries in India. Fisheries and aquaculture : Strategic Outlook for Asia. 8th Asian Fisheries Forum, Nov. 20-23, 2007, Kochi, India. Abst. No. MTO 020, p 83.
- Yasmeen Basade and Madan Mohan (2007). Effect of feeding frequency on growth performance, feed efficiency and bioenergetics of golden mahseer early fry. Fisheries and aquaculture : Strategic Outlook for Asia. 8th Asian Fisheries Forum, Nov. 20-23, 2007, Kochi, India. Abst. No. AQP 039, p 167.
- Tyagi, B.C (2007). Performance of Indignations and alien invasive fish species in Aquaculture System in Kumaon Himalayas in. 8th International Fisheries Forum. Kochi, 20-23 November 2007. 170p
- Sivaraman, G.K. and R. Kapila, (2007). RAPD-PCR as a tool for genetic characterization of coldwater fish fauna of Himalayan region. In 27th annual session of the academy of environmental biology and national Symposium on "Biomarkers of environmental Problems" organized by Dept. of Zoology and Dept. of Environmental Science Ch. Charan Singh University. Meerut (UP) Abstract no.48 page no. 37.
- Mahanta, P.C, R. Kapila, G.K. Sivaraman, and A.K. Nayak. (2007). Tapping the

fisheries sector for rural income generation in SHR. In: International seminar on conventional and biotechnological approaches for sustainable development in Sub –Himalayan region held at Indian Veterinary Research Institute Mukteshwar (Nainital) Uttarakhand from July 28-29,2007.

- Kapila, R. and P. Kumar. (2007). Jaal Krishi mai Sookshamjeviyo ki Bhoomika. In National Hindi Workshop " Parvitiya Matsayaki Paridrish : Vikas, Prabandan avem Sarakshan" organized at NRC on Coldwater Fisheries, Bhimtal from April 6-7, 2007 p47-49.

- Kapila, R. and Kumar, P. (2007) . Jaav Prodhiyokiki ki Matsaya Utpadan mai Bhoomika.In National Hindi Workshop " Parvitiya Matsayaki Paridrish : Vikas, Prabandan avem Sarakshan" organized at NRC on Coldwater Fisheries, Bhimtal from April 6-7, 2007 p 81-82.

- Nayak, A.K., R.S. Haldar and Amit Kumar Saxena (2007). Matsyaki anusandhan mein suchana proudyogiki ka yogadan. *In* National Workshop on "Parvatiya Matsyaki Paridushya: Vikas, Prabandhan evam Sanrakshyan" organized at NRCCWF, Bhimtal during April 6-7, 2007. pp 91-92.

- Nayak, A.K., Durgesh Pant and P.C. Mahanta (2007). Framework for development of GIS based decision support system for aquaculture in Kumaon hills. Presented in 8th Asian Fisheries Forum organized by Asian Fisheries Society during 20-23 November 2007 held at Kochi, INDIA. Abstract No: CMP 031.

- Kumar, P. and Ashok K. Nayak (2007). Bhougolik suchana tantra (GIS) aur Matsyaki. *In* National Workshop on "Parvatiya Matsyaki Paridushya: Vikas, Prabandhan evam Sanrakshyan" organized at NRCCWF, Bhimtal during April 6-7, 2007. pp 5-7.

- Kumar, P., Ashok K. Nayak, N.Okendro Singh and R.S. Haldar (2007). Geomorphological changes in major lakes of Kumaon region: A remote sensing study. Presented in 8th Asian Fisheries Forum organized by Asian Fisheries Society during 20-23 November 2007 held at Kochi, INDIA. Abstract No: EPP 038.

Release of Institute's publications by distinguised Guests

LIST OF ONGOING PROJECTS

Title of the Project	Project Leaders and Associates	Year of Start	Likely Year of Termination
Institutional Projects			
Studies on coldwater fisheries resources of India	Sh. Prem Kumar Sh. A.K. Nayak Sh. N. Okendro Singh	2004	2007
Studies on bio-chemical mechanism of cold tolerance in coldwater fish, *Schizothorax richardsonii*	Dr. R. Kapila	2004	2007
Evaluation of indigenous ingredients and feed supplements for feed formulation of indigenous upland fishes of Kumaon region	Dr. Y. Basade Dr. M. Mohan	2005	2007
Studies on induced maturation and seed production of Himalayan mahseer, *Tor putitora* and *Schizothorax richardsonii* in pond environment	Dr. B.C. Tyagi Dr. Shyam Sunder Sh. Prem Kumar Dr. R. Kapila	2005	2008
Cage culture of fishes in floating cages in subtropical Himalayan lake-Bhimtal	Dr. M. Mohan Dr. S. Sunder Dr. Y. Basade	2005	2008
Multivariate Statistical Analysis of Water Quality Data	Sh. N. Okendro Singh	2006	2008
Cold water Fish Health Management	Dr. Amit Pande Dr. N.N. Pandey Dr. Yasmeen Basade.	2008	2011
Genetic Characterization of Important Snow Trout Fish Species	Dr. G.K. Sivaraman Dr. A. Barat Dr. Rajeev Kapila	2008	2011
Performance studies of chocolate mahseer in Eastern and Western Himalayan region of India	Dr. D. Sarma Sh. N. Okendro Singh	2007	2010
Eco biological studies of two important hi altitudinal lakes of Arunachal Pradesh	Dr. D. Sarma	2007	2009

Development of GIS based decision support system for aquaculture in selected coldwater region	Sh. Ashok K. Nayak Sh. Prem Kumar Dr. P.C. Mahanta	2007	2010
Seed production in agricultural crops and fisheries	Dr. Madan Mohan Sh Prem Kumar	2006	
Fisheries Research and Development in NEH region	Dr. B. C. Tyagi		
Network Project on Fish Germplasm Exploration, Cataloguing and Conservation	Dr. P.C. Mahanta Sh. A.K. Nayak	2006	
Modelling of Length-weight Relationship and Growth pattern of selected Important Coldwater Fish species	Sh. N. Okendro Singh Dr. Debajit Sarma	2008	2011

PARTICIPATION IN CONFERENCES / MEETINGS / SYMPOSIUM / SEMINARS / WORKSHOPS

Conferences/Meetings/Symposium/Seminars/Workshops	Participants
Meeting of the Nodal Officers of NEH component at CIFRI Centre, Guwahati on 20-21.04.2007.	Dr. P.C. Mahanta
Meeting of the Directors' of ICAR Fisheries Institutes at S.V. Veterinary College, Tirupati on June 9-10, 2007.	Dr. P.C. Mahanta
Fourth Zonal Workshop on "Fisheries Sector Policy :Livelihoods and Sustainability Perspectives for Northern States organized by Central Institute of Fisheries Education, Mumbai in collaboration with the Department of Fisheries, Government of Haryana at Chandigarh on July 6 & 7, 2007.	Dr. P.C. Mahanta
Directors' Conference at NASC, Pusa, New Delhi on 16.07.2007.	Dr. P.C. Mahanta
Workshop organized by ICAR to discuss administrative and financial matters on 17.07.2007.	Dr. P.C. Mahanta
Meeting of the National Project on Water Conservation at IITR, Lucknow on July 21-22, 2007.	Dr. P.C. Mahanta
Executive Council Meeting of the Academy of Environmental Biology at CCS University, Meerut.	Dr. P.C. Mahanta
XX Meeting of the ICAR RCM I at Y.S. Parmar University of Hort. & Forestry, Solan, H.P on November 1-2,2007.	Dr. P.C. Mahanta Dr. Rajeev Kapila Dr. G.K.Sivaraman
National Symposium "Ecosystem Health and Fish for Tomorrow" organized by CIFRI, Barrackpore in commemoration of the Golden Jubilee Year of CIFRI on December 14-16, 2007.	Dr. P.C. Mahanta Dr. D. Sarma Dr. N.N. Pandey
Scientists-Farmers meet organized at the Department of Fisheries, Government of Arunachal Pradesh, Itanagar on 21.01.08.	Dr. P.C. Mahanta
The Review Meeting of Mega Seed project and Network Project on Fish Feeds and Feed Technology at CIFA Bhubaneshwar during April 6-8, 2007.	Dr. Madan Mohan
The Review Meeting of Mega Seed project at CIFA Bhubaneshwar during 24-25 September, 2007.	Dr. Madan Mohan

Networking Project Meeting of NRCCWF on 29-30th Sep. 2007 with Directors of Fisheries Departments and representatives from Universities from Hill States.	**Dr. P.C. Mahanta** **Dr. Madan Mohan**
The Review Meeting of ICAR Mega Seed Project at NRCCWF, Bhimtal on 22-23rd February 2008.	**Dr. Madan Mohan**
National Seminar "Coldwater Fisheries Development" organized by NRCCWF at Bhimtal.	**Dr. B.C. Tyagi**
The 8th Asian Fisheries Forum at Kochi during 20-23 November 2007.	**Dr. Madan Mohan** **Dr. Shyam Sunder** **Dr. B.C. Tyagi** **Dr. Rajeev Kapila** **Dr. A. Barat** **Dr. Prem Kumar** **Sh. A.K. Nayak** **Dr. G.K.Sivaraman**
Assam Meen Mahatsov at Guwhati organized by the Department of Fisheries Government of Assam at Guwahati during 29-30 March 2008.	**Dr. P.C. Mahanta** **Dr. B.C. Tyagi**
Meeting of Nodal Officer for NEH Region on 4th February 2008.	**Dr. B.C. Tyagi**
Technical Workshop on Right to Information Act organized by Integrated Training & Policy Research (Training Division) held at Russian Cultural Centre, 24, Ferozeshah Road, New Delhi, India, during 11-12 May 2007.	**Sh. N. O. Singh**
4th Indian Fisheries Science Congress organized by Indian Society of Fisheries Professionals at Patna during April 12-13, 2007.	**Dr. Shyam Sunder**
Fourth Zonal Workshop, Fisheries Sector Policy: Alternative livelihoods and sustainability perspectives from northern states organized by CIFE, Mumbai at Chandigarh during 6-7th July, 2007.	**Dr. Shyam Sunder**
Workshop on "Partnerships for reservoir fisheries development" organized by CIFRI, Barrackpore & CIAE, at Bhopal during July 27-28, 2007.	**Dr. Shyam Sunder**
National Symposium on 'Recent advances and rebuilding of fish and fisheries in north east India' organized by Deptt. of Pisciculture, St. Anthony's College, Shillong during August 22-23, 2007.	**Dr. Shyam Sunder**

'Taal-2007' 12th World Lake Conference organized by Ministry of Environment and Forests, Govt. of India in association with Govt. of Rajsthan, International Lakes Environment Committee, Japan at Jaipur during October 28-November 2, 2007.	**Dr. Shyam Sunder**
Workshop on 'Innovation of inland saline aquaculture in India and Australia' organized by CIFE at NASC, New Delhi on November 28th, 2007.	**Dr. Shyam Sunder**
Capacity building programme on Intellectual property protection and technology licensing in agriculture " under Indo-US agricultural Knowledge Initiative from February 11-13, 2008 at CCS Haryana Agricultural University, Hissar.	**Dr. Rajeev Kapila**
27th annual session of the academy of environmental biology and National Symposium on Biomarkers of environmental Problems organized from October 26-28, 2007 by Dept. of Zoology and Dept. of Environmental Science Ch. Charan Singh University. Meerut (UP).	**Dr. P.C.Mahanta** **Dr. Rajeev Kapila** **Dr. G.K. Sivaraman**
The meeting of the 'Network Project on Finfish and Shellfish Nutrition' held at New Delhi during August 21-22, 2007.	**Dr. Yasmeen Basade**
ICAR/NACA workshop on "Aquatic Epidemiology, Surveillance and Emergency Preparedness" held at CIBA, Chennai from 3rd to 7th Sept. 2007.	**Dr. Amit Pande**
National Workshop on "Development of Reservoir Fisheries and Conservation of Aquatic Biodiversity with particular reference to Tehri dam project (Uttarakhand) held at New P. G. College, Tehri Garhwal" from 1st to 2nd Dec. 2007.	**Dr. Amit Pande**
National Symposium on "Conventional and Biotechnological approaches for Sustainable Development in Sub-Himalayan Region (CBASD-2007)" held at the Indian Veterinary Research Institute, Mukteshwar (Nainital) from 28th–29th July 2007.	**Dr. Amit Pande** **Sh. Prem Kumar**
5th Annual Conference of the Biotechnology Society of India, held at Industrial Toxicology Research Institute, Lucknow from 17th –19th November 2007.	**Dr. P.C. Mahanta** **Dr. Amit Pande**
The National Seminar on Conservation of Bio-resources, held at Department of Life Sciences, Manipur University, w. e. f. 21st –22nd February 2008.	**Dr. Amit Pande**
5th Zonal Workshop on Fisheries and aquaculture Policy: Sustainable development and livelihood Perspectives for central states, held at Patna, during 25-27 October 2007.	**Dr. N.N. Pandey**

National Seminar on Recent Advances and Rebuilding of Fish and Fisheries Science in North East India 22-23 August, 2007.	**Dr. D. Sarma**
One-day brainstorming session on "**GIS in Agriculture**" at Indian Veterinary Research Institute, Mukteshwar on January 11, 2008.	**Sh. A.K. Nayak**
Conference on "**Application and trends in Data Warehousing, Data Mining and Data modeling**" at Forest Research Institute, Dehradun organized by Computer Society of India, Dehradun on Feb. 9-10, 2008.	**Sh. A.K. Nayak**

MEETING ORGANISED

Staff Research Council Meeting (SRC)

Annual Staff Research Council meeting was held under the chairmanship of Dr. V Suganan on July 13, 2007. The programme activities being undertaken and proposed during the current financial year were discussed in detail. The meeting was attended by all the scientists of the Institute.

Chairman - Scientists interaction during RAC

Research Advisory Committee Meeting (RAC)

The first meeting of the newly constituted RAC was held under the Chairmanship of Dr. S. P. Ayyar, Ex-Director CIFRI, Barrackpore from October 4-7, 2007 at Bhimtal. The progress made under each of the research projects and the new programmes to be taken up were discussed in detail during the meeting. The meeting was followed by a visit to NRCCWF Field Centre & Experimental Fish Farm at Champawat. The committee also visited different TOT sites nearby Champawat area and appreciated the work being undertaken by this Institute. The following are the members of Institute RAC meeting.

Prof. S.P. Ayyar, (Chairman)
Ex-Director CIFRI

Prof. W. Vishwanath,
Department of Life Sciences,
Manipur University, Manipur

Dr. Manjulata Bisht,
Prof. & Head,
Department of Zoology,
Kumaun University,
DSB Campus, Nainital

Dr. Prakash Nautiyal,
Reader, Department of Zoology,
H.N.B. Garhwal University,
Srinagar – Garhwal, Uttarakhand

Prof. R.K. Sinha,
Department of Zoology,
Patna University,
Patna – Bihar

Dr. V.V. Sugunan,
Asstt. Director General (I.Fy.), ICAR

RAC members at Chhirapani fish farm, Champawat

RAC Members at TOT farm in Pati Block, Champawat

Review Meeting of ICAR Mega Seed Project

Review Meeting of ICAR Mega Seed Project at NRCCWF, Bhimtal was held on 22-23rd February 2008 under the Chairmanship of Dr S. Ayyappan, DDG (Fy). About 45 participants from various ICAR Institutes as well as SAU's/ CAU attended the meeting and presented their reports on work carried during the financial year.

DDG (FY) taking Review meeting of ICAR Mega Seed Project

IJSC Meeting

The Institutes Joint Staff Councils meeting was held on July 25, 2007 and issues were discussed including of acquiring land for construction of residential accommodation for NRCCWF staff and engagement of AMA. The new IJSC was constituted after conducting polls on February 19, 2008. Following were elected members of staff side.

Administrative Group

1. Sh. Harish Ram
2. Sh. Jagdish Bhandari

Technical Group

3. Sh. T. M. Sharma
4. Sh. Bhagwan Singh

Supporting Staff Group

5. Sh. Ravinder Kumar
6. Sh. Manoj Kumar

Official language Hindi

Quarterly meeting of official language Hindi were conducted under the chairmanship of Director and review was done on the work going on in official language. Time to time instructions were issued to concerned sections of the Institute to carry work in Hindi.

National Workshop Organized

Workshop

Two days National Hindi Workshop " **Parvitiya Matsayaki Paridrish: Vikas, Prabandan avem Sarakshan**" from April 6-7, 2007 was organized by NRCCWF at Bhimtal in collaboration with Academy of Environmental Biology (AEB), Lucknow, taking into consideration the importance of hill fisheries resources available in Himalayan and Peninsular regions of India and to provide proper thrust in the development of hill fisheries in the country. The Chief Guest, Professor P.L. Gautam (Vice- Chancellor), G.B. Pant University of Agriculture and Technology, Pantnagar inaugurated the workshop. Dr. P.V. Dehadrai, Former DDG (Fisheries), ICAR, New Delhi presided over the function. Other guests of honour at the function were Dr. S. Ayyappan, DDG (fisheries), ICAR, New Delhi and Dr. Krishan Gopal, Secretary, AEB, Lucknow. On this occasion the chief guest and guest of honour released Institutes publications and the abstract book of the workshop. Dr. S. Ayyappan, DDG (Fisheries), ICAR, New Delhi was felicitated along with Academy of Environment Biology.

Lightening of lamp by chief guest at inauguration ceremony

Lightening of lamp by Dr. Krishan Gopal, AEB secretary

During the two days, apart from the inaugural session,special lectures, technical sessions and the plenary session were held. The plenary session was chaired by Dr. R.C. Pant, Former Vice Chancellor, Kumaon University, Nainital and Dr. S. Ayyappan, DDG (Fisheries), ICAR, New Delhi. Based on the deliberations made by various key speakers, participants and the reports of chairpersons of different sessions, the recommendations were prepared and discussed in detail.

Welcome of distinguish guests on the dais

Welcome address by Director

AEB honour to Dr. S. Ayaappan (DDG, Fy.)

Felicitation to Dr. S. Ayaappan (DDG, Fy.)

Scientific deliberations by distinguish guests

Felicitation to the Chief Guest Dr. P.L. Gautam

A view of technical session

Release of publication by Dr. P.V. Dehadrai, Ex. DDG(Fy.)

Distinguished guests at the workshop

A view of participants

PERSONNEL

List of staff (As on March 31,2008)

Research Management

Dr. P.C. Mahanta, Director

Scientific

1.	Dr. Madan Mohan, Principal Scientist	(Fish and Fisheries)
2.	Dr. Shyam Sunder, Principal Scientist	(Fish and Fisheries)
3.	Dr. B.C. Tyagi, Principal Scientist	(Fish and Fisheries)
4.	Dr. Rajeev Kapila, Senior Scientist	(Biochemistry, Animal Science)
5.	Dr. Yasmeen Basade, Senior Scientist	(Fish and Fisheries)
6.	Dr. Amit Pande, Senior Scientist	(Biotechnology)
7.	Dr. A. Barat, Senior Scientist	(Fish Genetics and Breeding)
8.	Dr. D. Sarma, Senior Scientist	(Fish and Fisheries)
9.	Dr. N.N. Pandey, Senior Scientist	(Aquaculture)
10.	Sh. Prem Kumar, Scientist (Senior Scale)	(Fish and Fisheries)
11.	Sh. A.K. Nayak, Scientist (Senior Scale)	(Computer Applications)
12.	Sh. N.O. Singh, Scientist	(Agricultural Statistics)
13.	Dr. G.K. Sivaraman, Scientist	(Animal Genetics and Breeding)

Technical

1.	Sh. R.S. Haldar, T-5	
2.	Sh. Baldev Singh, T-4	
3.	Sh. Amit Kumar Joshi, T-4	(Hindi Translator)
4.	Sh. Santosh Kumar, T-3	
5.	Sh. Ravinder Kumar, T-3	
6.	Sh. Vijoy Kumar Singh, T-3	
7.	Sh. Amit Kumar Sexana, T-3	
8.	Sh. Gopal, T-2	
9.	Sh. R.K. Arya, T-2	
10.	Sh. Hansa Dutt, T-2	

11. Sh. T.M.Sharma, T-2
12. Sh. Bhagwan Singh, T-2 (Driver)
13. Sh. Manoj Kumar Yadav, T-1 (Driver)

Administrative

1. Smt. Sujata Jethi, Asstt. Director (O.L.) (Transferred to IVRI on 30.06.2007)
2. Smt. Susheela Tewari, Stenographer
3. Sh. R.L. Raina, Asstt. Admn. Officer (Retired on superannuation on 31.03.2008)
4. Sh. B.C. Pandey, AF&AO
5. Sh. Harish Ram, Assistant
6. Smt. Khilawati Rawat, Assistant
7. Sh. P.C. Tewari, UDC
8. Sh. J.C. Bhandari, LDC
9. Sh. Pratap Singh, LDC
10. Smt. Munni Bhakt, LDC
11. Sh. H.S. Chauhan, LDC
12. Sh. H.S. Bhandari, LDC

Supporting

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

OTHER EVENTS ORGANISED

Environment Day Celebration

Environment Day was celebrated on June 5, 2007. On this occasion Shri Parmeshwar Narayan Shivpuri, involved in various social development activities in the region was the Chief Guest. Prof. Kavita Pandey, Head, Department of Physics, D.S.B. Campus, Nainital was invited as a special guest. On this day, apart from different institutions in the area, senior level school children of various schools in Bhimtal area as well as students and faculty from the Birla Institute of Applied Sciences were also present.

Plantation by Director on the eve of Environment Day

A school student performing Yoga

Foundation Day Celebration

Every year September 24 is celebrated as **NRCCWF Foundation Day**. This year it was

A view of Cultural Programme during Foundation Day Celebration

Celebration of Institute's Foundation Day

organized with some important lectures by the distinguished scientists on two different topics of interests viz; "**Survival of life in the harsh Antarctic environment**" and "**Contamination of drinking water, its impact on human health and mitigation**". Both the lectures were of great interest to the participants from nearby R&D organizations and other institutions particularly for the school children invited from different schools in Bhimtal. On this day prizes were distributed to the successful contestants who have participated in different competitions during Hindi Week Celebration at this Institute.

National Science Day Celebration

On February 28, 2008 National Science Day was organized at this Institute. Prof. H.R. Singh, Ex Vice Chancellor, Allahabad University delivered a guest lecture. Mrs. Jaya Gupta, a renowned social worker was the Chief Guest on this occasion. The programme was graced with the presence of Prof. A.K.Pant, Director, Birla Institute of Applied Sciences, Bhimtal and Dr. R.S. Chauhan, Director, Department of Fisheries, Government of Uttarakhand.

Address by Director on National Science Day

Participants attending lecture

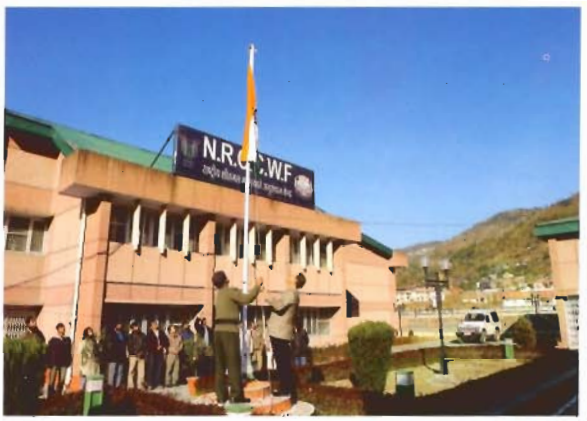
In addition to the different organizations/ institutions, school children from various schools in Bhimtal area were present. A film "**Global Warming – An Inconvenient Truth**" was also shown.

Official Language Week Celebration

The official language week was organized from 14th to 20th Dec 2007. On this occasion different competitions were organized for the promotion of "Hindi" by the Institute's Hindi-Cell. The competitions included essay writing, vocabulary, noting and drafting, typing and translation in Hindi were the major events organized.

Independence and Republic Days Celebration

Institute celebrated independence day and republic days on August 15, and January 26th with full devotion. On this occasion Director Dr. P.C. Mahanta unfurled the national flag and addressed the gathering of staff members . He emphasized to work in unity for achieving the goals of Institute in national interest. The function was concluded by distribution of sweets.



National Flag Hosting during Republic Day Celebration

Distinguished Visitors

- Dr.S. Ayyappan, Deputy Director General (Fy.), Indian Council of Agricultural Research, KAB II, New Delhi
- Dr. V.V. Sugunan, ADG (Inland Fisheries), Indian Council of Agricultural Research, KAB II, New Delhi
- Dr. Pushpa Tamag, Joint Director Fisheries, Government of Sikkim, Gangtok
- Dr. K.L. Sehal, Ex Director, NRCCWF, Bhimtal
- Dr. M.Y. Kamal, Former Vice Chancellor, SKUAST, Srinagar-Kashmir
- Dr. S.D. Tripathi, Ex Director, CIFE, Mumbai
- Dr. C.S. Singh, Ex Dean , College of Fishery Science, G.B.P.U.A.T, Pantnagar
- Dr. Kuldip Kumar, Ex Director & Warden of Fisheries, Govt. of Himachal Pradesh
- Dr. R.P. Medhi, Director, NRC on Orchids, Sikkim
- Sh. Meher Anil Ghamaji, Central Institue of Sub-Tropical Horticulture, Lucknow
- Sh. Shashikant Akkappa Naik, Horticulture Minister, Karnataka State
- Sh. Samir Mathur. IAS, Financial Secretary, Fisheries, Govt of Haryana, Chandigarh
- Sh. A.K. Upadhyay, IAS, Addl.Secretary DARE, New Delhi
- Smt. Teejan Bai, Folk Artist
- Dr. S.P. Ayyar, Ex Director, CIFRI, Kolkata
- Prof W. Vishwanath, Manipur University
- Prof. R.K. Sinha, Patna University, Patna
- Dr. Prakash Nautiyal, Reader, H.N.B. Garhwal University, Srinagar
- Dr. Manjulata Bisht, Head, Deptt. of Zoology, Kumaun University, Nainital
- Prof. Kavita Pandey, Head, Department of Physics, D.S.B. Campus, Nainital
- Shri Parmeshwar Narayan Shivpuri, Social Worker, Bhimtal
- Prof. H.R. Singh, Ex-Vice Chancellor, Allahabad University
- Mrs. Jaya Gupta, Social Worker, Bhimtal
- Dr. R.S. Chauhan, Director, Department of Fisheries, Government of Uttarakhand.
- Prof. A.K.Pant, Director, Birla Institute of Applied Sciences, Bhimtal
- Dr. Jaswant Singh, Reader, Department of Environmental Sciences, Dr. R.M.L. Avadh University, Faizabd (U.P.)
- Dr. Krishan Gopal, Deputy Director, ITRC, Lucknow

A group photograph of visitors, Institute officers with Ex. V.C. of Kumaun University, Nainital

School teachers and students during Environment Day celebration

Visitors at Institutes stall during Kisan Mela

Trainees in Biochemistry Laboratory

Sh. A.K. Upadhyay, IAS, Hon'ble Secretary, ICAR at Institute's hatchery

Mrs. Bibha Puri Das, IAS, Principal Secretary, Uttarakhand alongwith D.M., Nainital visiting Institute facilities

Dr. S. Ayyappan, DDG(Fy) with other distinguished guests

Dr. Atul Burghoin Angler at Ramnagar, U.K.

NOTES

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