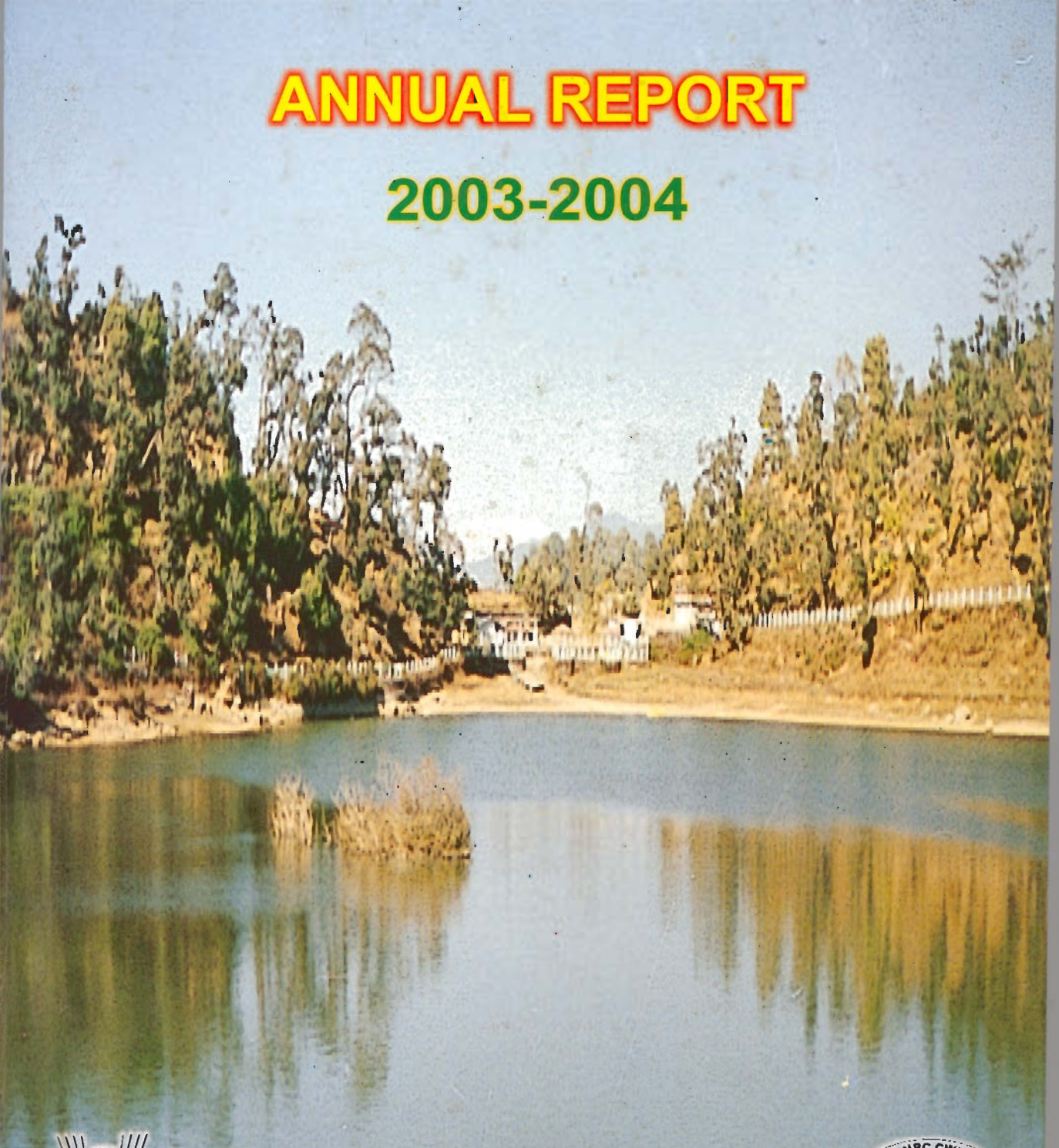
ANNUAL REPORT

2003-2004



National Research Centre on Coldwater Fisheries

(Indian Council of Agricultural Research)

Bhimtal-263 136, Distt: Nainital (Uttaranchal)

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NATIONAL RESEARCH CENTRE ON COLDWATER FISHERIES

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BHIMTAL - 263136, District - Nainital (Uttaranchal)

NRCCWF Annual Report 2003 - 2004

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

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PREFACE

PREFACE

The National Research Centre on Coldwater Fisheries during the year continued its research and outreach activities to promote the hill aquatic resource management with particular focus on indigenous and exotic fish species. In order to generate required scientific databases and develop suitable aquaculture technologies, the centre worked on seven projects covering three theme areas of temperate open-water fisheries, temperate aquaculture and frontline demonstrations. Apart from research and extension issues the centre also focused its attention in creating critical infrastructure facilities and human resources development in coldwater fishery sector.

The most important event of the year was that NRCCWF got its own complex at Bhimtal. The Phase-I of the complex housing Laboratories and other related facilities was made ready by CPWD in August and it was on August 12, 2003 that " Grehpravesh Puja" was performed by the members of staff in the new building and formally the Centre was shifted to this new complex on September 9, 2003. Having our own complex is a fulfillment of long cherished dream for all "NRCCWF parivar" connected previously with its creation and presently involved with its establishment and growth. The facilities of the modern complex will surely improve the research output from this centre which can be harnessed by all hill States.

Our co-operation with Govt. of Uttranchal grew from strength to strength. The NRCCWF apart from providing technical support to fishery sector in the State has been very strongly involved in the ambitious project on Restoration of Nainital and other Kumaon lakes. This important project is sponsored by the Ministry of Environment, Govt. of India under National Lake Conservation Programme. Another important technology extension activity of the centre has been the designing and establishment of hatchery for mahseer seed production at Koteshwar in Tehri district of Uttranchal through THDC sponsored consultancy. Similar hatchery establishment has been initiated near Pookote lake in Kerala in Wayanad District and also in Roying District of Arunachal Pradesh in North-east. As a special effort towards awareness programme different publications of coldwater fisheries were got translated in 6 different languages of North-eastern region and distributed among different clients in the region.

All mandatory meetings of Research Advisory Committee, Staff Research Council, Management Committee, Institute Joint Staff Council, Rajabsha Committee, were held as per schedule and actions were taken as per their suggestions for research and institute management.

The scientists, technical and administrative staff were provided adequate opportunities for professional participation and manpower development programme by their participation in different seminars, workshops and training programmes.

I express my sincere thanks to Dr. Mangla Rai , the Secretary, DARE D.G. ICAR & for his support and encouragement to the activities of NRCCWF. I am grateful to Dr. S. Ayyappan, DDG (Fisheries) ICAR for his guidance and continued support in furthering the R&D activities of this centre. Time to time support provided to this centre by the SMD especially Dr. V. R. Chitranshi (ADG, IFy), Dr. A.D. Dewan (ADG. MFy), Dr.Anil Agarwal (Pr. Scientist) and Shri A.S. Sethi, Under Secretary is thankfully acknowledged.

All the achievements highlighted in this report is the out come of the sincere efforts made by all members of staff of NRCCWF during the year for which they deserve appreciation and hope that in future too they will support the activities of this centre with more dedication.

This brief report of NRCCWF, I am hopeful will be useful to various persons and organizations interested in hill fishery development and aquatic resource management and I seek their indulgence and response to make it more presentable and informative in years to come.

I am thankful to Dr. C.B. Joshi, Principal scientist and Dr. Yasmeen Basade, Scientist (Senior Scale) in compiling the basic draft of this report and to all other colleagues who have extended their help. Shri Amit Joshi has rendered his assistance in Hindi version, which is dully acknowledged.

Bhimtal (Nainital)
August, 2004.

K.K. Vass
Director

विशिष्ठ सारांश

देश में पर्वतीय क्षेत्रों में जल संसाधन प्रबन्धन एवं अनुसंधान कार्यों को बढ़ावा देने के लिए भारतीय कृषि अनुसंधान परिषद द्वारा वर्ष 1987 में राष्ट्रीय शीतजल मात्स्यिकी अनुसंधान केन्द्र की स्थापना की गई। यह केन्द्र उत्तरांचल राज्य के नैनीताल जिले के भीमताल में स्थित है। वर्तमान में केन्द्र में 10 वैज्ञानिक, 11 तकनीशियन, 9 प्रशासनिक एवं 15 सहायक कर्मचारी कार्यरत हैं। वर्ष 2003–04 के लिए संस्थान के पास कुल बजट का प्रावधान 384 लाख. रू. था ।

विजन 2020 के पुनरावलोकन हेतु मात्स्यिकी के क्षेत्र में प्रतिष्ठित व्यक्तियों से युक्त अनुसंधान सलाहकार समिति एवं क्विनक्विनल रिव्यू टीम की संस्तुतियों के दिशा–निर्देशें के अनुरूप संस्थान अपनी अनुसंधान प्राथमिकताओं को बढ़ावा दे रहा है। केन्द्र की अपनी एक प्रब्रन्ध समिति भी है। इसके अतिरिक्त संस्थान को सुचारू रूप से चलाने हेतु विभिन्न आंतरिक समितियां जैसे– कर्मचारी अनुसंधान समिति, संस्थान संयुक्त कर्मचारी परिषद, राजभाषा समिति, परामर्श सेवा अनुभाग आदि का गठन भी किया गया है।

अपने आरम्भिक समय में राष्ट्रीय शीतजल मात्स्यिकी अनुसंधान केन्द्र के पास वैज्ञानिकों एवं तकनीकी कर्मचारियों की सीमित संख्या होते हुए भी इसने शीतजल मत्स्य संसाधनों के मूल्यांकन एवं पर्वतीय क्षेत्रो में प्रमुख शीतजल मत्स्य प्रजातियों के प्रसार हेतु समुचित तकनीकियों के विकास में महत्वपूर्ण योगदान दिया है। वर्ष के द्वौरान संस्थान ने अपना ध्यान मुख्य रूप से अनुसंधानों, तकनीकी हस्तांतरण, मानव संसाधन विकास, जन–जागरण कार्यक्म, परामर्श एवं संस्थान के निर्माण सम्बन्धी गतिविधियों आदि पर भी केन्द्रित किया है।

संस्थान के अनुसंधान कार्यक्मों की रूपरेखा तकनीकी हस्तांतरण, जल सम्वर्द्धन एवं प्राकृतिक जल स्रोतों की मात्स्यिकी को ध्यान में रख कर बनायी गयी है। इस वर्ष इस संस्थान द्वारा एक विश्व बैंक द्वारा पोषित राष्ट्रीय कृषि तकनीकी परियोजना तथा दो भारतीय कृषि अनुसंधान परिषद द्वारा वित्तित परियोजनाओं के अतिरिक्त सात अन्य अनुसंधान कार्यक्मों पर कार्य किया जा रहा है।

प्राकृतिक जल स्रोतों की मात्स्यिकी

हिमालयी क्षेत्रों में मात्स्यिकी सम्वर्द्धन एवं परिस्थितिकी परिरूपण

नैनीताल झील में प्रजातीय भिन्नता बहुत कम है। इस झील में वनस्पति प्लवक, जन्तु प्लवक एवं सूक्ष्म नितल जीव समूह की संख्या का अनुपात क्रमशः 2.0, 1.5 एवं 1.0 है। इसमें वनस्पति प्लवक (69 प्रजातियां) एवं नितल जीवों (30 प्रजातियां) की संख्या भी घट रही है।

झील में इस प्रकार के जीवों की बड़ी संख्या में लम्बी अवधि तक उपलब्धि झील मे पोषक तत्वों की प्रचुरता को प्रभावित करती है तथा जल को प्रदूषित भी करती है। जिस कारण वर्तमान में यह प्रणाली पारिस्थितिकीय प्रतिकूलता की ओर बढ़ रही है जिसमें सूक्ष्म प्लवकों की संख्या 60 प्रतिशत से अधिक है। इस प्रणाली में वनस्पति प्लवक एवं जन्तु प्लवकों का वार्षिक अनुपात 4:6 है जिस कारण प्रारम्भिक उत्पादों का पूरी तरह से उपयोग नही हो पाता है। नील हरित शैवाल जो कि इस प्रणाली में 35 प्रतिशत का योगदान करते हैं उनका उपयोग भी पूर्ण रूप से नही हो पा रहा है।

इस प्रणाली के जल की गुणवत्ता में कमी के कारण मछलियों की उत्पादकता मे काफी कमी आयी है। वर्तमान में इस झील में कामन कार्प व सिल्वर कार्प की अधिकता है। कभी–कभी झील के कम प्रदूषित हिस्सों में असेला प्रजाति भी पायी गयी है। गैम्बूसिया एफिनिस जिसे विदेशों से मंगाकर इस झील में प्रत्यारोपित किया गया है, की काफी प्रचुरता है और इसकी इस प्रचुरता के कारण पुंटियस तथा अन्य मछलियों के तरूण शिशुओं की उत्पादकता पर काफी असर पड़ा है।

मध्य हिमालयी नदी प्रणालियों की जल–जीव विविधता की विशेषताएं एवं संसाधन मूल्यांकन

इस परियोजना के अर्न्तगत इस वर्ष गढ़वाल हिमालय में स्थित भागीरथी एवं भिलंगना नदियों की जल जैव विविधता का अध्ययन किया गया। इन पर्वतीय नदी–प्रणालियों में प्राप्त शैवालों में बैसिलैरियोफाइसी की प्रधानता है जबकि हरे व नीले रंग के शैवाल केवल कुछ मौसम में ही पाए जाते हैं। हरे रंग के शैवाल ग्रीष्म के महिनों में दिखायी देते हैं जबकि नीले रंग के शैवाल बसंत के महीनों में दिखायी देते हैं। इन नदियों में प्राप्त प्रमुख पादप प्लवकों में– अम्फोरा अकेन्थिस, एमेरा, ओसिलाटोरिया, कोकोनीस, फ्रैजीलेरिया, गोम्फोनिमा, मास्टोग्लोइया, मेलोसीरा, नावीकूला, निश्चिया इत्यादि प्रमुख है। इसमें जन्तु प्लवकों का अंश बिलकुल नगण्य है। मौसमी शैवाल जो एक निश्चित क्रम में परिलक्षित होते है सामान्यतः तेज जल के बहाव के कारण बहुत तेजी से समाप्त हो जाते हैं। सूक्ष्म नितल जीव समूहों की गुणात्मक एवं संख्यात्मक दोनों की अधिकता नदी की उच्च उत्पादन प्रकृति को प्रदर्शित करती है। इन नदी–नालों के नितल जीव समूहों में इफिमैरोप्टेरा की प्रधानता है। इसके पश्चात ट्राइकोप्टेरा, कोलिओप्टेरा, ओडोनेटा तथा डिप्टीरा आदि की क्रमवार अधिकता प्राप्त की गयी है।

गढ़वाल हिमालय में प्राप्त मछलियां 2 वर्गों में बांटी गयी हैं– देशी प्रजातियां एवं विदेशी प्रजातियां। देशी प्रजातियों में–साइजोथोरैक्स रिचार्डसोनी, टौर पुटिटोरा, लेवियोडेरो एवं

लेबियो डायोचिलस व अन्य खाने वाली मछलियां जैसे– नीमाकाइलस, गारा, बैरिलस व ग्लैप्टोथोरैक्स आदि हैं। विदेशी प्रजातियों में – ट्राउट, (अन्कोरिंकस माइकिस) प्रमुख हैं।

हिमालय क्षेत्र की संकटग्रस्त माहसीर (टौर पुटिटोरा) में लिंग भेद

हिमालय क्षेत्र की झीलों एवं नदियों में माहसीर मछलियों का ह्रास बहुत तेजी से हुआ है। झीलों में मादा माहसीर मछलियों की प्राप्ति का प्रतिशत नदियों की अपेक्षा 12.12 प्रतिशत से कुछ अधिक था। यद्यपि प्रजनन अवधी में नदी –नालों में झीलों की अपेक्षा 77 प्रतिशत अधिक मादा माहसीर मछलियां पकड़ी गयी थी।

प्रयोगिक तौर पर यह देखा गया कि कम फोटो पीरीयड में मछलियां धीरे–धीरे अनुकूलन करती हैं क्योकि उक्त अवधि में मृत्यु दर और आहार ग्रहण क्षमता में बहुत अधिक भिन्नता नही होती है। तापक्रम से इनकी बढ़ोत्तरी प्रभावित होती है। नियन्त्रित परिस्थितियों में रखी झील की मछलियों में एस.जी.आर. की प्रतिशतता 2.66–0.90 तक थी जबकि नदी नालों की मछलियों में यह .33–0.81 तक थी। इन मछलियों में 23±1 डिग्री सें0ग्रे0 तापक्रम में प्रभावकारी बढ़ोत्तरी प्राप्त की गई। प्राकृतिक जल स्रोतों जैसे झील की मछलियों में एस.जी. आर. का प्रतिशत .6–1.2 तक था जबकि नदी नालों की मछलियों में यह अनुपात .33–1.3 तक प्राप्त किया गया।

मत्स्य पालन

देशी मत्स्य प्रजातियों के भोजन एवं पोषक तत्वों का विकास

मत्स्य आहार में अमीनो अम्ल का विश्लेषण

सी.एम.एफ.आर.आई. कोचीन की मदद से राष्ट्रीय शीतजल मत्स्य अनुसंधान केन्द्र भीमताल ने तीन प्रकार के आहारो के अमीनो अम्ल का विश्लेषण किया। सभी तीनों आहारों जैसे–एन.आर.सी.सी.डब्लू.एफ.–I, एन.आर.सी.सी.डब्लू.एफ.–II, व एन.आर.सी.सी.डब्लू.एफ. –III में आवश्यक अमीनो अम्ल उपलब्ध थे। एन.आर.सी.सी.डब्लू.एफ.–II की तुलना में एन. आर.सी.सी.डब्लू.एफ.–III में मैथोनाइन एवं आइसोलूसिन की सघनता 3.6 व 2.7 अधिक अंकित की गई।

पर्वतीय मत्स्य प्रजातियों के लिए भोज्य प्रोटीन श्रोत के रूप में स्थानीय लिग्यूमिन सीड के परिणाम

10%, 20%, 30%, व 40% प्रोटीन स्तर वाले काले सोयाबीन को मछलियों को खिलाने से पता चला कि 30%, प्रोटीन स्तर वाले काले सोयाबीन द्वारा पोषित तरूण महासीर मछलियों की वृद्धि, आहार ग्रहण क्षमता एवं प्रोटीन ग्राहय क्षमता से अच्छे परिणाम प्राप्त हुए जिसकी पी दर <0.5 से अधिक थी। अतः सुझाव है कि तरूण माहसीर के आहार में फिश मील के स्थान पर 30 प्रतिशत अधिक प्रोटीन वाले काले सोयाबीन को इस्तेमाल किया जा सकता है।

प्रयोगिक रूप से स्नो ट्राउट मछली को 16%, 24%, 32%, व 40% काले सोयाबीन युक्त आहार खिलाने से पता चला कि जिन मछलियों को काले सोयाबीन के स्थान पर प्रोटीन स्रोत के रूप में फिश मील दिया गया उनके भार में अधिक वृद्धि हुयी।

सुनहरी माहसीर (टौर पुटिटोरा) पर एन.आर.सी.सी.डब्लू.एफ.–III का प्रयोग

प्रारम्भिक तालाब निर्माण प्रक्रिया के पश्चात सीमेंट के तालाबों में दो बार (दिसम्बर 2003 में 200 की संख्या व जनवरी 2004 में 250 की संख्या) सुनहरी माहसीर के बच्चे संग्रहित किए गए तथा उक्त भोजन देने के पश्चात इनके भार में 0.1–0.3 ग्राम की वृद्धि हुयी। मछली को उनके भार के बराबर 5 प्रतिशत की दर से एन.आर.सी.सी.डब्लू.एफ.–III आहार दिया गया था। दिसम्बर माह में तालाब के जल में 8.5–10^0 से.ग्रे. तक तापक्रम में कमी होने के कारण 30 प्रतिशत मृत्युदर अंकित की गई। फरवरी एवं मार्च माह में 80 प्रतिशत उत्तरजीवितता देखी गई तथा उनके भार में 9.36 प्रतिशत की वृद्धि देखी गई।

उत्तरांचल के कुमायूं क्षेत्र में रेन्बो ट्राउट के सम्वर्द्धन के लिए व्यापक स्तर पर भोजन का विकास

कुमायूं के हिमालय क्षेत्र की एग्रोक्लाइमेटिक स्थितियों में रेन्बो ट्राउट की उत्तरजीवितता की दर एवं वृद्धि के मूल्यांकन हेतु 200 लीटर क्षमता वाले प्रत्येक टैंक में 50, 75 व 100 की दर से रेनबो ट्राउट के जीरों का संचय करके पालन किया गया। इन जीरों को उनके भार के 8 प्रतिशत की दर से प्रतिपूरक आहार दिया गया। प्रयोग के अंत में पाया गया कि कम संख्या में संग्रहित मत्स्य भण्डार की उत्तरजीवितता दर, भोजन ग्राहय क्षमता व वृद्धि में अच्छे परिणाम थे।

एक अन्य प्रयोग में रेन्बो ट्राउट के जीरों का संग्रहण, उनके भोजन ग्राह्य दर, भोजन लेने की बारम्बारता व उत्तरजीविता दर का भी मूल्यांकन किया गया। प्रत्येक टैंक में 20, 40 व 60 की संख्या में 1.81–2.96 ग्राम भार वाले रेन्बो ट्राउट के जीरों का संचयन किया गया। और उनको 20 जीरे वाले टैंक में 12 प्रतिशत, 40 जीरे वाले में 10 प्रतिशत व 60 जीरे वाले टैंक में 5 प्रतिशत की दर से भोजन दिया गया। 20 संख्या वाले टैंक में दिन में 4 बार भोजन दिया गया। इसी तरह 40 संख्या वाले टैंक में दिन में 3 बार और 60 वाले टैंक में दिन में 2 बार भोजन दिया गया। 8 सप्ताह के प्रयोग के पश्चात 40 संख्या वाले तालाबों में जिनको दिन में 3 बार उनके शरीर के 10 प्रतिशत भार के बराबर भोजन दिया गया उनके शरीर की वृद्धि दर के अच्छे परिणाम देखे गए।

पर्वतीय क्षेत्रों में विदेशी कार्प मछलियों की परिपक्वता, अण्डजनन एवं उत्प्रेरण विधि द्वारा गर्भाशय का विकास

पर्वतीय क्षेत्रों में मत्स्य पालक मिश्रित कार्प पालन जैसे– ग्रास कार्प, सिल्वर कार्प एवं कामन कार्प के यथोचित संयोजन के साथ भोजन एवं उत्प्रेरकों की समुचित व्यवस्था के द्वारा अत्यधिक मत्स्य उत्पादन प्राप्त कर सकते हैं। प्रजनन अवधि के दौरान इनके अण्डे प्राप्त करना एक प्रमुख समस्या है। पिछले 6–7 वर्षों की लम्बी अवधि के बाद प्रथम दो प्रजातियों ने ठण्डे पानी के तालाबों में परिपक्वता प्राप्त की जिससे उंचे क्षेत्रों पर ठण्डे पानी में इन मछलियों का भिन्न भिन्न प्रजनन व्यवहार परिलक्षित होता है।

ठण्डे पानी मे समुद्र तल से 1620 मी. की उंचाई वाले क्षेत्रों में कार्प मछलियों की प्रजनन की तकनीक का विकास एवं पूर्व परिपक्व बनाने हेतु 5,6 व 7 वर्ष की दोनों प्रजातियों के प्रजनकों को 3500–4820 किग्रा./हैक्टे. की दर से सीमेंट निर्मित तालाबों में रखा गया और उन्हे कृत्रिम आहार दिया गया। प्रजनकों को मध्य अप्रैल से जुलाई तक प्रत्येक 15 दिन में फिश पिटट्यूटरी हारमोन तथा 0.2–0.3 मिलीग्राम/किग्रा. की दर से 3–1 के अनुपात में ओवा–प्राइम दिया गया तथा पाया गया कि माह जुलाई में 5 वर्ष की नर एवं 6 वर्ष की मादा मछली परिपक्व हो गई। इन प्रयोगों से निष्कर्ष निकला कि इन प्रजातियों की परिपक्वता को आगे करने के लिए दिए गए उपचार प्रभावकारी हुए हैं।

इन प्रजातियों को एक बार पुनः उंचे क्षेत्रों पर प्रजनन हेतु सफलतापूर्वक उत्प्रेरित किया गया। 22–23 डिग्री सें0ग्रे0 के तापक्रम पर 14–16 घण्टे की अवधी में 1.3–1.6 मिली/किग्रा. में 2/3 खुराक की दर से जब ओवाप्राइम दिया जाता है तो ग्रास कार्प स्वतः ही अण्डे देने लगती है। सिल्वर कार्प प्राकृतिक रूप से अण्डे नही देती किन्तु हाथ द्वारा दबाकर उससे अण्डे

निकाले जा सकते हैं तथा उन अण्डो को शुष्क एनामिल ट्रे में रखकर निषेचित किया जा सकता है। सामान्यतः अण्डे सेंने की प्रक्रिया 22–24 डिग्री सें0ग्रे0 के बीच होती है लेकिन इन प्रजातियों के अण्डों का स्फुटन कम तापमान (21^0 से.0ग्रे0) पर नही किया जा सका।

अच्छी प्रकार से निर्मित तालाबों में 23.6–25.8 डिग्री से.0ग्रे0 के तापक्रम पर इन प्रजातियों के अण्डों से जीरा का उत्पादन किया जाता है। इन जीरों को कोबाल्टस क्लोराइड के साथ सोयाबीन केक व मूंगफली की खली से युक्त प्राकृतिक आहार दिया गया। सिलवर कार्प के आकार मे 114 दिनों में 20–45 मि.मी. व भार में 2.4 ग्रा. की वृद्धि हुयी जबकि इसी अवधि में ग्रास कार्प के आकार में 35–56 मि.मी. व भार में 3.8 ग्रा की वृद्धि हुयी। दोनो प्रजातियों की उत्तरजीविता 52–68 प्रतिशत के बीच थी। इनकी वृद्धि की गति जल के कम तापमान के कारण बहुत धीमी थी।

ग्रास कार्प व सिल्वर कार्प की उत्प्रेरित प्रजनन की तकनीक का विकास शीतजल के लिए किया गया है। शीतजल में इन प्रजातियों के अण्डों का व्यापक रूप से उत्पादन इस तकनीक का प्रयोग करके किया जा सकता है।

राष्ट्रीय कृषि तकनीकी परियोजना के अर्न्तगत माहसीर कार्यक्रम

राष्ट्रीय कृषि तकनीकी परियोजना के अर्न्तगत भीमताल के अतिरिक्त श्रीनगर, पालमपुर व पंतनगर में स्थित केन्द्र भी अपने नियमित कार्यक्रम के अनुसार कार्य कर रहे हैं साथ ही ये विभिन्न एग्रो क्लाइमेटिंग क्षेत्रों में माहसीर के सम्वर्द्धन हेतु तकनीकी के विकास एवं इसके लिए विभिन्न संसाधनों का पता लगाने के लिए सूचनाओं का भी संग्रह कर रहे हैं।

संकटग्रस्त, समाप्तप्राय हिमालयन माहसीर के पुर्नस्थापन के अतिरिक्त इस महत्वपूर्ण मछली के जननद्रव्यों को संरक्षित करने के लिए उत्तरांचल में रा.शी.ज.मा.केन्द्र के चम्पावत जिले में स्थित छिरापानी प्रयोगिक प्रक्षेत्र में एक जल प्रवाही माहसीर बीज हैचरी की स्थापना की गई है। हिमालय क्षेत्र के जल स्रोतों में माहसीर मछली के बीजों के पालन हेतु 12.0 x 7.5 मी. आकार के पौलिहाउसों के अन्दर वर्तमान में 1–2 मी. व्यास वाले 7 फाइबर ग्लास के टैंक, 16 हैचिंग तश्तरियां व 4 हैचिंग ट्रफ रखे गये हैं। प्रवाही हैचरी में पानी की आपूर्ति भंडार टैंक में एकत्र किए गए पानी से की जाती है। प्रत्येक हैचरी में आक्सीजन की मात्रा बढ़ाने के लिए फुहारे भी लगाए गए हैं।

इस नव स्थापित हैचरी में 15.0–23.5 डिग्री सें0ग्रे0 का तापक्रम माहसीर के अण्डे व जीरें के पालन पोषण हेतु उपयुक्त पाया गया। समुद्रतल से 1620 मी. की उंचाई पर स्थित करने

छिरापानी मत्स्य प्रक्षेत्र की पर्यावरणीय परिस्थितियों में पौलिहाउस के अन्दर रखे ट्रफों व टैंकों की हैचिंग क्षमता का मूल्यांकन करने हेतु भीमताल हैचरी से अगस्त 2003 में 15–30 मि.मी. आकार के 0.039–0.050 ग्राम भार वाले 2000 माहसीर के जीरे यहां लाए गए। लगभग 45 दिनों तक इन जीरों को कृत्रिम आहार खिलाने पर इनके आकार में 19.0–33.0 मि.मी. तथा भार में 0.042–0.80 ग्राम की वृद्धि हुयी।

तत्पश्चात् जनवरी 2003 के मध्य में भी प्राकृतिक स्रोतों से सुनहरी माहसीर के बच्चों (52–76 मि.मी., 2 ग्राम भार वाले) को संग्रहित किया गया तथा उनको तापअनुवर्तक (thermostate) युक्त टेंकों में पाला गया। तापअनुवर्तक से 2–6 डिग्री सें0ग्रे0 तक ताप बढ़ाने में मदद मिली। इन बच्चों को कृत्रिम आहार दिया गया तथा 40 दिन के पश्चात इन माहसीर के बच्चों के आकार में 59–85 मि.मी. तक भार में 3 ग्राम वृद्धि व उत्तरजीवितता 63. 9 प्रतिशत तक प्राप्त गयी।

श्यामलाताल झील में माहसीर मछलियों का संरक्षण एवं सम्वर्द्धन

संरक्षण एवं पुर्नवासन के मूल्यांकन के रूप में माहसीर को कुमायूं के पर्वतीय क्षेत्र में स्थित श्यामलाताल झील में पाला जा रहा है। श्यामलाताल झील में जाल डालने पर ज्ञात हुआ कि झील में माहसीर की संख्या बहुत अधिक हो चुकी है और झील के पर्यावरण के अनुसार वर्ष 2003–2004 में टौर पुटिटोरा प्रजाति की वयस्क मछली का संग्रहण 54.54 प्रतिशत था। इनके भार में अच्छी वृद्धि प्राप्त हुयी है।

अरूणाचल प्रदेश में चाकलेट माहसीर का कृत्रिम प्रजनन एवं बीज उत्पादन

जुलाई 2003 में रा.अनु.केन्द्र भीमताल तथा मत्स्य विभाग अरूणाचल प्रदेश के संयुक्त तत्वाधान में एक परियोजना शुरू की गई। भारतीय कृषि अनुसंधान परिषद द्वारा पोषित यह परियोजना अरूणाचल प्रदेश के रोइंग जिले में स्थित डिबोंग घाटी में स्थित है। इस क्षेत्र में चाकलेट महासीर को स्थानीय रूप से 'बोकर' अथवा कतली महासीर के नाम से जाना जाता हैं। यह उत्तर पूर्वी हिमालय क्षेत्र की बहुत मूल्यवान मछली है। कार्य के आरम्भिक दौर में स्थानीय नदियों जैसे– देओपानी, इपीपानी, डिफू, इंजूपानी तथा डिबैंग तथा 2 झीलों–शैली व मेहउ का सर्वेक्षण किया गया। स्थानीय नदियों में महासीर बीज स्थलों का भी सर्वेक्षण एवं पहचान की गई। सभी नदियों में दिओपानी में महासीर की सम्भावनाएं सबसे अधिक पायी गई इसलिए इस नदी प्रणाली में संरक्षण कार्य आरम्भ किया गया किंतु इस नदी में जल विद्युत उत्पादन ईकाई की स्थापना से इनके समाप्त होने की आंशका है। इसलिए इनको पुर्नस्थापित

के लिए रा.अनु.केन्द्र ने महासीर बीज के सम्वर्द्धन एवं पालन पोषण दोनो के लिए राज्य में इदुली मत्स्य प्रक्षेत्र में एक हैचरी की स्थापना की है। इदुली फार्म में प्राकृतिक स्रोतों से संग्रहित किए गए महासीर अंगुलिकाओं पर किए गए प्रारम्भिक प्रयोगों से पता चला कि उनमें वृद्धि दर बहुत प्रभावकारी थी। अरूणाचल प्रदेश के इस सुदूरवर्ती जिले में महासीर हैचरी की स्थापना का यह प्रयास एक लम्बा कदम होगा।

सूचना प्रौद्योगिकी

शीतजल मात्स्यिकी के मूल्यांकन एवं प्रबन्धन में कम्प्यूटर का प्रयोग

उत्तरांचल राज्य भारत का एक शीतजल राज्य है। जिसकी स्थापना 9 नवम्बर 2000 को हुयी थी। एक नए राज्य के रूप में यहां मात्स्यिकी संसाधन से सम्बन्धित कोई आंकड़े उपलब्ध नही थे। इसलिए इस नए राज्य के शीतजल क्षेत्र के मात्स्यिकी संसाधनों की सूचनाओं को कम्प्यूटर में एकत्र करना आवश्यक था इस दृष्टिकोण से सूचनाओं को माइक्रोसाफ्ट विजुअल बेसिक 6.0 सौफटवेयर के अन्तर्गत समाविष्ट किया गया है। ताकि आवश्यकता पड़ने पर आंकड़ों को फिर सरलतापूर्वक मूल्यांकित एवं संशोधित किया जा सके। आंकड़ों में राज्य के जिलों की सामान्य सूचनाओं, जिलों के विवरण, विकास खण्डों की संख्या व जल स्रोतों की संख्या आदि का उल्लेख किया गया है। आंकड़ों के अन्तर्गत उत्तरांचल राज्य के विभिन्न संसाधनों जैसे– नदियों, झीलों, तालाबों आदि की आख्याएं, सारणियां आदि का भी समावेश किया गया है। साथ ही पारिस्थितिकी पैमाने जैसे–तापक्रम, पारदर्शिता, पी. एच., धुलित आक्सीजन, क्षारीयता, बी.ओ.डी., सी.ओ.डी., प्लवक, नितल जीव समूह, मत्स्य प्रजातियां आदि के प्रति माह के आंकड़े एकत्रित करने का भी प्रावधान किया गया है जिसके आधार पर आख्याओं का निर्माण किया जा सकता है। आरम्भ में इस शीतजल मात्स्यिकी संसाधनों के कम्प्यूटरीकृत आंकड़ों के विकास हेतु नदियों और झीलों के कुछ आंकड़े पहले ही समाविष्ट किए जा चुके हैं। इस आंकड़ा सूची मे विभिन्न प्रकार की आंकड़ा प्रविष्टि जैसे– टैक्स बुक्स, कौम्बो बुक्स, विकल्प बटन, रेडियो बटन, आदेश बटन आदि को आंकड़ा फार्म में सरलता से समाविष्ट करने का भी प्रावधान है।

राष्ट्रीय शीतजल अनुसंधान केन्द्र की वेबसाइड

राष्ट्रीय शीतजल अनुसंधान केन्द्र की वेबसाइड के अन्तर्गत संस्थान का भवन परिसर, चम्पावत व भीमताल के प्रयोगिक मत्स्य फार्म, हैचरी आदि की तस्वीरें, संस्थान के अधिदेश, वैज्ञानिकों, तकनीकी एवं प्रशासनिक वर्ग के कर्मचारियों आदि के बारे में विस्तार से समायोजन किया गया है। वेबसाइड में संस्थान की परियोजनाओं एवं बाहरी संस्थाओं द्वारा पोषित

परियोजनाओं की सूचना एवं पिछले वर्ष इस दिशा में प्राप्त उपलब्धियों को चित्रों एवं सारणीयों के माध्यम से दर्शाया गया है। इस साइट में संस्थान द्वारा सुनहरी माहसीर, कार्प, विदेशी ट्राउट, देशी स्नो ट्राउट आदि के पालन में प्राप्त की गई उपलब्धियों एवं संस्थान द्वारा विकसित तकनीकियों को शामिल किया गया है। परामर्श सेवाएं, वर्तमान में चल रही और अब तक पूरी की गई परियोजनाओं को भी इसमें शामिल किया गया है। इसके अतिरिक्त संस्थान के भावी प्रशिक्षण कार्यक्मों एवं संस्थान द्वारा आयोजित सम्मेलन/संगोष्ठियों को दर्शाया गया है। यह वेबसाइड हिमालय क्षेत्रों में मत्स्य सम्वर्द्धन व इसके प्रबन्धन की नीतियों, शीतजल मात्स्यिकी संसाधनों एवं इस संस्थान के बारे में जानकारी प्राप्त करने वालों के लिए लाभकारी सिद्ध होगी।

विस्तार गतिविधियां

पर्वतीय क्षेत्रों के शीतजल स्रोतों में विदेशी कार्प मछलियों के पालन पोषण का प्रदर्शन

कुमायूं क्षेत्र के अल्मोड़ा, नैनीताल व चम्पावत की विभिन्न उंचाईयों (समुद्र तल से 800–1740 मी.) पर स्थित तालाबों मे चाइनीज कार्प का प्रतिपूरक आहार एवं कार्बनिक व अकार्बनिक उर्वरकों के प्रावधान के साथ मिश्रित पालन किया गया। मत्स्य किसानो से प्राप्त

चित्र. 1. संस्थान की अनुसंधान सलाहकार समिति द्वारा तकनीकी हस्तान्तरण परियोजना के तालाबों में मत्स्य उत्पादन का निरीषण

चित्र. 2. संस्थान की अनुसंधान सलाहकार समिति के सदस्य ग्राम पाटी जिला चम्पावत में मत्स्य किसानों के साथ

सूचनाओं के आधार पर पता चला कि सघन प्रबन्धन के परिणामस्वरूप ग्रास कार्प के भार में 50 प्रतिशत की बढ़ोत्तरी हुयी। मछली को जितनी अधिक हरी घास खिलायी गयी उतनी ही अधिक उसमें बढ़ोत्तरी हुयी। इन सभी तालाबों (33) का औसतन सामान्य उत्पादन 4972 किग्रा./है./8 माह अथवा 0.497 किग्रा./मी^{2} की दर से प्राप्त किया गया जबकि इसकी लागत मात्र 16.20–19.50 रूपए प्रति किलो थी।

पर्वतीय क्षेत्रों में आर्गनिक कार्प मत्स्य पालन का मूल्यांकन करने के लिए 2 तालाबों का चयन किया गया और उसमें 3 मछली/ मी^{3} की दर से 50 प्रतिशत ग्रास कार्प, 25 प्रतिशत सिल्वर कार्प एवं 25 प्रतिशत कामन कार्प का संचयन किया गया साथ ही जल की गुणवत्ता, मछली की वृद्धि एवं उसकी उत्तरजीविता का परीक्षण किया गया। इन मछलियों को उनके शरीर के भार के बराबर रसोईघर के अपशिष्ट उत्पाद के साथ 30 प्रतिशत आयल केक व 20 प्रतिशत चावल की पालिश युक्त प्रतिपूरक आहार दिया गया। इन तालाबो में अकार्बनिक उर्वरकों का भी प्रयोग किया गया। इन तालाबों में संग्रहित मछलियों की वृद्धि एवं उत्तरजीविता को देखने पर पता चला कि मछली की वृद्धि एवं उत्पादन को बढ़ाने में अकार्बनिक उर्वरकों का अधिक योगदान नही है। दोनो तालाबों की ग्रास कार्प के भार में लगभग समान वृद्धि हुयी। यह वृद्धि अधिक हरी घास खाने की मात्रा पर निर्भर थी। केवल

कामन कार्प के भार में कम वृद्धि पायी गई। किन्तु जिन तालाबों में अकार्बनिक उर्वरकों का प्रयोग किया गया उनमें सिल्वर कार्प का उत्पादन अच्छा रहा।

अप्रयोगिक तालाबों की अपेक्षा प्रयोगिक तालाबों में इन मछलियों का संचयी उत्पादन (0.986 किग्रा./मी^{3}) अच्छा रहा। इस उत्पादन को प्राप्त करने के लिए और अधिक प्रयोगों की आवश्यकता है।

मानव संसाधन विकास

संस्थान के वैज्ञानिक एवं तकनीकी व प्रशासनिक वर्ग के कर्मचारियों को उनके क्षेत्र से सम्बन्धित विभिन्न प्रशिक्षण कार्यक्मों में भेजा गया। संस्थान के वैज्ञानिकों ने विभिन्न संगोष्ठियों–सम्मेलनों, कार्यशालाओ आदि में भाग लिया तथा उनमें अपनी वैज्ञानिक उपलब्धियों से सम्बन्धित अनुसंधान पत्रों को प्रस्तुत किया। संस्थान ने शीतजल मात्स्यिकी की विभिन्न सम्भावनाओं पर अरूणाचल प्रदेश राज्य मात्स्यिकी विभाग के कार्मिकों एंव चौधरी चरण सिंह विश्वविद्यालय के स्नातक एवं स्नातकोत्तर क्षेत्रों के लिए प्रशिक्षण कार्यक्मों का आयोजन किया। संस्थान के जन–जागरण अभियान के अर्न्तगत संस्थान ने स्थानीय नागरिकों, भ्रमण पर आने वाले छात्रों, प्रतिष्ठित व्यक्तियों आदि को शीतजल मात्स्यिकी की विभिन्न सम्भावनाओं के सम्बन्ध में जानकारी दी।

अन्य गतिविधियां

संस्थान की विभिन्न समितियों जैसे अनुसंधान सलाहकार समिति, क्यू.आर.टी., संस्थान संयुक्त कर्मचारी परिषद तथा राजभाषा कार्यान्वयन समिति आदि की बैठकें नियमित रूप से आयोजित की गईं। सम्बन्धित समितियों की बैठकों में विभिन्न कार्यसूचियों पर चर्चा की गई तथा संस्थान की अनुसंधान गतिविधियों एवं प्रबन्धन को सुचारू रूप से चलाने के लिए उचित दिशा निर्देश दिए गए।

रा.शी.ज.अनु.केन्द्र देश की विविध संस्कृतियों का प्रतिनिधित्व करता है तथा इसका प्रत्येक सदस्य सांस्कृतिक सामंजस्यता एवं सच्ची सम्प्रदायिक भावना के साथ विभिन्न राष्ट्रीय दिवसों एवं घटनाओं में भाग लेता है।

EXECUTIVE SUMMARY

The National research Centre on Coldwater Fisheries (NRCCWF) was established in September 1987 by Indian Council of Agricultural Research (ICAR) entrusting the responsibilities of conducting and promoting research on coldwater fisheries, aquaculture and aquatic resource management in the hill regions of the country. The Centre is located at Bhimtal, district Nainital in the State of Uttaranchal. The Centre at present has nine scientists, eleven technicians, nine administrative, fifteen supporting personnel and one casual labour with temporary status. The Institute had a total budget of Rs. 384 lakhs for the year 2003-2004.

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

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

The research programmes are designed with major thrust on Openwater Fisheries, Aquaculture and Transfer of Technology. During the year the Institute worked on seven research programmes apart from two Cess fund projects and a NATP project for which this institute is a nodal centre.

Openwater fisheries:

Ecological modeling and fishery enhancement in Himalayan wetlands

The species diversity index in Nainital lake was estimated as 2.0,1.5, and 1.0 for phytoplankton, zooplankton and macro-zoobenthos, respectively. Even species richness in the system was in the decreasing order from phytoplankton (69 species) to macro-zoobenthos (30 species). Dominance of a few taxa in majority of the months reflected that levels of nutrients are high to sustain their population. The system has reached a bloom stage where ecological succession of smaller autotrophic organisms (nanoplankton more than 60%) tend to dominate over the larger ones. The mean annual ratio between phyto to zooplankton biomass was 3.3 and between phytoplankton to herbivore was 4.6, indicating that a major portion of primary production remained unutilized by the herbivore in the lake. The blue-greens alone contribute above 35% to the total annual mean phytoplankton biomass of the lake and mostly dominated by *Microcystis* and *Anabaena*, both being unpalatable, are not consumed by the important food fishes.

Because of stressed water quality in the lake, like low concentration of dissolved oxygen 0.5-4.2mg/l, the fish stocks that were reported to be available in lake in the past have drastically declined. Presently lake holds a population of *Cyprinus carpio* and *Hypophthalimichthys molitrix*. Specimen of *Schizothorax richardsonii* is also recorded on rare occasions, that too from the least polluted zones of the lake. The introduction of *Gambusia affinis* in the lake, which has presently dominated the highly enriched margins, has an impact on the natural balance of previously dominant fish species of *Puntius* alongwith juveniles of other species.

Resource assessment and aquatic biodiversity characteristics in central Himalayan river systems

The tributaries of major rivers viz., Bhagirathi and Bhilangana located in Garhwal Himalayas were assessed for aquatic biodiversity. In these mountain river systems bacillariophyceae were the dominant forms while

green algae and blue green algae occurred seasonally. Green algae appeared in summer months, while blue green in spring period. The dominant phytoplankton taxa were *Amphora, Achnanthes, Cymbella, Cocconeis, Fragilaria, Gomphonema, Mastogloia, Melosira, Navicula, Nitzschia, Oscillatoria*, etc. The contribution of zooplankton was insignificant. The benthic micro-biota (epiphytic) exhibited seasonal periodicity of algal colonies generally showing a sharp decline with the increase in rate of water flow. The richness of macro benthos population both quantitatively and qualitatively reflects high productive nature of the stream. Ephmeroptera dominated the benthic macro invertebrate population followed by Trichoptera, Coleoptera, Odonata and Diptera.

The fishes in Garhwal uplands belonged to two groups, native species namely, *Schizothorax richardsonii, Tor putitora, Labeo dero and Labeo dyocheilus* among food fishes and *Noemacheilus, Garra, Barilius and Glyptothorax* of low economic value and the exotic trout, *Onchorhynchus mykiss.*

Trait and gender of upland endangered mahseer, *Tor putitora*

The population structure of mahseer, *Tor putitora* in rivers and lakes exhibited 12.12% more female population of mahseer in lake stocks in comparison to river stocks. Growth related observations also delineated that scotophase brought about depressed growth in both lake and river stocks. Fishes were observed to gradually adjust to the reduced photoperiod since the mortality and food consumption did not vary much as compared to control group. The growth rate was significantly influenced by temperature. In the control group the SGR ranged from 0.266 to 0.90 in the lake stocks while it was 0.33 to 0.81 in the river stocks. It significantly increased when the two stocks were reared at temperature of 23 +1°C, which was 5°C above as compared to the average control values. The SGR range in lake stock was 0.6 to 1.2, whereas it varied from 0.33 to 1.3 in river stocks.

Aquaculture:

Nutrition and feed development for indigenous upland fish species

Amino Acid status of diets

Amino acid analysis of three diets prepared by NRCCWF, Bhimtal was carried out with the help of CMFRI, Cochin. All the three test diets viz. NRCCWF-I, NRCCWF-II and NRCCWF-III were observed to have all essential amino acids. However, the concentration of methionine and isolucine were recorded to be 3.6 and 2.7 folds higher in NRCCWF- III as compared to NRCCWF-II feed.

Response of locally available legume as a dietary protein source for upland fish species

Feeding trials with the test diets having nil, 10%, 20%, 30% and 40% dietary protein levels of black bean meal revealed that growth performance, feed efficiency, protein efficiency ratio and apparent digestibility coefficient of golden mahseer juveniles fed with diet having black bean meal protein up to 30% were significantly ($P<0.05$) higher, as compared to fish fed with nil, 10%, 20% and 40% dietary protein levels of black bean meal. Hence suggesting that fish meal can be replaced with black bean meal up to a level of 30% of the total dietary protein in the diets for golden mahseer juveniles.

In snow-trout feeding trials with the test diets having 16%, 24%, 32% and 40% of black bean meal revealed that the maximum growth in terms of percent weight gain was 23% in control group having only fish meal as a protein source and no black bean meal.

Field trial with NRCCWF-III feed on golden mahseer, *Tor putitora*

Golden mahseer juveniles having an initial weight of 0.1 – 0.3g were stocked in two installments (200 Nos. in December, 2003 and 250 Nos. in January, 2004) in a cemented pond (dimensions 14x 7x 4.5m). The fish were fed with the diet NRCCWF-III @ 5% of the body weight. During March, 80% survivability was recorded with an average percent weight gain of 9.36%.

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

To assess the growth performance and the rate of survival of rainbow trout along with the impact of stocking densities in the agro-climatic conditions of Kumaon Himalayan region, rainbow trout fry of 1.3-2.0 g body weight were stocked in trout fry rearing troughs of 200 l capacity @ 50, 75 and 100 fries per tank. These fry were fed with formulated diet at the rate of 8% of body weight. At the end of the trial the growth performance, feed efficiency and survival was found to be better in fish stocked at lowest density.

In another experiment, impact of stocking density, feeding rate and feeding frequency on the growth and survival of rainbow trout was assessed. Rainbow trout fry of 1.81-2.96g body weight were stocked in the trout rearing troughs at densities of 20, 40 and 60 Nos. per tank. The feeding rate was 12% in 20 fry tank, 10% in 40 fry tank and 5% in 60 fry tank. The fish of first tank with 20 Nos. were fed 4 times in a day, with 40 Nos. 3 times in a day and with 60 Nos.2 times in a day. On conclusion of the eight weeks trial the growth performance and feed efficiency were found to be better in the set with 40 fish per tank where fish were fed at 10% of their body weight and three times in a day.

Induced ovarian development, maturation and spawning of exotic carps in uplands

To prepone maturity and develop breeding technique in captivity for silver and grass carps in coldwaters at high altitude (1620 m asl), the brood stock of both the species having an age of 5,6,and 7 years stocked in cemented raceways and were regularly fed on artificial diet. The brooders were administered PG extract + ovaprime in 3:1 ratio @ 0.2-0.3 ml/kg of body weight at every 15 day interval from mid April onwards and only 5 year old males and 6 years old females matured in July. But the stock of the same age in control pond not provided with PG extract + ovaprime did not mature. Results infer that treatment given was effective to prepone the maturity of these species in cold waters.

These species were once again successfully induced to breed in captivity at high altitude. Grass carp spawned naturally when ovaprime was injected @ 1.3-1.6 ml/kg in 2/3 doses during 14 -16 hrs at 22-23 ° C. The silver carp did not release eggs naturally but had to be hand stripped and the eggs fertilized in dry enamel trays. Hatching process was normal at 22-24° C but egg reared at low temperature (< 21 ° C) could not hatch in either species.

The spawn produced of these brood fishes was grown to fry and advance fry stage in well-prepared nursery ponds at 23.6 ° C - 25.8 ° C. The fry were fed on artificial diet consisting of groundnut oil cake, soya cake fortified with cobalt chloride. Silver carp attained the size of 20-45 mm / 2.4g in 114 days. Grass carp, however, in the same period attained the size of 35-56 mm /3.8 g. In both the species survival ranged 52-68 %. This may be due to almost nil natural food (plankton) production in cemented nursery ponds. The growth of fry was very slow because of low ambient temperature.

The **Induced breeding technique of grass and silver carp** has been developed for **coldwater.** The adoption of the technique may lead to mass seed production of these species in coldwater region.

Mahseer programme under NATP

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

In order to restore the dwindling fishery of Himalayan mahseer and to conserve this important germplasm a flow-through mahseer seed hatchery has been designed, got fabricated and installed at Chirapani experimental fish farm of NRC on coldwater fisheries, Champawat in Uttaranchal. At present 4 hatching troughs 16 hatching trays and 7 fiberglass tanks of the size 1 and 2 m diameter have been housed in a polythene enclosure (12.0 X 7.5 m) for raising mahseer fish seed for

ranching in the depleted water bodies in Himalayas. The water supply in the hatchery troughs is regulated through a storage tank and showers have also been provided in each unit to enhance the oxygen concentration.

For testing the working of newly fabricated hatchery, during August 2003, 1000 Nos. of fertilized eggs of mahseer, Tor putitora were transported from Bhimtal to Champawat. The hatching of these eggs started after 124 hrs of stripping and completed within 156 hrs with 84.5% hatching rate at the temperature range of 19.0-21.0^{0}C. The initial size of fry produced in the hatchery was 9-11 mm in length with average weight of 0.011 g. The absorption of yolk sac was completed within 1-2 weeks of hatching and then were transferred from hatchery trays to the troughs for further rearing. After 15 days of rearing these hatchlings attained the size of 10-18 mm in total length and 0.015-0.030 g in body weight. The fry were then shifted to the nursery tanks for further rearing. Mahseer eggs and fry in newly fabricated hatchery performed well at the temperature range of 15.0-23.5^{o}C To assess the hatching and rearing efficacy within the poly house enclosure at the prevailing environmental conditions of Chirapani Farm located at an elevation of about 1620 m asl. 2000 Nos. of mahseer (Tor putitora) fry having a size 15-30mm total length and 0.039-0.050 g body weight were transported from Bhimtal hatchery in August, 2003 for rearing trials. After rearing for about 45 days on artificial feed these fry grew to 19.0-33.0 mm in total length and 0.042-0.80 g in body weight.

In another experiment 650 Nos. of mahseer juveniles (50-70 mm in length and 1.5 g av. wt.) collected from nearby streams were stocked in rearing tanks during November, 2003 and fed with artificial diets. The results revealed that the stocks could not withstand the severe cold (water temperature < 5 ^{0}C). To combat this problem, another stock comprising natural population of golden mahseer fry (52-76 mm av. wt.2 g) were collected during middle of January, 2003 and reared in rearing tanks fitted with thermostats. These gadgets helped to enhance the temperature by 2-6^{0}C. The fry were fed with artificial diets and in a period of about 40 days, the size of the fry ranged 59-85 mm (av. wt. 3 g) with a survival rate of 63.9%.

As a conservation and rehabilitation measure, the mahseer are being reared in a natural lake-Shyamlatal in Kumaon hill. The netting operations

carried out in Shyamlatal lake during the period under report revealed that mahseer fishery has got established and is growing well in the lake environment, with 54.54% recovery of adult specimen of 240-400 mm in length and 210-680 g in weight, initially stocked during the year 2000-2001.

Artificial propagation and seed raising of chocolate mahseer - *Neolissocheilus hexagonolepis* in Arunachal Pradesh

A collaborative project between NRCCWF and Department of Fisheries, Government of Arunachal Pradesh was launched in July 2003. The project is located in the Dibang valley, Roying District of Arunachal Pradesh and supported by ICAR. The Chocolate mahseer is locally known as 'Boker' or 'Katli mahseer' besides being endemic to the region, it is highly prized fish of North-eastern Himalayas. As a part of work initiation, a detailed survey of local streams viz., Deopani, Epipani, Diphu, Enjupani and Dibang and also two lakes Shalley and Mehao in the district was carried out. The mahseer seed collection sites in local hill streams have also been surveyed, identified and among all the rivers Deopani has been assessed to have the maximum potential, so conservation activity can be initiated in this system. But threat to population does exist from the Hydro-Power Generating unit established on this river. Therefore, to restore the population a hatchery unit has to be established by NRCCWF at Iduli Fish Farm of the State to produce the mahseer seed both for culture and ranching to conserve the stocks. The initial rearing trials of mahseer fingerlings collected from nature in the Iduli farm have revealed very encouraging growth rate. This initiative will go a long way to establish mahseer fishery in this remote district of Arunachal Pradesh.

Information technology:

Computer application in coldwater fisheries assessment and management

The efforts have been initiated in computerization of fishery resources databases of coldwater region of the State, to be made available at one point, which can be accessed and retrieved easily. To make database more user friendly, menus, forms etc. were designed in Microsoft Visual Basic 6.0 software and the corresponding tables in Microsoft Access 2000. The

database contains general information about the districts down to blocks and water bodies. The database forms, tables, menus, reports were designed for different resources viz., lakes, rivers, ponds, reservoirs. For the ecological parameters such as water temperature, transparency, pH, dissolved oxygen, alkalinity, BOD, COD, plankton, benthos and fish species, it has the option for entering data on monthly basis. Accordingly the reports can be generated. These database formats contain different type of data entry fields such as text boxes, combo boxes, option buttons, radio buttons, command buttons for easy entry of data. Further the primary keys are provided in the tables to avoid duplicate data entry.

Website of NRCCWF

This website contains relevant information about the Institute's facilities through photographs, the mandate, organizational structure and manpower support (Scientific, Technical and Administrative). It also includes the information on institutional and externally aided projects and achievements presented through tables and pictures. The information available on various fish species viz., golden mahseer, exotic carps, exotic trout, indigenous snow-trout apart from the technology generated by this institute is placed at the site, which is being updated periodically. This website will be helpful for the user to know more about this Institute and coldwater fishery resources, fish culture avenues in Himalayan regions and its management strategies.

Extension activities:

Demonstration of exotic carp farming in upland coldwaters

The demonstration of composite carp farming technology involving different Chinese carps with the provision of supplementary feed and judicious use of organic and inorganic fertilizers was continued in the adopted ponds located at different altitudes (800- 1740 m asl) in Champawat, Nainital, Almora area of Kumaon region. Based on the feed back information, stocking density of grass carp when increased to 50% in the ponds subjected to intensive management practices, resulted in high biomass contribution from this species in total production. The production of fish was once again found linked to the management

Fig. 1. RAC team observing the fishing in a TOT pond at Pati in Champawat district

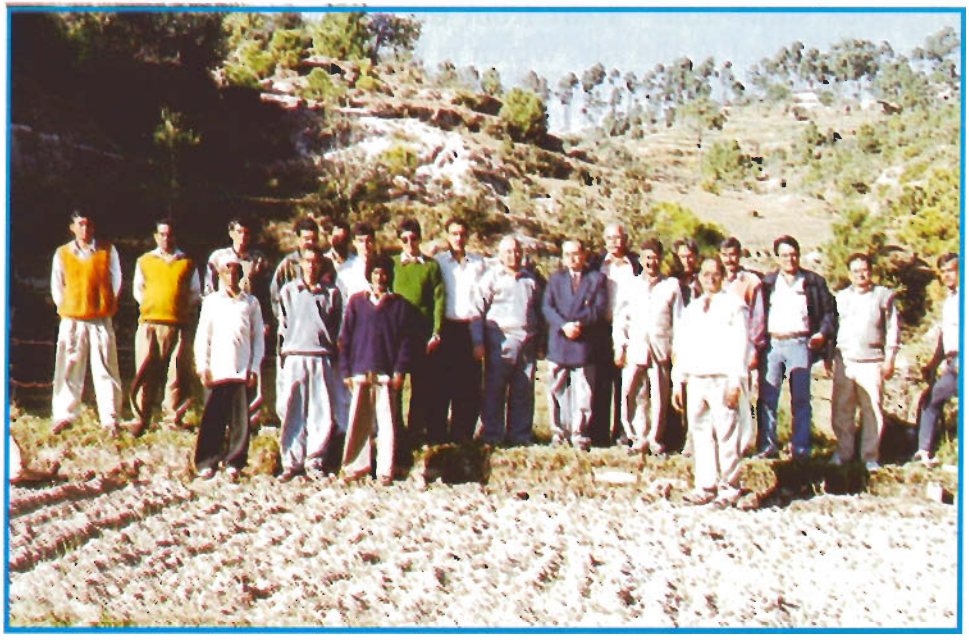


Fig. 2. RAC team members with the fish farmers at Pati in Champawat district

practices adopted by the farmer. The estimated average fish production in all ponds (33) together was 4972 kg/ha/8 months or 0.497 kg/m^2 at a cost of Rs. 16.20-19.50/kg.

To assess the efficacy of organic fish farming in the hills, 2 ponds were selected and stocked with Chinese carps @ 3 fish/m^2 in a combination of 50% grass carp, 25% silver carp and 25% common carp. During the rearing period, observations were recorded on water quality, fish growth and survival. Supplementary feed (house hold wastes + 30% oil cake + 20% rice polish) was fed to fishes daily @ 2-3% of their body weight. The control pond received the prescribed dosage of inorganic fertilizers.

The growth and survival of the stocked fishes in treated and control ponds indicated that use of inorganic fertilizes is in no way helpful in accelerating the fish growth and production. Grass carp attained almost equal weight in both the ponds confirming that its growth is dependent to weed quantity consumed. Only common carp attained less weight but silver carp performed better in control pond where inorganic fertilizers were used. The cumulative production was better in treated ponds (1.056 kg/m^2) as compare to control ponds (0.986 kg/m^2). To draw the conclusion further trials are necessary.

HRD activities:

The staff members of the Institute both scientific and technical including administrative staff were deputed for various training programmes to enlighten them about the new developments in their respective fields. Scientists of the Institute also participated in the various seminars, symposia, workshops and conferences and presented their scientific achievements. The Institute in turn imparted training to the post-graduate students of the Chaudhary Charan Singh University, Meerut and to the officials of the Arunachal Pradesh State Fisheries on the different aspects of coldwater fisheries resources; coldwater fish culture, breeding, disease management, the crafts and gears used in coldwater fisheries. Under the mass awareness programme of the Institute, the scientists appraised the local masses, students, visiting dignitaries, etc. about the different aspects of coldwater fish and fisheries.

Other activities:

The meetings of the various committees of the Institute viz., Research Advisory Committee, Staff Research Council, QRT, 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 the research activities.

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

INTRODUCTION

Establishment and growth

Indian Council of Agricultural Research (ICAR) established the National Research Centre on Coldwater Fisheries (NRCCWF) on September 24, 1987. The main objective of its establishment was to strengthen fishery research in Coldwater sector, encompassing the Himalayan and Penninsular parts of the country. The Centre till September 2003 operated from three rented buildings in Bhimtal, located in the state of Uttaranchal. But shifted to its own campus at Bhimtal Industrial area w.e.f. September 09, 2003, it was a great achievement for the Centre during the year. The Institute has a field centre located at Chirapani in the district Champawat of Uttaranchal state which is operating from January, 1992.

Mandate

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

Location

The headquarters of NRCCWF is located at Bhimtal at an altitude of 1470 m asl in the district of Nainital of Uttaranchal state. It is about 25 km away from the famous tourist place of Nainital. The nearest railway station is Kathgodam, which is about 280 km from Delhi. The nearest airport is Indra Gandhi International Airport, New Delhi. The experimental field

station of the Institute at Chirapani in Champawat district of Uttaranchal State is about 150 km from Bhimtal.

Faculty

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

Management

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

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

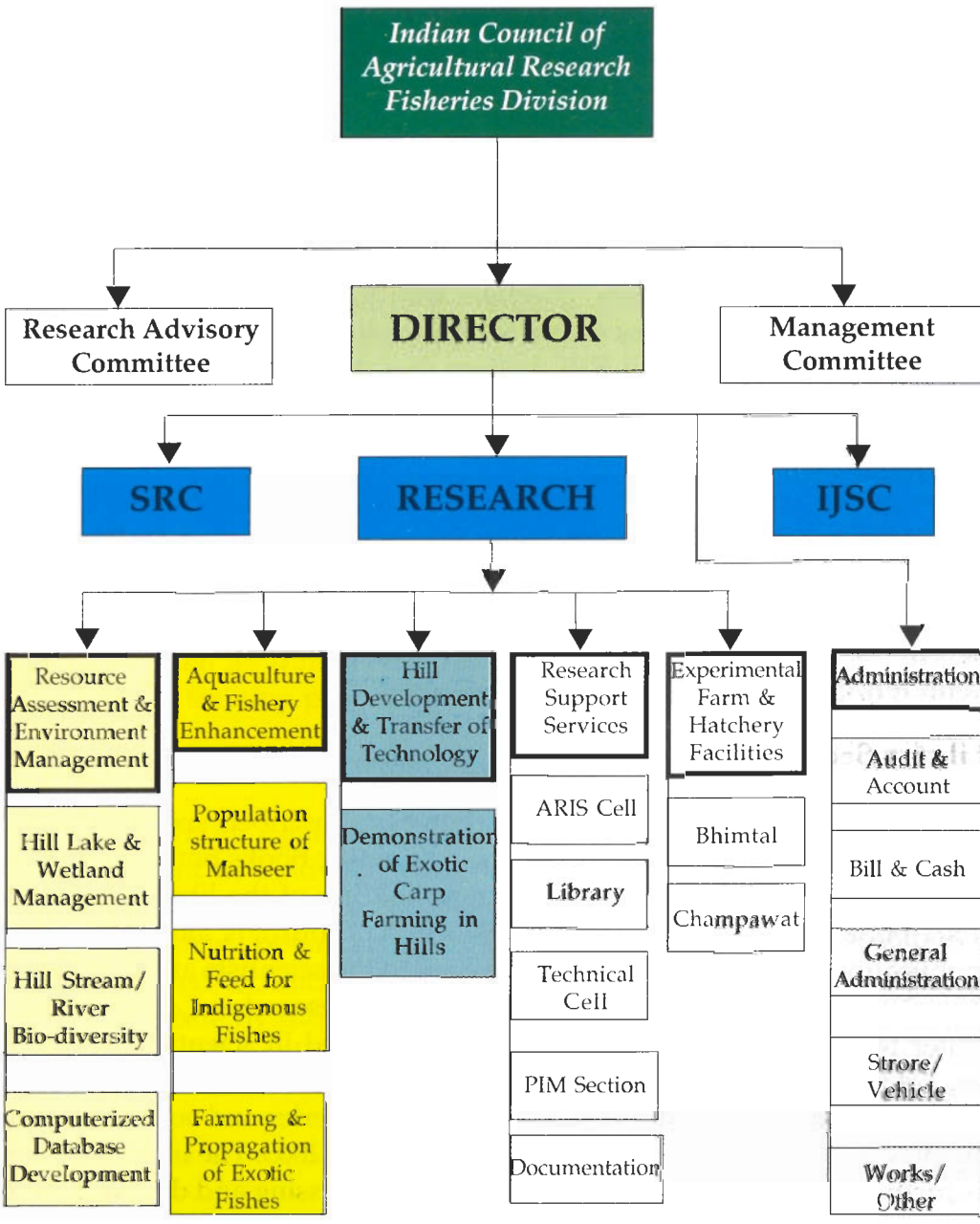
Research Support Facilities

Infrastructure

Building and Farm

The Institute till September 2003 was housed in three rented buildings at Bhimtal but w.e.f. September 09, 2003 it moved into its own new complex constructed at the Bhimtal Industrial Area. A pilot scale mahseer seed production unit is also operating at Bhimtal on the land belonging to the State Fisheries Department, which in addition to the mahseer hatchery houses a laboratory which provides backup facilities to seed production activities of the Centre. The Centre has an experimental fish farm facility at Chirapani in Champawat district of Uttaranchal state which has trout hatchery, cemented raceways for nursery and brood stock rearing, few circular iron tanks for conducting yard trials on various culture aspects of the indigenous and exotic fish species.

ORGANOGRAM



NATIONAL RESEARCH CENTRE ON COLDWATER FISHERIES

Support Services

Project Implementation and Monitoring Cell

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

Technical Cell

The technical cell is entrusted with the responsibilities of dealing with all technical matters within and outside the ICAR system. This cell takes care of the training programmes, deputation, participation of scientists in seminars, symposia, workshops, meetings, etc., and organizing of conferences.

Library Section

The library of the Centre during the year subscribed six foreign and eight Indian journals. About sixty seven scientific books both Indian and foreign were also procured. The current holding of the library includes 1301 books, 1575 foreign journals, 936 Indian journals and 2000 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 for the years from 1971 to 2003. The library section is further continuing its efforts in collection, processing and disseminating scientific/ technical information to the potential users.

Documentation Section

This section is entrusted with the responsibility of publication of scientific bulletins, brochures and pamphlets. During the current year this section published. Six pamphlets in NEH language viz., Assamese, Bengali, Manipuri and Nepali and three reports.

ARIS Cell

The computer related facilities are provided to the scientists and other staff members of the Institute by this cell. This cell has taken initative in developing formats to computerize the on-going research project achievements. This cell also shoulders the responsibilities of providing internet facilities, basic and advanced computer training to the staff members of the Institute. Total LAN system and internet through V-Sat was installed in the new complex.

Extension Wing

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

National Agricultural Technology Project

A National Agricultural Technology Project on Aquaculture Management in Coldwaters is under operation, with the Institute as a lead centre covering the Kumaon Himalayan region for assessing the mahseer fishery potentials and culture possibilities. Implementation of the approved technical programme of the project and monitoring the progress made by the other cooperating centres in different Himalayan regions is additional responsibility of the lead centre.

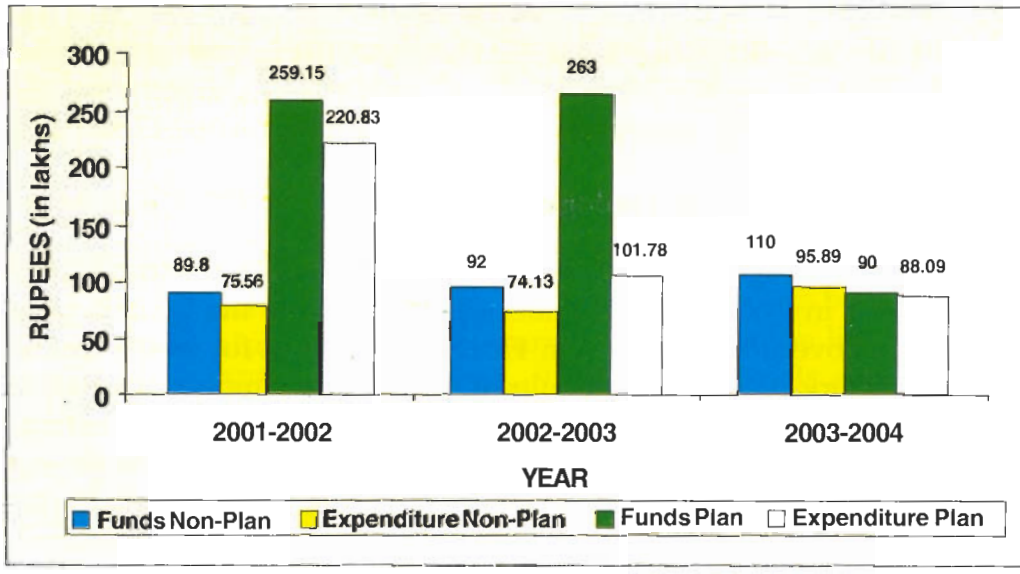
Financial Statement

Abstract

(Rupees in Lakhs)

Year	Funds Non-Plan	Expenditure Non-Plan	Funds Plan	Expenditure Plan
2001 – 2002	89.80	75.56	259.15	220.83
2002 - 2003	92.00	74.13	100.50	100.40
2003 - 2004	110.00	95.89	90.00	88.09

Budget/Expenditure for the Year 2001-2002 to 2003-2004



Budget Statement for the year 2003-2004

(Rupees in Lakhs)

Code	Head of Account	Budget (R.E.)		Expenditure	
		Plan	Non-Plan	Plan	Non-Plan
02	Pay & Allowances	-	89.10	-	70.87
10	T. A.	3.00	1.10	1.91	0.87
15	Other Charges Including Equipments	45.00	15.00	44.18	14.04
20	Works & Land	40.00	10.65	40.00	9.85
25	Other items Fellowship/ Scholarship/ Awards/NEH Information Technology	2.00	0.30	2.00	00.26
	Grand Total	**90.00**	**116.15**	**88.09**	**95.89**

Staff Position as on 31-03-2004

S. No.	Category	Post Sanctioned	In Position
1.	Director (RMP)	01	01
2.	Scientific	20	9
3.	Technical	13	11
4.	Administrative	14	09
5.	Supporting	17	14
	Total	65	44

RESEARCH ACHIEVEMENTS

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

Institutional projects

Sustainable fishery development in Kumaon lakes

K.K. Vass, H.S. Raina, C.B. Joshi and Yasmeen Basade

During the period under report special emphasis was made to study the abiotic and biotic characteristics of Nainital lake and other Kumaon lakes to assess their present status and further scope to improve their fishery. The main findings of these are as under:

Production functions

Nainital Lake holds a sizeable population of phytoplankton contributing towards carbon fixing at various levels. The depth profile production data indicated that maximum productive zone is between surface to 3 m depth while between 3 to 6 m it was marginal and beyond 6 m the production level was very negligible. The estimated yearly mean gross production was to the level of 85-111.5 mg C m^{-3} d^{-1}. The system also recorded high level of respiratory loss, which ranged between 185-945 mg C m^{-3} d^{-1} with maximum gross production of 1965 mg C m^{-3} d^{-1} and net production of 873 mg C m^{-3} d^{-1}. This mean that in Nainital lake more than 60% of the carbon photosynthesized is used in respiratory loss and at times respiratory loss is very high. Based on the above production estimates, the total net carbon production of this lake is estimated at 307.4 g C m^{-2} y^{-1}, which works out to 3.07 tonnes C $h^{-1}y^{-1}$ in this system. In terms of energy the net production is estimated at 2.9 x 10^6 g Cal m^{-2} y^{-1} , this is a sizeable energy for sustaining other food chains, provided this energy is converted effectively without any environmental limiting factors operating within the system.

Biotic communities

The species diversity index estimated for Nainital lake is quite low and is to the order of 2.0,1.5, and 1.0 for phytoplankton, zooplankton and

macrozoobenthos, respectively. Even species richness in the system is declining from phytoplankton (69 species) to macrozoobenthos (30 species) in large number during majority of months reflected high nutrient levels and enriched lake water. Presently the system has reached a bloom stage of ecological succession where smaller autotrophic organisms (nanoplankton contributing more than 60%) tend to dominate over the larger ones. The mean annual ratio between phyto to zooplankton biomass is 3.3 and between phytoplankton to herbivorous is 4.6, indicating that a major portion of primary production remains unutilized by the herbivore in the lake. The blue-greens alone contribute above 35.0% to the total annual mean phytoplankton biomass of the lake and most of it contributed by *Microcystis* and *Anabaena* both being unpalatable, are not consumed by the important food fishes.

Dominance of macro crustacean plankton community on account of their adaptation in low oxygen concentration levels can be used as indicator of the organic pollution in this lake. Amongst Cyclopoids, *Mesocyclops leuckarti* and *Eucyclops serrulatus* are predominant species. These two species, alongwith *Tropocyclops prasinus, Diaphanosoma excisum, Alona affinis* constituted important components of zooplankton community in this lake. The occurrence of ciliated protozoan particularly around the inlets of the open drains of the lake is also very significant. The mean annual zooplankton biomass in the lake has been estimated in the range of 5.0 to 700 mg m^{-3} mainly contributed by the community of crustacean. However, the lake exhibits low species diversity of zooplankton, associated with the larger zooplankton standing crop indicating higher trophic status of the system.

The average standing crop of macrozoobenthos in the lake Nainital is 1650 ind.m^{-2} mainly contributed by *Tubifex tubifex, Chironomus plumosus, Limnodrilus* spp., *Hemiclepsis marginata, Gyraulus convexiusculus, Forcipomyia* spp. etc. Relative abundance of various groups of benthos on an annual average basis revealed that Diptera was numerically most dominant (48%) followed by Oligochaeta.

Because of stressed water quality in the lake the fish stocks that were reported to be available in lake in the past have drastically declined.

Presently lake holds a population of *Cyprinus carpio* and *Hypophthalimichthys molitrix*. Specimen of *Schizothorax richardsonii* is also recorded on rare occasions that too from the least polluted zones of the lake. The introduction of *Gambusia affinis* in the lake, which has presently dominated the highly enriched margins, has an impact on the natural balance of previously dominant fish species of *Puntius* alongwith juveniles of other species.

Resource assessment, ecology and biodiversity characteristics in Central Himalayas

H.S. Raina, Shyam Sunder and A.K. Singh

A survey was conducted for resource assessment and aquatic biodiversity evaluation of various streams and tributaries of Garhwal Himalayan ecosystems. The tributaries of major rivers Bhagirathi and Bhilangana were investigated. Main findings accomplished during the period from these ecosystems are as under:

General ecology and physico-chemical features

These ecosystems located in Garhwal Himalayas are typical mountainous river systems having glacial or spring origin. Their substrata generally comprised boulders, stones mixed with pebbles, gravel and sand in upper reaches while at lower reaches it is mixed with mud and sand. The catchments of these tributaries are predominantly forest, grassland and agricultural land with low population density, thus still free from major nutrient influx.

The chief physico-chemical characteristics are as: water flow 0.75 - 3.2 m/sec.; water temperature 7.0 -22.0 °C; pH 7.6 - 8.4; dissolved oxygen 8.0 - 9.4 mg/l; free carbon dioxide nil- 1.0 mg/l; total alkalinity 26-42 mg/l; chlorides 18.5- 40.00 mg/l; total dissolved soils 68.0-95.0 mg/l; specific conductivity 136.5 - 192.0 micro mhos at 25°C; calcium 16.0 - 20.0 mg/l; magnesium 2.5- 3.5 mg/l; silicates 3.1 - 3.5 mg/l; sulphate 22- 26 mg/l; potassium 2.2 - 3.5 ug/l; manganese 0.01 - 0.02 mg/l and iron nil-0.01 mg/l.

Biological features

The density of plankton ranged between 65 - 4,320 units/l in upper zones of the rivers to 110-12,450 units/l in lower reaches. In terms of growth and occurrence of phytoplankton in various tributaries of Bhagirathi and Bhilangana rivers, bacillariophyceae contributed 37.05 - 94.0%. The contribution of green algae and blue green algae was far less and was more of a seasonal occurrence. Green algae were more dominant in summer months; while blue green in spring period. The dominant phytoplankton taxa recorded were *Amphora, Achnanthes, Cymbella, Cocconeis, Fragilaria, Gomphonema, Mastogloia, Melosira, Navicula, Nitzschia, Oscillatoria etc.* The contribution of zooplankton is insignificant and ranged between 1.5 -3. 5 % in total population.

The benthic micro-biota (epiphytic) in highland waters play a key role in dispersal of insects and fishes which grasp the algae and other organisms growing on bottom stones and forms very important food component of fishes inhabiting in these ecosystems. The population density of micro-biota was in the range of 0.04 to 1.10 million units sq. cm. Bacillariophyceae (65.0- 90.0%) dominated the bulk of the population in all the rivers and their tributaries. Among other groups green algae (Chlorophyceae) contributed 1.2-8.0%, followed by blue green algae (Cyanophyceae) 0.5 - 7.5 %. The other zoo-organisms including benthic protozoan and rotifers occurred in negligible density. The principal forms recorded at all the sampling stations were *Centropyxis, Arcella, Difflugia, Lecane, Trichocerca, Keratella.* The study on microbiota revealed that benthic algae exhibited seasonal periodicity of algal colonies generally showing a sharp decline with the increase in rate of water flow.

The richness of macro benthos population both qualitatively and quantitatively reflects high productive nature of the stream. The wet biomass of these organisms ranged between 0.350 - 25.5 g m^{-3} (31 - 560 ind m^{-2}). The benthic macro invertebrate population was dominated by Ephmeroptera (6.5 - 52.0%) followed by Trichoptera (7.0 -.39.0 %); Coleoptera (2.5 -13.5%); Odonata (nil- 3.0%); and Diptera (nil- 3.0%). Mollusca were also recorded but from lower reaches of these ecosystems.

In all 27 genera of benthic organisms were recorded from the various major groups maximum in Diptera (8 genera).

Fish biodiversity

Experimental fishing was carried out by the conventional cast net covering a specific stretch of the stream. During the period fifteen species belonging to three orders, five families and ten genera were recorded, of which *Schizothorax richardsonii, Tor putitora, Labeo dero, and Labeo dyocheilus* are important food species while others though are of smaller size *(Nemacheilus, Garra, Barilius, Glyptothorax)* and of low economic value, but are significant from biodiversity view point. It appears that fresh water fishes in Garhwal uplands belong to two groups, native species, which are widely distributed in streams and their tributaries and exotic trout, *Onchorhynchus mykiss* introduced in a few rivers including Pinder river.

Impact of migration on *Tor putitora* due to recent impoundment of Tehri dam at the confluence of Bhagirathi and Bhilangana rivers has also been assessed during the period under report. The survey revealed that the impoundment having maximum depth of 15 m is still in the stabilizing phase and has very low biological life. So far the system does not depicted thermal or chemical stratification. It is contemplated that physical obstruction, at Tehri Dam is likely to prevent the free passage of migratory fish to feeding or to breeding grounds.

Fish production and present status

Compared to Kumaon region of Uttaranchal, the fish production in Garwhal region was of low magnitude. However, in this region the fish diversity and fish catch biomass in upper torrential reaches are comparatively high as lower zones are being heavily exploited. Estimated daily fish biomass production was to the tune of 50-110 kg. from these ecosystems, which is locally consumed.

This fishery normally constitutes a subsistence fishery for a section of the society, in these hill areas who earn some livelihood for their families. The fish catch per unit effort ranged between 340 - 870 g per day with

conventional gears. In upper zones *S.richardsonii* alongwith species of *Labeo dero, Garra* are caught during pre-monsoon and winter months. Species of *Tor (Tor putitora, Tor chelynoides)* being the migratory fish, also significantly contributes to the catches mainly from pre- monsoon till autumn. During rainy season when streams are totally gorged, fishing with local methods becomes practically difficult.

Nutrition and feed development for upland fish with the focus on indigenous species

Madan Mohan, Yasmeen Basade and Rajeev Kapila

Response of feed formulated from locally available ingredients on golden mahseer fingerlings

An experiment (May-Aug, 2003) for 90 days to ascertain the response of feed formulated from locally available ingredients was tested on mahseer fingerlings (length 46-86 mm; weight 3.0-4.0 g) The diets were prepared by using locally available legume (bhatt bean) by replacing fish meal as a protein source. Five levels (16-40%) by weight of this component were used in duplicate in the hatchery troughs. Water quality parameters were regularly monitored and were found in optimum range during the period of trial. After completion of the experiment the fingerlings recorded a growth range of 64 - 98 mm in total length and 5.0-7.0 g in weight. The growth was observed to be maximum with diet having combination 32 % of bhatt meal and 24% of fish meal.

Estimation of digestive enzyme (amylase and protease) before and after the nutritional trials

Maximum 6.4 fold increase in the levels of digestive enzyme amylase was recorded in fish groups of *Tor putitora* in a 90 days trial with diet having no bhatt bean but 100% fish meal. While minimum of 1.5 fold increase in this enzyme was recoded in feed having 40% Bhatt meal, 20% fish meal and no wheat meal. However, no significant variation in proteolytic activity was recorded in various fish groups of mahseer fed

with artificially formulated diets. Though, 1.8- 2.8 fold increase in proteolytic activities was recoded before and after the completion of experiment.

Amino Acid analysis of diets prepared by NRCCWF

Amino acid analysis of three diets prepared by NRCCWF, Bhimtal were carried out with the help of CMFRI, Cochin. All the three test diets viz. NRCCWF-I, NRCCWF-II and NRCCWF-III were observed to have all essential amino acids. However, the concentration of methionine and isolucine were recorded to be 3.6 and 2.7 folds higher in NRCCWF- III as compared to NRCCWF-II feed. Whereas, least concentration of leucine (1.81%) and phenylalanine (1.22%) were estimated in NRCCWF-III diet.

Feeding trial on snow trout with locally available legume

A new trial with artificial diets prepared with locally available legumes (Bhatt beans) by replacing fish meal as a protein source for snow trout fry (*Schizthorax richardsonii*) was initiated on 20.10.2003. Five levels (16-40%) by weight of this component are being used in duplicate in flow through hatchery troughs. Seventy five fry of snow trout (initial length 14-35 mm ; initial weight 0.06-0.20 gm) were stocked in each experimental tank. One set of fish were fed with NRCCWF-III diet as control having no Bhatt meal and 40% of fish meal by weight.

Levels of digestive enzyme amylase and protease were estimated in the intestine of this fish. Activity of amylase ranged from 70.2-86.4 U/ min/mg of protein while protease ranged from 1.32-2.25 U/min/mg of protein before the onset of experiment with locally available leguminous feed.

After completion of 150 days of experiment on snow trout (*Schizothorax richardsonii*) the maximum growth in terms of percent weight gain was 23% in control group having only fishmeal and no Bhatt (locally available legume) as a protein source (NRCCWF-III). Feeding 16%, 24%, 32% and 40% of Bhatt registered a weight gain of 13%, 11.03% 9.23% and 8.57%, respectively, with plant as a protein source in place of

fishmeal. The FCR was observed to be 5.43(control), 9.74, 10.94, 13.10 and 13.89 respectively in the five sets of feeding trials.

Amylase activities were observed to increase from 1.59 to 2.92 and protease activities 1.21 to1.69 folds, respectively after 150 days of experimentation. The maximum increase in activities was recorded in control groups fed with NRCCWF-III diets which also supports growth pattern indicated above.

The survival of test fish was in the range of 80-100% in control against 70-95% recorded in the test diet.

Water quality parameters in the trough ranged from dissolved oxygen 7.0-7.8 mg/l; free carbon dioxide 1.8-2.2 mg/l; total alkalinity 62-66 mg/l; water temperature 02 -20^{0}C; water pH 7.0-7.2 respectively.

Field trial with NRCCWF-III on golden mahseer *Tor putitora*

During the period under report one cemented pond (dimensions 14X 7X 4.5 meters) was selected for conducting field trial of NRCCWF-III feed. Five hundred fry of golden mahseer transported from river Kosi near Garjia were stocked after proper conditioning during November 2003. Feed was given @5% of body weight per day during the experimental period. The monthly sampling in December 2003 revealed a weight range of 0.2-0.36 g. However, 30 % mortality was also recorded in the pond due to decrease in water temperature to 8.5-10^{0}C.

Levels of digestive enzyme b-amylase ranged from 14.4 –26.2 U/min/ mg of protein while total protease activity in the gut of these specimens ranged from 1.8-2.7 U/min/mg of protein in the test fish before feeding NRCCWF-III diet.

Water quality parameters estimated in the pond water were dissolved oxygen 8.0-9.0 mg/l; free carbon dioxide nil-2.0 mg/l; total alkalinity 64-70 mg/l; water temperature 8.5 -18^{0}C; pH 7.2-7.6 respectively.

In another experiment 450 juveniles of golden mahseer were stocked in two installments (200 in December and 250 in January) in cemented

pond (dimensions 14X 7X 4.5 meters) and fish were fed with NRCCWF-III feed. During the month of January 2004, 50% mortality was recorded as water temperature in pond dropped to 3°C during night. Fish were observed to stop feeding due to cold stress. Moreover lot of algal bloom developed in the pond, which may also be the cause of mortality. During the experimental period 80% mahseer survival was recorded after feeding NRCCWF-III diet, though average percent weight gain during this period was only 9.36%.

Levels of digestive enzyme b-amylase ranged from 18.0 –32.8 U/min/mg of protein while total protease activity in the gut of these specimens ranged from 1.6-3.8 U/min/mg of protein in the specimens after feeding NRCCWF-III feed. Thus 1.22 and 1.16 fold increase in the activities of amylase and protease were recorded before and after feeding NRCCWF-III diet to the mahseer in pond from December onwards.

Water quality parameters in the pond varied from dissolved oxygen 5.8-9.0 mg/l; free carbon dioxide nil-2.8 mg/l; total alkalinity 60-78 mg/l; water temperature 3.0 -18°C; pH 7.2-7.6 respectively.

Studies on induced ovarian development, maturation and spawning of grass carp (*Ctenopharyngodon idella*) and silver carp (*Hypophthalmichthys molitrix*) in coldwaters

B.C. Tyagi

The studies conducted so far have inferred that polyculture of carps namely silvercarp, grass carp and common carp in a judicious combination with the provision of feed and fertilizers has enabled the farmer to get good yield of fish in hill regions. Availability of their seed in growing season is a major constraint as the first two species attain

Fig. 3. Mature silver carp (female) at expereimental fish farm, Champawat

maturity after a long period of 6-7 years and exhibit different breeding behavior in coldwater at high altitudes. The experiment to prepone maturity and develop breeding technique in captivity of these carps in coldwaters at high altitude (1620 m asl) were continued during the period under report.

The brood stock of both the species having an age of 5,6,and 7 years and reared on artificial diet in cemented raceways @ 0.35-0.4820 kg/ m^2 were administered PG extract + Ova prime in 3:1 @ 0.2-0.3 ml/kg at every 15 day interval from mid April onwards and only 5 year males and 6 years old females were observed to mature in July. The stock of the same age in control pond did not mature. Results infer that treatment given was effective to prepone the maturity of these species in cold waters.

Fig. 4. Fertilized eggs of silver carp

After pre-maturation treatment the ready spawners were successfully induced to breed in captivity at high altitude. Grass carp spawned naturally when Ova prime was injected @ 1.3-1.6 ml/kg in 2/3 doses during 14 -16 hrs at 22-23 ° C. The silver carp species did not release eggs naturally but was hand stripped and the eggs fertilized in dry enamel trays. Hatching process was recorded normal at 22-24° C but egg reared at low temperature (< 21 ° C) could not hatch in either species.

The spawn produced was reared up to fry and advance fry stage in well prepared nursery ponds at 23.6 ° C - 25.8 ° C. The fry were fed on artificial diet consisting of groundnut oil cake, Soya cake fortified with Cobalt chloride. Silver carp attained the size of 20-45 mm / 2.4g in 114 days. Grass carp, however, in the same period attain the size of 35-56 mm /3.8 g. In both the species survival ranged between 52 to 68 % which may be attributed to paucity of natural food - plankton in nursery pond. The growth is very slow because of low water temperature.

The spawning agent its doses and hatching process were studied in detail and standardized. The **Induced breeding technique of grass and silver carp** has been developed for **coldwater regions**. The adoption of the technique may lead to mass scale seed production of these species at high altitudes.

Conservation and genetic upgradation of golden mahseer, *Tor putitora*

A.K. Singh and Rajeev Kapila

Sex and growth under experimental conditions in mahseer, *Tor putitora*

The gonads were collected from the lake as well as riverine stocks of *Tor putitora* maintained under laboratory conditions at 23°C ± 1 (5 degree above ambient temperature). The samples were fixed in Bouin's solution, thereafter impregnated in wax after processing them in different grades of alcohol followed by Hematoxyline and Eosin stains. The sections of 5 micron were examined under microscope for determining the sex differentiation. The female population observed was 12.12% more in lake stocks than the river stocks maintained at higher temperature. Though 7.7 % more females were caught from rivers during spawning season as compared to lake stocks.

Growth related observations also delineated that scotophase brought about more or less depressed growth in both lake and river stocks. Fishes were observed to gradually adjust to the reduced photoperiod since the mortality and food consumption did not vary much as compared to control groups. The growth rate percent day-1 was significantly influenced by temperature. In the control group the SGR% ranged from 0.266 to 0.90 in the lake stocks while it was 0.33 to 0.81 in the river stocks. It significantly increased when the two stocks were reared at temperature of 23+1°C, which was above 5°C as compared to the average control values. The SGR% range in lake Stock was 0.6 to 1.2 where as it varied from 0.33 to 1.3 in river stocks. The investigations revealed that temperature and scotophase appeared to have marked effect on growth and sex differentiation in golden mahseer *Tor putitora*.

Measurement of levels of oxidative stress enzymes in liver samples of *Tor putitora* from riverine and lake habitats

The analysis of three indictor enzymes of oxidative stress viz. Superoxide dismutase, Glutathione reductase and Catalase were carried out in liver samples of golden mahseer *Tor putitora*, from riverine and lake habitats with the help of Department of Biochemistry, NDRI, Karnal. The range of activities of these enzymes was recorded from 40-89, 0.476-0.84 and 170.56- 674.116 units/ mg of protein.

Statistically no significant variations in the levels of these enzymes were observed in riverine and lake stocks of *Tor putitora*. However, some reference values of these enzymes are now known for future comparisons.

Demonstration of exotic carp farming in coldwaters

B.C. Tyagi

The demonstration of mixed carp farming technology based on Chinese carps alone with the provision of supplementary feeding and judicious

Fig. 5. Stream belt converted into fish pond

use of organic and inorganic fertilizers was continued in the adopted ponds located at different altitudes (800- 1740 m asl) in Champawat, Nainital, Almora areas of Kumaon region. Based on the feed back information, stocking density of Grass carp increased to 50% in the ponds subjected to intensive management practices resulted in higher biomass contribution from the species in total production The production of fish was once again found linked to the management practices adopted by the farmer. The average production in all ponds (33) together was estimated to be 4972 kg/ha/8 months or 0.497 kg/m^2 at a cost of Rs. 16.20-19.50/kg.

Fig. 6. Netting in a village pond in Bhimtal block under TOT programme

To assess the efficacy of organic fish farming in the hills, 2 ponds were selected and stocked with Chinese carps @ 3 fish/m^2 in a combination of 50% grass carp, 25% silver carp and 25% common carp. During the rearing period, observations were recorded on water quality, fish growth and survival. Supplementary feed (house hold wastes + 30% oil cake + 20% rice polish) was fed to fishes daily @ 2-3% of their body weight. The control pond received the prescribed dosage of inorganic fertilizes.

The growth and survival of the stocked fishes in treated and control ponds indicated that use of inorganic fertilizes is in no way helpful in accelerating the fish growth and production (Table). Grass carp attained almost equal weight in both the ponds confirming that its growth is

Fish growth under organic farming

A. Treatment (organic farming)	Fish Growth (g) in 6 months at 19-27 ° C		
Fertilizers: RCD+oilcake @5000+50 Kg/ha/Yr at 10 Days intervals Plus Feed: House hold/ cattle yard wastes+30% oil cake +20% RP@ 2-3% of Body weight /day	Grass carp 582	Common carp 270 (1.056 kg/ m^2)	Silver carp 204
Control pond			
Treatment as in A Plus Inorganic fertilizers@ urea300+ SSP 300+ Potash 50 kg/ha/yr	569g	207g (0.986 kg/ m^2)	210g

dependent to weed quantity fed. Only common carp attained less weight but silver carp performed better in control pond where inorganic fertilizes were used. The cumulative production is better in treated ponds (0.986 kg/m^2) as compare to control ponds (0.926 kg/m^2). To draw the conclusion further trials are necessary.

Manpower and data base development through Computer application

A.K. Nayak and K.K. Vass

To develop a computerized database for Coldwater Fisheries Resource & Management

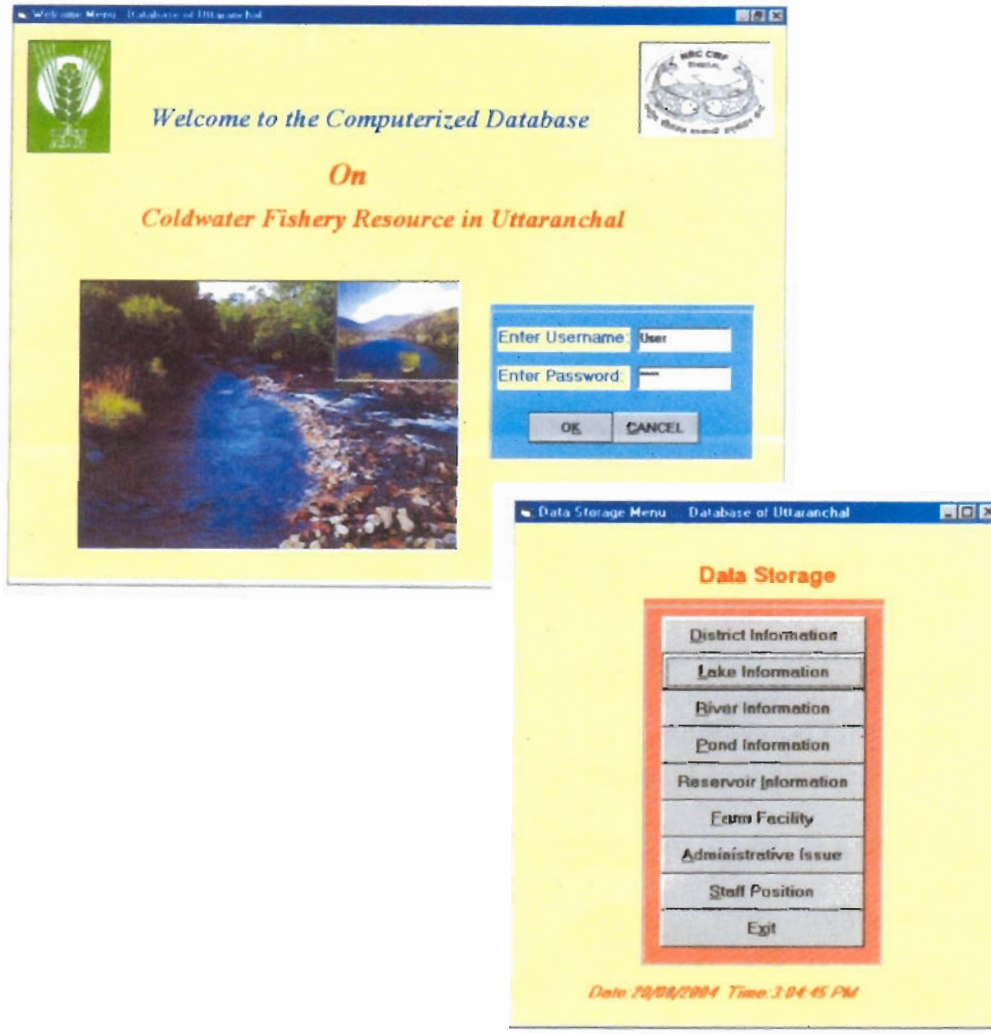
The Uttaranchal a new state, there is no database of the fisheries resources. So there is a need to collect the information about the fisheries

resources of coldwater region of the state at one point to develop the computerized database, which can be accessed and retrieved easily. For the database to make more user friendly, menus, forms etc. were designed in Microsoft Visual Basic 6.0 software and the corresponding tables in Microsoft Access 2000. The database contains general information about the districts of the state and to store information such as details of the districts, number of blocks, number of water bodies etc. Also the database forms, tables, menus, reports etc. were designed for different resources of Uttaranchal state such as lakes, rivers, ponds, reservoirs etc. The ecological parameters such as temperature, transparency, pH, dissolved oxygen, alkalinity, BOD, COD, plankton, benthos, fish species etc. has the option for entering data on monthly basis. Accordingly the reports can be generated. Initially some data of lakes and rivers have already been fed to the database for developing the computerized databank for coldwater fisheries resources of this region. This database formats contains different type of data entry fields such as text boxes, combo boxes, option buttons, radio buttons, command buttons etc. for making easy way of data entering into forms. Also the primary keys were introduced in the tables to avoid duplicate data entry. Finally we proposed to release the CD on coldwater Fisheries Resources of Uttaranchal.

To develop a software to computerize the research project programmes

For developing a software to computerize the ongoing research programmes of this institute, the related database formats have been created in Microsoft Visual Basic 6.0 software as front end tool and the relative tables were designed in Microsoft Access 2000 as back end tool. The forms and related tables are linked for making a computerized research project database.

This database will contain the project information for every year. Some project data of this Institute has initially been fed into it to test the software. It will help scientists to collect the project related information through computerized databank.



To develop the Website of NRCCWF

This website contains relevant information about the Institute's facilities through photographs, the mandate, organizational structure and manpower support (Scientific, Technical and Administrative). It also includes the information on institutional and externally aided projects and achievements presented through tables and pictures. The information on golden mahseer, exotic carps, exotic trout, indigenous snow-trout and the technology generated by this institute. The site is being updated periodically. This

website will be helpful for the user to know more about this Institute and coldwater fisheries resources, fish culture avenues in Himalayan regions and its management strategies. 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/index.html.

In-house training programmes to officer/staff of NRCCWF

In-house training programme on "Microsoft Excel 2000" was organized for the scientist/staff of this Institute in batches. The training was imparted during June – July, 2003 and for Technical & Administrative staff of this Institute at Bhimtal in December 2003. This training included creating of tables, using formulae, making pie/ bar diagram & graphs and other mathematical calculations.

Externally funded projects

1. National Agricultural Technology Project

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

C.B. Joshi, Shyam Sunder, A.U. Khan and Pushpesh Sanga

As per instructions of ICAR this project has been extended up to 30th November 2004. The work programme for of project during the current year and the extended period included a focus on artificial propagation and conservation of golden mahseer. In brief the achievements are highlighted as follows:

After selecting the suitable site, a flow-through mahseer seed hatchery has been designed, fabricated and installed at Chirapani experimental fish farm of NRC on coldwater fisheries, Champawat in Uttaranchal. It has a capacity of 4 hatching troughs 16 hatching trays and 7 fiberglass tanks of the size 1 & 2 m dia. It has been housed in a polythene enclosure (12.0 X 7.5 m) for raising maheer fish seed in enclosure system. The water

Fig. 7. RAC team members visits mahseer hatchery at Champawat

Physiochemical parameters of mahseer hatchery

Parameters	Values
Water temperature (°C)	4.8-23.2
Dissolved Oxygen (mg/l)	8.8-10.1
Free Carbon Dioxide (mg/l)	0.0-3.6
pH	5.5-6
Total alkalinity (mg/l)	26.3-36.6
Chloride (mg/l)	6.6-9.8
Calcium (mg/l)	3.9-4.8
Magnesium (mg/l)	1.43-1.76
Total hardness (mg/l)	8.9-9.6

supply in the hatchery troughs is regulated through a storage tank and showers have also been provided in each unit to augment the oxygen level.

Incubation and hatching of mahseer eggs in newly installed hatchery at Champawat

During August 2003, 1000 Nos of fertilized eggs of mahseer, *Tor putitora* were transported from Bhimtal to Champawat for commissioning the working of newly fabricated hatchery. The hatching of these eggs started after 124 hrs of stripping and completed within 156 hrs with 84.5% hatching rate at the temperature range of 19.0-21.0^{0}C. The initial size of fry produced in the hatchery was 9-11 mm in length with average weight of 0.011 g. These fry after complete absorption of yolk sac within 1-2 weeks of hatching were transferred from hatchery trays to the troughs for further rearing. After 15 days rearing of these hatchlings in the trough the size of fry achieved was 10-18 mm in length and 0.015-0.030 gm in weight. The fry were then shifted to nursery tanks of 1 m dia in size for further development.

Incubation and early fry rearing of mahseer at Champawat

Total no. of fertilized eggs	:	1000
Incubation period	:	124-156 hrs.
Water temperature range (^{0}C)	:	19.0-21.0
Initial size of fry produced, Length (mm)	:	9-11
Av. weight (gm)	:	0.011
Period of yolk absorption	:	1-2 weeks
Period of rearing in the troughs	:	15 days
Growth performance Length (mm)	:	10-18
Weight (g)	:	0.015-0.030

Raising of stocking material (mahseer fry) in the hatchery

The rearing experiment of mahseer eggs and fry in newly fabricated hatchery was satisfactory at the temperature range of 15.0-23.5^{0}C inside the polythene enclosure. To observe the efficacy of the hatching troughs and tanks inside the polyhouse under the environmental conditions prevailing at Chirapani Farm located at an elevation of approx. 1620 m asl, about 2000

Nos. of young fry of mahseer (*Tor putitora*) of the size ranged 15-30mm in length and 0.039-0.050 g in weight were brought from Bhimtal hatchery in August,2003 for rearing trials. After rearing for 45 days the fry grew to 19.0-33.0 mm in total length and 0.042-0.80 g in weight. The barley and soybean flour mixed with diluted extract of goat liver @ approx. 10-15 % of the body weight was fed to fry.

The water quality in the hatchery troughs/trays inside the polythene enclosure during the hatching and fry rearing period (August-September-2003) ranged as follows : water temperature 17-23°C, pH 7.4-7.6, dissolved oxygen 7.8-8.4mg/l, free carbon dioxide nil-3.6mg/l and total alkalinity 28-52mg/l.

Raising of golden mahseer fry in hatchery tanks at Champawat

Date of transportation of early fry from Bhimtal to Champawat		:	5-8-2003
Total no. of fry transported		:	2000
Mortality during transportation		:	800
Total no of fry stocked		:	1200
Size of the fry	length (mm)	:	15-30
	Weight (g)	:	0.039-0.050
Rate of feeding (% of the body weight)		:	10-15
Date of sampling		:	19-9-2003
Rearing duration		:	45 days
Size of recovered fry	length (mm)	:	19.0 - 33.0
	Weight (g)	:	0.042 - 0.080

In another experiment 650 mahseer (50-70 mm av. wt. 1.5 g) collected from nearby streams were stocked in rearing tanks during November, 2003 and fed with artificial diets. The fry showed an insignificant growth during winter months and finally the stock could not withstand the severe cold (water temperature $< 5\ ^{0}C$), hence all the fry died. To combat this

problem, another stock comprising natural population of golden mahseer fry (52-76 mm av. wt.2 g) were collected during middle of January, 2003 and reared in rearing tanks fitted with thermostats. These gadgets helped to enhance the temperature by 2-6^{0}C. The fry were fed with artificial diets and in a period of about 40 days, the size of the fry ranged 59-85 mm (av. wt. 3 g) with a survival rate of 63.9%.

Shyamlatal lake (Kumaon Himalaya)

The netting operations carried out in Shyamlatal lake during the period under report revealed that mahseer fishery has been established and grown well in the lake environment with 54.54% recovery of adult specimen of *Tor putitora* (240-400 mm in length and 210-680 g in weight) stocked during the year 2000-2001. In all two gill nets of the size 75 X 5 m with 25-75 mesh size were used for this experimental fishing. Besides mahseer, 5 Nos. *Cyprinus carpio* specimens have also been recorded in the catches.

Fig. 8. Mahseer seed ranching in Shyamlatal lake by RAC team members

The water quality of Shyamlatal lake analyzed during May-June 2003 ranged as follows: water temperature 24.5-26.2^{0}C, pH 7.2-7.6, dissolved oxygen 7.6-7.8 mg/l, Free carbon dioxide 2.0mg/l, and total alkalinity 30-32mg/l. The water of the lake was muddy and turbid during the most of the period with transparency ranging from 25-36 cm.

Besides earlier stocking of 7000 mahseer seed in Shyamlatal lake, collected from the natural streams, a token stocking of 500 golden mahseer fingerlings (35-50 mm in length and av. wt 1 g) produced and reared at Champawat hatchery was done by the Chairman of Research Advisory committee of the Institute in the presence of other RAC members, Director and Scientists of the Institute and local residents in the vicinity of Shyamlatal lake during fourth week of October,2003.

Fig. 9. Mahseer catches during gill net fishing at Shyamlatal lake

Though there are not many mahseer sanctuaries in Kumaon waters to conserve the germplasm of mahseer which is under great threat due to various anthropogenic causes, but existing one need protection. The Shyamlatal lake, however, can fuction as a mahseer century to protect this depleting germplasm.

ICAR Cess Fund Projects

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

K.K. Vass, Madan Mohan, K.S. Negi and Sangeeta Singh

Experiment 1:

An experiment was conducted for ascertaining survival and growth of rainbow trout alongwith the impact of density on its growth in physico-chemical and climatic conditions of Kumaon Himalaya. Rainbow trout fry 1.3-2.0 g weighing were stocked in trout fry rearing troughs of 200 lil. capacity at 50, 75 and 100 No. density. These fry were fed with NRCCWF formulated diet got prepared at CIFA feed mill at the rate of 8% of fish body weight.

From the initial length of 30-53mm and initial average weight of 1.74 g, the fry grew at average weight of 2.60-3.10 g. The weight gain, growth per day, FCR, feed efficiency and even survival was observed to be better in fishes stocked in lowest density.

Water quality parameters during incubation period ranged dissolved oxygen 7.0-7.80 mg/l; free carbon dioxide 1.0-1.6 mg/l; total alkalinity 22-28 mg/l; water temperature 19.0-21.50^{0}C; pH 7.70-8.1 respectively.

Experiment 2 :

Another experiment was carried out to ascertain impact of fry density, feeding rate and feeding frequency on the growth and survival of rainbow trout. Rainbow trout fry of 1.81-2.96g-weight range were stocked in trout rearing troughs at 20, 40, 60 No. densities. The feeding rate 12% in 20 fry tank, 10% in 40 fry tank and 5% in 60 fry tank. The fish of first tank with 20 nos. were fed 4 times in a day, with 40 fish 3 times a day and with 60 fish 2 times in a day.

From the initial length of 40-71mm and initial average weight of 1.81-2.96 g , the fry grew 63 - 138 mm in length and in average weight of 6.85-

14.90 g. The weight gain, growth per day FCR, feed efficiency was found to be better in 40 fish tank where fish were fed 10% of their body weight and three times in a day.

Water quality parameters during incubation period ranged dissolved oxygen 8.00 mg/l; free carbon dioxide 1.2-2.00 mg/l; total alkalinity 15-22 mg/l; water temperature 19.0-22.0^{0}C; pH 7.20-7.80 respectively.

Artificial propagation and seed raising of Chocolate mahseer -*Neolissocheilus hexagonolepis* (McClelland) in Arunachal Pradesh

H.S. Raina, Boni Amin Laskar and Azen Pujen

A collaborative project between NRCCWF and Department of Fisheries, Govt. of Arunachal Pradesh on artificial propagation and seed production of chocolate mahseer -*Neolissochelius hexagonolepis* has started in July, 2003. The project is located in Lower Dibang Valley, Roing district of Arunachal Pradesh and supported by ICAR. This species is locally known, as the

Fig. 10. Fish ponds at Iduli fish farm in Roying district of Arunachal Pradesh

"Boker" or the *"Katli mahseer"* besides being endemic (game and food fish) in the region, is highly prized fish of North-eastern Himalayas. Chocolate mahseer inhabits the rivers, lakes and reservoirs situated in the range of 250 to 1,500 m altitudes. In view of importance of northeastern Himalayan region and particularly for this fish species, the Institute realized to explore possibilities on artificial propagation of this species for producing its seed for planting in wild waters in upland regions of different states in NE region to rehabilitate/ restore their stocks. And improve subsistence fishery to the local fishermen and offer sport to the anglers. This will be indirectly help to improve the income of marginal and small-scale farmers, living along the vicinity of streams and rivers of NE region.

Fish diversity

As a work component of the project a detailed survey of different rivers/streams (Deopani, Epipani, Diphu, Enjupani and Dibang) and lakes (Shally and Mehao) has been carried out to study the fish diversity of the region. The study revealed that the area is bestowed with rich aquatic resources and pristine fish fauna. The investigation revealed that these ecosystems hold twenty-five (25) varieties of fish species, among which *Neolissochelius hexagonolepis* and *Tor putitora* from mahseer group and *Schizothorax richardsonii* and *Schizothoraichthys progastus* from snow-trouts show predominance. The main dominant fauna in the lotic ecosystems comprised of *Neolissocheilus hexagonolepis, Tor putitora, Schizothorax richardsonii, Schizothoraichthys progastus, Labeo dyocheilus, Aspidoparia morar, Xenenthodon cancila, Parambasis ranga, Psilorhychus balitora, Macrognathus aral, Barbus conchonius,Danio aequipinnatus, Barilius bola, B. barila, B. bendelisis,B. vagra, B.shacra, Garra gotyala, G. annandalei, Lepidocephalus guntea, Olyra longicaudata, Acanthocobitits botia, Silurus* spp.*,Badis badis, Noemacheilus rupecola, Ambyceps apangi,* etc. Shally lake mainly inhabits high population of *Neolissocheilus hexagonolepis* alongwith minor carps and the introduced fish fauna like Indian Major carps and exotic Chinese carps. State Fishery Department is engaged in fishery practices in this lake and regularly stocks the seed of these species including the seed of Chocolate mahseer collected from the natural waters. The lake hold high population of Chocolate mahseer both juveniles and adult fishes and presently thriving well with other alien species. Lake with approx. 2 ha. area, a close type system

Chocolate mahseer angling in this area. Potential of seed collection areas of Chocolate mahseer in different streams and lakes in this district have also been identified. Amongst the above streams, river Deopani has been identified as one of the best resource for Chocolate mahseer seed collection and easily exploited for this purpose .

Fishery development activities

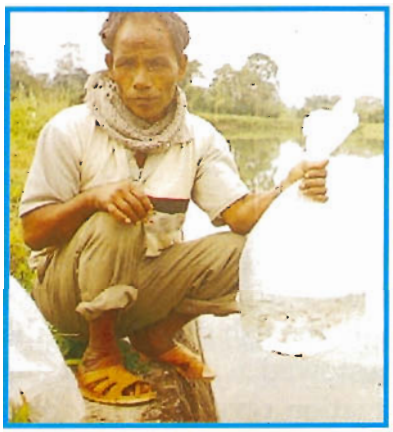
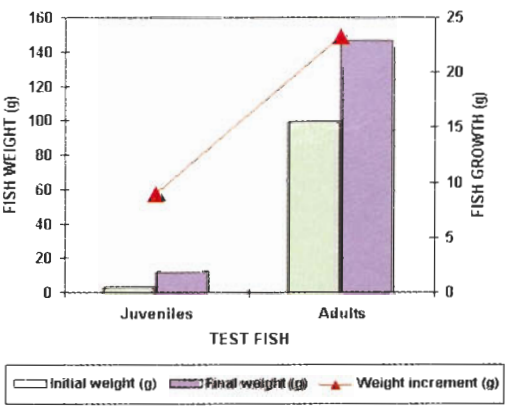


Fig. 11. Stocking of chocolate mahseer fingerlings in a fish pond in Arunachal Pradesh

Fig. 12. Recovery of chocolate mahseer from a fish pond in Arunachal Pradesh

At Iduli Fish Farm of Arunachal Pradesh State Fisheries Department, Roing (28^0 15' N and 95^0 25' E) fishery activities have been initiated with rearing of about 3,000 Chocolate mahseer - *Neolissocheilus hexagonolepis* fishes (average length 160 mm and weight 110 gram) in earthen ponds. Raising of fingerlings from advance fry are also being made in the same farm. The fishes were collected from the wild waters.



Growth performance of juvenile and adult chocolate mahseer reared at Iduli farm under pond conditions during winter months (90 days) in Roing.

The trials conducted to evaluate its growth behaviour under pond environment revealed a record growth increment range of 7.31 g to 23.36 g during winter months (minimum recorded in February and maximum in March). Conventional feed was used as the supplementary feed during the rearing period. Results so far obtained are very encouraging, further rearing trials are under progress.

Development of hatchery and farm facilities

A modern flow-through hatchery alongwith stock raising facilities is being established at Iduli Fish Farm of the Roing district in the State Arunachal Pradesh, through Rural Works Division construction agency of Arunachal Pradesh. This will help in raising brood stock and producing intensive seed of this species in captivity for culture and ranching to conserve the stocks in wild waters.


TECHNOLOGY ASSESSED & TRANSFERED

FARM ACTIVITIES

Rainbow trout breeding at Champawat

The brood stock of rainbow trout which was being maintained at Experimental Fish Farm Chirapani, Champawat after attaining age of four years when fully ripe female weighed 1350-2500 g and males 1000-1400 g. They were stripped and fertilized by "dry method". About 15200 eggs were stripped. They were placed in hatching trays with the capacity of 2400 eggs/ tray. After 10 days eyed ova were formed at 4.5-7.5 ^{0}C temperature regime. During incubation , rate of survival was 42.6%. As rainbow trout requires quite long period for hatching, it took 61 days for its completion. A total of 4320 fry were produced with the rate of survival from stripping to swim up fry of 28.42%. When about 3/4th of the egg yolk was absorbed, the fry were fed with emulsified hen's egg yolk, finely minced goat liver and powdered trout feed. After about a fortnight, fry were fed with formulated dry feed . The fry grew to 18-24 mm after one month and 50-75 mm after three months.

Water quality parameters during incubation period ranged as follows: dissolved oxygen 9.0-10.2 ppm; free carbon dioxide 0.8-1.6 ppm; total alkalinity 18-22 ppm ; water temperature 4.5 –7.5^{0}C ; pH 8.0-8.2.

Induced breeding and rearing of grass carp and silver carp

These species were once again successfully induced to breed in captivity at high altitude. Grass carp spawned naturally when ovaprime was injected @ 1.3-1.6 ml/kg in 2/3 doses during 14 -16 hrs at 22-23 ^{o} C. The silver carp species did not release eggs naturally but could be hand stripped and fertilized the eggs in dry enamel trays. Hatching process was recorded normal at 22-24^o C but egg reared at low temperature (< 21 ^{o} C) could not hatch in either species.

The spawn produced of these species were grown to fry stage and advance fry stage in well prepared nursery ponds at 23.6^o C - 25.8^o C. The fry were fed on artificial diet consisting of groundnut oil cake, soya cake fortified with cobalt chloride. Silver carp attain the size of 20-45 mm / 2.4g in 114 days. Grass carp, however, in the same period attain the size

of 35-56 mm /3.8 g. In both the species survival ranged 52-68 %. It may be attributed to almost nil natural food (plankton) production in nursery pond. The growth was very slow because of low water temperature.

The **Induced breeding technique of grass and silver carp** has been developed for **coldwater.** The adoption of the technique may lead to mass seed production of these species in coldwater

Seed production of golden mahseer (*Tor putitora*) at Bhimtal

During the period under report, 12 Nos. of wild spawners of golden mahseer (*Tor putitora*) collected from Bhimtal lake were stripped for egg taking and 57930 fertilized eggs were produced. The size of female brooders was 350-540 mm in length and 400-1500 g in weight where as size of the males used for fertilization of the eggs ranged 330-500 mm in length and 300-900 g in weight. The rate of fertilization recorded ranged 83.3-96.15%. In all 48320 mahseer advanced fry were produced at Bhimtal hatchery with a survival rate of 87.0-93.34% from eggs to swim up fry stage.

Breeding and seed production of golden mahseer during 2003

Total no of female fish stripped	:	12 Nos.
Size of the female fish -length	:	350-540mm
- Weight	:	400-1500g
Size of the male fish -length	:	330-500mm
-Weight	:	300-900g
Eggs stripped	:	61930 Nos.
Total eggs/female	:	4639 Nos.
Rate of fertilization	:	83.3-96.15%
Total Number of fertilized eggs	:	57930 Nos.
Swim up fry produced	:	51132 Nos.
Advanced fry produced	:	48320 Nos.
Cumulative survival from fertilized eggs to swim up fry	:	87.0-93.34%

Rearing of golden mahseer at Bhimtal

A trial was initiated for raising of brood stocks of golden mahseer in 12 x 5m earthen pond at mahseer hatchery complex, Bhimtal. About 250 fry of golden mahseer were stocked and after a rearing period of 28 months they attained a size of about 240-420mm with the corresponding weight of 150-600g.

Mahseer Coversation Goshthi

A gosthi was organized in the vicinity of Shyamlatal lake during last week of October, 2003 in which Gram Pradhan, local people including students and women participated in the presence of Chairman and members of the Institutes research Advisory Committee, Director and other scientists. The participants were appraised regarding the importance of fishery in general and mahseer in special besides the conservation and protection measures of this important fish species in addition to perils of unauthorized fishing in natural biotopes. A token ranching of golden mahseer seed was done by the Chairman RAC on the occasion.

Fig. 13. Mass awarness campaign at Shyamlatal lake

Awareness Programme

Fish culture awareness programme were conducted at Chafi, District Nainital; Pati District Champawat.

Saradotsav

Institutes activities were exhibited at the "Sarad Utsav" organized by the Government of Uttaranchal at Lohaghat, District Champawat from 10-14 November, 2003. Shri. Mehra, Hon'ble Minister for Agriculture, Government of Uttaranchal and Hon'ble Minister for Forest, Government of Uttaranchal visited the exhibition.

Exhibitions

Fig. 14. Dr. S. Ayyappan, DDG (Fisheries) visits NRC's exhibition stall at CIFRI Allahabad

The Institutes activities were displayed in the "Matsya Pradarshani" organised by CIFRI Allahabad on the occassion of Hindi workshop held during March 15-16, 2004.


EDUCATION & TRAINING

Training

- A training programme entitled "Breeding and Seed Production of Himalayan Mahseer, *T. putitora*" was organized during 15-20 September, 2003 for the eight Fisheries Officers from North East States. In all eight trainees, four from Arunachal Pradesh, two from Nagaland and one each from NEHU, Shillong and DRDO Pithoragarh participated in this training programme.

- Two officers from FIRMA, Kerala State Fisheries Department received training on various aspects of mahseer propagation and culture at this institute during December 15-20, 2003.

- In-house training programme on "Microsoft Excel 2000" was organized for the scientist/staff of this Institute in batches. The training was imparted to Scientists of this institute during June – July, 2003 and for Technical and Administrative staff of this Institute at Bhimtal in December 2003. The training was conducted 2 hrs. daily during the office hour for each group. This training includes creating tables, using formulae, making pie/ bar diagram and graphs and other mathematical calculations.

- Training was imparted to the Postgraduate students of Zoology from Chaudhary Charan Singh University, Meerut regarding various aspects of coldwater fish and fisheries.

AWARDS & RECOGNITION

- Shri. A.K. Nayak passed Hindi Praveen examination in May 2003 conducted by Central Hindi Training Institute, Department of Official Languages, New Delhi.

- Shri. R.S. Haldar, T-5 passed Hindi Pragya examination in May,2003 conducted by Central Hindi Training Institute, Department of official languages, New Delhi.

- Shri. A.K. Nayak received 'Young Scientist Award' by the Society of Biosciences, Muzaffarnagar at the National Seminar organized at National Institute of Ocean Technology, Chennai on January 22, 2004 for the paper "Computerized database for fishery resource survey in Uttaranchal" presented at National Seminar on Aquatic Resource Management in Hills organized by National Research Centre on Coldwater Fisheries at Nainital during October 4-5, 2002.

LINKAGES & COLLABORATIONS

Linkage with North-East

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

State Agriculture Universities

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

Sister Institutes and Outside ICAR

- The Institute have linkages with other sister Institutes – CIFA, Bhubaneswar and CMFRI, Kochi.

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

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

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

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

PUBLICATIONS

Seminar/Symposium/ Workshops

Joshi, C.B. 2003. *Paschim himalaya kshetro ke jal shroton ki sajawati machhaliyan.* In Hindi workshop organized by CIFRI Allahabad. (Abstract published)

Joshi, C.B. 2003. *Bharat main sheet jal matsyaki ka vartaman sthar:Samasyain evem Sambhvawnai.* In Hindi Workshop organized by CIFRI Allahabad. (Abstract published)

Kapila, R. and Mishra, D.P. 2003. Allozyme and RAPD reveal similar genetic relationships between populations of coldwater fish, *Schizothorax richardsonii* (Gray). In 10th Congress Federation of Asian and Oceanian Biochemists and Molecular Biologists (FAOBMB) from December 7-11, 2003at Indian Institute of Science, Bangalore, Abstract No.P19-05, 125p.

Tyagi, B.C., Kapila S. and Bhanja., S.K. 2003. Development of Mixed Carp Culture Technology and its adoption in Kumaon Himalyas. In Proc. Nat. Conf. Fish. Eco. Ext.Mgt.CIFE, Mumbai.114-123.

Tyagi, B.C. 2004. *Jaliye sansadhano ka vagyanic prabhandhan.* In Hindi Workshop, 15-16 March 2004,CIFRI, Barrackpore: 118

Research Articles

Kapila, R. and Mishra, D.P. 2003. A simplified procedure for total DNA isolation from coldwater fish, *Schizothorax richardsonii* (Gray). *Indian Journal of Fisheries Sciences* 50(4) 547-551.

Singh, N.O. and Wahi, S.D. 2003. Effect of sample size and structure on the bootstrap estimate of variance of heritability. *Indian Journal of Animal Sciences.* 73(5), 545-548.

Departmental Books/ Reports/ Bulletins/ Pamphlets

Fishery Restoration in Nainital Lake 2004. NRCCWF Publication No. 09 (80 pp.) K.K.Vass, H.S.Raina and R.S. Haldar.

A Success Story On ***Paddy cum Fish Culture in Apatani Plateau*** (Arunachal Pradesh) 2003 NRCCWF Publication (21 pp) Edited by K.K.Vass and H.S.Raina

Aquatic Resource Management in Hills. National Seminar October 4-5, 2002. Proceedings and Recommendations 2004. NRCCWF Publication (33pp.). Compiled and edited by K.K. Vass and Shyam Sunder.

Departmental Publications Translated and Published in NEH Languages viz., Assamese, Bengali, Manipuri and Nepali

- Flow through hatchery for mahseer. By C.B. Joshi.
- NRC extension services. By B.C. Tyagi
- Coldwater fish diets. By Shyam Sunder
- Snow trout fishery in Himalaya. By Shyam Sunder
- Breeding techniques of golden mahseer. By H.S. Raina
- Trout fishery in India. By C.B. Joshi

ONGOING PROJECTS

Title of the Projects	Project Leaders & Associates	Year of Start	Likely year of termination
Institutional Projects			
Ecological modeling and fishery enhancement in lakes/ wetlands in Himalayan/ sub-Himalayan region	Dr. K.K. Vass Dr. H.S. Raina Dr. C.B. Joshi Dr. Y. Basade	1998	2004
Establishment of baseline information with respect to aquatic resource assessment and bio-diversity with application of GIS	Dr. H.S. Raina Dr. S. Sunder Dr. A.K. Singh	1998	2004
Nutrition and feed development for upland fish with the focus on indigenous species	Dr. M. Mohan Dr. Y. Basade Dr. R. Kapila	1998	2004
Culture and breeding of exotic Chinese carps in Himalayan uplands	Dr. B.C. Tyagi	2000	2004
Amenability of sex and trait of upland endangered mahseer *Tor putitora* for sustainable reproductive management	Dr. A.K. Singh Dr. R. Kapila	2001	2004
Technology dissemination to the clients through pilot scale testing and demonstration programmes	Dr. B.C. Tyagi	1998	2004
Computer application in coldwater fisheries resource assessment and management.	Shri. A.K. Nayak Dr. K.K. Vass	2000	2004

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


CONSULTANCY, PATENTS,
COMMERCIALIZATION
OF TECHNOLOGY

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

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

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

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

MEETINGS

Staff Research Council (SRC)

Annual Staff Research Council meeting of the Institute was held on 26th May 2003 at Bhimtal under the Chairmanship of Dr. K.K. Vass, Director, NRCCWF, Bhimtal; Dr. V.R. Chitranshi, ADG (Inland Fisheries), ICAR, New Delhi also attended the meeting. In the meeting the progress of each on-going research project during the year 2002-2003 was critically discussed and evaluated. The work programme for the year 2003-2004 was finalized.

Management Committee (MC)

The Management Committee meeting was held on May 27, 2003. The committee discussed the action taken on the previous meeting and fifteen fresh agenda items were discussed in detail and approval accorded to majority of items. Apart from the Director, Dr. K.K. Vass; Dr. Amresh Kumar, Dean Animal Sciences, G.B. Pant University of Agricultural Sciences and Technology; Dr. V.R. Chitranshi, ADG (Inland Fisheries), ICAR, New Delhi, Dr. M.P.Singh Kohli, Principal Scientist, CIFE, Mumbai, Dr. Madan Mohan, Dr. H.S. Raina, Principal Scientist, NRCCWF; Shri. Pant, FAO, IVRI, Bareilly and Shri. R.L. Raina, AAO, NRCCWF.

Quinquennial Review Team (QRT)

The third Quinquennial Review Team was constituted vide Council Order No. 8-13/2002-IA-VI, received on May 30th 2003, to evaluate the work done by National Research Centre on Coldwater Fisheries, Bhimtal during the period from April, 1998 to March 2003. The prelimnary meeting was held at SMD, ICAR, New Delhi in the chamber of DDG (Fy), ICAR between Chairman, DDG (Fy) and the Director, NRCCWF on 22nd July 2003 to finalize the basic modalities to conduct review of centre as per the approved procedure/ guidelines of ICAR.

The QRT visited the NRCCWF during October 20-21, 2003 and had its first meeting at Bhimtal. The Memorandum prepared by the Institute along with other relevant documents were presented to the committee members. The team interacted with the scientists and other categories of staff including administrative, technical, supporting on various issues as per the terms of reference. The team comprised as below. The team inspected

Dr. K. Gopakumar	Ex-DDG(Fy), ICAR, New Delhi	Chairman
Prof. (Dr.) M.S. Johal	Head, Fisheries Laboratory, Department of Zoology, Punjab University, Chandigarh	Member
Dr. C. Saha	Ex-Director, CIFA, Bhubneshwar	Member
Prof. (Dr.) S.L. Shanbhogue	Ex- Director, Instruction College of Fisheries, Manglore	Member
Dr. J.R. Dhanze	Professor, Department of Fisheries College of Veterinary and Animal Sciences, Himachal Pradesh Krishi Vishawvidhalaya, Palampur	Member
Dr. Shyam Sunder	Principal Scientist, NRCCWF, Bhimtal	Member Secretary

Fig. 15. QRT Chairman Dr. K. Gopakumar, Ex-DDG (Fy) releasing the QRT memorandum during 1st meeting

Fig. 16. The team QRT members discussing with the Director and staff members of the institute

Fig. 17. QRT members in the meeting hall

various facilities created during the review period. The scientists presented their project accomplishments for the period under review before the committee. The committee appreciated the progress made by the Centre in the field of research and extension with the available manpower and infrastructure facilities.

The second meeting of the committee was held between November 22 – 26, 2003 in which apart from the Chairman, Dr. K. Gopakumar, The Members viz., Dr. Shanbouge, Dr. Saha and Dr. Dhanze participated. The committee held detailed discussions on the draft report including proposed recommendations at Bhimtal on 22,23 and 26 November, 2003. While on 24-25 November 2003 they inspected the Experimental Fish Farm and Field Station at Champawat and also visited Shyamlatal lake developed by the centre as mahseer conservation site.

X Plan Meeting

The X Plan document of the Institute was discussed in detail at a special divisional meeting held on February 13 to 14 at CMFRI, Cochin which was held under the Chairmanship of Madam Bhatnagar, the Principal Advisor (Agriculture), Planning Commission, Government of India; Shri. Basu, Additional Secretary and Financial Advisor (ICAR) and Dr. S. Ayyappan, DDG (Fy) were also present in the meeting.

The final X Plan EFC of NRCCWF was discussed and approved in a meeting held under the Chairmanship of Dr. Mangala Rai, the Secretary DARE and DG, ICAR on 20 June 2003 at Krishi Bhawan, New Delhi.

Fish Farmers Development Agency (FFDA) of Uttaranchal

The first meeting of the Uttaranchal's revised FFDA was held at the Secretariat, Dehradun on 28 June 2003 and was attended by Dr. K.K. Vass, Director as a member of the committee. The revised set-up of FFDA, the 'Uttaranchal Rajya Matsya Palak Vikas Abhikaran' in the state was discussed. In the meeting eleven agenda items were discussed and the members lent their approval to majority of cases, however, some modification were proposed in certain items. This will be a novel approach to be adopted in any hill state in the country.

Research Advisory Committee (RAC)

The Research Advisory Committee meeting was held on October 29-31, 2003. The RAC was attended by the following committee members:

Dr. S.N. Dwivedi	Former Director General, MPCS&T, Bhopal; Former Director, CIFE, Mumbai; Former Additional Secretary, Government of India.	Chairman
Shri. S.N. Ogale	Manager (Environment), Tata Power Company, Lonavla	Member
Dr. U.P. Singh	Dean College of Fisheries, G.B. Pant University Of Agriculture and Technology, Pantnagar	Member
Dr. Kuldeep Kumar	Advisor Fisheries & CEO Government of Himachal Pradesh, Bilaspur	Member
Prof. M. K. Joyti	Department of Zoology, Jammu University (J&K), Jammu	Member
Dr. K.K. Vass	Director, NRCCWF, Bhimtal	Member
Dr. Madan Mohan	Principal Scientist, NRCCWF, Bhimtal	Member Secretary

After a brief welcome by the Director and the introductory remarks by the members of the committee the progress made under each research project of the Institute for the year 2002-2003 was discussed. The Chairman and the members of the committee were satisfied with the progress made under each activity, however, the members gave certain suggestions to be implemented by respective Principal Investigators. The Chairman and other Members finalized recommendations for the year 2003-2004. The meeting ended with vote of thanks proposed by the Member Secretary. The Chairman and other members of the committee visited various sites to inspect the institute's field activities. In Pati Blockof district Champawat

Fig. 18 - 21. RAC meeting being held at the institute

the committee witnessed the fishing in farmers ponds and were happy to see the fish hauls. They expressed satisfaction with the progress made in exotic carp farming in remote areas under Transfer of Technology programme of the Institute. The experimental farm and newly fabricated coldwater fish seed hatchery at Chirapani, Champawat was also inspected by the committee. The RAC members also paid a visit to mahseer conservation site developed by the institute at Shyamlatal lake, and saw the experimental mahseer catch from the lake and also stocked mahseer seed produced at Bhimtal in the lake.

Rajbhasha Committee

The regular quarterly meetings of the Hindi cell of the Institute were convened in September and December months under the Chairmanship of the Director. In the meetings it was decided to celebrate the year as *Hindi chetana varsh* in order to bring awareness among the staff members about our National language. The Committee members include the following:

Dr. K.K. Vass	Director	Chairman
Dr. A.K. Singh	Senior Scientist	Member Secretary
Shri. A.K. Nayak	Scientist	Member
Smt. Susheela Tewari	Stenographer	Member
Shri. Harish Ram	Assistant	Member
Shri. Amit Kumar Joshi	Hindi Translator	Member
Shri. Ravinder Kumar	T-3	Member

Joint Staff Council (IJSC)

The Institute's Joint Staff Council's meetings were held regularly at quarterly intervals under the Chairmanship of the Director and was attended by all the members from official and staff side. In the meetings action taken on previous agenda items were reviewed and various new agenda items regarding welfare of the staff were discussed. IJSC comprised the following members:

Official side	Staff side
Dr. K.K. Vass, Director & Chairman	Shri. Harish Ram, Asst. & Member CJSC
Dr. Madan Mohan, Principal Scientist	Shri. T.M. Sharma, T-2
Dr. Shyam Sunder, Principal Scientist	Shri. Baldev Singh, T-3
Dr. A.K. Singh, Senior Scientist	Shri. J.C. Bhandari, LDC & Member Secretary
Dr. K.D. Joshi, Scientist (SS)	Shri. Ravinder Kumar, SSG-III
Shri. R.L. Raina, AAO & Member Secretary	Shri. H.S. Bhandari, SSG-II

PARTICIPATION IN CONFERENCES, SEMINARS, MEETINGS & WORKSHOPS

Conferences/ Meetings/ Symposiums/ Seminars/ Workshops	Participants
X Plan EFC discussion and presentation, ICAR, New Delhi. June 19-20,2003.	Dr. K.K. Vass
Meeting for implementation of State level FFDA in Uttaranchal, Secretariat, Dehradun. June 28, 2003.	Dr. K.K. Vass
Meeting of Directors, Administrative Officer and Finance and Accounts Officers of Fisheries Research Institutes, ICAR, New Delhi. July 11,2003.	Dr. K.K. Vass
Meeting to develop modality for conducting examination in respect of posts in administrative categories at ICAR HQ and its Institutes. ASRB, New Delhi. July 15, 2003.	Dr. K.K. Vass
Meeting of QRT Chairman with DDG (Fisheries) at ICAR, New Delhi. July 22, 2003.	Dr. K.K. Vass
Director's conference and meeting of RAC Chairman of ICAR Institutes and meeting for programmes/action plan in NEH region & Sikkim ICAR, New Delhi. July 29-31, 2003.	Dr. K.K. Vass
National Conference on Eco-restoration. National Institute of Ecology and Indian Council of Forestry Research and Education (ICFRE), Dehradun. October 16, 2003.	Dr. K.K. Vass
High level meeting of Ministry of Environment regarding mahseer restoration programme in the Tehri reservoir. Tehri Hydro Development Corporation. Ltd., Tehri. November 10-11, 2003.	Dr. K.K. Vass
National Workshop. Methodologies for Prioritization of Fisheries Research in India. NAARM, Hyderabad. November 10-11, 2003.	Shri. A.K. Nayak

10th Congress of Federation of Asian and Oceanic Biochemists and Molecular Biologists. Indian Institute of Science, Banglore. December 7-11, 2003.	Dr. R. Kapila
Meeting for fishery development action plan for Champawat district. Champawat. January 12, 2004.	Dr. K.K. Vass
National Seminar. Frontiers in Marine Biosciences Research (MBR 2004). National Institute of Ocean Development, Chennai. January 22-23, 2004.	Shri. A.K. Nayak
National Workshop on "Strategies and Options for Increasing and Sustaining Fisheries and Aquaculture Production to benefit poor households in India" (ICAR-ICLARM) project organized by National Centre for Agricultural Economics and Policy Research. New Delhi. January 29-30, 2004.	Dr. K.K. Vass
Meeting of Ministry of Environment and Forests, Government of India, Paryavaran Bhavan, New Delhi. February 20, 2004.	Dr. K.K. Vass
Meeting on Seed Production in Agricultural Crops and Fisheries" ICAR. New Delhi. February 24-25, 2004.	Dr. K.K. Vass
Hindi Workshop. Central Inland Capture Fisheries Research Institute at Allahabad. March 15-16, 2004.	Dr. C.B. Joshi Shri. A.K. Joshi Shri. T.M. Sharma

EVENTS

Grehpravesh puja

The NRCCWF complex at Bhimtal was made almost ready by CPWD and on the auspicious day of 'Raksha Bandhan' August 12, 2003 the members of staff took initiative to perform house warming celebration at this new complex. A traditional puja with the recitation of mantras by the Purohit was performed. All members of staff participated in this eventful celebration. All staff members invoked the blessings of God for future growth, development and prosperity of NRCCWF.

Fig. 22. Grehpravesh puja at New NRCCWF Complex, Bhimtal

Independence day celebrations

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

Fig. 23. Independence Day celebrations at new NRCCEF Complex, Bhimtal

Hindi pakhwada

Hindi Week Celebrations were organized by the Institute at Bhimtal during 15-21, September 2003. For the efficient use of Rajbhasha among the Institute staff and provide encouragement to them in its use, competitive events were held during the period. A large number of members of staff participated in different event viz., essay writing, noting, drafting, Hindi translation, computer typing in Hindi and vocabulary test. Based on the recommendations of the evaluation team Shri. P.C. Tewari

and Pushpesh Sanga were declared first and second, respectively in essay writing. Shri. P.C. Tewari and Harish Ram were declared first and second respectively in noting and drafting. Shri Harish Ram and Baldev Singh were declared first and second, respectively in Hindi translation. Shri. Pratap Singh and Mrs. Khilawati Rawat were declared first and second, respectively in Hindi computer typing while in Hindi vocabulary Shri. A. K. Nayak and Pushpash Sanga were both declared first and Shri. R.S. Haldar as second. Apart from this major celebration during the period, the mandatory meetings of the Rajbhasha Committee were held as per schedule.

National science day

National science day was celebrated at NRCCWF on February 28, 2004. The theme for the year was 'to create scientific awareness in the country'. Thus students from local schools and local masses were invited. Essay and debate competitions were organized among the students and there were deliberations from the Director of the Institute and the Chief guest, Chairperson of Nagar Palika Committee, Bhimtal. At the end of the function the Chief guest gave presents to the winners.

Fig. 24. Shri Ashok Nayak (Scientist) is receiving award on National Science Day

DISTINGUISHED VISITORS

Following distinguished dignitaries visited the Institute during the year 2003 – 2004.

- Dr. S. Ayyappan, DDG(Fy), ICAR, New Delhi.
- Dr. S.N. Dwivedi, Ex-Director General, MPCS&T, Bhopal; Ex-Director, CIFE, Mumbai; Ex-Additional Secretary, Government of India.
- Dr. K. Gopakumar, Ex-DDG(Fy), ICAR, New Delhi.

Fig. 25. Director showing the model of the new NRCCWF Complex to Dr. S. Ayyappan, DDG (Fy.)

Fig. 26. DDG (Fy.) observing the fishing in an experimental pond at Mahseer hatchery, Bhimtal

- Dr. V.R. Chitranshi, ADG (Inland Fisheries), Indian Council of Agricultural Research, New Delhi.
- Shri. S.N. Ogale, Manager (Environment), Tata Power Company Ltd., Lonavla (Maharashtra).
- Dr. A.P. Sharma, Dean Fisheries, G.B. Pant University of Agriculture and Technology, Pantnagar (Uttaranchal).
- Dr. S.D. Sharma, Director, IASRI, New Delhi.
- Shri. A.S. Sethi, Under Secretary (Fy), ICAR, New Delhi.
- Dr. V.P. Kothiyal, Director Works, ICAR, New Delhi.
- Prof. Survesh Kumar, Head Department of Zoology, Kumaon University, Nainital.
- Prof. Krishna Swarup, National Academy of Science, Allahabad.

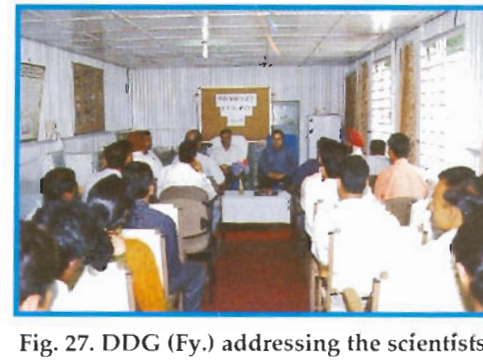


Fig. 27. DDG (Fy.) addressing the scientists and staff members of the institute

Fig. 28. Commissioner Kumaon Shri Rakesh Sharma visiting the institute

- Shri. Rakesh Sharma, IAS, Commissioner Kumaon, Nainital.
- Shri. Amit Kumar Ghosh, DM, Nainital.
- Shri. D.S. Garbiyal, CDO, Nainital.
- Dr. H.S. Gupta, Director, VPKAS, Almora.
- Shri. S.R. Chanyal, Joint Director Fisheries, Uttaranchal.
- Dr. Kuldeep Kumar, Advisor Fisheries & CEO Government of Himachal Pradesh, Bilaspur.
- Dr. V.N. Sharda, Director, CSWCRT&I, Dehradun.
- Prof. M. K. Joyti, Department of Zoology, Jammu University (J&K), Jammu.
- Prof. (Dr.) M.S. Johal ,Head, Fisheries Laboratory, Department of Zoology, Punjab University, Chandigarh.

Fig. 29. Commissioner Kumaon viewing the institute's activities

Fig. 30. Commissioner Kumaon visits the library of the institute

- Dr. C. Saha, Ex-Director, CIFA, Bhubneshwar.
- Prof. (Dr.) S.L. Shanbhogue, Ex-Director, Instruction College of Fisheries, Manglore.
- Dr. J.R. Dhanze, Professor, Department of Fisheries, College of Veterinary and Animal Sciences, Himachal Pradesh Krishi Vishwavidhalaya, Palampur.
- Dr. M. P. Singh Kohli, Principal Scientist, Central Institute of Fishries Education, Mumbai.
- Mrs. Chitra Thapa, Chairperson, Nagar Palika Committee, Bhimtal.

PERSONNEL

LIST OF PERSONNEL AS ON MARCH 31, 2004

SCIENTIFIC

1. Dr. K.K. Vass, Director
2. Dr. Madan Mohan, Principal Scientist
3. Dr. H.S. Raina, Principal Scientist
4. Dr. C.B. Joshi, Principal Scientist
5. Dr. Shyam Sunder, Principal Scientist
6. Dr. B.C. Tyagi, Principal Scientist
7. Dr. A.K. Singh, Senior Scientist (Inter-Institutional transfer to NBFGR w.e.f. 01-12-2003)
8. Dr. K.D. Joshi, Scientist (Senior Scale) (Relieved on promotion to CICFRI w.e.f. 26-06-2003)
9. Dr. Rajeev Kapila, Scientist (Senior Scale)
10. Dr. Yasmeen Basade, Scientist (Senior Scale)
11. Shri. A.K. Nayak, Scientist
12. Shri. N.O. Singh, Scientist (Joined on August 8,2003)

ADMINISTRATIVE

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

TECHNICAL

1. Shri. R.S. Haldar, T-5

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

SUPPORTING

1. Shri. Japhu Ram, SSGr IV (Retired on September 30, 2003)
2. Shri. Sant Ram, SSGr IV
3. Shri.Ravinder Kumar, SSGr III
4. Shri. Om Raj, SSGr III
5. Shri. H.S. Chauhan, SSGr III
6. Shri. H.S. Bhandri, SSGr II
7. Shri. Dharam Singh, SSGr II
8. Shri.Sunder Lal, SSGr II
9. Shri. Manoj Kumar, SSGr II
10. Shri. Pooran Chandra, SSGr II
11. Shri. Prakash Akela, SSGr I
12. Shri. Kuldeep Kumar, SSGr I
13. Shri. Bhola Dutt, SSGr I
14. Shri. Chandra Shekhar, SSGr I
15. Smt. Basanti Devi, SSGr I

CASUAL LABOUR WITH TEMPORARY STATUS

1. Shri. Mangala Prasad

SPECIAL INFRASTRUCTURAL DEVELOPMENT

Completion of Phase-I of NRCCWF New Complex and Shifting to New Complex

The construction of NRCCWF Complex Phase-I at Industrial Area, Bhimtal has been completed and the office and laboratories of NRCCWF housed in various rented buildings have been shifted to the New Complex on 9th September, 2003.

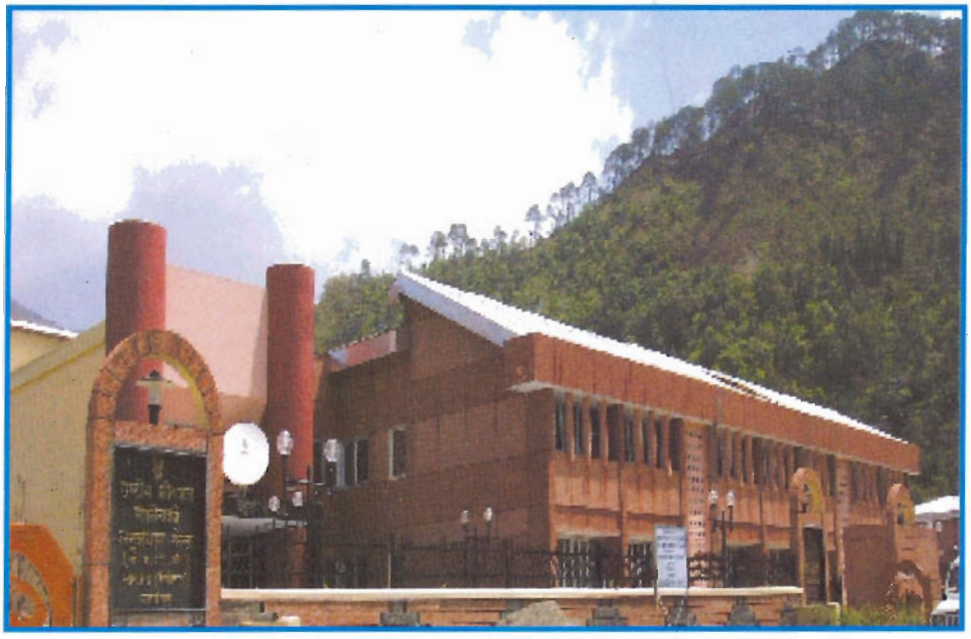


Fig. 31. The construction of NRCCWF Complex Phase-I completed

Construction of Phase-II of NRCCWF Complex

The construction of NRCCWF Complex Phase-II has been initiated at the Industrial Area, Bhimtal and is in progress. The progress of work is regularly being monitored by CPWD officials as well as by the Institute authorities.

New work awarded to CPWD at Champawat

The work for construction of a culvert on a small perennial stream flowing between the two pockets of the Institute's experimental fish farm at Chirapani has been awarded to CPWD.