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# वार्षिक प्रतिवेदन
# Annual Report
# 1996 - 97

भाकृअनुप
ICAR

National Bureau of Fish Genetic Resources, Lucknow

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# FOREWORD

Realising the importance of fish genetic resources in the sustainable development of capture and culture fisheries, the Indian Council of Agricultural Research established the National Bureau of Fish Genetic Resources in 1983. The Bureau has a national mandate to plan, conduct and coordinate research programmes relating to conservation of fish genetic resources. Realising the inadequate database for undertaking such a programme, the Bureau has concentrated its efforts through multipronged strategies of compiling the required information, generating data to fill the gaps, developing methodologies and programmes on conservation and coordinating conservation efforts. Even with the limited scientific strength of sixteen and being housed in a rented building, NBFGR has been able to make significant contributions which are highlighted in this report.

During the year, the Bureau has successfully implemented its programme on building the database on fish genetic resources, developing *in situ* conservation methodology for the endangered golden mahseer, biochemical and cytogenetic characterization of economically important as well as endangered species and further refining of the gene banking technology.

Scientific and technical personnel have contributed significantly towards the fulfilment of the mandate of the Institute. Library personnel have offered excellent back up service in bringing this Annual Report. All other categories of officers and staff have lent their support to Bureau's work. I compliment all the NBFGR staff for their concerted efforts. I am thankful to Dr. R.S. Paroda, Director General for support and encouragement extended in implementing our mandate. Dr. P.V. Dehadrai, Deputy Director General (Fisheries) and Dr. M.Y. Kamal, Assistant Director General (Fisheries) have provided the much needed support required for the growth of the Institute.

A.G. PONNIAH

DIRECTOR

# प्रतिवेदन का हिन्दी सारांश

## 1996–1997

### भूमिका

### संक्षिप्त इतिहास

हमारे देश के अन्तर्स्थलीय एवं समुद्री मत्स्य विकास सम्बन्धी राष्ट्रीय कार्यक्रमों के अन्तर्गत यह सुनिश्चित किया गया है कि मछली उत्पादन में केवल वृद्धि ही पर्याप्त नहीं है अपितु प्रकृति प्रदत्त विभिन्न मत्स्य प्रजातियों एवं उनमें पायी जाने वाली विभिन्नता का संरक्षण भी अत्यन्त आवश्यक है। भारत सरकार द्वारा इसके महत्व को ध्यान में रखते हुए कुछ समय पूर्व राष्ट्रीय मत्स्य आनुवंशिक संसाधन ब्यूरो की स्थापना का अनुमोदन किया गया। भारतीय कृषि अनुसंधान परिषद के अन्तर्गत ब्यूरो ने पिछले कुछ वर्षों से अपना काम भी आरम्भ कर दिया है। ब्यूरो का स्थायी मुख्यालय मई 1994 में इलाहाबाद से लखनऊ स्थानान्तरित किया गया तथा 51.88 एकड़ भूमि पर तेलीबाग लखनऊ में ब्यूरो का भवन एवं मत्स्य फार्म निर्माणाधीन है।

### उद्देश्य

राष्ट्र के समस्त मत्स्य आनुवंशिक संसाधनों के विषय में समग्र सूचनाओं तथा ज्ञान का एकत्रीकरण एवं वर्गीकरण (कैटलागिंग), मत्स्य आनुवंशिक संसाधनों का संरक्षण, अन्य संस्थानों के सहयोग से मत्स्य आनुवंशिक संसाधनों का रखरखाव और लुप्तप्राय (एन्डैन्जर्ड) प्रजातियों का संरक्षण तथा भारतीय जल संसाधनों के लिए विदेशी मत्स्य प्रजातियों का चयन एवं नियंत्रण।

### संगठन

ब्यूरो के कार्य को सुचारु रूप से क्रियान्वयन हेतु ब्यूरो के संगठनात्मक ढांचे में निम्नलिखित चार केन्द्रों का प्रस्ताव है:

1. मृदु जलीय मत्स्य संसाधन केन्द्र
2. शीतल जलीय मत्स्य संसाधन केन्द्र
3. क्षार जलीय मत्स्य संसाधन केन्द्र
4. समुद्र जलीय मत्स्य संसाधन केन्द्र

उपरोक्त चारों केन्द्रों पर सम्बन्धित मत्स्य प्रजातियों के संरक्षण एवं शोध कार्य होंगे। इसके अतिरिक्त मुख्यालय पर स्थित निम्न चार सम्भाग (सेक्शन) संरक्षण एवं शोधक्षेत्र में कार्यरत हैं।

1. कोशिकानुवंशिकी
2. जीव रसायन आनुवंशिकी
3. जीव विज्ञान
4. संरक्षण एवं प्रबन्धन

# प्रमुख अनुसंधान उपलब्धियां

## 2.1 एफ. बी. -2 चयनित उच्च जल क्षेत्रों में महाशीर संरक्षण

भारत में जलीय संसाधन के *इन सीटू* संरक्षण में लोगों की भागीदारी नहीं के बराबर थी। इस तथ्य को ध्यान में रखते हुए कुमायूँ के कुछ पर्वतीय क्षेत्रों में महाशीर के संरक्षण के लिए उचित प्रभावी योजना तैयार की गयी जिसका निम्नवत् प्रमुख घटकों के अन्तर्गत अध्ययन किया जा रहा है।

### पर्वतीय नदियों पर अध्ययन

शीतजल के विभिन्न नदी-नालों का सर्वेक्षण कर मछलियों की स्थिति से सम्बन्धित आंकड़े एकत्रित किये गये। लधिया नदी का चलथी पुल से शारदा नदी के संगम तक करीब 124 स्थानों पर 15 मानकों (पैरामीटर्स) का प्रयोग कर प्राकृतिक वासस्थल के चल सम्पत्ति का विवरण (हैबिटेट इन्वेन्ट्री) एकत्र किया गया। प्राकृतिक वासस्थल के चल सम्पत्ति का विवरण (हैबिटेट इन्वेन्ट्री) एकत्र करने से साफ तौर पर यह पता चलता है कि लुप्तप्राय महाशीर के आवासीय स्थान में विनाशकारी परिवर्तन हो रहा है। वर्तमान अध्ययन से यह भी ज्ञात होता है कि लधिया नदी में बिसौरिया नाला के मिलने के बाद चट्टानों के क्षीण होने से उत्पन्न कणों के जमाव के कारण लुप्तप्राय महाशीर मछली के प्रजनन क्षेत्रों का भी विनाश हो रहा है।

### महाशीर पुनर्स्थापना

पर्वतीय क्षेत्रों में महाशीर के पुनर्स्थापना के उद्देश्य से राष्ट्रीय शीत जल मत्स्य अनुसंधान केन्द्र हल्द्वानी, गोविन्द बल्लभ पन्त कृषि एवं प्रौद्योगिकी विश्वविद्यालय तथा उ०प्र० मत्स्य विभाग अल्मोड़ा के सहयोग से कोसी नदी में गरमपानी के निकट मत्स्य बीजों को डाला गया।

### जन-जागृति कार्यक्रम

महाशीर के संरक्षण के लिए इस संस्थान एवं कुमायूँ विश्वविद्यालय अल्मोड़ा के प्राणी विज्ञान विभाग के सहयोग से जन-जागृति कार्यक्रम का आयोजन किया गया। इस कार्यक्रम में विभिन्न संस्थानों से वैज्ञानिक, विद्यार्थी, स्वयंसेवी संस्थाऐं एवं किसान सम्मिलित हुए। उच्च जल क्षेत्रों में भी कई स्थानों पर अनेक गोष्ठियां आयोजित की गयीं। इन गोष्ठियों में स्थानीय किसानों एवं मछुआरों को एकत्रित कर अनेक महाशीर बचाओ समितियों का गठन किया गया। हिन्दी और अंग्रेजी में 'महाशीर बचाओ' शीर्षक पर पत्रिका (बुलेटिन) का वितरण किया गया। महाशीर बचाओ समिति के सदस्यों को परिचय-पत्र प्रदान किये गये। बहुत से स्थानों पर जन-जागृति के लिए 'महाशीर बचाओ' संदेश को लिखा गया तथा होर्डिंग भी लगाये गये।

## 2.2 एफ. बी. 9: भारतीय मत्स्य आनुवंशिक संसाधन का डाटा बैक विकसित करना

इस परियोजना का उद्देश्य मत्स्य संरक्षण कार्यक्रम के उपयोग के लिए मत्स्य आनुवंशिक संसाधन का डाटा बेस विकसित करना है।

इस अवधि के दौरान अब तक उपलब्ध सूचनाओं की सहायता से मछलियों के आवासीय वातावरण, उपलब्धता, वर्गीकृत स्थिति, पर्यायवाची नाम आदि का परस्पर जाँच द्वारा "भारतीय मत्स्य आनुवंशिक संसाधन'' के डाटा बेस का नवीनीकरण किया गया। मछलियों के वर्गीकृत स्थापन के लिए नेल्सन (1994) की वर्गीकरण विधि का अनुसरण किया गया। भारत की मुख्य नदियों में पायी जाने वाली विभिन्न मत्स्य प्रजातियों की जानकारी उपलब्ध डाटा बेस में रखी गयी।

भारतीय शार्क की 68 प्रजातियों का प्रारम्भिक डाटा तैयार कर विश्व प्रकृति निधि (WWF) को उनके उपयोग के लिए भेजा गया।

भारतीय जल क्षेत्रों में तिलापिया मछली की सुधरी प्रजाति के समावेश विषयक पर एक ब्रेन स्टार्मिंग सत्र का आयोजन किया गया। उक्त विषय पर गहन चर्चा हुई और महत्वपूर्ण सुझावों को भारतीय कृषि अनुसंधान परिषद, नई दिल्ली भेज दिया गया।

स्वदेशी मूल्यवान लुप्तप्राय मत्स्य संसाधन के प्राकृतिक संरक्षण हेतु विभिन्न प्रदेशों एवं केन्द्र-शासित प्रदेशों में स्थित प्राकृतिक स्थानों का डाटा संग्रह किया गया जिसमें से कुछ जल क्षेत्रों का उपयोग मत्स्य संसाधन संरक्षण के लिए किया जा सकता है।

## 2.3 बी.जी.-10: प्राकृतिक प्रदत्त व्यावसायिक महत्व की और लुप्त-प्राय मछलियों का आनुवंशिकीय अध्ययन

मत्स्य संसाधन के प्रभावशाली प्रबन्धन के लिए मत्स्य आनुवंशिक सूचनाओं का उपलब्ध होना अत्यन्त आवश्यक है। इस उद्देश्य को ध्यान में रखते हुए व्यावसायिक महत्व की भारतीय मुख्य कार्पस, विदेशी एवं लुप्तप्राय मछलियों की आनुवंशिक सूचना एकत्र की गयी। इन मछलियों का आइसोइन्जाइम, समविद्युत विभव केन्द्रीकरण एवं डी.एन.ए. चिन्हक के द्वारा परीक्षण किया गया।

### भारतीय मुख्य कार्प्स

भारतीय मुख्य कार्प जैसे रोहू, कतला एवं मृगल के संकर का अध्ययन ई एस टी-1, एस ओ डी, ओ डी एच, ए ए टी, जी 6पी डी एच, एक्स डी एच, 6पी जी डी एवं एम डी एच आइसोइन्जाइम प्के द्वारा किया गया और ये चिन्हक प्रजाति विशेष के लिए प्रभावकारी पाये गये।

भारतीय मुख्य कार्प के आनुवशिकीय भिन्नता के अध्ययन में अल्फा जी पी डी एच, पी जी एम, ई एस टी-1, एक्स डी एच एवं ए ए टी आइसोइन्जाइम उपयोगी पाये गये।

### वायु-श्वांसी मछलियां

समविद्युत विभव केन्द्रीकरण तकनीकी द्वारा *चन्ना पंक्टेटस* के आंख के प्रोटीन एवं हीमोग्लोबिन का अध्ययन किया गया। अल्फा क्रिस्टैलिन के तीन बैंड, बीटा क्रिस्टैलिन के 11 बैंड एवं गामा क्रिस्टैलिन के चार बैंड पाये गये। इस प्रकार का पैटर्न *चन्ना पंक्टेटस* के प्रजाति विशिष्टता को दर्शाता है। इस विधि द्वारा *चन्ना पंक्टेटस* के हीमोग्लोबिन का अध्ययन करने पर 12 बैंड पाये गये किन्तु अन्तःप्रजाति भिन्नता नहीं पायी गयी।

### पूर्वस्थापित विदेशी मछलियां

आइसोएन्जाइम एवं समविद्युत विभव केन्द्रीकरण चिन्हक द्वारा बिलासपुर (हि. प्र.) मछली फार्म एवं रिवाल्शर ताल (हि. प्र.) के कामन कार्प मछलियों का आनुवंशिकीय चित्रण किया गया। अध्ययन से यह पाया गया कि फार्म की कार्प मछलियों में 33.2 प्रतिशत गोल्डफिश का संकरण पाया गया। इस अध्ययन के बाद बिलासपुर फार्म की कार्प मछलियों को रिवाल्शर ताल की मछलियों द्वारा विस्थापित करने की संस्तुति की गयी।

कामन कार्प, गोल्डफिश एवं गोल्डफिश कामन कार्प संकर मछलियों का अध्ययन समविद्युत केन्द्रीकरण विधि द्वारा भी किया गया जिसमें संकर मछली में कामन कार्प एवं गोल्डफिश के आनुवंशिक सम्मिश्रण पाये गये।

### ट्राऊट

हिमाचल प्रदेश के फार्म से प्राप्त बाउन ट्राऊट एवं रैनबो ट्राउट मछलियों का पांच आइसोजाइम द्वारा अध्ययन किया गया जिसमें उक्त दोनों मछलियों में आनुवंशिकीय भिन्नता पायी गयी।

### लुप्तप्राय प्रजातियां

### हिल्सा (*टेनुआलोसा इलीसा*)

फरक्का से प्राप्त किये गये हिल्सा मछली के सैम्पुल से 16 एन्जाइम का अध्ययन किया गया जिसमें 4 एन्जाइम्स में बहुरूपता पायी गयी।

### समुद्री श्वेत मछली

लुप्तोन्मुख समुद्री मछली लेक्टेरियस लेक्टेरिययस का ई एस टी, एल डी एच, ए ओ डी, ए ए टी, एम डी एच, एम ई पी एवं ओ डी एच आइसोजाइम प्रोफाइल का अध्ययन किया गया। भविष्य में विभिन्न समुद्री तटों की मछलियों का जनसंख्या आनुवंशिकी विश्लेषण किया जायेगा।

### डी एन ए चिन्हक

मांगुर, सिंघी और रोहू मछलियों से माइट्रोक्रान्ड्रियल डी एन ए को निकालने की विधि का मानकीकरण किया गया एवं जीनोमिक डी एन ए को भारतीय मुख्य कार्प मछलियों के यकृत से निकालने की विधि का भी मानकीकरण किया गया।

माइटोकान्ड्रियल डी एन ए के वृद्धि हेतु दो प्रकार के यूनिवर्सल प्राइमर जिनका उत्पाद 2.0 के बी और 2.5 के बी था, चुने गये। यह देखा गया कि 2.0 के बी अंश के साथ कुछ छोटे-2 अंश भी निरन्तर उपस्थित थे जबकि 2.5 के बी अंश के साथ कोई निरन्तर पैटर्न नहीं प्राप्त हुआ।

## 2.4 सी. जी.-11: लुप्तप्राय व्यावसायिक महत्व की मछलियों में गुणसूत्रों एवं प्रदूषण से उत्पन्न होने वाले आनुवंशिक विषाक्तता का अध्ययन

इसके अन्तर्गत प्रदूषको से उत्पन्न होने वाले आनुवंशिक विषाक्तता एवं कोशिका आनुवंशिक चिन्हकों के प्रयोग द्वारा आनुवंशिक विभिन्नता का अध्ययन किया गया।

### गुणसूत्रों में विभिन्नता

मछलियों के गुणसूत्रों में आनुवंशिक भिन्नता के अध्ययन के लिए सी-बैडिंग तकनीकी का प्रयोग किया गया।

### सी-बैंडिंग

रोहू *(लेबियो रोहिता)*, *मेस्टासिम्बैलस अरमेटस*, *पुन्टिसस* प्रजाति, *सिरहिनस मृगल*, सौरी *(चन्ना पंक्टेटस)*, *मिस्टस विटेटस* एवं *लेबियो गोनियस* आदि प्रजाति की मछलियों में सी-बैंडिंग का अध्ययन किया गया। रोहू में आठ गुणसूत्र जोड़ो पर सी-बैंड पाये गये जिसमें अधिकतर सेन्ट्रोमेरिक प्रकार के थे जो टलोसेन्ट्रिक गुणसूत्र जोड़ो पर पाये गये। अन्य मछलियों में सी-बैंड साफ-साफ नहीं मिले। सी-बैंड अध्ययन के लिए और अधिक परीक्षण की आवश्यकता है।

### अन्तः पात्र (*इन विट्रो*) कोलचीसिन प्रयोग से गुणसूत्र पाने की तकनीकी

प्रयोगशाला से सुदूर कार्य क्षेत्रों में यह विधि अत्यन्त उपयोगी है। अन्तः पात्र में कोशिका संवर्धक द्रव के साथ 1-2 बूंद (0.05 प्रतिशत) कोलचीसिन का प्रयोग कई प्रजाति के मछलियों के गुर्दा तथा गिल ऊतकों पर किया गया। यद्यपि इस तकनीकी से अच्छे प्रकार के गुणसूत्र प्राप्त हुए तथापि प्रजाति विशेष के लिए उक्त तकनीकी में कुछ सुधार लाने की आवश्यकता महसूस की गयी।

### आनुवंशिक विषाक्तता

जल प्रदूषकों के आनुवंशिक विषाक्तता प्रभाव के अध्ययन के लिए सूक्ष्म केन्द्रक परीक्षण (माइक्रोन्यूक्लियस टेस्ट) विधि का प्रयोग किया गया।

सौरी (*चन्ना पंक्टेटस*) मछलियां मैलाथियान (50 प्रतिशत इ सी) कीटनाशी 0.033 मीली प्रतिलीटर के घोल में 5-16 दिन तक एक्विरियम में पाली गयी। पांच दिन रखाव के बाद पाली गयी मछलियों के रक्त कोशिकाओं में सूक्ष्म केन्द्रक (माइक्रोन्यूक्लियस) देखे गये। मैलाथियान से उपचारित मछलियों में सूक्ष्म केन्द्रक 2.6 प्रतिशत की तुलना में बिना उपचारित मछलियों में सूक्ष्म केन्द्रक 0.3 प्रतिशत पाये गये।

### सिस्टर क्रोमैटिड एक्सचेन्ज (एस सी ई)

मछलियों में जल प्रदूषण से होने वाली सम्भावित आनुवंशिक विषाक्तता आंकलन हेतु इस तकनीकी का मानकीकरण (स्टैन्डरडाइजेशन) किया गया। बी आर डी यू डी एन ए बेस अनालाग 50-500 माइक्रो ग्राम प्रतिग्राम शारीरिक भार की दर से *चन्ना पंक्टेटस, क्लैरियस बाट्रेकस* और *एनाबास टेस्टुडिनिस* मछलियों पर प्रयोग किया गया। *चन्ना पंक्टेटस* में बी आर डी यू के समायोजन के द्वारा क्रोमैटिड विभेद बी आर डी यू के 0.5 मिलीग्राम मात्रा में प्राप्त किया गया जबकि 1.0 मि. ग्रा. या अधिक मात्रा पर मल्टीपल एक्सचेंज प्राप्त किया गया। *चन्ना पंक्टेटस* में बेस लाइन वैल्यू 0.038 प्रतिगुणसूत्र 0.5 मिग्रा मात्रा पर प्राप्त की गयी।

## 2.5 सी. एम.-4: चुने हुए लुप्तप्राय और व्यावसायिक महत्व के प्रकृति में पायी जाने वाली प्रजाति के जीन बैंक तकनीकी का विकास

जीन बैंकिंग मछलियों के *एक्स सीटू* संरक्षण के लिए एक प्रभावकारी साधन है। रोहू के मत्स्य वीर्य के हिम परिरक्षण (क्रायोप्रिजर्वेशन) पर पर्याप्त काम हुआ है। इस अवधि में कतला और नैन में इस तकनीकी का विस्तार किया गया।

## कतला और नैन मछलियों के मत्स्यवीर्य के लिए तनुकारकों एवं प्रशीतन प्रोटोकाल का मूल्यांकन

वयस्क कतला रोहू, और नैन मछलियों से मत्स्य वीर्य एकत्र किया गया। मत्स्य वीर्यः तनुकारकः डी एम एस ओ 1:3.5:0.5 अनुपात में मिलाने के बाद मत्स्य वीर्य को स्ट्रा में भर कर तरल नत्रजन वाष्प में 10 मिनट उपचार के बाद तरल नत्रजन में रख दिया गया। हिम परिरक्षण के बाद शुक्राणुओं के गतिशीलता एवं प्रस्फुटनता (हैचिबिलिटी) परीक्षण द्वारा मूल्यांकन किया गया। विभिन्न तनुकारकों के प्रभाव का शुक्राणुओं के गतिशीलता पर कोई विशेष अन्तर नहीं देखा गया। प्रशीतन के बाद मूल्यांकन पर शुक्राणुओं की गतिशीलता कतला में 22.53 से 24.65 प्रतिशत तथा नैन के से 24.03 प्रतिशत आंका गया। एन बी एफ जी आर 9बीं तनुकारक का कतला और नैन दोनों के प्रस्फुटन दर पर सबसे अच्छा प्रभाव (कतला 44.98 प्रतिशत एवं नैन 37.82 प्रतिशत) पाया गया।

## जीन बैंक का उत्थान

अधिक मात्रा में अण्डों के प्रस्फुटन के लिए एक पोर्टेबल अण्ड प्रस्फुटन सिस्टम का विकास किया गया जिससे हिमकृत मत्स्य वीर्य से अण्ड निषेचन एवं प्रस्फुटन पर अधिक मात्रा में प्रयोग किया जा सकता है।

## अण्डे एवं शुक्राणुओं के अनुपात का आप्टिमाइजेशन

प्रस्फुटन दर बढ़ाने हेतु अण्डे एवं शुक्राणुओं का सही अनुपात अति आवश्यक है। इसके अन्तर्गत रोहू मछली के अण्डे और शुक्राणुओं का उचित अनुपात ज्ञात करने के लिए कुछ प्रयोग किये गये। प्रथम प्रयोग में जब शुक्राणुओं की संख्या स्थिर रखी गयी थी तब $0.8 \times 10^9$ शुक्राणु प्रति 100 अण्डों के अनुपात से सबसे अच्छी प्रस्फुटन दर 59.8 प्रतिशत प्राप्त किया गया। दूसरे प्रयोग से जिसमें अण्डों की संख्या स्थिर रखी गयी थी, यह अनुभव किया गया कि $0.048 \times 10^9$ शुक्राणु प्रति 100 अण्डों का अनुपात 50 प्रतिशत प्रस्फुटन के लिए पर्याप्त है।

## जर्मप्लाज्म का स्थानान्तरण

जीन बैंक का वास्तविक उपयोग जल क्षेत्र तक ले जाना है। इस उद्देश्य के अनुपालन हेतु हिमाचल प्रदेश से एकत्रित हिमकृत रेनबो ट्राऊट के वीर्य का उपयोग नीलगिरि (तमिलनाडु) के रेनबो ट्राऊट का संकरण कराने के लिए किया गया। इस कार्य को आगे बढ़ाने के उद्देश्य से पुनः हिमाचल प्रदेश से रेनबो ट्राऊट मत्स्य वीर्य का संग्रह कर हिम परिरक्षण किया गया है जिसका उपयोग नीलगिरि में अन्तःप्रजाति संकरण में किया जायेगा।

## 2.6 सी. एम.-12: एक्स *सीटू संरक्षण* के लिए जैव प्रौद्योगिकी तकनीकी का विकास

पूर्ण रूप से जीन बैंक विकसित करने के लिए हिमकृत अण्डों एवं भ्रूण का संरक्षण आवश्यक है। इस परियोजना का उद्देश्य मत्स्य भ्रूणों के हिमकृत परिरक्षण करने की विधि एवं हिमकृत शुक्राणुओं से एन्ड्रोजिनेसिस तकनीकी द्वारा पूर्ण जिनोम प्राप्त करने की तकनीकी का विकास करना है।

### मत्स्य भ्रूण हिमकृत परिरक्षण

इस अध्ययन में विट्रीफिकेशन और अतिमन्द हिमिकरण विधि का प्रयोग किया गया।

### विट्रीफिकेशन

इस विधि में दो प्रकार के विलयनों वी-1 एवं वी-2 का परीक्षण भारतीय मुख्य कार्य के 3 दिन के मत्स्य जीरों पर किया गया। इस अध्ययन से यह निष्कर्ष निकाला गया कि वी-2 विलयन 25 डिग्री ताप पर वी-1 से कम विषैला है किन्तु कुछ समय बाद सभी मत्स्य जीरे मृत पाये जाने के कारण इस तकनीक में सुधार की आवश्यकता है।

### मन्द हिमकरण

इसके अन्तर्गत भारतीय मुख्य कार्प के टेलबड अण्डों के उपर दो प्रकार के हिम परिरक्षकों (अ-1. 5 मो. डी एम एस ओ + 0.5% पी वी. पी, ब-1.5 मो. मिथनाल + 0.5% पी वी पी) का 15 डिग्री से. एवं 25 डिग्री से. पर 30 मिनट तक के लिए प्रभाव का अध्ययन किया गया। इस अध्ययन से यह ज्ञात हुआ कि इन भ्रूणों में परिरक्षक 'अ' $15^{0}$ से. ताप पर परिरक्षप 'ब' से अधिक विषाक्त है।

एक अन्य प्रयोग में क्रायोफ्रीजर के द्वारा विभिन्न क्रमों में ताप 15 डिग्री से शून्य डिग्री. से. तक, 3 डिग्री से. प्रतिमिनट की दर से तथा शून्य से नीचे -12.5 डिग्री से. तापमान तक 1 डिग्री. से प्रतिमिनट की दर से लाया गया। -7 डिग्री से. तापमान पर आइस सीडिंग 30 सेकन्ड तक किया गया। लार्वो का जीव परीक्षण प्रत्येक तापमान पर त्वरित थाइंग कर किया गया। इस अध्ययन से यह पाया गया कि -7/-8 डिग्री से. पर 20/30 सेकेन्ड तक अच्छा आइस सीडिंग प्राप्त किया गया। प्रारम्भिक परिणाम यह दर्शाते हैं कि जिस तापमान पर हिम परिरक्षकों का हिमकरण होता है उसी समय लार्वो की मृत्यु हो जाती है किन्तु उनकी शारीरिक संरचना यथावत रहती है। इस तकनीक में पुनः सुधार की आवश्यकता है।

### गुणसूत्र अभियान्त्रिकी

इस विधि के द्वारा कतला मछली के अण्डों को एकत्रित कर शुक्राणुओं के साथ मिलाकर तालाब के जल में अंडों का निषेचन कराने के बाद विभिन्न समयान्तराल पर 41 डिग्री से. तापमान पर 90 सेकन्ड तक गर्म झटका देकर विकसित होने के लिए रख दिया गया। निषेचन के उपरान्त विभिन्न समयान्तराल के बाद अण्डों का प्रस्फुटन दर ज्ञात किया गया। यह समयान्तराल विभिन्न प्रजाति के मछलियों के लिए भिन्न-भिन्न होता है।

### केन्द्रीय औषधि अनुसंधान संस्थान के साथ सहकार्य

जैव प्रौद्योगिकी विभाग की अनुशंसा के आधार पर इस संस्थान ने केन्द्रीय औषधि अनुसंधान संस्थान, लखनऊ द्वारा संश्लेषित दवा सी डी आर आई-1 का परीक्षण रोहू, कतला तथा नैन मछलियों के प्रजनन पर किया गया। यह दवा रोहू और कतला के उत्प्रेरित प्रजनन में शत प्रतिशत प्रभावकारी पायी गयी किन्तु नैन मछली के उत्प्रेरित प्रजनन में 59 प्रतिशत ही प्रभावकारी पायी गयी। इससे यह निष्कर्ष निकाला गया कि सी डी आर आई -1 मुख्य कार्य के प्रजनन के लिए बहुत उपयोगी है।

## 7: पुस्तकालय एवं सूचना सेवायें

**7.1 पुस्तकालय सेवायें :** ब्यूरो का पुस्तकालय समस्त वैज्ञानिकों के लिये आवश्यक वैज्ञानिक सूचनायें एवं विभिन्न प्रकार के लेखों एवं बिब्लियोग्राफी के भण्डारण का स्रोत है। रा.म.आ.सं. ब्यूरो के पुस्तकालय में इस वर्ष तक 1428 पुस्तकें, 5000 से अधिक पत्र वैज्ञानिक पत्रिकाएं, 1180 विविध प्रकार के प्रकाशन, 1633 पुनर्मुद्रित प्रतियां तथा 126 मानचित्रों का संयोजन किया गया है जिससे ब्यूरो के शोध प्रोजेक्ट्स को अधिक से अधिक वैज्ञानिक कृतियां उपलब्ध करायी जा सकी हैं। इस वर्ष पुस्तकालय ने अपने भण्डारण में 60 नयी पुस्तकें, 79 प्रकाशन, 41 पुनर्मुद्रित प्रतियां तथा 1 मानचित्र का समावेश किया।

**7.2 विनिमय सेवायें :** पुस्तकालय अपने सदस्यों के लिए देशी एवं विदेशी 64 अग्रणी पत्रिकाओं को खरीदता है। देशी एवं विदेशी वैज्ञानिक पत्रिकाओं तथा पत्र - पत्रिकाओं को विनिमय के माध्यम से अथवा निःशुल्क प्राप्त करता है। ब्यूरों ने वार्षिक प्रतिवेदन और विभागीय प्रकाशनों को विभिन्न अनुसंधान संगठनों, विश्वविद्यालयों, उद्यमियों, मत्स्य पालकों को निःशुल्क भेजे ताकि ब्यूरो के अनुसंधान की प्रगति के विषय में दूसरे वैज्ञानिक संस्थानों, विश्वविद्यालयों एवं विभिन्न विभागों को जानकारी हो सके।

**7.3 सूचना सेवायें :** ब्यूरो ने इस वर्ष अपने वैज्ञानिकों, तकनीकी अधिकारियों तथा बाहरी विभागों

को 750 वैज्ञानिक रचनाओं की पुनर्मुद्रित प्रतिलिपियों को उपलब्ध कराया। इसके अतिरिक्त मत्स्य आनुवंशिकी पर चुनी हुई बिब्लियोग्राफी को सी डी एस/आई एस आई एस पैकेज पर संकलन किया गया। ब्यूरो के पुस्तकालय का यह अनुभाग रेप्रोग्राफी सेवाओं के लिये एक सक्रिय खण्ड है।

**7.4 तकनीकी रिपोर्ट :** ब्यूरो की अनुसंधानात्मक प्रगति से सम्बन्धित 50 रिव्यू तथा शोध-पत्रों को विभिन्न राष्ट्रीय तथा अन्तर्राष्ट्रीय पत्रिकाओं में प्रकाशन हेतु पत्राचार किया। ऐसी प्रकाशित अनुसंधानात्मक प्रगति से भ.कृ.अ.प. को ज्ञात कराया। वैज्ञानिक समस्याओं और प्रश्नों का उत्तर भी इसी अनुभाग द्वारा प्रस्तुत किया गया। इस अनुभाग ने ब्यूरो के वैज्ञानिकों द्वारा सेमिनार, संगोष्ठी तथा सम्मेलन आदि से सम्बन्धित कार्य भी किये।

**7.5 रेप्रोग्राफी सेवायें :** पुस्तकालय का यह अनुभाग विभागीय प्रकाशनों का त्वरित रेप्रोग्राफी सेवायें बनाये रखता है। इसके साथ साइक्लोस्टाइलिंग, कॉम्ब बॉइंडिंग तथा इलेक्ट्रोडेटा बाइंडिंग सुविधायें भी संस्थान को समय-समय पर उपलब्ध कराता है।

# 3. INTRODUCTION

## 3.1 Brief History

In view of the national programme for improvement and expansion of both inland and marine fisheries of the country, it has been recognized that enhancement of fish production alone is not enough and conservation of the diversity of the natural fish population is a necessary prerequisite. Appreciating this, the Government of India approved establishment of the Bureau at the end of Sixth Five-Year Plan.

The National Bureau of Fish Genetic Resources was thus sanctioned in December, 1983 under the Indian Council of Agricultural Research.

The infrastructure consisting of building and the farm complexes are under construction in a 51.88 acre plot on the Ring Road, Telibagh, Lucknow.

## 3.2 Mandate

* Collection, classification and evaluation of information on fish genetic resources of the country;
* Cataloguing of genotypes;
* Maintenance and preservation of fish genetic material in co-ordination with other agencies and conservation of endangered fish species; and
* Monitoring the introduction of exotic fish species in Indian waters.

## 3.3 Organisation

The organisational set-up of the Bureau was structured for meeting the objectives. Four centres have been approved in order to take up work on different resources. These are : (i) Freshwater Fish Genetic Resource Centre, located at the headquarters of the Bureau, (ii) Brackishwater Fish Genetic Resources Centre to be located at the headquarters of the Central Institute of Brackishwater Aquaculture, (iii) Marine Fish Genetic Resource Centre is being set up at the Central Marine Fisheries Research Institute at Cochin and (iv) Coldwater Fish Genetic Resource Centre will be located at the headquarters of the National Research Centre for Coldwater Fisheries.

The following subject matter sections have been set up at the headquarters of the Bureau at Lucknow :

i) Cytogenetics
ii) Biochemical Genetics
iii) Biology
iv) Conservation and Management.

The Section of Sl.No. (i) and (ii) would be under the Genetic Characterization Division while the other sections would be under the Conservation Biology Division.

## 3.4 Staff Position

The overall staff position as on 31st March, 1997 is given below :

| Sl.No. | Category of posts | Post sanctioned (No.) | Post created (No.) | Staff in position | Posts vacant (out of created posts) |
|---|---|---|---|---|---|
| 1. | Research Management (Director) | 01 | 01 | 01 | — |
| 2. | Scientific | 40 | 40 | 16 | 24 |
| 3. | Technical | 35 | 24 | 22 | 02 |
| 4. | Administrative | 16 | 16 | 14 | 02 |
| 5. | Supporting | 29 | 15 | 15 | — |
| | **Total** | **122** | **96** | **68** | **28** |

## 3.5 Finance

Allocation of fund and expenditure incurred during the year 1996-97.

| | Budget-Allocation (Rs. in Lakhs) | Expenditure (Rs. in Lakhs) |
|---|---|---|
| Plan | 260.00 | 258.55 |
| Non - plan | 54.00 | 54.00 |
| **Total** | **314.00** | **312.55** |

# 4. RESEARCH ACHIEVEMENTS

## 4.1 Project FB-2 : Conservation of Mahseer in Selected Upland Waters

In India, *in situ* conservation of aquatic resources with public participation has not yet been implemented. In order to develop a package of effective protocols, studies were carried out in a limited area in Kumaon hills (U.P.) for conservation of mahseer. During the period, effort was directed in the following three areas (1) Habitat survey of mahseer streams, (2) Ranching and (3) Mass awareness programme.

### Survey of the Streams

Various upland coldwater stretches of Uttar Pradesh were surveyed and data collected on endangered status of their fish fauna. Habitat inventory of Ladhiya stream from Chalthi bridge upto its confluence with Sharda river (about 15 km) was done covering 15 parameters at 124 sites. Observations were taken on stream depth, width, substrate type, gradient, riparian zone dynamics, bank stability, channel width etc. Using these parameters, the impact due to the natural erosion from Bisauria valley was assessed. The pool-riffle ratio has been sharply decreased after the confluence of Bisauria Nala. The pool riffle ratio from Chalthi bridge to Bisauria Nala was 2:3 while the pool-riffle ratio after Bisauria confluence was 1:4. The detail of occurrence of various types of fish habitat is given in Table 1.

The fishes use pools mostly as their hiding cover and resting place. The undercut banks formed in the banks of the stream provide ideal protection against predators. Pools also help migrating fishes like *Tor puititora* to attain sufficient speed to cross any obstruction like shallow depth, bed of boulders etc. In the riffle area, the fishes are more prone to their predators. Cracks and space between the boulders which are mostly used by fish as a hiding cover in the riffle types were blocked with sand and silt after the confluence of Bisauria

**Table 1 : Percentage occurrence of different types of fish habitat before and after Bisauria Nala joins Ladhiya stream.**

| Habitat type | No. of occurrence (%) | | | |
|---|---|---|---|---|
| | Before Bisauria | | After Bisausia | |
| Pool | 15 | (84.00%) | 16 | (20.00%) |
| Glide | 2 | ( 4.50%) | 0 | (00.00%) |
| Riffle | 15 | (34.00%) | 28 | (35.00%) |
| Cascade | 1 | ( 2.25%) | 8 | (10.00%) |
| Run | 6 | (13.50%) | 18 | (22.30%) |
| **Total no. of observations** | **44** | | **80** | |

Nala. The habitat inventory has clearly revealed the changes in habitat of the endangered *T. putitora*. The present study also indicates that the spawning ground (gravel bed) for *T. putitora* was badly damaged because of heavy sedimentation in Ladhiya stream after Bisauria Nala joins it.

## Mass awareness programmes

A mass awareness programme on conservation of endangered golden mahseer (*Tor putitora*) was organized jointly by NBFGR and Department of Zoology, Kumaon University, Almora at the Department of Zoology premises on June 25, 1996 which was largely attended by scientists of different institutions, students, NGOs and fish farmers (Fig.1). The Director and Scientists of the Bureau stressed the need for the conservation of mahseer which is declining very fast and highlighted the conservation measures. The Head, Professors and Readers of Department of Zoology, Kumaon University also stressed the need for conservation of mahseer in Kumaon region. The participants took keen interest in the discussion and interacted very lively in the Gosthi. It was a beginning of the mass awareness about the requirement and methods of conservation of mahseer in the Kosi stream in U.P. hills.

For conservation of mahseer in upland waters, several gosthis at various places like Tanakpur, Chalthi, Amrohi and Ritha Saheb were organized. These gosthis were largely attended by local people, fishermen, members of different 'Mahseer Bachao Samitis' of the three zones of Ladhiya river. Scientists and other staff of the NBFGR stressed the need of conserving mahseer. Scientists also indicated the reasons for decline and highlighted conservation measures that could be taken up. Emphasis was given for declaring certain parts of the Ladhiya and Sharda rivers as Fish Sanctuary. The Chief Guest of the Gosthi at Tanakpur, Mr. Kavi Dayal, Forest Officer, Sharda Range, suggested that the Forest Department should also be associated in this project which might be useful for the conservation of mahseer in this area. He also informed that under the Forest Conservation Act, there is a provision for a fine of Rs. 10,000/- and one year imprisonment if a person is caught dynamiting or using bleaching powder to kill the fish. The participants took keen interest in the gosthi . Bulletin (in Hindi and English) on 'Save Mahseer' was also released and distributed to the participants. Identity cards were also distributed to the members of 'Mahseer Bachao Samitis' for their effective participation in the programme (Fig.2). Hoarding with educative slogans for conservation of mahseer were also fixed at various places in different areas as a part of the mass awareness programme (Fig.3).

## Restoration by ranching

As a measure of replenishing the declining population of mahseer, mahseer seed ranching programme was organized on June 27, 1996 at Garampani in Kosi stream in U.P. hills (Fig.4). This was done in collaboration with National Research Centre on Coldwater Fisheries, Aquaculture Division of the G.B. Pant University of Agriculture and Technology and U.P. State Fisheries Department.


Fig. 1. ''Mahseer Bachao Gosthi'' at Almora.

Fig. 2. Members of the ''Mahseer Sanrakshan Samiti'' receiving Identity Cards.


Fig. 3. Participants of the ''Mahseer Bachao Gosthi'' and NBFGR project team with ''Save Mahseer'' hoarding.


Fig. 4. Ranching of mahseer in Kosi river.

## 4.2 Project FB-9 : To Develop Databank of Fish Genetic Resources of India

The project aims at developing a database of fish genetic resources of India that can be utilised in undertaking conservation programme. During the period, the available database on 'Fish Genetic Resources of India' was revised by cross-checking the synonyms, taxonomic position of fishes, their habitats and distribution with the help of latest available literature. For taxonomic placement of fishes, the classification of Nelson (1994) was followed. Total number of fish species in different major river systems and States (Table 2) were added to the database.

Preliminary data on the Indian sharks consisting of 68 species was prepared and sent to WWF and the same has been incorporated in their publication 'The Trade in Sharks and Shark Products in India'

A Brain Storming Session on 'Introduction of Improved Strains of Tilapia in Indian Waters' in response to the recommendations of ICLARM/ISRAEL, was organised on 7-8 January, 1997 at NBFGR, Lucknow. The matter was discussed in detail. The important suggestions/opinions of the Experts' Committee have been sent to ICAR.

For conservation of indigenous, valuable and threatened fish resources in wildlife sanctuaries, a tentative list of 441 number of wildlife sanctuaries, some of which are having water bodies useful for fish sanctuaries in different States and Union Territories of India, has been collected and given in Table 3.

**Table 2 : Number of fish species in different major river systems and States.**

| River System/States | No. of Species* |
|---|---|
| Ganga river system | 382 |
| U.P. and Bihar | 111 |
| Ken in Banda, U.P. | 58 |
| Brahmaputra | 126 |
| Mahanadi | 99 |
| Cauvery | 80 |
| Narmada | 95 |
| Tapti | 57 |

*** Many species are common to different river systems.**

**Table 3 : Number of Wildlife Sanctuaries in different States of India.**

| Sl. No. | State/Union Territory | Nos. |
|---|---|---|
| 1. | Andaman & Nicobar Islands | 94 |
| 2. | Andhra Pradesh | 20 |
| 3. | Arunachal Pradesh | 09 |
| 4. | Assam | 09 |
| 5. | Bihar | 19 |
| 6. | Chandigarh | 01 |
| 7. | Daman & Diu | 01 |
| 8. | Delhi | 01 |
| 9. | Goa | 04 |
| 10. | Gujarat | 21 |
| 11. | Haryana | 09 |
| 12. | Himachal Pradesh | 33 |
| 13. | Jammu & Kashmir | 16 |
| 14. | Karnataka | 20 |
| 15. | Kerala | 12 |
| 16. | Maharashtra | 24 |
| 17. | Madhya Pradesh | 32 |
| 18. | Manipur | 01 |
| 19. | Meghalaya | 03 |
| 20. | Mizoram | 03 |
| 21. | Nagaland | 03 |
| 22. | Orissa | 17 |
| 23. | Punjab | 06 |
| 24. | Rajasthan | 22 |
| 25. | Sikkim | 04 |
| 26. | Tamil Nadu | 13 |
| 27. | Tripura | 04 |
| 28. | Uttar Pradesh | 28 |
| 29. | West Bengal | 16 |
| | **Total** | **445** |

In addition to the above, a list of aquatic fish sanctuaries whose location has been decided by virtue of religious sentiments or legislation in twelve States of India has been compiled from various publications and given in Table 4.

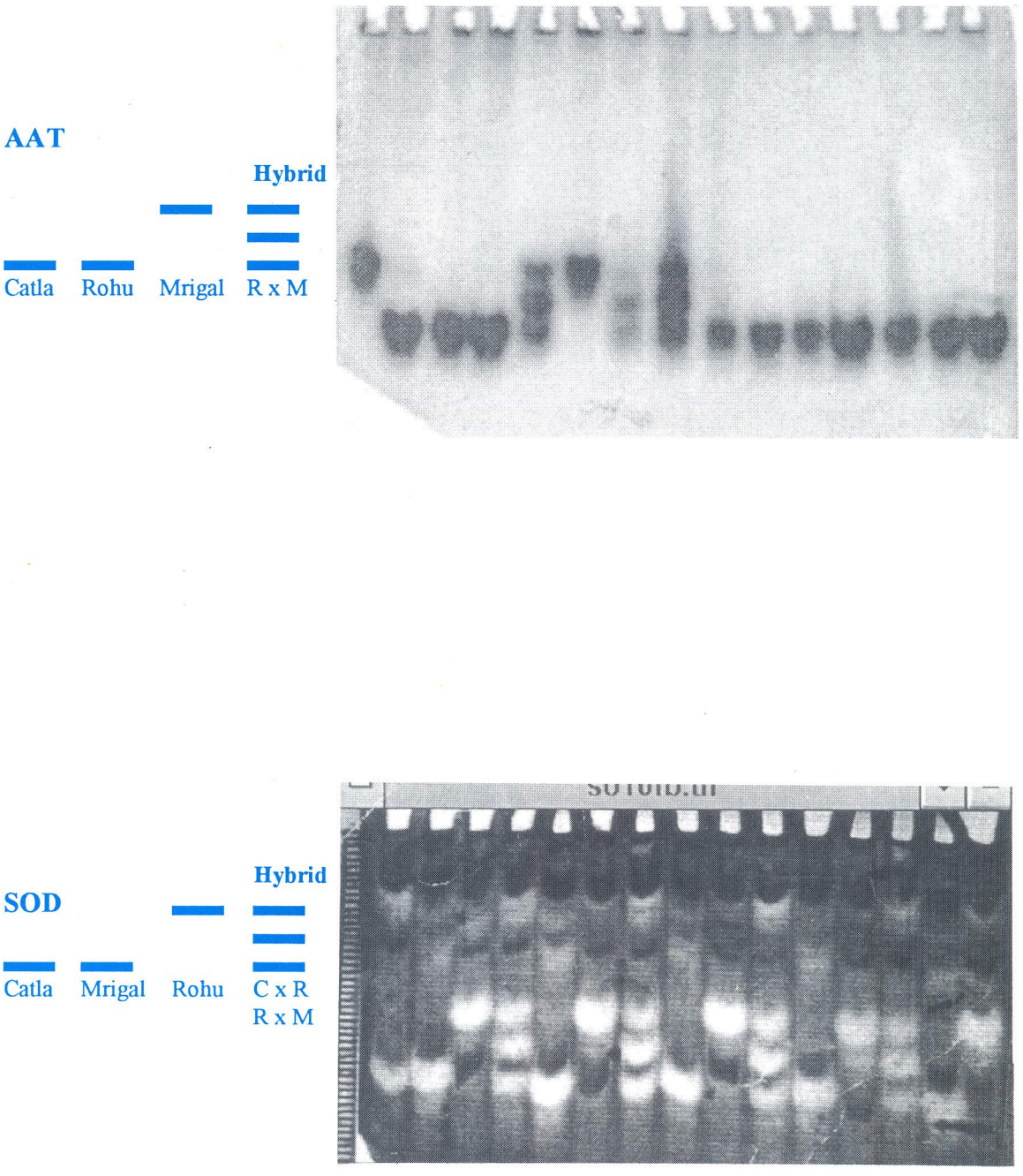
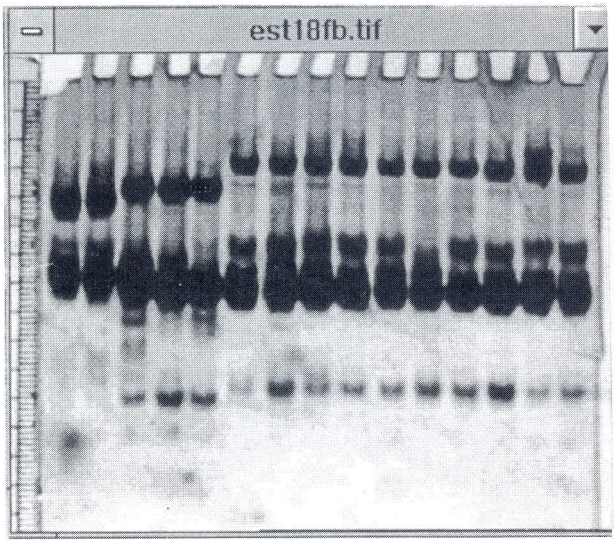



Fig. 5. Species – specific markers in Indian major carps.



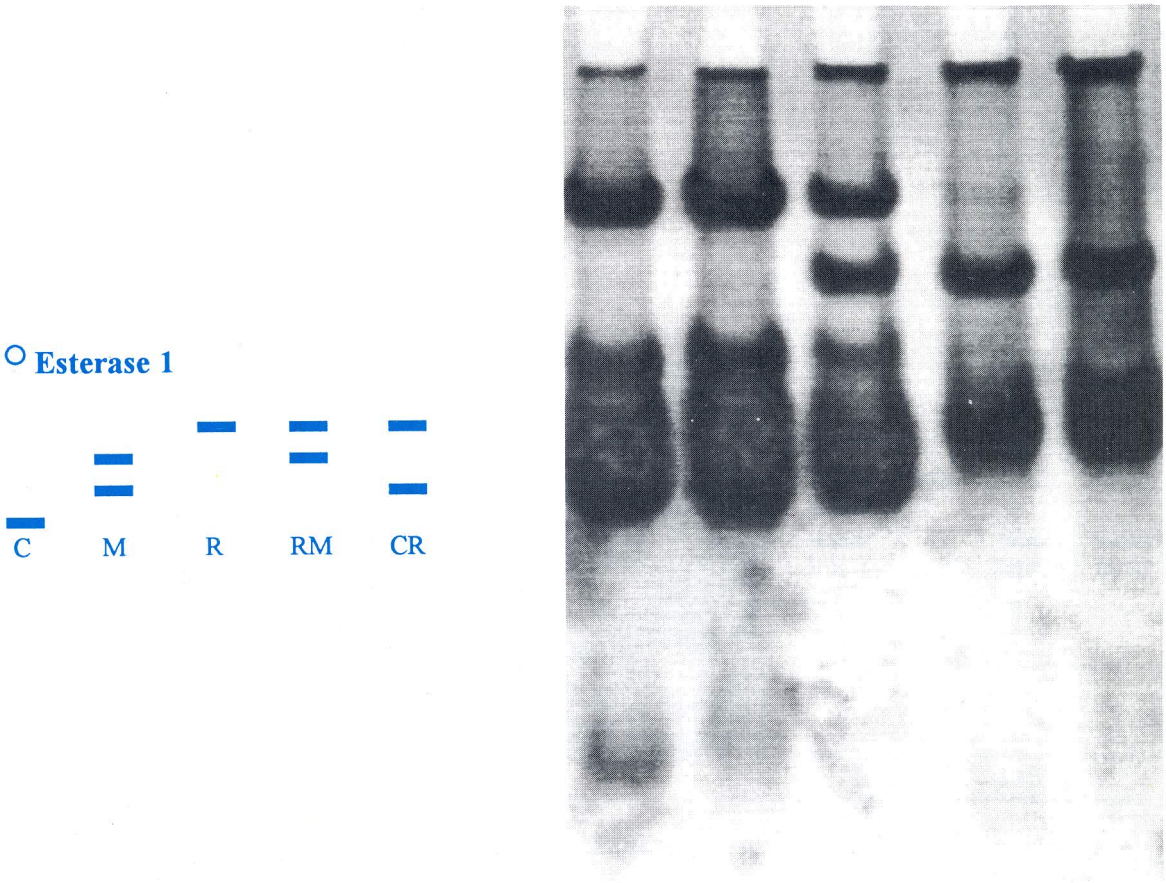




Fig.6. Species – specific markers in Indian major carps.

**Table 4 : Available information on location of Fish Sanctuaries in different States of India.**

| States | By virtue of religious sentiments (Nos.) | By virtue of legislation introduced by Department of Fisheries or Forest (Nos.) |
|---|---|---|
| J.&K. | 2 | 4 |
| Punjab | 1 | 1 |
| H.P. | 1 | 2 |
| U.P. | 5 | 2 |
| Delhi | - | 9 |
| Bihar | - | 1 |
| A.P. | - | 1 |
| M.P. | - | 1 |
| T.N. | - | 3 |
| Kerala | - | 1 |
| Karnataka | - | 8 |
| Maharashtra | 1 | - |
| **Total** | **10** | **33** |

## 4.3 Project BG-10 : Genetic Profile of Prioritized Endangered Species and Wild Strains of Commercially Important Species

For effective management of stocks, there is a need for genetic information of targeted stocks. With this objective in mind, genetic profile of commercially important fishes like Indian major carps, air-breathing fish and introduced exotic species were screened along with endangered fishes. The fishes were screened with already standardized isozyme and isoelectric focussing genetic markers. Work on standardizing the methodology with DNA markers was also carried out.

### Commercially important species

#### Indian major carps

Screening of the hybrids of Indian major carps like catla, rohu and mrigal from hatchery seed was carried out based on morphology and isozyme studies. The enzymes EST-1, SOD, ODH, GLDH, AAT, G6PDH, XDH, GPI, 6PGD and MDH were found to be useful as species - specific markers (Fig. 5,6).

In stock identification studies, αGPDH, PGM, EST - 1, XDH and AAT were found to be polymorphic in Indian major carps and are useful in identifying genetic variation in different stocks of catla, rohu and mrigal.

## Air-breathing fishes

Isoelectric focussing pattern of eye-lens protein profiles of local stocks of *Channa punctatus* showed 18 major protein bands. Based on their isoelectric points (pI), the bands were classified into three groups - α, β and γ crystallines, pI 4.98-5.56 as α–crystalline, pI 5.6 - 5.7 as β-crystallines and pI 7.6 - 8.0 as γ-crystallines. The α-crystallines of *C. punctatus* contained 3 bands which formed 13% of the total soluble proteins. There were 11 β-crystalline bands which formed 57% and 4 γ-crystalline bands having 30% of total soluble proteins.

The IEF profiles of *C. punctatus* haemoglobin showed species-specific pattern and 12 major bands were obtained. There were no significant intraspecies differences in the IEF pattern of local population of *C. punctatus*.

## Introduced exotic fishes

### Common carp

Samples of common carp from Bilaspur State Fish Farm and Rewalsar Lake (H.P.) were characterized through isozyme markers. The analysis revealed contamination of goldfish genome in the farm common carp stocks (Fig.7). The distinctive markers identified are Esterase-2 (EST-2), Superoxidedismutase (SOD) and Octanalol dehydrogenase (ODH). Total of 33.3 per cent introgression was detected. Rewalsar stock did not show any such phenomenon. The finding provided supportive data for the work under the project 'Genetic Upgradation of Commercially Important Fishes of Himachal Pradesh' funded by DBT (Govt. of India). Cross-breeding experiments under the project revealed Rewalsar stock to out-perform the farm stock. In view of the above, replacement of Bilaspur stock with common carp from Rewalsar Lake was recommended.

Eye lenses of common carp, goldfish and their hybrids were characterized by IEF using 5.0 to 8.0 pH ampholines. Species-specific patterns were obtained for both parents and hybrids. Seventeen bands were obtained for common carp and twenty one bands for goldfish and their hybrids exhibited twenty six bands on visual observation. For comparison, the bands were divided into six zones and the zones III and IV of hybrid specimens exhibited bands of both common carp and goldfish.

### Trouts

Distinct genetic differences were detected between Swedish (imported) and local hatchery stocks of rainbow trout (*Oncorhynchus mykiss*) in H.P. using isozyme markers. Species-specific patterns of isozymes were observed in brown (*Salmo trutta*) and rainbow trout (*O. mykiss*) in case of 5 isozymes.

## Endangered species

### Hilsa

Hilsa (*Tenualosa ilisha*) is threatened in certain range of its distribution. Specimens from Farakka Barrage area across river Ganges were screened. Out of the 17 enzyme systems studied in liver tissue, polymorphism was detected in PGM, AAT, G6PDH, EST, α -GPDH and XDH. More samples will be screened for quantifying intrapopulation differences.

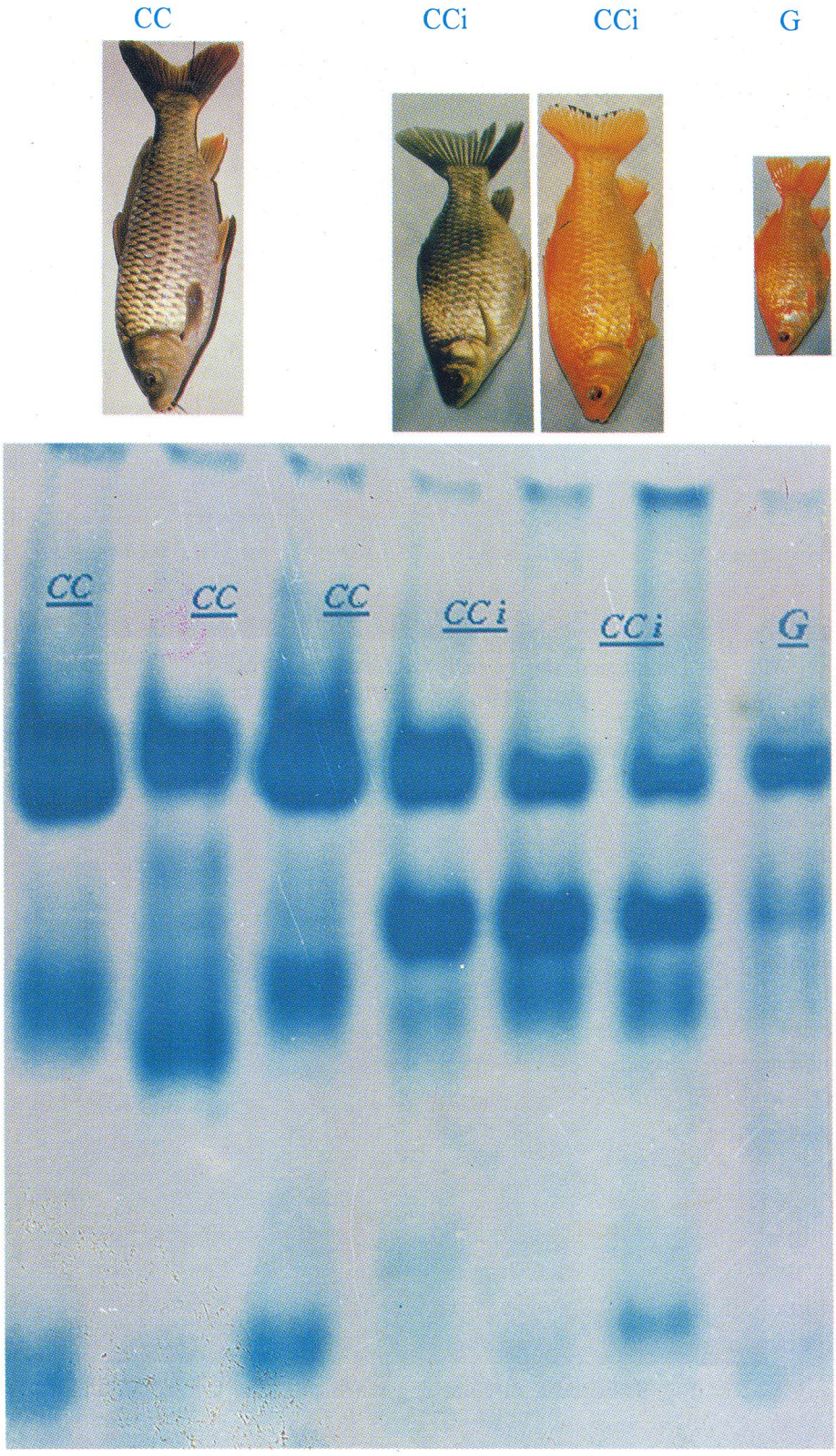



Fig. 7. Genetic contamination in farmed common carp with goldfish genome detected through marker Esterase II. Common carp (CC), Introgressed common carp (CCi) and goldfish (G).

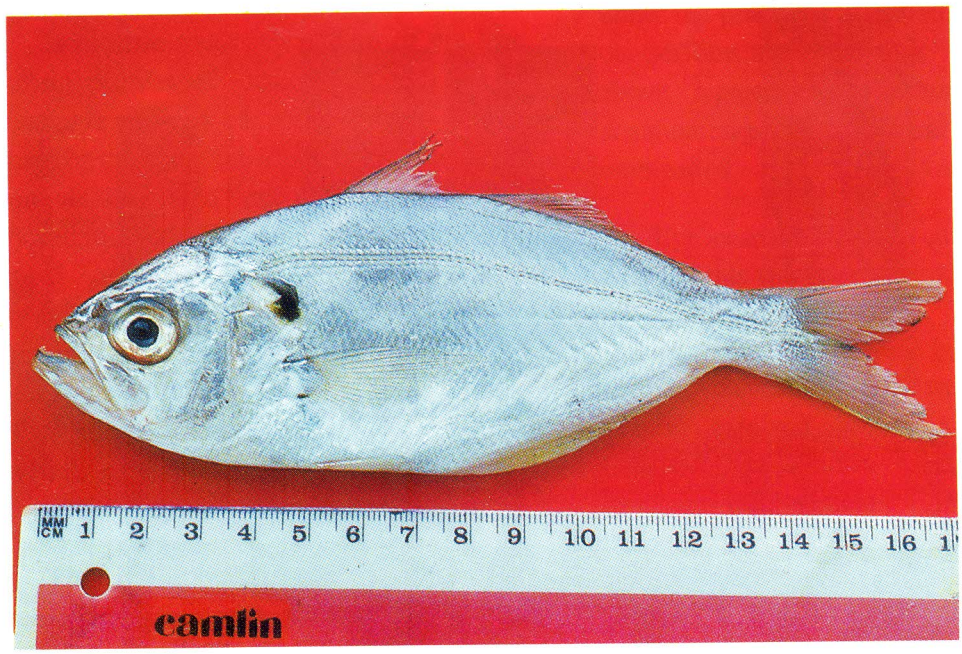



Fig. 8. Threatened marine fish, *Lactarius lactarius*.

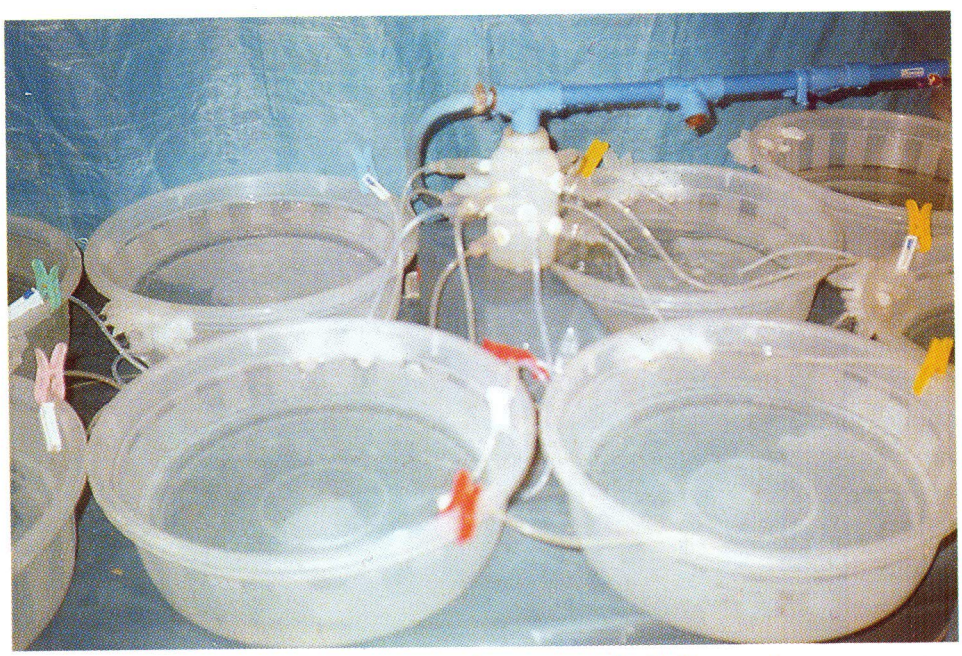


Fig. 9. Portable circular egg-rearing system for Indian major carps.

**Marine whitefish**

Basic isozyme profile of threatened marine monotypic fish, *Lactarius lactarius* (Fig.8), was determined for use in population genetic analysis. Optimal running conditions were standardized and basic profile of enzymes like LDH, SOD, AAT, MDH, MEP, ODH and EST were obtained. Further enzymes will be added and the fish stocks from different coasts will be screened for population genetic analysis.

**DNA markers**

The methodology of isolating mitochondrial (mt) DNA with alkali lysis method in common carp, already standardized, was applied for other fishes viz. *Clarias batrachus, Heteropneustes fossilis* and rohu (*Labeo rohita*) to optimize the methodology but the results were not encouraging.

Genomic DNA isolation methodology was standardized for Indian major carps. Fresh/frozen livers were incubated in lysis buffer (10mM Tris - pH 8.0, 10mM EDTA, 1% SDS and 0.1 mg/ml proteinase K) at 37° C overnight. After phenol chloroform extractions, DNA was precipitated with ethanol and suspended in TE buffer. Concentrations of DNA in each sample was determined by comparing with known concentrations in agarose gel.

For amplification of particular mtDNA fragment, two universal primers whose amplified product was 2.0 and 2.5 kb which included ND1 and 16s RNA and ND5 and ND6 genes, respectively, were selected. It was observed that along with the specified 2.0 kb amplified fragment, other smaller fragments of lower molecular weight appeared consistently. The pattern of these fragments are species-specific in Indian major carps. However, with 2.5 kb fragments, no consistent pattern could be observed.

## 4.4 Project CG-11 : Chromosomal Profile of Endangered Species and Fishes of Economic Importance with Special Reference to Genotoxic Effect of Pollutants

In order to quantify genetic variations using cytogenetic markers within and between populations and to screen genotoxicity of pollutants, studies were carried out.

### Chromosomal variations

**C-Banding**

Specimens of *Labeo rohita* (juveniles), *Mastacembalus armatus, Puntius* spp. *Cirrhinus mrigala, Channa punctatus, Mystus vittatus* and *Labeo gonius* were screened for C-banding with a maximum sample size of five. C-bands has been observed in *Labeo rohita* using 5% barium hydroxide for three minutes. The distribution of C-bands was multisite type. C-bands were found on 8 pair of chromosomes, out of which one was metacentric and rest were telocentric. The majority of telocentrics revealed the presence of centromeric C-bands. Preliminary screening of C-banding has been observed in *C. mrigala.* However, more trials are needed to study the consistency of C-banding in *L. rohita.* C-bands were not distinctly observed in *M. armatus, Puntius* spp., *C. punctatus, M. vittatus* and *L. gonius.*

***In-vitro* colchicinization**

Under this study, trials have been carried out on *Puntius* spp., *Labeo rohita, Cirrhinus reba, Cyprinius caprio* var. *communis* and *Channa punctatus*. The gill and kidney tissues dissected out and maintained in 6 ml Minimum Essential Medium (MEM) containing 2 drops cholchicine (0.5%) for one hour and chromosomes were prepared by using standardized technique. Good metaphase spreads have been observed in *Puntius* spp, however, desirable results have not been obtained in other tested species. Further standardization is needed to determine the species-specific modification of protocol.

## Genotoxic studies

**Micronucleus Test (MNT)**

In order to evaluate genotoxic effect of pollutants, an easier and quick method i.e. micronucleus test (MNT) was employed. In *Channa punctatus*, the sublethal dose was worked out to be 0.033 ml/liter of malathion (E.C. 50%) and the fishes were maintained in the same concentration for the periods of 5, 11 and 16 days. Micronucleus has been detected in the peripheral blood cells of *C. punctatus* after an exposure of 5 days (Fig.10). The percentage of micronucleus in treated cells was 2.6 against the control value 0.3. The percentage of micronuclei ranged from 0.07 to 1.0 with longer exposure.

**Sister chromatid exchange**

Trials on sister chromatid exchange have been carried out in *Channa punctatus, Clarias batrachus* and *Anabas testudineus*. The live specimens were injected intraperitoneally with BrdU at different doses of 50 - 500 µg/gm body weight of fish. The chromosome preparation were done as per standardized technique. In *Clarias batrachus*, it has been found that specimens could not tolerate BrdU injection and succumbed. The sister chromatid differentiation (SCD) by incorporation of base analogue BrdU into two rounds of cells cycle have been achieved in air-breathing fish, *Channa punctatus*. Sister chromatid differentiation was obtained in BrdU tested dose of 0.5 mg/gm body weight. Generally, single sister chromatid exchanges were observed at lower dose of BrdU (0.5 mg/gm body weight) and multiple exchanges in case of higher doses 1 mg/gm and 2 mg/gm body weight (Fig.11). The base-line value of sister chromatid exchange, observed in *C. punctatus* was 0.038/ chromosome at 0.5 mg/gm of BrdU dose.

## 4.5 Project CM-8 : Development of Sperm Banking Technique of Selected Endangered Fishes and Wild Strain of Commercial Species

Gene banking is one of the cost-effective means of *ex situ* conservation. Already considerable work has been carried out for cryopreservation of rohu milt. During period under study, extension of technique to catla and mrigal, upscaling and transfer of genome were studied.

### Evaluation of freezing protocol and extenders for *Catla catla* and *Cirrhinus mrigala*

The milters of catla, rohu and mrigal with good flowing milt were injected with ovaprim @ 0.2 ml/kg body weight and held with female

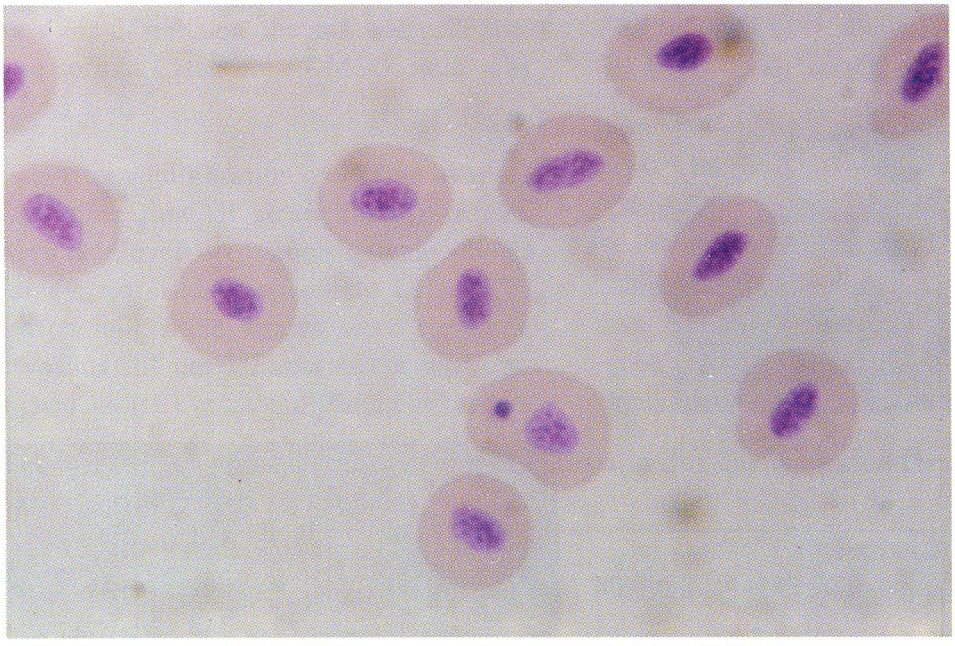


Fig. 10. Induced micronucleus in peripheral blood cells of *Channa punctatus* exposed to malathion.

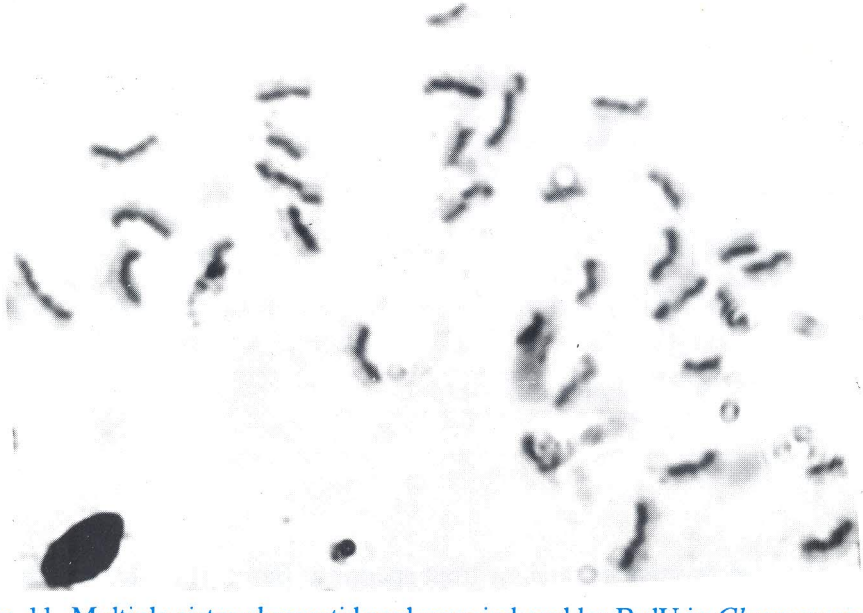
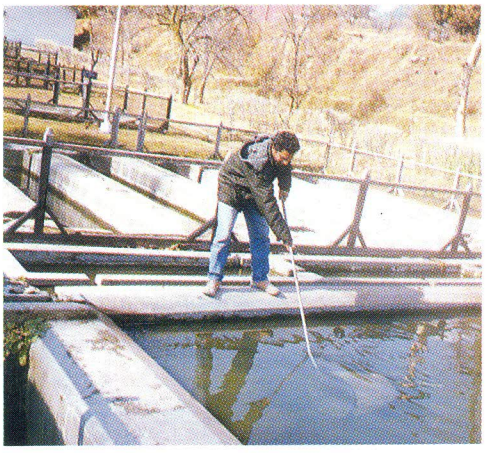


Fig. 11. Multiple sister chromatid exchange induced by BrdU in *Channa punctatus*.



(a) Collection of brooders

(b) Collection of milt

(c) Cryopreservation of milt.

Fig. 12. Cryopreservation of rainbow trout sperms at Barot (H.P.) for crossbreeding of Nilgiri population at Avalanche (T.N.).

fishes under continuous water exchange. After 4 hrs of injection, the milt was collected. The milt : Extender : DMSO ratio was 1.0 : 3.5 : 0.5

After equillibration of 10 min over ice (including time of straw filling), straws were held over $LN_2$ vapours (temp -80°C) for 10 min and plunged into $LN_2$. The frozen milt filled straws were stored in cryocans till use. Experiments were designed to (i) evaluate different extenders for catla and mrigal sperm and (ii) optimize egg - sperm ratio in rohu through hatchability test.

Mature female fish injected with ovaprim @ 0.5 ml (catla), 0.4 ml (rohu) and 0.35 ml (mrigal) per kg body weight were held under water exchange. The free flowing eggs were collected and used for experiment. The activator, Tris glycine with BSA (pH 8.2), found good in motility assessment, was used in all trials with cryopreserved milt.

**Table 5 : Sperm cryopreservation of Indian major carps : extenders used and their chemical composition.**

| Chemical composition (mg/100 ml) | Extenders | | | |
|---|---|---|---|---|
| | NBFGR 3B | NBFGR 7 | NBFGR 7B | NBFGR 9B |
| Sodium chloride | 750.00 | 750.00 | 750.00 | 650.00 |
| Potassium chloride | 38.00 | 20.00 | 20.00 | 141.70 |
| Calcium chloride dihydrate | 00 | 20.00 | 20.00 | 30.00 |
| Sodium bicarbonate | 200.00 | 20.00 | 20.00 | 00 |
| Magnesium sulphate ($MgSO_4.7H_2O$) | 20.00 | 00 | 00 | 19.70 |
| Sodium dihydrogen phosphate | 50.00 | 00 | 00 | 00 |
| Glucose | 100.00 | 00 | 00 | 54.00 |
| Glycine | 500.00 | 00 | 00 | 500.00 |
| Yolk (hen's egg) (%v/v) | 2.00 | 00 | 2.00 | 00 |
| pH | 7.40 | 7.30 | 7.40 | 7.20 |

**Table 6 : Comparative evaluation of extenders through Net Motility Score (n=6) of cryopreserved sperm of catla and mrigal.**

| Extender | Net Motility Score | |
|---|---|---|
| | *Catla catla* | *Cirrhinus mrigala* |
| 3B | 22.53 | 23.30 |
| 7 | 24.30 | 23.89 |
| 7B | 24.65 | 24.00 |
| 9B | 24.63 | 24.03 |

**Table 7 : Comparison of different activating media with respect to Net Motility Score (n=6) of cryopreserved sperm of catla and mrigal.**

| Activator | *Catla catla* | *Cirrhinus mrigala* |
|---|---|---|
| 1% $N_2S_2O_3$ | 00.00 | 1.67 |
| Pond water (pH 8.4) | 24.50 | 24.15 |
| Tris glycine (pH 8.0) | 24.48 | 23.98 |
| Tris glycine-BSA (pH 8.2) | 25.52 | 24.90 |

## Comparative evaluation of extenders

### Motility assessment

In both catla and mrigal, motility and duration of sperms cryopreserved with different extenders were recorded (Table 5). The filtered pond water was used as activator. The net motility score (NMS) was used as quantitative term to compare different extenders. Motility is generally judged subjectively in the scale 10 - 100%. In the NMS, motility level and motility duration both were considered and calculated as NMS = sum of motility level/ 10 and motility duration/5. As shown in Table 6, the motility does not vary between extenders.

Of the four activating media evaluated with extender 9B, $Na_2S_2O_3$ proved an unsuitable activator in that practically nil motility was observed in both catla and mrigal. Pond water (pH 8.4), Tris-glycine (pH 8.0) and TG with BSA (pH 8.2) have more or less similar NMS (Table 7).

### Hatchability test

The sperm cryopreserved using extender 9B resulted in maximum mean hatching percentage in both catla as well as mrigal (Table 8). The mean hatching values were 44.98% (catla) and 37.83% (mrigal) equivalent to 83.11% and 65.46% of control values, respectively. TG with BSA was used as activator for cryopreserved milt in hatchability test.

Hatchability reflects distinct differences between various extenders (Table 8) which could not be revealed by motility assessment. Hence, motility appears to be only useful in screening the various compositions/steps.

**Table 8 : Comparative hatching performance (n=8) of sperm of catla and mrigal cryopreserved with different extenders.**

| | *Catla catla* | | *Cirrhinus mrigala* | |
|---|---|---|---|---|
| Treatment | Percent hatching (Mean ± S.D) | Percentage of control | Percent hatching (Mean ± S.D) | Percentage of control |
| Control | 54.12±8.21 | 100.00 | 57.78±5.06 | 100.00 |
| 3B | 19.31±4.84 | 35.68 | 20.73±2.96 | 35.88 |
| 7 | 14.48±6.83 | 26.75 | 28.22±6.02 | 48.84 |
| 7B | 22.19±7.63 | 41.01 | 35.55±3.34 | 59.80 |
| 9B | 44.98±10.44 | 83.11 | 37.82±3.41 | 65.46 |

**Table 9 : Hatching percentage with varying egg number against constant cryopreserved milt volume (n=3).**

| Number of Straws | Egg number (approx.) | Total milt volume | Sperm/100 ($X10^9$) | Hatching (%) (Mean ± S.D.) |
|---|---|---|---|---|
| 1 | 750 | 0.6 | 0.080 | 52.93± 7.82 |
| 1 | 1500 | 0.6 | 0.040 | 33.71± 8.52 |
| 1 | 2250 | 0.6 | 0.027 | 21.30± 4.38 |
| 1 | 3750 | 0.6 | 0.016 | 19.64± 5.51 |

However, it does not appear to reflect actual success of cryopreservation.

## Upscaling of gene banking

### Portable hatching system

Small portable system is needed to rear eggs in the experiment as IMC eggs give better hatching response if they are in motion and water exchange. The system was required to rear eggs fertilized with the cryopreserved milt on large scale.

The circular current rearing system was designed in a simple way using commonly available materials like IV infusion sets clipped onto side wall of 30 L transparent plastic tub having outlet on opposite side of inlet to give continuous water exchange @ 375 ml/min that kept the eggs in circular motion (Fig.9). The system was tested with rohu eggs collected from hatchery out of regular breeding operation. At an average 73% (n=3) hatching was achieved from these eggs, giving 3633 hatchlings when 5000 eggs were kept for rearing. The advantage of the system is convenience in transport, assembling and water exchange adjustable upto 750 ml/min. The system was used in the experiments for optimizing egg: milt ratio in rohu. The smaller form of the system with 2L capacity basin was used for rearing catla and mrigal eggs in above experiments.

## Optimizing egg-sperm ratio

The fresh eggs were obtained through induced breeding of *L. rohita*. The sampling of eggs was done using micropippette set at 1000 µl and microtip with cut end to accommodate easy sucking of eggs. 1 ml of the eggs, thus sampled, were found to be about 750. By sampling 1 to 5 times, egg number could be varied from 750 to 3750.

**Table 10 : Hatching percentage with varying cryopreserved sperm density against constant egg number (n=3).**

| Number of Straws used | Egg number (approx.) | Total sperm Density ($X10^9$) | Sperm/100 eggs ($X10^9$) | Hatching (%) (Mean± S.D.) |
|---|---|---|---|---|
| 1 | 3750 | 0.6 | 0.016 | 17.90± 8.06 |
| 2 | 3750 | 1.2 | 0.322 | 27.56± 8.06 |
| 3 | 3750 | 1.8 | 0.048 | 50.01± 7.17 |
| 4 | 3750 | 2.1 | 0.064 | 49.19± 4.58 |
| 5 | 3750 | 3.0 | 0.080 | 51.37± 6.19 |

The milt, cryopreserved and stored for 4 days, was used. The extender used was NBFGR 7. This extender has been found to be the best in our previous work with *Labeo rohita*. The milt collected from five males was pooled. The PCV of the pooled milt was 56%, sperm density 6.68 X $10^9$ per ml; equivalent to 0.6 X $10^9$ sperms per 0.5 cc French medium straws. The variation in sperm density was done through varying number of straws.

Two experiments were conducted to optimize the egg : sperm ratio using cryopreserved milt, with either egg number or sperm density kept constant. Increasing the egg number from 750 to 3750 fertilized with constant milt from only one straw equivalent to 0.6 X $10^9$ sperms resulted in lowering of percent hatching. The hatching percent was at the highest at 0.08 X $10^9$ sperms per 100 eggs (52.9%±7.82) (Table 9).

In the second experiment, egg number was kept constant at 3750. The sperm density varied from 0.6 to 3.0 X $10^9$ sperms. Here, the increase of sperm number from 0.6 X $10^9$ to 1.8 X $10^9$ raised hatching percentage nearly three-folds from 17.9 ± 4.60 to 50.0 ± 7.17, thereafter, the increase was negligible (Table 10). It appears that 0.048 X $10^9$ sperms per 100 eggs may be sufficient to give 50.0% hatching. Further increasing the sperm density per 100 eggs did not increase hatching.

## Transfer of germplasm

The attempt was made to validate the concept of transfer of genepool through gene banking under actual field conditions. Based on our earlier successful introduction of wild genome into hatchery stocks of H.P. using cryopreserved milt, studies were undertaken to crossbreed Nilgiri rainbow trout with stocks from Himachal Pradesh using frozen sperms.

The rainbow trout introduced in Nilgiris in 1906 is known to have slower growth as compared to the stock in H.P. The sperms collected in December 1995 from milters at Barot Hatchery (MSL 2000 meters) was cryopreserved and stored for one year at -196°C under liquid nitrogen. In December 1996, the frozen sperms were utilized for fertilizing the eggs collected from running ripe females netted from natural streams at Lakkadi, Daverppetta, Avalanche, Power House (MSL range 2000 to 2300 meters). The fertilized eggs were transported to Avalanche Hatchery and held for rearing in wooden trays under running conditions. Total 3667 eggs were kept for rearing and 2567 eggs recorded to be in eyed stage after 25 days. This is indicative that transfer of germplasm is quite successful even over the long distances. The sites involved in the programme are not only distant but are also at locations difficult to reach. The present programme was greatly affected due to calamities as work scheduled for peak season (November) had to be changed to December and eyed stage did not hatch out including controls due to snowfall and temperature turning subzero.

To continue the work further, fresh collection has been made during January 1997 from Barot (H.P.) and sperms are held frozen and will be used in the breeding season in November, 1997 at Nilgiris for the purpose of intraspecific hybridization (Fig.12 a,b,c).

## 4.6 Project CM-12 : Development of Biotechnological Technique for *Ex Situ* Conservation

For developing fully-operational gene bank, we need to preserve eggs and embryos. This project aims at developing methodology for cryopreservation of embryos. Also, the project aims to develop chromosomal engineering technique of androgenesis for retrieval of whole genome from cryopreserved sperm.

### Embryo cryopreservation

To achieve embryo cryopreservation, both the approaches of vitrification and programmed slow freezing were attempted.

### Vitrification

The following two solutions (V1, V2) : (i) V1 [50% ethylene glyocol + 10% polyvinyl pyrollidone (PVP)] and (ii) V2 (25% glycerol + 20% propandiol + 5% PVP) were screened for their use as vitrificaiton solutions on 3 day old dechorinated spawn of Indian major carps at 25°C. In vitrification experiments, embryos/ larvae died in most cases, prior to freezing during the initial exposure to high concentration of cryoprotectants itself. Therefore, to assess the toxicity of both vitrification solutions as a functions of exposure period, the larvae were exposed for different time intervals (1, 5, 15, 30 sec, 1 and 2 min) and the survival was observed immediately, 3 hr and 20 hr after treatment. The time 1 sec to 2 min were selected to cover the time normally taken for processing the samples before vitrification can be attempted under different vitrification protocols.

It was found that at 2 min exposure, the mean survival percentage after 3 and 20 hrs of treatment, was (i) with VI, 30.74 and 15.38 and (ii) with V2, 77.09 and 54.17, respectively. The study indicated the vitrification solution V2 is less toxic to the spawn at 25°C and can be used for vitrification experiments on Indian major carp larvae. However, vitrification with these solutions resulted in complete mortality indicating the need for standardization of other variables.

### Slow freezing

Dechorionated tail-bud eggs of Indian major carps were exposed to the cryoprotectants (i) 1.5 M DMSO + 0.5% PVP and (ii) 1.5 Methanol + 0.5% PVP at 15°C and 25°C for 30 min to examine their tolerance to various cryoprotectants. The embryos were incubated in hatchery water after exposure to cryoprotectants and their survival was tested after 2 and 20 hrs. It was observed that after 2 hrs, the survival was 100% in both cryoprotectants. But 20 hrs after exposure, the rate of survival of larvae exposed to solution (i) at 15°C was 14.29% and at 25°C was 57.14% and the survival in solution (ii) at 15°C, 42.86% and at 25°C, 33.33%. The chorion of developing embryos act as the barrier in penetration of cryoprotectants leading to death of embryos during freezing. The study indicated that the tail-bud stage of Indian major carps survives even after manual dechorionation and such embryos can be used in cryopreservation experiments. The study has indicated that for IMC embryos, DMSO is more toxic at lower temperatures.

In second set of experiments, the dechorionated eggs after exposure to the cryoprotectants (solutions i and ii) at 15°C for

**Table 11 : Hatching percentage of catla fertilized eggs heat shocked at different time after fertilization (TAF) in four trials (I, II, II, IV).**

| TAF (min) | Hatching (%) I | II | III | IV | Mean |
|---|---|---|---|---|---|
| 8.30 | 10.71 | 22.46 | 6.65 | 11.57 | 12.85 |
| 10.30 | 1.12 | 14.96 | 25.55 | 9.61 | 12.85 |
| 11.00 | 12.31 | 19.77 | 11.08 | 13.76 | 14.23 |
| 12.00 | 18.56 | 17.63 | 35.89 | 19.39 | 22.87 |
| 13.00 | 2.32 | 3.74 | 13.76 | 12.23 | 7.26 |
| 14.00 | 1.16 | 3.20 | 18.16 | 1.75 | 6.07 |
| 15.30 | 9.09 | 6.95 | 3.04 | 1.75 | 4.46 |
| 16.30 | 9.09 | 10.16 | 13.44 | 16.17 | 12.22 |
| 17.30 | 1.16 | 3.21 | 20.10 | 12.01 | 9.12 |
| 18.30 | 10.23 | 5.74 | 2.03 | 5.10 | 5.78 |
| Control | 43.18 | 78.07 | 68.09 | 52.62 | 60.49 |

30 min, the larvae were frozen in cryopfreezer in a step-wise manner from 15°C to 0°C at the rate of cooling of 3.0°C/min and from 0°C to ice-seeding temperatures at the rate of 1°C/min. The final freezing temperatures were +5, -2, -7, -10, -11.5 and -12.5°C. At -7°C, the ice-seeding with a contact period of 30 sec was also carried out. The survival of larvae was tested at each temperature after rapid thawing to 37°C. Immediately after thawing, survival (60-70%) was recorded in embryos exposed to both cryoprotectants (solutions i and ii) upto a freezing temperature of -7°C without ice-seeding. But after 20 hrs, the survival declined to 40% and 25% in DMSO and methanol, respectively. The pattern of survival of embryos frozen to temperature +5 to -7°C was more or less similar. At -7°C with ice-seeding, survival (66%) was recorded immediately in solution (ii) while with solution (i) no survival was observed. Below -7°C (-10, -11.5 and -12.5°C), no survival was recorded. Programmed freezing runs were carried out to determine the ice-seeding temperature of both solutions. The results indicate that ice-seeding was achieved at -7/-8°C for a contact period of 20 to 30 sec. When the molarity of cryoprotectant was increased to 2.0 M, the ice-seeding temperature was -9°C. Without ice-seeding, the solution froze at temperature -10°C and below. These preliminary results indicate that the death of the larvae occurred at the temperature in which the solution froze. However, the physical structural integrity was maintained indicating that further refinement of technique can give results.

## Chromosomal engineering

Catla eggs were freshly collected through induced spawning using ovaprim @ 0.5 ml/kg body weight. The eggs were sampled with a plastic spoon, 150-200 eggs dry mixed with 100 µl of fresh milt, followed by mixing with pond water (100 µl). The eggs were washed and held till heat shock. Heat shock was given by immersing eggs in 41°C water for 90 sec at different time intervals after fertilization (TAF) of 8.30, 10.30, 11.00, 12.00, 13.00, 14.00, 15.30, 16.30, 17.30 and 18.30 min.

After heat shock treatment, eggs were allowed to develop. The four trials carried out indicate the presence of more than one optimum TAF and fish to fish variations. However, the general profile revealed that the maximum hatching is at the 12th min after fertilization (22.87%) (Table 11). Thereafter, hatching rate falls and again rises at 16.30 min (12.22%). This pattern appears to be the result of sensitive periods during the course of development as has been observed in work on gynogenesis by other workers. The present results give a general profile, however, the timings can change depending upon the rearing temperature and fish to fish variation.

## 4.7 Collaborative Work with CDRI, Lucknow

In response to recommandations of DBT Task Force on Aquaculture and Marine Biotechnology, NBFGR had undertaken trials to check the efficiency of a preparation CDRI 1, synthesized by Central Drug Research Institute, Lucknow, for inducing ovulation in Indian major carps. The CDRI 1 has combination of synthetic GnRH analog with dopamine inhibitor. To test the efficacy of this agent, three independent trails were carried out with *Catla catla* (n=26, 0.5 to 3.4 kg), *Labeo rohita* (n=34, 0.4 to 1.4 kg) and *Cirrhinus mrigala* (n=34, 0.6 to 1.5 kg). The drug was injected @ 0.4 µl (catla), 0.3 µl (rohu) and 0.35µl (mrigal) per kg body weight. The drug was found effective in inducing breeding success of 100% for catla and rohu while for mrigal, mean 59% breeding response was observed. More than 33 lakhs spawn for each species were produced in these trials. Experiments to determine hatching success revealed that the mean hatching was 69%, 72% and 54% in catla, rohu and mrigal, respectively. The present study reconfirms the earlier trials that CDRI 1 is an effective and promising agent for induced breeding of major carps.

# 5. TRANSFER OF TECHNOLOGY

## 5.1 Advisory Services

Technical advises pertaining to various aspects like construction and renovation of fish ponds, water quality management, eradication of weed and predatory fishes, and management of nursery, stocking and brood stock ponds were given to fish farmers who visited the Bureau. They were also appraised of the latest aquaculture technologies of polyculture and integrated fish farming including re-cycling of agricultural wastes. The farmers were also acquainted with the applications of synthetic drugs in fish breeding and obtaining better survival percentage.

## 5.2 Farmers' Day

The Bureau participated in the celebration of the 'Farmers' Day' at Krishi Vigyan Kendra, Daroga Kheda, Lucknow on 10.10.1996. Improved quality of fish seed were distributed to the progressive fish farmers and they were also appraised of the latest technologies on aquaculture. Dr. P.V. Dehadrai, Deputy Director General (Fisheries) and Shri Dinesh Rai, IAS, Secretary, U.P. State Fisheries and Animal Husbandry were the Chief Guest on the occasion/function.

## 5.3 Participation in AQUA FAIR-1997

With a view to highlighting the recent advances in fisheries research, AQUA FAIR-1997 was organized by the Inland Fisheries Society of India during the 'National Seminar on Changing Perspectives of Inland Fisheries', March 16-17, 1997 at Central Inland Capture Fisheries Research Institute, Barrackpore. The exhibition was inaugurated by Dr. P.V. Dehadrai, Deputy Director General (Fisheries), Indian Council of Agricultural Research, New Delhi. Most of the fisheries institutions of the country including National Bureau of Fish Genetic Resources, Lucknow participated in the Fair. Various research activities going on at Bureau were highlighted through charts, blow-up photographs and publications. Distinguished scientists of the country as well as fish farmers from West Bengal visited our pavilion (Fig.13). They were appraised of the major research achievements of NBFGR in cataloguing of fish germplasm resources of India, identifying factors responsible for the decline of our fish germplasm resources, *in situ* and *ex situ* measures for the conservation of endangered species, and cytogenetic and biochemical genetic characterization of commercially important and threatened species. Technologies developed by the Bureau for the cryopreservation of milt of commercially important as well as endangered species and monosex production of tilapia were highlighted. Details about the techniques involved in androgenesis and transgenesis of fishes together with the applications of genetic principles in the enhancement of aquaculture production and conservation of threatened fishes were also discussed with the distinguished visitors. Relevant literature published by the Bureau on carp culture, Annual Reports, Brochures and Pamphlets on Mahseer Conservation were also

distributed among the visitors. The Abstract Proceedings 'Fish Genetics and Biodiversity Conservation for Sustainable Production', September 26-27, 1996 at NBFGR, Lucknow was the centre of attraction to the eminent scientists and scholars who visited our stall.

## 5.4 Mass Awareness

The strategy developed and adopted by NBFGR may serve as model for *in situ* conservation of other threatened fishes.

## 5.5 Training Imparted

- Dr. P. Kishore Chandra, Scientist of CIBA, had an exposure to Cryopreservation of sperms of fishes.

- Ms Quendarisa Kharbuli, Research Scholar, Deptt. of Zoology, North Eastern Hill University, Shillong had been given training on Mitochondrial and genomic DNA analysis.

## 5.6 Radio Talks

Talks delivered in All India Radio, Lucknow.

- Dr. A.K. Singh, Farm Manager (T-7) delivered a radio talk on 'Machhalion ki achchhi paidavar ke liye sujhav' on October 24, 1996.

- Dr. A.K. Singh, Farm Manager (T-7) delivered a radio talk on 'Machhalion mei milt sanrakshan avam sanvardhan ki avasyakta' on January 23, 1997.

## 5.7 Other Activities

A batch of 37 B.F.Sc. students from College of Fisheries, University of Agricultural Sciences, Mangalore visited the Bureau. They were appraised of the various research activities of the different divisions.

# 6. LINKAGES

1. Central Inland Capture Fisheries Research Institute, Barrackpore, West Benga
2. Central Institute of Freshwater Aquaculture, Bhubaneshwar, Orissa.
3. Central Marine Fisheries Research Institute, Cochin, Kerala.
4. National Research Centre on Coldwater Fisheries, Haldwani, Nainital.
5. Department of Fisheries, Government of Uttar Pradesh, Lucknow.
6. Department of Fisheries, Government of Himachal Pradesh, Bilaspur.
7. Department of Fisheries, Government of Tamil Nadu, Madras.
8. Zoological Survey of India, Madras, Tamil Nadu.
9. Nature Conservators, Muzaffarnagar, U.P.
10. Department of Biotechnology, Ministry of Science & Technology, New Delhi.
11. Industrial Toxicology Research Centre, Lucknow.
12. Central Drug Research Institute, Lucknow.
13. Department of Geography, BHU, Varanasi, U.P.
14. Indian Institute of Remote Sensing, Dehradun.
15. Manonmaniam Sundarnar University, Tuticorin.
16. School of Life Sciences, NEHU, Shillong, Meghalaya.
17. Department of Zoology, Kumaon University, Almora, U.P.
18. Aquaculture Division of the G.B Pant University of Agriculture and Technology, Pantnagar, U.P.

# 7. HONOURS AND AWARDS

- Dr. P. Das, Ex-Director was elected as Member of the Governing Body of Institute of Ethnobiology, National Botanical Research Institute, Lucknow.

- Dr. P. Das, Ex-Director became Member of the Academic Advisory Committee of the Dr. Babasaheb Bhim Rao Ambedkar University at Lucknow.

- Dr. P. Das, Ex-Director became Member of the Project Evaluation Committee (Scientific Panel) of the ICAR, New Delhi.

- Dr. P. Das, Ex-Director has been awarded Honorary Fellowship of the Bioved Research Society of Allahabad, U.P.

- Dr. A.G. Ponniah, Director was elected as Fellow of the Academy of Environmental Biology (FAEB) of Muzaffarnagar, U.P.

- Dr. A.G. Ponniah, Director was elected as Fellow of the Nature Conservators (FNC) of Muzaffarnagar, U.P.

- Dr. A.K. Pandey, Scientist (Senior Scale) was elected Fellow of Nature Conservators (FNC) of Muzaffarnagar.

# 8. MANPOWER DEVELOPMENT

## 8.1 : Scientific and Technical

The following personnel had undergone training as follows :

| Sl. No. | Name | Title of the training | Duration of training | Place of training |
|---|---|---|---|---|
| 1. | Dr. S.K. Srivastava, Sr. Lab Technician(T-4) | Computer Networking | 8 - 12 April, 1996 | M/s CMC Ltd., Delhi |
| 2. | Mrs. S. Das, Librarian (T-0) | Information Technology: Application in Library & Information Services | 10 - 12 April, 1996 | IIM, Lucknow |
| 3. | Dr. A.K. Pandey, Scientist (Sr. Scale) | Computerization of Monthly Accounts | 18 - 20 April, 1996 | NAARM, Hyderabad |
| 4. | Mr. R.C. Srivastava, AFAO | | | |
| 5. | Mr. Navin Kumar, Sr. Clerk | | | |
| 6. | Mr. Sanjeev Kumar Srivastava, Scientist | PC Trouble Shooting | 22 - 27 April, 1996 | M/s CMC Ltd., Delhi |
| 7. | Dr. S.K. Srivastava, Sr. Lab Technician (T-4) | | | |
| 8. | Dr. A. Barat, Technical Officer (T-5) | E. Mail | 17 - 21 June, 1996 | M/s CMC Ltd., Delhi |

| Sl. No. | Name | Title of the training | Duration of training | Place of training |
|---|---|---|---|---|
| 9. | Mr. R. Dayal, Technical Officer (T-5) | PC Trouble Shooting | 17 - 21 June, 1996 | M/s CMC Ltd., Delhi |
| 10. | Dr. O.P. Pandey, Scientist (Sr. Scale) | MS Windows | 24 - 28 June, 1996 | M/s CMC Ltd., Delhi |
| 11. | Dr. A.K. Pandey, Scientist (Sr. Scale) | | | |
| 12. | Mr. R. Dayal, Technical Officer (T-5) | | | |
| 13. | Mr. P.C. Mahanta, Sr. Scientist | Financial Rules | 15 - 22 July, 1996 | Institute of Secretariate |
| 14. | Dr. O.P. Pandey, Scientist (Sr. Scale) | | | Training & Management (ISTM), New Delhi |
| 15. | Mr. R.S. Patiyal, Technical Officer (T-5) | Induced Breeding, Hatchery Operation | 16 - 31 Aug., 1996 | CIFE, Chinhat, Lucknow |
| 16. | Mr. Sanjeev Kumar Srivastava, Scientist | Statistical Softwares for Data Analysis | 19 - 29 Nov., 1996 | NAARM, Hyderabad |
| 17. | Mr. P. Chithamparam, Library Assistant (T-4) | Information Technology: Application in Library and Information Services | 8 - 10 Jan., 1997 | IIM, Lucknow |
| 18. | Mr. V.S. Basheer, Scientist | Selective Breeding of Rohu, *Labeo rohita* | 19 - 20 March, 1997 | Central Institute of Freshwater Aquaculture, Bhubaneswar |

# 9. LIBRARY AND INFORMATION SERVICES

## 9.1 Library Services

The objective of the library of this Bureau is to provide a comprehensive information services to the entire scientific and technical groups. The library supports NBFGR research projects by providing literature-based information, primary documents and bibliographic data. It has now built up a good collection of 1428 books, over 5000 volumes of journals and serials, 1180 miscellaneous publications, 1633 reprints and photocopies and 126 maps and charts to meet the needs of the users.

60 new books, 79 publications, 41 reprints and 2 maps were acquired during the year under report. The library subscribes to 58 National and International journals and receives 64 Journals and serials in exchange/as gratis. The total expenditure incurred by the library during the year was Rs. 7,53,000.00.

## 9.2 Exchange Services

The library maintained exchange relationship with 64 leading National and International Research Institutes, R and D Organizations, Agricultural Universities and Academic Universities by mailing Annual Reports, reprints of scientific papers and departmental publications as a part of resource sharing and exchanging of information.

The library continued free mailing of Bureau's publications to various Research Institutes, Organizations, Universities, State Fisheries Departments, FFDAs, Enterpreneurs and Fish Farmers to keep them abreast about the activities of this Bureau. The library also provided services to the scientific personnel, Research Scholars, individuals through inter-library loan services and reading room facilities.

## 9.3 Information Services

The library introduced a new service i.e. Current Awareness Service of Books Added to the Library. Bibliographic search service, document supply and reference services including selected databases are offered by the library to its users. The library supplied 750 photocopies of scientific papers to NBFGR scientists, technical staff and to the externals on requests.

## 9.4 Technical Reports

Technical reports on the progress of research activities of the Bureau were compiled and sent to ICAR. 50 review and research papers and abstracts of the Director and scientists were communicated to various National and International journals and Symposia/Seminars/Conferences for presentation and publication.

Technical queries regarding the activities of the Bureau from various quarters of the country and abroad were attended to by the Section. Bio-data sheets in respect of the scientists were compiled and mailed to 10 organizations for inclusion in different year-books and directories.

## 9.5 Reprography Services

The Section maintained active reprography services by producing departmental publications. The Section also provided cyclostyling, comb-binding and electro-data binding facilities for departmental publications.

## 9.6 General Publications

Working paper brought out on :

- 2nd phase of QRT Meeting held on March 25-26, 1996.
- Meeting of the Research Advisory Committee held on April 13, 1996.
- QRT Meeting Report (2nd Draft, 1989-1993) held on April 14, 1996.
- Management Committee Meeting held on April 14, 1996.
- Meeting of Committee for Introduction of Exotic Aquatic Species held on April 15, 1996.
- Report of the Divisional Meeting of ICAR Fisheries Institutes at CMFRI, Cochin during August 2-3, 1996.
- Meeting of the Management Committee held on September 3, 1996.
- Symposium Abstract : Fish Genetics and Biodiversity Conservation for Sustainable Production held on 26-27 Sept., 1996 at NBFGR, Lucknow.
- Research Project proposal for 1996-97 of NBFGR, Lucknow
- Strain Identification in *Labeo rohita* and *Catla catla* with DNA markers : Project proposal for financial support from Department of Biotechnology, Govt. of India, New Delhi, Dec. 6, 1996.
- Brain Storming Session on Introduction of Improved Strains of Tilapia in Indian Waters in response to the recommendations ICLARM/ ISRAEL, held at NBFGR, Lucknow, during 7 - 8 January, 1997.
- Annual Report for 1995-96.

# 10 CONFERENCES, SYMPOSIA AND WORKSHOPS

## 10.1 Symposium Organized

The symposium on 'Fish Genetics and Biodiversity Conservation for Sustainable Production' was organized jointly by the National Bureau of Fish Genetic Resources and Nature Conservators (Muzaffarnagar) at the New Campus, Canal Road, Lucknow during September, 26-27, 1996. The purpose of the Symposium was to achieve the following objectives:

1. Reviewing the present status and threats to our fish genetic resources as well as their habitats, pinpoint prioritized endangered species and conservation strategies.
2. Pooling togather rich experiences in varied but relevant areas including *in situ* and *ex situ* conservation of fish germplasm and their habitats, genetic characterization, and biotechnology with regard to conservation.
3. Discussing the possible ways and means of genetic manipulations on stock improvement to enhance fish production.
4. Integrating the synthesized information to update priorities and formulate the stock improvement methods and to combat the threats to our fish germplasm resources and their habitats in the light of symposium recommendations.

Dr. P. Das, Director, NBFGR, while welcoming all the participants mentioned that scientific efforts and the rich biodiversity of our country were the key factors behind the increase in fish production from 0.4 million tonnes to roughly 4.8 million tonnes in recent times. Yet the nation needed further enhancement in fish catches which would be possible through further improvement in husbandry conditions and application of genetic techniques. He remarked that due to anthropogenic interventions, many fishes had become endangered. Due to reduced genetic variability, these fishes would loose ability to adopt to the changing environment and ultimately quit the wonderful biological world of ours. He emphasized the need for instituting urgent conservation measures. He expressed happiness that there was favourable political will supported by a competent band of scientific and technical community. Concerted efforts would certainly lead to effective conservation measures. He expressed the hope that the present symposium would enable compilation of information as well as synthesis of the same and formulation of a decisive action plan.

The Symposium was inaugurated by Prof. D.R. Gadekar, Vice-Chancellor, Dr. Babasaheb Bhim Rao Ambedkar University, Lucknow who remarked that a great variety of biological wealth and the various ingredients of this

biodiversity were interlinked with each other(Fig.15,16). Any change in this equilibrium of ecosystem would result in decline in fish abundance or even in extinction of species. In view of this, there was an urgent need for scientific and rational management of our resources and developing effective strategies for conservation of fishes. He emphasized that subjects like fish genetics and biodiversity needed to be given proper representation in the academic structure of Universities. Dr. P.V. Dehadrai, Deputy Director General (Fisheries), Indian Council of Agricultural Research, New Delhi in his presidential address, admired the important achievements and progress of NBFGR in the field of fish germplasm conservation and characterization. He said that it was our duty to ensure the sustainability of Indian aquatic biodiversity. For any development and conservation efforts, studies on genetic variations within a species and between species were prerequisites. Further work pertaining to the documentation of genetic resources, evaluation of resources, quantitative genetics and biotechnological outputs was urgently required for genetic improvement and augmenting aquacultural production.

The Symposium was attended by top Scientists, Professors from various Universities, Planners from both Central and State levels and senior-most Developmental officials of the country. The participation of Dr. John Salini, CSIRO, Division of Fisheries, Australia, Dr. K.I. Numachi, School of Marine Sciences and Technology, Kokai University, Japan, Dr. A.K.M. Nuruzaaman, Member-Director, Bangladesh Agricultural Research Council (BARC), Dhaka, Bangladesh and Prof. M.S. Shah, Khulna University, Khulna, Bangladesh elevated the Symposium to an International level and made the discussion all the more lively and useful.

The Symposium was composed of four scientific sessions viz (i) Declining trends in piscine abundance and their habitat degradation, (ii) *In situ* conservation of fish germplasm resources and their habitat restoration, (iii) *Ex situ* conservation and introduction of non-local fish germplasm and (iv) Genetics and biotechnology for fish biodiversity conservation and enhancing fish production. In each session, 2-3 Key Speakers delivered invited lectures. Broad topics of interest were identified for each session and these topics were supported by a set of Resource papers. Salient points/interesting observations of resource papers were summed up by the identified experts. All the resource personnel participated during the discussions in relevant session (Fig. 17-19).

The Plenary Session was chaired by Dr. S.N. Dwivedi, Ex-Additional Secretary, Govt. of India and Chairman, DBT Task Force while Dr. M. Devaraj, Director, CMFRI, Cochin and Dr. K. Gopakumar, Director, CIFT, Cochin were Co-Chairpersons. The recommendations were presented at the Session by Dr. P. Das.

The salient points of recommendations are as follows :

1. Recognizing the damage caused to fish germplasm resources due to increasing population, industrialization and urban-

ization, the symposium recommended that conservation of genetic diversity must be an integral part of policies, programmes and projects that affect fish resource development.

2. Recognizing the requirement of Database for effective conservation programmes, it has been recommended that more research be undertaken on the biology, ecology and genetics of the species targeted for conservation.

3. Recognizing that unless effective steps are taken to protect the fish habitats, more species are likely to be endangered and restoration of habitat is essential for effective *in situ* conservation programmes, the symposium recommended intensification of efforts in these areas.

4. Recognizing the relatively less awareness among the public about conservation of aquatic biodiversity, the symposium recommended that more education, training and mass awareness programmes be launched on aquatic biodiversity conservation for the long-term sustainable production.

5. Since legal measures to protect fish germplasm are not effectively implemented in all parts of India, it is recommended that all State Governments may adopt suitable measures to protect their germplasm resources by declaring sanctuaries and initiating conservation programmes.

6. Understanding that effective conservation for sustainable production can be possible only when legal issues and socio-economic concerns of all the concerned parties are considered, it is recommended that socio-economic, legal and ethical issues and their analysis should become part of the conservation process.

7. Recognizing the enormous potential of our rich fish diversity, the symposium recommended that greater awareness be brought about on intellectual property rights and patent protection for the process and products derived out of research on biodiversity.

8. Recognizing that over-harvesting and discarding bye-catch of less economically important species may lead to serious erosion of biodiversity, it is recommended that these aspects need to be quantified and remedial measures like designing optimum gears, mesh-size regulation and fishing devices that allow escape of the juveniles of commercial and endangered species must be carried out.

9. Understanding the need to have a balanced view on introduction of exotics and transplantation of species within India whereby increased fish production can be achieved without loss of native germplasm, the symposium recommended that specific guidelines may be developed and the introduction should be evaluated on species and location-specific consideration. The need for intensification of research on identification of new endemic species for culture to fill specific ecological niches or demand of the industry was stressed.

10. Recognizing the damages caused by some undesirable exotic fishes which have gained entry into India from other countries, it was recommended that the magnitude of the problem be assessed and steps initiated to eradicate and/or contain their further spread.

11. Recognizing that accidentally and/or intentionally released fish from hatchery may adversely affect wild fish populations, the symposium recommended that this problem be assessed and appropriate approaches be adopted.

12. Recognizing that importance of *ex situ* methods like gene banking and breeding of captive stocks as a supplement or alternative to *in situ* conservation for selected species, it was recommended that on-going programmes on these fields be strengthened.

13. Recognizing that unless genetic diversity within a species is clearly documented, there is a scope for loss of genetic variation, the symposium recommended that on-going programmes in these fields be intensified.

14. Recognizing the vast potential for increasing fish production on a long-term sustainable level through programmes on fish genetic and biotechnology, it was recommended that these areas should receive extra funding for carrying out more programmes.

These recommendations were later on circulated among the concerned State and Central Government Departments and NGOs for necessary actions.

## 10.2 Important Meetings/Events

- 2nd phase of QRT Meeting held on March 25-26, 1996.
- Meeting of the Research Advisory Committee held on April 13, 1996.
- QRT Meeting held on April 14, 1996.
- Management Committee Meeting held on April 14, 1996.
- Meeting of the Committee for Introduction of Exotic Aquatic Species held on April 15, 1996(Fig. 20).
- Divisional Meeting of ICAR Fisheries Institutes held at CMFRI, Cochin during August 2-3, 1996.
- Meeting of the Management Committee held on September 3, 1996(Fig. 14).
- Farewell to Dr. P.Das, Director on his retirement was held at NBFGR, Lucknow on September 30, 1996 (Fig.29).
- A meeting on Brain Storming Session on Introduction of Improved Strains of Tilapia in Indian Waters in response to recommendations of ICLARM/ISREAL held at NBFGR, Lucknow during January 7 - 8, 1997(Fig. 21).

## 10.3 Participation

The Scientists and Technical Staff of the Bureau participated in the following Conference/ Symposia/Meeting etc.

| Sl. No | Name of the Seminar/ Symposia/ Workshop | Organised by | Title of the paper and authors | Name of the participants |
|---|---|---|---|---|
| 1. | National Seminar on Fisheries Education, 23 - 24 May, 1996. | Central Institute of Fisheries Education, Bombay. | — | Dr. P. Das |
| 2. | National Seminar on Impact of Pesticides on the Environment & Human Health, 10 - 11 June, 1996 | Industrial Toxicology Research Centre, Lucknow. | — | Dr. P. Das<br>Dr. A.G. Ponniah<br>Dr. D. Kapoor<br>Shri P.C. Mahanta<br>Dr. A.K. Pandey<br>Dr. O.P. Pandey<br>Dr. K.K. Lal<br>Dr. P.K. Sahoo<br>Dr. A.K. Singh<br>Dr. K.D. Joshi<br>Mrs. S. Das<br>Dr. A. Barat<br>Shri R.S. Patiyal<br>Dr. S.K. Srivastava |
| 3. | Seminar on Networking, 26 July, 1996. | M/s Alphabetics Pvt. Ltd., New Delhi. | — | Shri Sanjeev Kumar Srivastava |
| 4. | National Symposium on Vertebrate, Reproduction, 29 - 31 October, 1996. | Karnatak University Dharwad, Karnatak. | Fish reproductive pheromones : current status and potential applications in aquaculture. - Guest Lecture - A.K. Pandey | Dr.A.K. Pandey |


Fig. 13. NBFGR stall at AquaFair at CICFRI, Barrackpore.

Fig.. 14. Institute Management Committee Meeting.


Fig. 15. Symposium "Fish Genetics and Biodiversity Conservation for Sustainable Productions." Dr. P.V. Dehadrai, DDG (Fy.) lighting the lamp at the Inaugural Ceremony. (L-R) Dr. P. Das, Director, NBFGR, Dr. D.R. Gadekar, Vice Chancellor, Ambedkar University and Dr. P.V. Dehadrai (DDG - Fy.).

Fig. 16. Participants during Inaugural Session of the Symposium.

| Sl. No | Name of the Seminar/ Symposia/ Workshop | Organised by | Title of the paper and authors | Name of the participants |
|---|---|---|---|---|
| 5. | Sixty-Sixth Annual Session of National Academy of Sciences, India, 31 Oct. to 2 Nov., 1996. | Marathwada University, Aurangabad, Maharashtra. | Hypothalamo - neurosecretary system of the sea bass,*Lates calcarifer* (Bloch). - K.K. Lal & A.K. Pandey | Dr. A.K. Pandey |
| | | | Effect of long-acting thyroid stimulator (Lats) and thyroid hormones on pineal melatonin *in vitro*. - A.K. Singh & G.C. Prasad | Dr. A.K. Singh |
| 6. | Seventeenth Annual Session of Academy of Environmental Biology:Sympo on Enironmental Management in Semi- Arid Tropics with Special Reference to Developing Countries. | M.D. Univ., Rohtak, Haryana. | Gene banking for conservation fish biodiversity. - Dr. A.G. Ponniah. | Dr. A.G. Ponniah |
| | | | Pesticides induced alteration in calcium metabolism in vertebrates. - S.A. Suryawanshi, S.P. Rangoonwala & A.K. Pandey | Dr. A.K. Pandey |
| | | | Effect of over-crowding and oxygen depletion on gill of the fry of Indian major carps, *Labeo rohita* and *Catla catla*, - Balbir Singh & A.K. Pandey | |

| Sl. No. | Name of the Seminar/ Symposia/ Workshop | Organised by | Title of the paper and authors | Name of the participants |
|---|---|---|---|---|
| 7 | Ninth All India Congress of Cytology & Genetics, 22 - 25 November, 1996. | Punjab University, Chandigarh. | Karyotype and NOR of golden mahseer, *Tor putitora*. - A. Barat & A .G. Ponniah | Dr. A. Barat |
| 8 | Fourth Asian Fisheries Forum : Indian Branch, 24 - 28 November, 1996. | Cochin University of Science & Technology, Cochin. | Conservation of fish genetic resources. - P. Das | |
| | | | Variability in fish gamete quality and its impact on cryopreservation success. - A.G. Ponniah | |
| | | | Hypothalamo - neuro-secretary system of the marine teleost, *Ariomma indica* (Day, 1870). - A.K. Pandey & M. Peer Mohamed | Dr. A.K. Pandey |
| | | | Polyploidy and its evolutionary significance in fishes. - O.P. Pandey, N.S. Nagpure & A. Barat | |
| | | | Localization of Nucleolar Organizer Region (NORs) in *Cyprinus carpio specularis*. - A. Barat, P. Sahoo & N.S. Nagpure | |
| | | | Implication of pineal melatonin in reproductive management and sex differentiation. - A.K. Singh & A.K. Pandey | Dr. A.K. Pandey |


Fig. 17. One of the Technical Session of the Symposium. (L-R) Dr. P. Das, Dr. P.V. Dehadrai, Dr. K.I. Numachi and Dr. John Salini.


Fig. 18. Prof. C.S. Singh presenting a point during the technical session (on the dias L-R) Dr. P. Das and Dr. George John, Director DBT.

Fig. 19. Group photograph of the Symposium participants.

Fig. 20. Discussion during the meeting of the Committee for Introduction of Exotic Aquatic Species.

Fig. 21. Brain Storming Meeting on Introduction of Improved Strains of Tilapia in Indian Waters. (L-R) Dr. E.G. Silas, Dr. M.Y. Kamal, Dr. A.G. Ponniah, Dr. S.N. Dwivedi and Dr. N.K. Thakur.

| Sl. No | Name of the Seminar/ Symposia/ Workshop | Organised by | Title of the paper and authors | Name of the participants |
|---|---|---|---|---|
| 9. | National Workshop on River Fisheries Management, 8 - 9 January, 1997. | U.P. State Fisheries Department. | — | Dr. A.G. Ponniah<br>Dr. D. Kapoor<br>Shri P.C. Mahanta<br>Dr. (Mrs.) Rehana Abidi<br>Dr. A.K. Singh<br>Shri S.M. Srivastava |
| 10. | Workshop on Networking and Biological Data Analysis, 4 - 6 February, 1997. | Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneshwar, Orissa. | — | Shri Sanjeev Kumar Srivastava |
| 11. | National Symposium on Conservation of Biodiversity, 22 - 23 February, 1997. | Bioved Research Society, Allahabad. | Ecological and genetic implications of red tilapia aquaculture.<br>- A.K. Singh & A.G. Ponniah<br><br>Fish germplasm resources of India : imperiled status and conservation.<br>- D. Kapoor, P.C. Mahanta & A.K. Pandey<br><br>Fish biodiversity of the State of Arunachal Pradesh.<br>P. Nath, P.C. Mahanta & D. Dayal | Shri P.C. Mahanta<br>Dr. A.K. Pandey<br>Dr. A.K. Singh |
| 12. | Workshop on Selective Breeding of Rohu, *Labeo rohita*, 19 - 20 March, 1997. | Central Institute of Freshwater Aquaculture, Bhubaneshwar. | — | Sh. V.S. Basheer |

# 11. VISITORS

The following distinguished personalities visited the Bureau during 1996-97 (Figs.22-28).

| | | |
|---|---|---|
| 1. | Awasthi, S.K. (Shri) | Senior Research Officer, U.P. State Fisheries, Lucknow. |
| 2. | Bhadula, S.K. (Dr.) | Deputy Director General (AH & F), UPCAR, Lucknow. |
| 3. | Dehadrai, P.V. (Dr.) | Deputy Director General (Fisheries), ICAR, New Delhi. |
| 4. | Devaraj, M. (Dr.) | Director, CMFRI, Cochin. |
| 5. | Dubey, G.P. (Dr.) | Retired Director of Fisheries, M.P., Bhopal. |
| 6. | Dwivedi, S.N. (Dr.) | Retired Additional Secretary, Department of Ocean Development, New Delhi. |
| 7. | Gadekar, D.R. (Prof.) | Vice-Chancellor, Dr. B.R. Ambedkar University, Lucknow. |
| 8. | Gopakumar, K. (Dr.) | Director, CIFT, Cochin. |
| 9. | Goswami, U. (Prof.) | Department of Zoology, Gauhati University, Guwahati. |
| 10. | Gupta, H.M. (Shri) | Joint Director, U.P. State Fisheries, Lucknow. |
| 11. | Jakhar, Sushila (Sushree) | Member, Management Committee, Sikar, Rajasthan. |
| 12. | John, George (Dr.) | Director, Department of Biotechnology, New Delhi. |
| 13. | John, Salini (Dr.) | CSIRO Marine Laboratory, Cleveland, Australia. |
| 14. | Johri, V.K. (Shri) | Ex-M.D., U.P. Fisheries Development Corporation, Lucknow. |
| 15. | Kamal, M.Y. (Dr.) | Assistant Director General (Fisheries), ICAR, New Delhi. |
| 16. | Kapoor, R. (Dr.) | General Manager (Computer), UPDESCO, Lucknow. |

Fig. 22. DDG (Fy.) Dr. P.V. Dehadrai and Secretary, ICAR Shri G.S. Sahni examining the model of NBFGR at building site.

Fig. 23. Dr. A.K. Singh (second from left) explaining the work on exotic fishes to the visitors.

Fig. 24. Draft list of Database on Fish Biodiversity of India being explained. (L-R) Sushree Vibha Pandey, Director, Finance, ICAR, Dr. A.G. Ponniah, Director, NBFGR and Dr. D. Kapoor, Senior Scientist.

Fig. 25. Discussion on mass awareness programme in the Fish Conservation and Management Division. (L-R) Dr. Dilip Kumar, NACA, Philippines and Shri P.C. Mahanta, Senior Scientist.

| | | |
|---|---|---|
| 17. | Khuda-Baksh, A.R. (Prof.) | Member, Research Advisory Commitee, Kalyani University, Kalyani. |
| 18. | Krishnamurthy, V. (Dr.) | Director of Fisheries, Andaman & Nicobar Islands, Port Blair. |
| 19. | Kumar, Dilip (Dr.) | Co-Ordinator, NACA, Philippines. |
| 20. | Lohani, J.C. (Shri) | Deputy Director, U.P. State Fisheries, Lucknow. |
| 21. | Mishra, S.R. (Dr.) | Director, IISR, Lucknow. |
| 22. | Narain, Pushpendra (Shri) | Managing Director, U.P. Fisheries Development Corporation, Lucknow. |
| 23. | Numachi, K.I. (Prof.) | School of Marine Science & Technology, Kokai University, Japan. |
| 24. | Nuruzzaman, A.K.M. (Dr.) | Member-Director (Fisheries), Bangladesh Agricultural Research Council, Dhaka, Bangladesh. |
| 25. | Pandey, K.C. (Prof.) | Vice-Chancellor, Ch. Charan Singh University, Meerut. |
| 26. | Pandey, K.D. (Shri) | Director of Fisheries, U.P. State Fisheries, Lucknow. |
| 27. | Pandey, Vibha (Sushree) | Director (Finance), ICAR, New Delhi. |
| 28. | Pathak, S.C. (Dr.) | General Manager (Fisheries), NABARD, Mumbai. |
| 29. | Prasad, R. (Shri) | Deputy Director, U.P. State Fisheries, Lucknow. |
| 30. | Raina, H.S. (Dr.) | Director (Acting), NRC of CWF, Haldwani, Nainital. |

| | | |
|---|---|---|
| 31. | Rishi, K.K. (Prof.) | Kurukshetra University, Kurukshetra, Haryana. |
| 32. | Shah, M.S. (Prof.) | Khulna University, Bangladesh. |
| 33. | Sharma, S.K. (Prof.) | Indian Institute of Managements, Lucknow. |
| 34. | Silas, E.G. (Dr.) | Ex-Vice Chancellor, Kerala Agricultural University, Trichur/Cochin. Kerala. |
| 35. | Singh, C.S. (Prof.) | Dean, G.B. Pant University of Agriculture & Technology, Pantnagar. |
| 36. | Singh, R.P. (Shri) | Member, Management Committee, Sheikhpura, Bihar. |
| 37. | Singh, V.D. (Dr.) | Fisheries Consultant, New Delhi. |
| 38. | Sinha, M. (Dr.) | Director, CICFRI, Barrackpore. |
| 39. | Tripathi, Y.R. (Dr.) | Retd. Director of Fisheries, U.P., Lucknow. |
| 40. | Tyagi, A.P. (Prof.) | Head, Department of Zoology, D.A.V. College, Muzaffarnagar. |
| 41. | Verma, S.R. (Dr.) | General Secretary, Society of Nature Conservators, Muzaffarnagar. |
| 42. | Walker, Sally (Ms) | Secretary, Zoo Outreach Organization, Coimbatore. |
| 43. | Sahai, R. (Dr.) | Principal Scientist, NBAGR, Karnal. |
| 44. | Mohamed, M.P. (Dr.) | Principal Scientist, CMFRI, Cochin. |
| 45. | Diwan, A.D. (Dr.) | Principal Scientist, CIFE, Mumbai. |
| 46. | Reddy, P.V.G.K. (Dr.) | Principal Scientist, CIFA, Bhubaneshwar. |
| 47. | Sugunan, V.V. (Dr.) | Senior Scientist, CICFRI, Barrackpore. |

Fig. 26. Dr.(Mrs.) Vindhya Mohindra, Scientist, presenting work on DNA to DDG (Fy.) and Secretary, ICAR in Biochemical Genetics laboratory.

Fig. 27. Dr. P. Das, Director, NBFGR presenting NBFGR publication to Dr. K.I. Numachi, Kokai University, Japan.

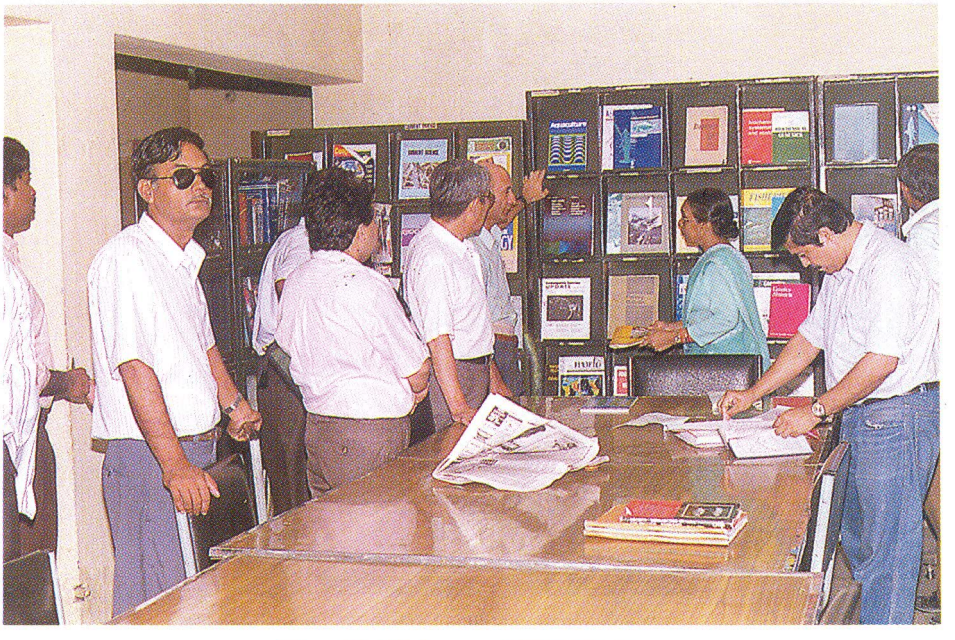


Fig. 28. Visitors at NBFGR library.

Fig. 29. A view of Farewell of Dr. P. Das who retired on 30. 9. 1996.

# 12. SCIENTIFIC PUBLICATIONS

**Barat, A., P.K. Sahoo, N.S. Nagpure and A.G. Ponniah, 1996.**

Micronucleus test (MNT) of peripheral blood cells in the air-breathing fish, *Channa punctatus,* treated with malathion (Abstract). *In* Symposium on Fish Genetics and Biodiversity Conservation for Sustainable Production, 26-27 September, 1996 held at NBFGR, Lucknow. Organised by NBFGR, Lucknow & Nature Conservators, Muzaffarnagar, p.60.

**Barat, A. Peyush Punia and A.G. Ponniah, 1996.**

Karyotype and localization of NOR in threatened species, *Tenualasa ilisha* (Ham.) (Clupeidae: Pisces). *La Kromosomo*, II-82 : 2825- 2832.

**Das, P., 1996.**

Environmental degradation threatening fish biodiversity. Invited Lecture at the National Seminar on Impact of Pesticides on the Environment and Human Health, June 10-11, 1996. Organised by the Academy of Environmental Biology (North Zone Chapter), Lucknow.

**Das, P., 1996**

Manpower requirement for fish genetics and biodiversity conservation in India (Abstract). *In* National Seminar on Fisheries Education, 23-24 May, 1996. Organised by Central Institute of Fisheries Education, p.49.

**Das, P., 1996.**

Strategies for *ex situ* conservation of endangered species (Abstract). *In* Symposium on Fish Genetics and Biodiversity Conservation for Sustainable Production, 26-27 September, 1996 held at NBFGR, Lucknow. Organised by NBFGR, Lucknow & Nature Conservators, Muzaffarnagar, p. 39.

**Das, P. and A.G. Ponniah, 1996.**

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**Lal, K.K., S.K. Srivastava, P.K. Sahoo and A.G. Ponniah, 1996.**

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**Ponniah, A.G. and P.K. Sahoo, 1996.**

Production of hybrids of fish using cryopreserved milt. *In* Third *In*dian Fisheries Forum Proceedings, 11-14 October, 1993, Pantnagar (M.M. Joseph & C.V. Mohan, eds.). Asian Fisheries Society : Indian Branch, Mangalore, P. 95-96.

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# 13. PERSONNEL

## 13.1 List of Personnel

### RESEARCH MANAGEMENT

**Dr. P. Das** - **Director (upto 30 Sept., 1996)**
**Dr. A.G. Ponniah** - **Director (from 30 Sept., 1996)**

### SCIENTIFIC

| | | |
|---|---|---|
| 1. | Dr. D. Kapoor | - Senior Scientist |
| 2. | Shri P.C. Mahanta | - Senior Scientist |
| 3. | Dr. A.K. Pandey | - Scientist (Senior Scale) |
| 4. | Dr. (Mrs.) Rehana Abidi | - Scientist (Senior Scale) |
| 5. | Dr. A. Gopalakrishnan | - Scientist (Senior Scale) |
| 6. | Shri S.P. Singh | - Scientist (Senior Scale) (on study leave) |
| 7. | Dr. N.S. Nagpure | - Scientist (on study leave) |
| 8. | Shri Peyush Punia | - Scientist (on study leave) |
| 9. | Dr. Kuldip Kumar Lal | - Scientist |
| 10. | Dr. (Mrs.) Vindhya Mohindra | - Scientist |
| 11. | Shri Sanjeev Kumar Srivastava | - Scientist |
| 12. | Shri Basdeo Kushwaha | - Scientist |
| 13. | Shri Birbal Singh | - Scientist |
| 14. | Shri V.S. Basheer | - Scientist |
| 15. | Dr. Uttam Kumar Sarkar | - Scientist |
| 16. | Dr. Neeraj Sood | - Scientist |

### TECHNICAL

| | | |
|---|---|---|
| 1. | Dr. A.K. Singh | Farm Manager, T-7 |
| 2. | Shri A.K. Mishra | Electrical Foreman, T-5 |
| 3. | Shri Babu Ram | Farm Engineering Assistant, T-5 |
| 4. | Shri Rajesh Dayal | Field Surveyor, T-5 |
| 5. | Shri S.M. Srivastava | Field Surveyor, T-5 |
| 6. | Shri R.S. Patiyal | Farm Assistant, T-5 |
| 7. | Dr. S.K. Srivastava | Sr. Laboratory Technician, T-4 |
| 8. | Shri P. Chithamparam | Library Assistant, T-4 |
| 9. | Shri Ajay Kumar Singh | Junior Survey Assistant, T-II-3 |
| 10. | Shri S.K. Paul | Junior Survey Assistant, T-II-3 |
| 11. | Shri K.L. Thakur | Laboratory Technician, T-II-3 |
| 12. | Km. Reeta Chaturvedi | Computer Operator, T-II-3 |
| 13. | Shri B.K. Rao | Sample Sorter, T-2 |
| 14. | Shri R.K. Shukla | Sample Sorter, T-2 |

| | | |
|---|---|---|
| 15. | Shri Ved Prakash | Library Attendant, T-2 |
| 16. | Shri Ramashankar Sah | Dark Room Assistant, T-2 |
| 17. | Shri B.N. Pathak | Gestetnar Operator, T-1 |
| 18. | Shri Samarjit Singh | Driver, T-1 |
| 19. | Shri Om Prakash | Driver, T-1 |
| 20. | Shri Madan Lal | Farm Technician, T-1 |
| 21. | Shri Raj Bahadur | Laboratory Technician, T-1 |
| 22. | Shri Gulab Chandra | Electrician, T-1 |

## ADMINISTRATIVE

| | | |
|---|---|---|
| 1. | Shri R.C. Srivastava | Assistant Finance & Accounts Officer |
| 2. | Shri Awadh Sah | Superintendent |
| 3. | Shri R.C.P. Sinha | Stenographer |
| 4. | Shri Panchoo Lal | Assistant |
| 5. | Smt. Chanda Tiwari | Assistant |
| 6. | Shri A.K. Dwivedi | Junior Stenographer |
| 7. | Km. Mamta Roy | Junior Stenographer |
| 8. | Shri Mohan Tiwari | Senior Clerk |
| 9. | Shri Navin Kumar | Senior Clerk |
| 10. | Smt. Kaneez Fatima | Junior Clerk |
| 11. | Shri Swapan Debnath | Junior Clerk |
| 12. | Shri S.N. Srivastava | Junior Clerk |
| 13. | Shri Vinay Kumar Srivastava | Junior Clerk |
| 14. | Shri Sreelal Prasad | Junior Clerk |

## SUPPORTING

| | | |
|---|---|---|
| 1. | Shri Sree Ram | Fieldman, SSG-IV |
| 2. | Shri K.K. Singh | Fieldman, SSG-III |
| 3. | Shri Ram Baran | Fisherman, SSG-III |
| 4. | Shri Laxchman Prasad | Fisherman, SSG-III |
| 5. | Shri Dukhi Shyam Deo | Fisherman, SSG-II |
| 6. | Shri Indrajeet Singh | Messenger, SSG-II |
| 7. | Shri Anil Kumar | Safaiwala, SSG-II |
| 8. | Shri Prahlad Kumar | Safaiwala, SSG-II |
| 9. | Shri Chhote Lal | Fisherman, SSG-II |
| 10. | Shri Ashok Kumar | Laboratory Attendant, SSG-I |
| 11. | Shri Dinesh Kumar | Laboratory Attendant, SSG-I |
| 12. | Shri Santosh Kumar Singh | Fisherman, SSG-I |
| 13. | Shri Balram Babu Bajpai | Lab. Attendant, SSG-I |
| 14. | Shri Rajan Kumar Malhotra | Lab. Attendant, SSG-I |
| 15. | Shri Ashok Kumar Awasthi | Lab. Attendant, SSG-I |

## 13.2 Appointments

### Director

1. Dr. A.G. Ponniah was appointed as a Director of the Bureau w.e.f. 25.2.97 (forenoon).

### Scientists

1. Shri Basdeo Kushwaha joined the Bureau as a Scientist on 2.9.96 (forenoon).
2. Shri Birbal Singh joined the Bureau as a Scientist on 2.9.96 (forenoon).
3. Shri V.S. Basheer joined the Bureau as a Scientist on 16.12.96 (forenoon).
4. Dr. Uttam Kumar Sarkar joined the Bureau as a Scientist on 31.1.97 (forenoon).
5. Dr. Neeraj Sood joined the Bureau as a Scientist on 31.1.97 (afternoon).

### Administration and Technical

1. Shri A.K. Dwivedi, Junior Stenographer joined NBFGR on 1.8.96
2. Shri Gulab Chandra, Electrician (T-1) joined NBFGR on 1.8.96
3. Shri S.N. Srivastava, Junior Clerk joined NBFGR on 23.9.96
4. Shri Vinay Kumar Srivastava, Junior Clerk joined NBFGR on 23.9.96
5. Shri Sreelal Prasad, Junior Clerk joined NBFGR on 24.9.96
6. Shri K.L. Thakur, Laboratory Technician (T-II-3) joined NBFGR on 8.11.96
7. Km. Mamta Roy, Junior Stenographer joined NBFGR on 26.11.96
8. Km. Reeta Chaturvedi, Computer Operator (T-II-3) joined NBFGR on 26.12.96

## 13.3 Promotions

| Sl.No. | Name & Designation | Promoted to (designation) | Date of promotion |
|---|---|---|---|
| 1. | Shri Navin Kumar, Junior Clerk | Senior Clerk | 30.7.96 |
| 2. | Shri Swapan Debnath, Lab. Attendant, SSG-III | Junior Clerk | 30.7.96 |
| 3. | Shri Madan Lal, Fisherman, SSG-III | Farm Technician | 30.7.96 |
| 4. | Shri Raj Bahadur, Lab. Attendant, SSG-III | Laboratory Technician | 30.7.96 |
| 5. | Smt. Chanda Tiwari, Senior Clerk | Assistant | 19.2.97 |
| 6. | Shri K.K. Singh, Fieldman, SSG-II | Fieldman, SSG-III | 22.9.96 |
| 7. | Shri Ram Baran, Fisherman, SSG-II | Fisherman, SSG-III | 22.9.96 |
| 8. | Shri Lachman Prasad, Fisherman, SSG-II | Fisherman, SSG-III | 22.9.96 |

## 13.4 Regularized the Following Temporary Mazdoors in Group - D Posts

| Sl. No. | Name & Designation | Regularized to the post | Date of regularization |
|---|---|---|---|
| 1. | Shri Ashok Kumar, Temporary Mazdoor | Laboratory Attendant, SSG-I | 30.7.96 |
| 2. | Shri Dinesh Kumar, Temporary Mazdoor | Laboratory Attendant, SSG-I | 30.7.96 |
| 3. | Shri Santosh Kumar Singh, Temporary Mazdoor | Fisherman, SSG-I | 30.7.96 |
| 4. | Shri S.N. Srivastava, Temporary Mazdoor | Lab. Attendant, SSG-I | 30.7.96 |

## 13.5 Study Leave Granted

1. Dr. N.S. Nagpure, Scientist of the Bureau has been relieved from the Bureau in the afternoon of 13.9.96 for proceeding on Study Leave for 3 years w.e.f. 16.9.96 at Academic Section, Indian Veterinary Research Institute, Izatnagar (U.P.).

## 13.6 Transfers from NBFGR to Other Institutes

1. Dr. K.D. Joshi, T-5 relieved from the Bureau on the afternoon of 29.6.96 for joining on appointment as Scientist (on probation) at National Research Centre on Coldwater Fisheries, Haldwani.
2. Dr. (Mrs.) P.K. Sahoo, Scientist relieved from the Bureau on the afternoon of 31.7.96 to enable to join the place of her transfer at National Research Centre for Women in Agriculture, Bhubaneswar.
3. Dr. O.P. Pandey, Scientist (Sr. Scale) relieved from the Bureau on the afternoon of 10.10.96 to enable to join the place of his transfer at Indian Veterinary Research Institute, Izatnagar.
4. Smt. S. Das, Librarian (T-5) relieved from the Bureau in the afternoon of 1.2.97 to enable to join the place of her Inter-Institutional transfer at CICFRI Centre at Salt Lake, Calcutta.
5. Dr. A. Barat, Senior Laboratory Technician (T-5) relieved from the Bureau on the afternoon of 11.3.97 to join the place of his Inter-Institutional transfer at Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar.

## 13.7 Others

1. Dr. P. Das, Director retired from the Bureau on 30.9.96 and the charge was taken over by Dr. A.G. Ponniah, Principal Scientist on 30.9.96 (afternoon).

# 14. RESEARCH ADVISORY COMMITTEE

List of members of the Research Advisory Committee of NBFGR, Lucknow.

| | | |
|---|---|---|
| 1. | Dr. A.G.K. Menon<br>Emeritus Scientist<br>ZSI, Chennai | Chairman |
| 2. | Dr. K.C. Mazumdar<br>Scientist E-II<br>CCMB, Hyderabad | Member |
| 3. | Dr. S.R. Verma<br>Professor of Zoology<br>DAV College, Muzaffarnagar | Member |
| 4. | Prof. K.Chatterjee<br>Head, Department of Zoology<br>NEHU, Shillong | Member |
| 5. | Prof. A.R. Khuda-Baksha<br>Department of Zoology<br>Kalyani University, Kalyani | Member |
| 6. | Dr. M.Y. Kamal<br>ADG (Fy.), ICAR<br>New Delhi | Member |
| 7. | Dr. P. Das<br>Director, NBFGR<br>Lucknow | Member |
| 8. | Ms. Sushila Jakhar<br>Advocate, Dasa Ki Dhani<br>Sikar, Rajasthan | Member |
| 9. | Shri Rajeshwar Prasad Singh<br>Sheikpura, Bihar | Member |
| 10. | Dr. A.G. Ponniah<br>Principal Scientist<br>NBFGR, Lucknow | Member-Secretary |

# 15. SCIENTIFIC RESEARCH COUNCIL

List of members of Scientific Research Council of NBFGR, Lucknow.

| | | |
|---|---|---|
| 1. | Dr. P. Das.<br>Director,<br>NBFGR, Lucknow | Chairman<br>(till 30.9.96) |
| 2. | Dr. A.G. Ponniah<br>Director<br>NBFGR, Lucknow | Chairman<br>(from 30.9.96) |
| 3. | Prof. T. Subramoniam<br>Dean (Research)<br>Madras University<br>Chennai | Member |
| 4. | Prof. K.K. Rishi<br>Department of Zoology<br>University of Kurukshetra<br>Kurukshetra, Haryana | Member |
| 5. | Dr. M.Y. Kamal<br>ADG (Fy.), ICAR<br>New Delhi | Member |
| 6. | Prof. Samir Bhattacharya<br>Department of Zoology<br>Visva Bharati University<br>Santiniketan | Member |
| 7. | Dr. D. Kapoor<br>Senior Scientist<br>NBFGR, Lucknow | Member |
| 8. | Shri P.C. Mahanta<br>Senior Scientist<br>NBFGR, Lucknow | Member |
| 9. | Dr. A. Gopalakrishnan<br>Scientist (Senior Scale)<br>NBFGR, Lucknow | Member |
| 10. | Dr. N.S. Nagpure<br>Scientist<br>NBFGR, Lucknow | Member |
| 11. | Dr. K.K. Lal<br>Scientist<br>NBFGR, Lucknow | Member |

# 16. INSTITUTE MANAGEMENT COMMITTEE

List of members of the Management Committee of NBFGR, Lucknow :

| | | | |
|---|---|---|---|
| 1. | Dr. A.G. Ponniah<br>Director<br>NBFGR, Lucknow | - | Chairman |
| 2. | Dr. M.Y. Kamal<br>ADG (Fy.)<br>ICAR, New Delhi | - | Member |
| 3. | Dr. C.S. Singh<br>Head, College of Fisheries<br>G.B. Pant University of Agriculture &<br>Technology, Pantnagar (U.P.) | - | Member |
| 4. | Sushree Sushila Jakhar<br>Advocate<br>Dasa Ki Dhani<br>Sikar, Rajasthan | - | Member |
| 5. | Shri R.P. Singh<br>Raj Savitriniketan<br>Shaikhpura, Bihar | - | Member |
| 6. | Shri K.D. Pandey<br>Director of Fisheries<br>Govt. of Uttar Pradesh, Lucknow | - | Member |
| 7. | Director of Fisheries<br>Govt. of M.P.<br>M.P. | - | Member |
| 8. | Finance Advisor<br>DARE<br>ICAR, New Delhi | - | Member |
| 9. | Dr. D. Kapoor<br>Sr. Scientist<br>NBFGR, Lucknow | - | Member - Secretary |
| 10. | Shri P.C. Mahanta<br>Sr. Scientist<br>NBFGR, Lucknow | - | Member |
| 11. | Dr. A.K. Pandey<br>Scientist (Sr. Scale)<br>NBFGR, Lucknow | - | Member |

# 17. STAFF WELFARE ACTIVITIES

## 17.1 Institute Joint Staff Council

The Institute Joint Staff Council with the below mentioned members existed at the Bureau and considered the matters of common interest concerning the staff.

### Official side

| | | | |
|---|---|---|---|
| 1. | Dr. A.G. Ponniah<br>Director<br>NBFGR, Lucknow | - | Chairman |
| 2. | Dr. D. Kapoor<br>Sr. Scientist<br>NBFGR, Lucknow | - | Member |
| 3. | Shri P.C. Mahanta<br>Sr. Scientist<br>NBFGR, Lucknow | - | Member - Secretary |
| 4. | Dr. A.K. Pandey<br>Scientist (Sr. Scale)<br>NBFGR, Lucknow | - | Member |
| 5. | Dr. (Mrs.) Rehana Abidi<br>Scientist (Sr. Scale)<br>NBFGR, Lucknow | - | Member |
| 6. | Shri R.C. Srivastava<br>A.F. & A.O.<br>NBFGR, Lucknow | - | Member |
| 7. | Shri A. Sah<br>Superintendent<br>NBFGR, Lucknow | - | Member |

### Staff side

| | | | |
|---|---|---|---|
| 1. | Shri P. Chithamparam<br>Library Assistant (T-4)<br>NBFGR, Lucknow | - | Secretary |
| 2. | Shri S.K. Paul<br>Junior Survey Asstt. (T-II-3)<br>NBFGR, Lucknow | - | Member |

| | | | |
|---|---|---|---|
| 3. | Shri Navin Kumar<br>Senior Clerk<br>NBFGR, Lucknow | - | Member |
| 4. | Shri S.N. Srivastava<br>Junior Clerk<br>NBFGR, Lucknow | - | Member |
| 5. | Shri Inderjit Singh<br>Messenger, SSG-II<br>NBFGR, Lucknow. | - | Member |
| 6. | Shri Santosh Kumar Singh<br>Fisherman, SSG - I<br>NBFGR, Lucknow | - | Member |

## 17.2 Grievance Committee

The Grievance Committee has been formed with the members nominated and elected as below:

**Nominated**

| | | | |
|---|---|---|---|
| 1. | Dr. A.G. Ponniah<br>Director | - | Chairman |
| 2. | Dr. D. Kapoor<br>Sr. Scientist | - | Member |
| 3. | Shri P.C. Mahanta<br>Sr. Scientist & Head of Office | - | Member |
| 6. | Shri R.C. Srivastava<br>A.F. & A.O. | - | Member |
| 7. | Shri A. Sah<br>Superintendent | - | Member - Secretary |

**Elected**

| | | | |
|---|---|---|---|
| 1. | Dr. A.K. Pandey<br>Scientist (Sr. Scale) | - | Scientific |
| 2. | Shri Rajesh Dayal<br>T - 4 | - | Technical |
| 3. | Shri Navin Kumar<br>Senior Clerk | - | Administrative |
| 4. | Shri Om Prakash<br>Driver | - | Auxiliary |
| 5. | Shri Ram Baran | - | Supporting |

# APPENDIX - I

**Statement showing the total number of employees and member of Scheduled Castes and Scheduled Tribes amongst them as on 31.3.97.**

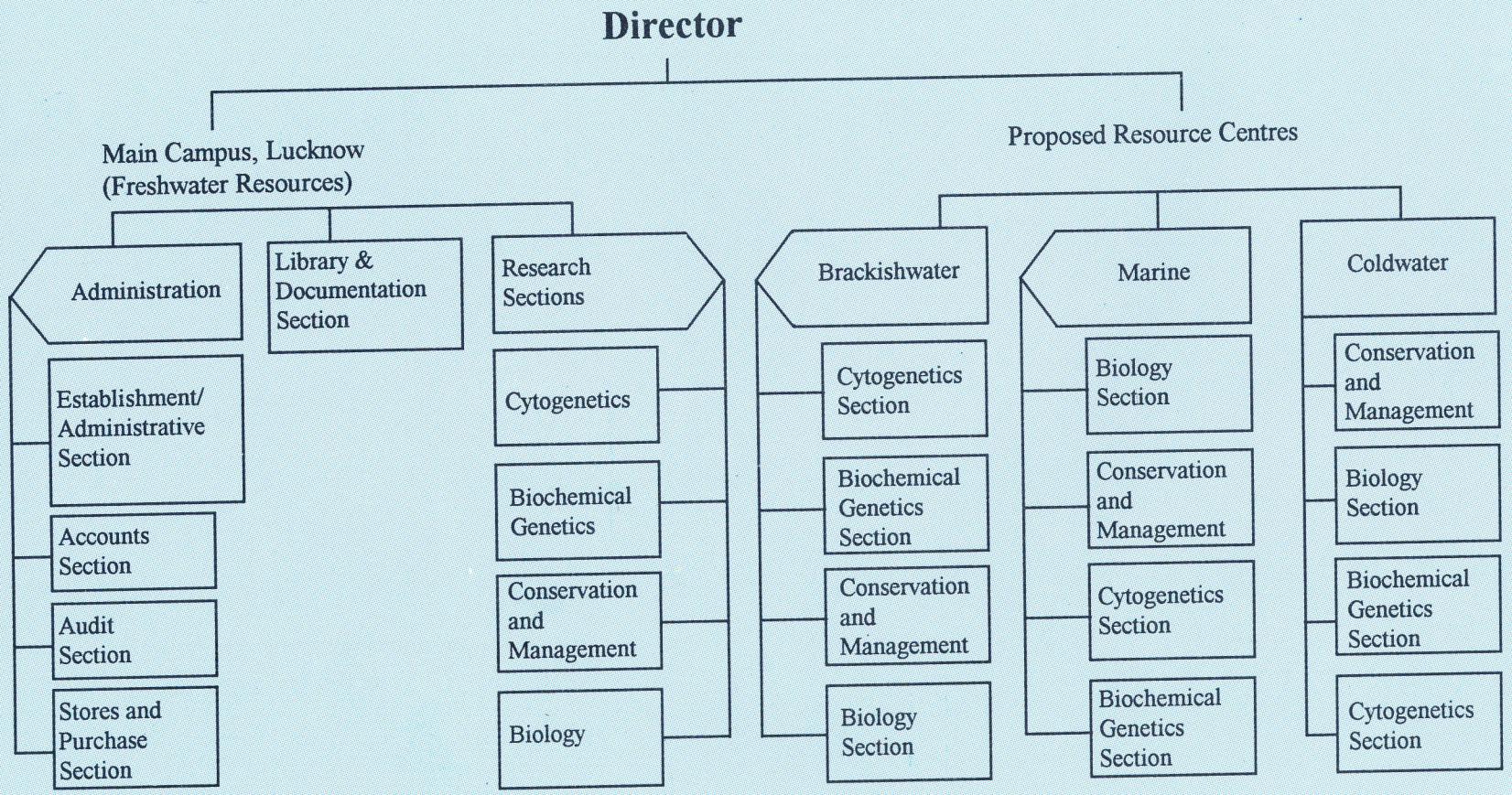
| Sl.No. | Group/Class | Total no. of employees | SC | % SC | ST | %ST |
|---|---|---|---|---|---|---|
| **Group 'A' (Class - I)** | | | | | | |
| 1. | Director | 1 | – | – | – | – |
| 2. | Senior Scientist | 2 | – | – | – | – |
| 3. | Scientist (Sr. Scale) | 4 | – | – | – | |
| 4. | Scientist | 10 | 1 | 10 % | – | – |
| 5. | Farm Manager (T-7) | 1 | – | – | – | |
| | **Total** | **18** | **1** | **10 %** | **–** | **–** |

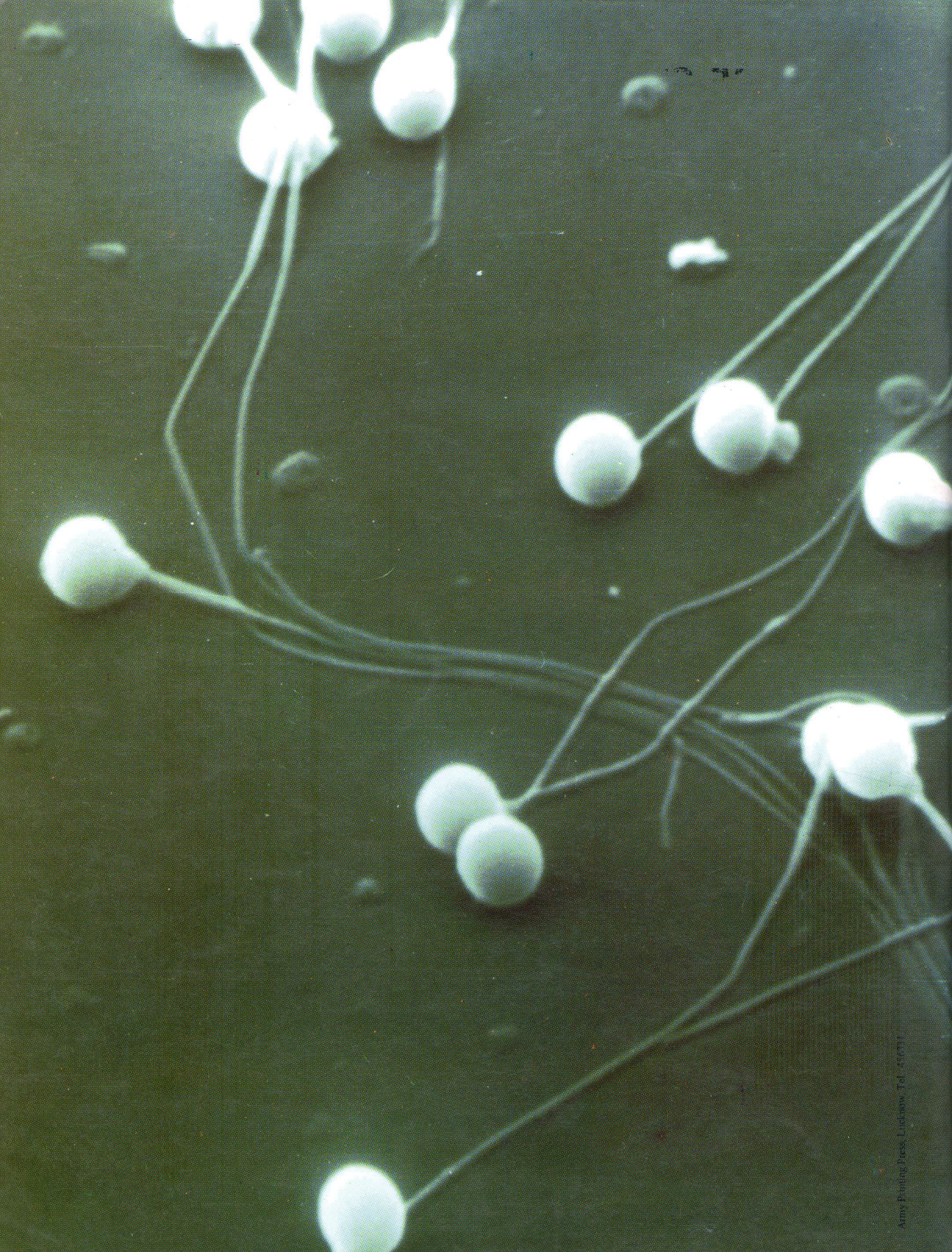
| Sl.No. | Group/Class | Total no. of employees | SC | % SC | ST | %ST |
|---|---|---|---|---|---|---|
| **Group 'B' (Class - II)** | | | | | | |
| 1. | Asstt. Finance & Accounts Officer | 1 | – | – | – | – |
| 2. | Superintendent | 1 | – | – | 1 | 100% |
| 3. | Technical (T-5) | 5 | 1 | 20 % | 1 | 20 % |
| 4. | Technical (T-4) | 2 | – | – | – | – |
| | **Total** | **9** | **1** | **20 %** | **1** | **20 %** |

| Sl.No. | Group/Class | Total no. of employees | SC | % SC | ST | %ST |
|---|---|---|---|---|---|---|
| **Group 'C' (Class - III)** | | | | | | |
| 1. | Technical (T-II-3) | 4 | – | – | – | – |
| 2. | Technical (T-2) | 4 | 1 | 25% | 1 | 25% |
| 3. | Technical (T-1) | 5 | 1 | 20% | – | – |
| 4. | Stenographer | 1 | – | – | – | – |
| 5. | Assistant | 2 | 1 | 50% | – | – |
| 6. | Senior Clerk | 2 | 1 | 50% | – | – |
| 7. | Junior Stenographer | 2 | 1 | 50% | – | – |
| 8. | Junior Clerk | 5 | – | – | 1 | 20% |
| 9. | Auxiliary & Administrative (non-ministerial) | 1 | – | – | – | – |
| 10. | Fieldman, SSG - IV | 1 | 1 | 100% | – | – |
| | **Total** | **27** | **6** | | **2** | |

| Sl.No. | Group/Class | Total no. of employees | SC | % SC | ST | %ST |
|---|---|---|---|---|---|---|
| **Group 'D' (Class - IV)** | | | | | | |
| 1. | Supporting, SSG - III | 3 | – | – | 1 | 33.33% |
| 2. | Supporting, SSG - II | 3 | 1 | 33.33% | – | – |
| 3. | Supporting, SSG - II (Safaiwala) | 2 | 2 | 100% | – | – |
| 4. | Supporting, SSG - I | 6 | 2 | 66.66% | – | – |
| | **Total** | **14** | **5** | | **1** | |

# Organisational Chart





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