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बकिम चन्द्र झा
पी. आर. राव

सामग्री कम्पोजिंग/ : मो. कासिम
लेजर प्रिंटिंग

केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद्)
बैरकपुर: पश्चिम बंगाल

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निदेशक के कक्ष से

‘अंतरराष्ट्रीय खाद्य एवं कृषि संगठन रोम, इटली के प्रतिनियुक्ति के पश्चात् 9 जनवरी 1995 को केन्द्रीय अंतर्स्थलीय मत्स्य प्रग्रहण अनुसंधान संस्थान’ बैरकपुर, पश्चिम बंगाल में इस अनुसंधान संस्थान का कार्य भार ग्रहण किया। प्रारंभिक दौर में संस्थान में चल रहे अनुसंधान कार्यों के समीक्षा के दौरान यह ज्ञात हुआ कि वर्ष 1992-93 का वार्षिक प्रतिवेदन, अपरिहार्य कारणों से, अभी तक प्रकाशित नहीं हो पाया है। अतः इस दिशा में तुरंत कार्रवाई की गई एवं जिसके परिणामस्वरूप आज यह प्रतिवेदन आपके सामने है। केन्द्रीय अंतर्स्थलीय मत्स्य प्रग्रहण अनुसंधान संस्थान, देश के जरूरत के मद्देनजर, बड़े जल संसाधन जैसे कि नदियों, जलाशयों, झीलों ज्वारनदमुख आदि में मछली का उत्पादन और इनके प्राकृतिक स्वरूप के संरक्षण की दिशा में प्रयासरत है। परंतु आज के परिपेक्ष में यह तब तक सम्भव नहीं है जब तक पर्यावरण सम्बन्धी विकारों का उचित उपचार न हो। अतः हमारा संस्थान जलीय प्रदूषण के रोक-थाम की दिशा में भी ठोस काम कर रहा है एवं हमने बहुत ही उपयोगी आंकड़े इकट्ठा किया है।

जलीय प्रदूषण की समस्या ने आज एक गंभीर रूप धारण कर लिया है एवं हमारे जल संसाधन, विशेषकर हमारी नदियों के जल, काफी दूषित हो गए हैं, जो मत्स्य पालन एवं आखेट के लिए घातक सिद्ध हो रहे हैं। जल में पलने व बढ़ने वाले जीव-जन्तुओं के प्रकार तथा मात्रा में निरंतर गिरावट आ रहे हैं, जो देश हित में नहीं है। इस संदर्भ में ‘गंगा परियोजना निदेशालय’, भारत सरकार, द्वारा कर रहे कार्यों की, जिसमें हमारे संस्थान का भी महत्वपूर्ण योगदान है, हम सराहना करते हैं। यह खुशी की बात है कि आज गंगा नदी का जल हरिद्वार से लेकर वाराणसी तक विशेषकर अति प्रदूषित कानपुर क्षेत्र में, तुलनात्मक दृष्टिकोण से पिछले वर्षों की अपेक्षा काफी स्वच्छ हो गया है जिसका श्रेय गंगा परियोजना को ही जाता है।

आज हमारा संस्थान मूलभूत शोध कार्यों के अतिरिक्त परामर्शदाता के रूप में भी कार्य कर रहा है और इस संदर्भ में हमारे पास कई संस्थानों के आग्रह आते रहे हैं जैसे कि 'उत्तर-पूर्व सचिवालय', शिलांग 'राष्ट्रीय ताप विद्युत निगम', भारत सरकार, आदि मुख्य हैं ।

इस प्रतिवेदन के विलम्ब से प्रकाशन के लिए तथा इसके छपाई में कोई गलती या कमी रह गई हो तो हमें खेद है । भविष्य में और भी उत्तम कार्य के साथ प्रतिवेदन प्रस्तुत किया जायगा ।

मुझे आशा है आप यह प्रतिवेदन पसंद करेंगे ।

शुभकामनाओं के साथ,

विश्व रमण प्रसाद सिन्हा

1 जुलाई, 1995

वार्षिक प्रतिवेदन 1992-93

केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान
(भा. कृ. अनु. प.) : बैरकपुर : पश्चिम बंगाल

संक्षिप्त इतिहास

केन्द्रीय अंतर्स्थलीय मत्स्य प्रग्रहण अनुसंधान संस्थान मात्स्यकी शोध एवं प्रबन्ध में अग्रणीय स्थान रखता है। यह संस्थान अब अपने स्थापना के 46वें वर्ष में प्रवेश कर चुका है। इसकी स्थापना 17 मार्च 1947 को कलकत्ता में 'केन्द्रीय अंतर्स्थलीय मत्स्य अनुसंधान केन्द्र' के रूप में भारत सरकार के खाद्य एवं कृषि मंत्रालय के अंतर्गत हुई थी। यह भारत सरकार के 1943 के उस ज्ञापन का परिणाम था जिसमें मत्स्यकीय संसाधनों के विकास पर अविलम्ब कार्यवाही करने पर बल दिया गया था। तदुपरान्त, कृषि, वानिकी तथा मत्स्यकीय से सम्बन्धित उप-समिति ने इसका जोरदार शब्दों में अनुमोदन किया था।

इस संस्थान के छोटे से इतिहास काल में कई महत्वपूर्ण पड़ाव आये। सबसे पहला पड़ाव था वर्ष 1959 का जब कलकत्ता में स्थित 'अनुसंधान केन्द्र' को 'अनुसंधान संस्थान' का पूर्ण दर्जा प्राप्त हुआ एवं बैरकपुर में हुगली नदी के तट पर नवनिर्मित भव्य भवन तथा मनोरम परिवेश में इसका स्थानांतरण हुआ।

इस संस्थान के इतिहास में दूसरा महत्वपूर्ण पड़ाव था वर्ष 1967 का जब यह संस्थान भारतीय कृषि अनुसंधान परिषद् का विधिवत् सदस्य बना और इस प्रकार मत्स्यकीय शोध कार्यों को सही मान्यता एवं अधिक स्वायत्तता प्राप्त हुए।

1970 का दशक इस संस्थान के इतिहास में अत्यंत ही फलदायी एवं गौरवशाली रहा है। 1971 में शुरू हुए चार अतिविशिष्ट और समयोचित समन्वित राष्ट्रीय परियोजनाओं ने मत्स्यकीय अनुसंधान को नई दिशा ही नहीं दिया अपितु समुचित जागृति का भी सृजन किया। ये परियोजनाएँ थी 'मिश्रित मत्स्य पालन', 'नदीय मत्स्य बीज संचयन', 'वायु श्वासी मत्स्य पालन' और 'जलाशय पारिस्थितिकी का अध्ययन एवं प्रबन्धन'। एक और समन्वित राष्ट्रीय परियोजना 1973 में 'खारा जल मत्स्य पालन' के नाम से शुरू की गयी थी। सन् 1974 में प्रथम दो परियोजनाओं का एकीकरण होकर 'मिश्रित मत्स्य पालन एवं मत्स्य बीज उत्पादन' हो गया। मत्स्य पालन के उपयोगिता को समझते हुए भारतीय कृषि अनुसंधान परिषद् ने 1977 में 'मीठा जल जीव पालन अनुसंधान एवं प्रशिक्षण केन्द्र' की स्थापना धौली, उड़िसा में किया, जिसने बाद में चलकर संस्थान का दर्जा हासिल किया। मिश्रित मत्स्य पालन एवं मत्स्य बीज उत्पादन परियोजना ने विशेषकर, मत्स्य अनुसंधान एवं उत्पादन में आशातित सफलता हासिल किया और इस प्रकार मत्स्यकीय उत्पादन के अम्बर में एक नये क्षितिज का उदय हुआ। लोगों में मत्स्य पालन के

प्रति सही चेतना के साथ-साथ कृषि के इस आयाम के प्रति विश्वास का भी जागरण हुआ और इस प्रकार मत्स्य पालन ने एक आन्दोलन का रूप ले लिया और यही कारण है कि आज हम इसे उद्योग के रूप में देख रहे हैं ।

संस्थान के इतिहास ने एक और करवट लिया वर्ष 1985 में जब इस संस्थान ने तीन नये मत्स्यकीय अनुसंधान संस्थानों को जन्म दिया और वे हैं:- केन्द्रीय मीठा जल जीव पालन अनुसंधान संस्थान, धौली, उड़िसा, केन्द्रीय खारा पानी जलजन्तु पालन अनुसंधान संस्थान, मद्रास एवं राष्ट्रीय शीतजल मत्स्यकीय अनुसंधान केन्द्र, हल्दवानी । अप्रैल, 1987 को इस संस्थान का पुनः नामकरण 'केन्द्रीय अंतर्स्थलीय मत्स्यकीय प्रग्रहण संस्थान' हो गया एवं इसे उन्मुक्त जलीय संसाधनों में शोध का कार्यभार सौंपा गया ताकि इन संसाधनों का मत्स्यकीय प्रबन्धन पर्यावरण के अनुकूल हो सकें और साथ ही इनका संरक्षण भी हो सकें ।

प्रारम्भ से ही संस्थान के शोध कार्यक्रम का प्रमुख उद्देश्य था मत्स्यकी संसाधनों का सही मूल्यांकन, उचित संरक्षण तथा उद्देश्यपूर्ण उपयोग । अतः इस संस्थान ने अपने शोध कार्यक्रमों का मात्र निर्वाह ही नहीं किया अपितु कई कीर्तिमान भी स्थापित किए । विभिन्न प्रकार के जलीय संसाधनों जैसे कि नदी, जलाशय, झील, पोखर, तालाब, ज्वारनदमुख आदि के पारिस्थितिकी के गुणधर्मों को सुलझाने के सार्थक प्रयास के साथ-साथ मत्स्य उत्पादन और प्रग्रहण प्रक्रियाओं में भी समुचित सुधार लाया है । इस संस्थान ने जलीय पर्यावरण का भी गहन अध्ययन एवं शोध किया है ताकि 'जैविक विविधता' के स्तर को बनाये रखने के उपाय खोजे जा सकें और स्वस्थ मछलियों का उत्पादन हो सके ।

इस संस्थान द्वारा किये गये ठोस अनुसंधान का ही परिणाम है कि आज देश के समक्ष कई महत्वपूर्ण तकनीकी एवं प्रबन्धन प्रणालियाँ उपलब्ध हैं जो निम्न हैं:-

- 1) नदीय संसाधनों से मत्स्य बीज संचयन प्रणाली ।
- 2) मत्स्य बीज परिवहन सम्बन्धित तकनीक ।
- 3) कार्प मछलियों का प्रेरित प्रजनन एवं नर्सरी प्रबन्धन प्रणाली ।
- 4) चाइनिज कार्प का बंध प्रजनन विधि ।
- 5) जलीय अपतृणों का नियंत्रण विधि ।
- 6) मिश्रित मत्स्य पालन प्रणाली ।
- 7) वायु-श्वासी मछलियों का उत्पादन प्रणाली ।
- 8) छोटे जलाशयों में मत्स्यकीय प्रबन्धन ।
- 9) खारा जल मत्स्य पालन प्रणाली ।
- 10) घोंघा उत्पादन प्रणाली ।

आज देश के अंतर्स्थलीय मत्स्य उत्पादन करीब 20.0 लाख टन है जो 1950-51 के 2.2 लाख टन से लगभग नौ गुना अधिक है । यह अपने आप में एक कीर्तिमान है । इसमें उपरोक्त तकनीक एवं शोध प्रणालियों का ही योगदान है ।

संस्थान के उद्देश्य

इस संस्थान के निम्नलिखित मुख्य उद्देश्य हैं:-

- 1) अंतर्स्थलीय जलीय संसाधनों में मत्स्य समुदाय की संख्या एवम् प्रकार पर शोध कर समुचित प्रबन्धन प्रणाली का विकास तथा उत्पादन में वृद्धि ।
- 2) मत्स्यकीय जल संसाधनों में विभिन्न प्रकार के जीव-जन्तुओं का प्रभाव पर शोध द्वारा उचित वैज्ञानिक प्रणाली का विकास कर इनका संरक्षण और प्रबन्धन ।
- 3) नदी-घाटी परियोजनाओं का नदी तल क्षेत्र एवं जलाशयों के पारिस्थितिकी पर विपरीत प्रभाव का समुचित अध्ययन तथा इनके प्रबन्धन के लिए उचित वैज्ञानिक पद्धति का विकास ।
- 4) अंतर्स्थलीय मत्स्यकीय से सम्बन्धित आँकड़ों का क्रम-बद्ध संचयन एवम् प्रसार ।
- 5) मत्स्यकीय शिक्षा, प्रशिक्षण एवम् प्रसार कार्यक्रमों का आयोजन ।
- 6) मत्स्य प्रग्रहण तथा उत्पादन, जलीय प्रदुषण, संरक्षण आदि पर परामर्शक सेवाएँ ।

संगठन

उपरोक्त उद्देश्यों की प्राप्ति हेतु संस्थान के अनुसंधान कार्यक्रम देश के प्रमुख मत्स्यकी संसाधनों के अनुरूप सात प्रभागों के अंतर्गत रखा गया है । नदीय मत्स्यकी प्रभाग, अपने इलाहाबाद स्थित मुख्यालय से देश के प्रमुख नदियों में पर्यावरण संरक्षण को सर्वोपरि मान कर शोध कार्य कर रहा है ताकि सही प्रबन्धन प्रणाली का विकास हो सके । नदीय प्रभाग के तत्काल परियोजनाओं में गंगा, यमुना, ब्रह्मपुत्रा, नर्मदा एवम् इसकी सहायक नदियाँ आती हैं । जलाशय मत्स्यकी प्रभाग का मुख्यालय बंगलोर में है एवम् इसके केन्द्र तमिलनाडु, आन्ध्र प्रदेश, मध्य प्रदेश, हिमाचल प्रदेश तथा उत्तर प्रदेश में स्थित हैं । यह प्रभाग जलाशयों की पारिस्थितिकी का अध्ययन कर संसाधनों से मत्स्य उत्पादन के लिए उचित प्रबन्धन प्रणाली विकसित करता है । बैरकपुर स्थित ज्वारनदमुखी मत्स्यकी प्रभाग देश के सबसे बड़े खारा जल प्रवाह हुगली-मातलाह तंत्र के विभिन्न आयामों पर शोध कर रहा है । नर्मदा ज्वारनदमुख पर भी अनुसंधान कार्य इस प्रभाग के अंतर्गत होता है । पर्यावरण प्रबन्धन प्रभाग देश के विभिन्न जलीय संसाधनों में प्रदुषण की अवस्था एवम् जैविक विविधता पर पड़ने वाले इसके दुष्प्रभाव पर शोध का संचालन बैरकपुर मुख्यालय से करता है साथ ही इसके उपचार के लिए भी दिशा निर्देश तैयार करता है । आर्द्र क्षेत्र प्रभाग का मुख्यालय बैरकपुर में स्थित है और यह गंगा तथा ब्रह्मपुत्र तल क्षेत्र के बाढ़ बहुल झीलों में पारिस्थितिकी

का गहन अध्ययन कर इनके संरक्षण की दिशा में कार्यरत है साथ ही साथ इन जल संसाधनों में पल रहे जैविक विविधता के स्वरूप को यथास्थित बनाये रखकर मत्स्य उत्पादन में वृद्धि के लिए प्रवन्धन के नये प्रणालियों के विकास के लिए प्रयासरत है। हिल्सा मत्स्यकी प्रभाग, मालदह हिल्सा मछली पर शोध कर रहा है एवम् प्रयास कर रहा है कि गंगा नदी में इसके पुनः स्थापना हो सके। मत्स्य संसाधन मूल्यांकन प्रभाग बैरकपुर मुख्यालय से देश के मत्स्य संसाधनों का मूल्यांकन, वर्गीकरण एवम् मत्स्य सांख्यिकी पर शोध कर के मत्स्य उत्पादन एवम् पालन के लिए नए आयामों को विकसित करने में मदद कर रहा है।

मुख्य उपलब्धियाँ

मत्स्य स्वास्थ्य अनुमापन एवं रोग नियंत्रण

संस्थान ने जन्तुमारी वणकारी संलक्षण मत्स्य रोग (इन्युस) सम्बन्धि अपने अन्वेषणों को व्यापक रूप से पूरे देश में जारी रखा। इस अवधि में इस रोग से प्रभावित नये राज्य जैसे केरल और राजस्थान में अध्ययन किये गये। केरल में लवणीय जल क्षेत्र के मत्स्य प्रजातियों में 'इट्रोप्लस' और 'मुजिले' मछलियाँ अत्यधिक प्रभावित पायी गई जबकि अलवणीय क्षेत्र में 'चन्ना', 'मस्तासेमबिलस' और 'पुन्टियस' प्रजातियाँ अत्यन्त संवेदनशील पायी गईं। राजस्थान में यह रोग सीमित तौर पर केवल टोंक जिले के मौसी जलाशय में ही देखी गई। जन्तुमारी वणकारी संलक्षण रोग ग्रसित मछलियों के अध्ययन से पाया गया कि माक्रोकोकस लियुटियस, स्टेफाइलोकॉकस एवं साइट्रोवेक्टर बुयोन्डी तथा सेयरोलेगविया कवक इस रोग के कारक हो सकते हैं।

इस अवधि में शोध की दिशा उपचारात्मक उपायों के विकास की ओर रही। मछलियों के चार प्रजातियों, चन्ना पंकटेस, कतला कतला, सिरहिनस ग्रीगाला और लेबियो रोहिता पर रोग संबंधी प्रयोग किये गये। प्रारम्भ में इस रोग से प्रभावित जलाशयों में 100 कि. ग्रा. प्रति हे. के दर से चूने का उपयोग किया गया, साथ ही 1 पी.पी.एम. के दर से ब्लिचिंग पाउडर का भी इस्तेमाल किया गया। ऐसा देखा गया कि ब्लिचिंग पाउडर (1 पी.पी.एम. प्रति लीटर) रोग के निदान में अत्यधिक प्रभावकारी है, क्योंकि 15 दिनों के अन्दर इसमें विशेष सुधार पाया गया। इस रोग से पहले प्रभावित तीन जलीय क्षेत्रों में रोग न फैलने देने के लिए निरोधात्मक प्रयोग (100 कि. ग्रा. प्रति हे. के दर से चूने का तथा 0.5 पी.पी.एम. प्रति लीटर की दर से ब्लिचिंग पाउडर का प्रयोग) विशेषकर वर्षा ऋतु के पश्चात किया गया। इससे प्राप्त परिणाम उत्साहवर्धक थे क्योंकि इन क्षेत्रों में इस महामारी का प्रकोप नहीं हुआ। इस प्रयोग को ज्वारनदमुखी भेरियों में भी किया गया जो इस रोग से प्रभावित थे। ऐसे जलाशय जिसमें 20 प्रतिशत रोग का प्रसार था, उनमें चूने (100 कि. ग्रा. प्रति हे.) एवं ब्लिचिंग पाउडर (1 पी.पी.एम. प्रति लीटर) का व्यवहार विशेष प्रभावशाली पाया गया। इस प्रकार के रोग निरोधात्मक उपचार से 60 प्रतिशत रोगग्रस्त मछलियों के घाव एक महीने के अन्दर ठीक होते देखे गये।

समुपयोजित, निम्न समुपयोजित और असमुपयोजित मत्स्य संसाधनों का मूल्यांकन

अंतर्सर्तीय मत्स्य संसाधनों के आँकड़े तुलनात्मक दृष्टिकोण से ठोस नहीं हैं, कारण संसाधनों का विस्तार एवं प्रारूप तथा मत्स्यन केन्द्रों का फैलाव बहुत अधिक है। के. अ. प्र. मा. अनु. संस्थान ने इस समस्या को सुलझाने हेतु आवश्यक कदम उठाया ताकि 7वीं व 8वीं पंचवर्षीय योजनाओं में ठोस आँकड़े प्राप्त हो सके। इस कार्य के लिए एक मानक कार्य प्रणाली का होना अत्यन्त आवश्यक समझा गया। अतः इस कार्यक्रम के संदर्भ में देश भर के 19 राज्यों व केन्द्र शासित प्रदेशों के 40 जनपदों के जलीय संसाधनों के आँकलन हेतु दो प्रकार के सांख्यिकीय संहिताओं को विकसित किया गया। अंतरिम परिणाम से यह इंगित होता है कि क्षेत्रफल के आधार पर संसाधनों का आकलन गुच्छीय औसत की तुलना में अधिक ठोस है। राज्य सरकारों के उपयोग हेतु एक मानक प्रणाली संबंधी संहिता को भी विकसित किया गया है।

ज्वारनदमुख आर्द्र क्षेत्र का प्रबन्धन

अलवणीय जल क्षेत्र के बड़े झींगे मेक्रोबेकियम रोजनबर्जी मछलियों को बनतला व कान्तातला के मलजल पोषित ज्वारनदमुखी आर्द्र क्षेत्र (भेरी) में संवर्धन करने हेतु किए गए प्रयोगों से उत्साहवर्धक परिणाम प्राप्त हुए हैं। इन अध्ययनों का प्राथमिक उद्देश्य यह देखना था कि झींगा मछलियाँ मलजल से उत्पन्न पारिस्थितिक दबाव को झेल पायेंगे या नहीं। एक आर्द्र क्षेत्र के लगभग 0.053 हे. में किशोर अवस्था वाली मे. रोजनबर्जी झींगा मछलियों को (औसत भार 2.77 ग्रा.) 4000 प्रति हे. के दर से संग्रहित किया गया। प्रयोग में संग्रहण दर को कम रखा गया ताकि रात के समय जल क्षेत्र में आक्सीजन कम होने की सम्भावना न रहे। दूसरे दौर के अध्ययन, इस आशय से प्रारम्भ किया गया कि अधिकतम संग्रहण दर प्राप्त किया जा सके एवं प्रबन्ध प्रणालियों को भी मानक बनाया जा सके। बड़े झींगा मछलियों के अतिरिक्त तिलापिया मछली की दो उप-जातियाँ ओरियोक्रोमिस निलोटिकस और ओ. मोजमबिकस को भी उसी भेरी में 20,000 प्रति हे. से संग्रहित किया गया जिससे उपज दर में वृद्धि के अतिरिक्त, खरपतवार नियंत्रण में भी सहायता मिली।

पारिस्थितिक प्राचालों (पॉरामीटर) का अनुमापन एवं मत्स्य संसाधनों पर इनका प्रभाव

गंगा नदी में जलीय गुणवत्ता का अनुमापन

पारिस्थितिक अनुमापन कार्यक्रम के अंतर्गत, संस्थान ने देश की प्रमुख गंगा नदी में जलीय गुणवत्ता का अनुमापन किया। इस अनुमापन कार्य के लिए 10 भौतिक व रसायनिक प्राचालों जैसे तापमान, घुली आक्सीजन, कुल क्षारीयता, कठोरता, कैल्शियम, विशिष्ट चालकता, फॉस्फेट, नाइट्रेट तथा जैव-रसायनिक आक्सीजन माँग पर आधारित एक जलीय गुणवत्ता सूचकांक का उपयोग किया गया। रानाघाट (चुर्नी नदी का संगम स्थल), बारानगर (कलकत्ता शहर का औद्योगिक क्षेत्र) नुरपुर (रूपनारायण नदी का संगम स्थल) में जलीय गुणवत्ता सूचकांक का स्तर 100 पाया गया जो मात्स्यकी के लिए

उपयुक्त है। गंगा नदी में कन्नौज और हायमंड हारबार के बीच के पूरे क्षेत्र के तलछटों में विष कीटनाशक तत्व पाये गए हैं, किन्तु इनकी मात्रा क्षम्य सीमाओं के अंतर्गत है।

वैज्ञानिक समुपयोजन, प्रबन्धन एवं संरक्षण द्वारा मत्स्य उत्पादन में वृद्धि हेतु प्रणालियों का विकास

संस्थान ने उमरांग तथा खानदोंग जलाशयों में मात्स्यिकी के विकास की सम्भावनाओं के अध्ययन हेतु एक योजना तैयार किया। इस परियोजना का मुख्य उद्देश्य जलाशय की उत्पादकता संबंधी पर्यावरणीय प्राचलों का अध्ययन, जलाशयों की मौलिक उत्पादन क्षमता का मूल्यांकन, मत्स्य उपज में वृद्धि हेतु प्रबंधन संहिता तैयार करना, अवसंरचना, श्रमशक्ति (तकनीकी, गैर-तकनीकी व प्रशासनिक) व वित्तीय आवश्यकताओं और परियोजना का आर्थिक लाभ संबंधी विश्लेषण आदि हैं। इस परियोजना में पर्यावरण संबंधी आकलन समाहित है। इस योजना में जलीय परितंत्र में वास करनेवाली समस्त जैव समुदाय विशेषकर मत्स्य प्रजातियों के अध्ययन पर जोर दिया गया। इस तरह पर्यावरणीय, विभिन्नताओं के साथ-साथ इस अध्ययन से एक स्तर से दूसरे स्तर में उर्जा का स्थानांतरण की विधा का भी पता चलेगा और संग्रहण कार्यक्रम की रूप रेखा तैयार की जा सकेगी। संग्रहण प्रणाली से संग्रहित किए जानेवाली प्रजातियों के आमाप संबंधी दिशा निदेश प्राप्त किए जा सकेंगे। यह परियोजना समुपयोजन संबंधी रूप रेखा प्रस्तुत करेगी। यह कार्य उत्तर-पूर्वी परिषद शिलांग हेतु परामर्शक सेवा के रूप में की जाएगी।

बाढ़ बहुल आर्द्र क्षेत्रों में मत्स्यिकीय के नये आयाम

प. बंगाल और असम में बाढ़ बहुल मैदानी झील मात्स्यिकी के मुख्य स्रोत हैं, जिनमें संस्थान ने मत्स्य उपज को अधिकतम करने हेतु शोध कार्य किया। प्रारम्भिक प्रयोग के तौर पर अकायपुर बील में स्थापित दो पेन संरचनाओं में देशी व विदेशी कार्प मछलियों तथा अलवणीय क्षेत्र के बड़े झींगा मछलियों में रोजेनबर्गी को संग्रहित किया गया। अंतरिम परिणामों से इंगित होता है कि यह पद्धति बील जल क्षेत्रों की मत्स्य उपज को बढ़ाने में बड़ी लाभदायक होगी।

मुख्य घटनाएँ

घोंघा पालन पर कार्यशाला

इस संस्थान के सहयोग से समुद्री उत्पाद निर्यात विकास प्राधिकरण ने जी. ए. रेनडेरियोन कम्पनी, कलकत्ता में दिनांक 24 सितम्बर 1992 को एक एकदिवसीय कार्यशाला घोंघा मांस का प्रक्रमण एवं विपणन विषय पर आयोजित किया। इस कार्यशाला में स्थानीय उद्यमियों द्वारा घोंघे के मांस का निर्यात की सम्भावनाओं पर विचार किया। मत्स्य निदेशालय, राज्य मत्स्य विकास निगम तथा विभिन्न निर्यात संस्थाओं के अधिकारियों ने इस कार्यशाला में भाग लिया।

हिन्दी सप्ताह

भारत संघ के राजभाषा कार्यान्वयन नीति के अनुपालन के तहत हिन्दी सप्ताह (14 से 20 सितम्बर 1992) के अवसर पर संस्थान में एक सभा का आयोजन किया गया।

मुख्य बैठकें

इस वर्ष संस्थान में निम्नलिखित बैठकों का आयोजन किया गया:-

1. कर्मचारी अनुसंधान परिषद् (स्टाफ रिसर्च कौंसिल) की बैठक दिनांक 20 व 21 अप्रैल, 1992 को सम्पन्न हुई।
2. संस्थान की प्रबन्ध समिति की 8वीं बैठक 10 मार्च, 1992 को हुई।
3. पंचवर्षीय समीक्षा दल (क्विन क्विनियल रिव्यू टीम) की बैठक 30 जून से 2 जुलाई तक बैरकपुर में, 4 व 5 जुलाई, 1992 को पटना में, 15 व 16 मार्च, 1993 को बंगलोर में तथा 17 व 18 मार्च, 1993 को कोयम्बतूर में सम्पन्न हुई।

सहयोगिक अनुसंधान परियोजनाएँ

संस्थान ने उमरोंग तथा खानदोंग जलाशयों में मात्स्यकी विकास की सम्भावनाओं के अध्ययन हेतु एक योजना को अन्तिम रूप दिया। उत्तर-पूर्वी परिषद्, शिलांग के सहयोग से एक अन्य परामर्शिक परियोजना पर भी कार्य चल रहा है।

प्रौद्योगिकी हस्तान्तरण

प्रसार व राष्ट्र निर्माण कार्य

1. अनुसंधान/सर्वेक्षण

पश्चिम बंगाल के सुन्दरवन क्षेत्र (केनिंग से सुन्दरवन तक) में मत्स्यन कार्य से जुड़े मछुओं की सामाजिक व आर्थिक स्थितियों का अध्ययन किया गया। लगभग 29.2 प्रतिशत मछुओं की मासिक आय मत्स्यन के व्यस्त काल में 901 से 1000 रुपये तक होती है, मन्दी के समय इनमें से 23.4 प्रतिशत मछुएँ जाल बुनने, दैनिक मजदूरी आदि कार्यों से जुड़ जाते हैं तथा साहूकारों से अक्सर रुपये लेते रहते हैं। यह सर्वेक्षण कार्य 21 से 70 वर्ष के आयु वाले मछुओं के बीच किया गया, जिनमें से अधिकतर अनुसूचित जाति के हैं।

अन्य प्रसार कार्य निम्नलिखित है

सलाहकारी सेवाएँ

सलाहकारी सेवाएँ निम्नलिखितों को दी गयी हैं-

क) वैयक्तिक रूप से

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ख) पत्र-व्यवहार द्वारा

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2. प्रशिक्षण कार्यक्रम

राजस्थान राज्य सरकार के प्रसार अधिकारियों, बंगलादेश के गैर सरकारी संगठन तथा संस्थान में कार्यरत अधिकारियों के लिए अंतर्स्थलीय मात्स्यकी के विभिन्न पहलुओं पर कुल पाँच प्रशिक्षण कार्यक्रमों का आयोजन किया गया ।

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अन्य कार्य

संस्थान के कार्य कलाप तथा अंतर्स्थलीय मात्स्यकी के क्षेत्र में हुई प्रगति से संबंधित सूचनाएँ कुल 23 दलों को दी गई, जिनमें विभिन्न महाविद्यालयों तथा संस्थाओं के 520 छात्र/प्रशिक्षणार्थी शामिल हैं। विभिन्न राज्य सरकारों के मत्स्य विभागों को मत्स्य पियूष ग्रन्थियाँ प्राप्त करने में सहायता प्रदान की गई।

कृषि विज्ञान केन्द्र

कृषि विज्ञान केन्द्र, काकद्वीप मुख्यतः प्रशिक्षण, प्रसार सर्वेक्षण 'प्रयोगशाला से भूमि की ओर' कार्यक्रम, आदि कार्यों में संलग्न रहा। प्रशिक्षण कार्यक्रम विभिन्न विषयों से संबंधित थे, जैसे:- मात्स्यकी, फसल उत्पादन, बागवानी, गृह-विज्ञान तथा पशु विज्ञान। इन प्रशिक्षण कार्यक्रमों का पाठ्यक्रम स्थानीय किसानों की आवश्यकताओं के अनुरूप बनाया गया। प्रशिक्षण कार्यक्रमों का विवरण निम्नलिखित है:-

क्रम सं.	विषय	प्रशिक्षण कार्यक्रम का स्थान	कार्यक्रमों की संख्या		प्रशिक्षणार्थियों की संख्या	
			लक्ष्य	लक्ष्यप्राप्ति	लक्ष्य	लक्ष्यप्राप्ति
1.	मात्स्यकी	केन्द्र परिसर में केन्द्र परिसर से बाहर	8 30	8 35	80 450	78 700
2.	फसल उत्पादन	केन्द्र परिसर में केन्द्र परिसर से बाहर	4 25	4 26	40 250	40 260
3.	बागवानी	केन्द्र परिसर में केन्द्र परिसर से बाहर	7 28	7 30	70 450	67 540
4.	गृह-विज्ञान	केन्द्र परिसर में केन्द्र परिसर से बाहर	9 17	9 25	90 510	90 630
5.	पशु-विज्ञान	केन्द्र परिसर में केन्द्र परिसर से बाहर	6 17	1 4	60 170	10 117
	कुल	केन्द्र परिसर में केन्द्र परिसर से बाहर	34 117	29 1209	340 1800	285 2247

कृषि विज्ञान केन्द्र ने पश्चिम बंगाल के विभिन्न जनपदों में दलहनों व तिलहनों की खेती संबंधी प्रदर्शनियों का भी आयोजन किया ।

पुस्तकालय व प्रलेखन सेवाएँ

केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान के पुस्तकालय ने संस्थान के अनुसंधान तथा विकास कार्यों में महत्वपूर्ण भूमिका निभाया है । इस पुस्तकालय का उपयोग न केवल संस्थान के वैज्ञानिक बल्कि विभिन्न विश्वविद्यालयों, संस्थानों तथा अन्य संगठनों के शोधकर्त्ताओं, अध्यापकों एवं प्रशिक्षणार्थियों ने सार्थक रूप से किया । पुस्तकालय ने अपने भंडार में 129 पुस्तक तथा 54 विविध प्रकाशनों की वृद्धि की एवम् 28 विदेशी तथा 59 भारतीय जर्नलों को मंगाया । इस समय संस्थान के पुस्तकालय में 6678 पुस्तकें, 2950 विविध प्रकार के अन्य प्रकाशन, 4197 पुनर्मुद्रित लेख तथा 935 मानचित्र उपलब्ध हैं । इस वर्ष के दौरान पाँच नए विनियम संबंध स्थापित किए गए हैं ।

अन्तर-पुस्तकालय ऋण के रूप में 36 पुस्तकें अन्य पुस्तकालयों को भेजी गई । यह पुस्तकालय इस वर्ष भी विभागीय प्रकाशनों को विभिन्न अनुसंधान संगठनों, विश्वविद्यालयों, उद्यमियों तथा मत्स्य-पालकों को निःशुल्क भेजता रहा ताकि वे अंतर्स्थलीय मात्स्यकी अनुसंधान की प्रगति की जानकारी प्राप्त कर सकें । इस वर्ष के दौरान पुस्तकालय हेतु रु. 5,58,765/- की राशि खर्च की गई ।

इस अनुभाग में फोटोग्राफी तथा रेप्रोग्राफी सेवाओं के लिए एक सक्रिय एकक बना है । संस्थान के वैज्ञानिकों के अतिरिक्त विभिन्न अनुसंधान संस्थानों और विश्वविद्यालयों को फोटोग्राफ्स, पुनर्मुद्रित लेख तथा फोटोकॉपीयों निःशुल्क दी गई । इस अनुभाग ने एक साइक्लोस्टाइलिंग और जिल्दसाज एकक को भी संस्थान के विभिन्न अनुभाग के सेवार्थ कायम रखा ।

तकनीकी रिपोर्ट

संस्थान के अनुसंधानात्मक प्रगति से संबंधित 13 से भी अधिक तकनीकी रिपोर्टों का संकलन किया गया । संस्थान के वैज्ञानिकों के अनुसंधानात्मक लेखों को विभिन्न वैज्ञानिक पत्रिकाओं में प्रकाशित करने से पूर्व उनका संवीक्षण किया गया । समस्याओं और प्रश्नों का जवाब भी अनुभाग के वैज्ञानिकों द्वारा प्रस्तुत किया गया । इस अनुभाग ने संस्थान के वैज्ञानिकों द्वारा सेमिनार, संगोष्ठि, सम्मेलन आदि में भाग लेने से संबंधित कार्यों का भी पर्यवेक्षण किया ।

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(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
Barrackpore 743 101 West Bengal INDIA

Editorial Board

<i>Editors</i>	:	Dr. V.R.P. Sinha Mrs. G.K. Vinci Dr. B.C. Jha Dr. M.K. Das
<i>Assistance</i>	:	Mr. H. Chaklader Mrs. Anjali De
<i>LASER Composing</i>	:	Mr. H. Chaklader Miss Sefali Biswas
<i>Printing</i>	:	Md. Quasim
<i>Cover design</i>	:	Mr. P. Dasgupta

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ANNUAL REPORT 1992-93

CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE
BARRACKPORE

BRIEF HISTORY

The Government of India, in a memorandum brought out in 1943, stressed the need for having a separate central department in the best interest of the development of fisheries resources of the country. This memorandum was later endorsed by the Fisheries Sub-Committee of the Central Government Policy Committee on Agriculture, Forestry and Fisheries. Based on this, the Central Inland Fisheries Research Station was formally been established on 17 March, 1947 in Calcutta under the Ministry of Food and Agriculture, Government of India. From the modest beginning as an interim scheme, the organisation has since grown to the status of a premier research institution in the field of inland fisheries in the country. By the year 1959, the Station acquired its status as Central Inland Fisheries Research Institute (CIFRI) and moved to its own buildings at Barrackpore, West Bengal.

Since 1967, the Institute is under the administrative fold of Indian Council of Agricultural Research (ICAR). The main objectives were to conduct investigations for a proper appraisal of inland fisheries resources of the country and to evolve suitable methods for their conservation and optimum utilisation. While fulfilling the above objectives, the Institute directed its research efforts towards understanding the ecology and production functions of inland water bodies available in the country like the river systems, lakes, ponds, tanks, reservoirs and ox-bow lakes. These studies have unravelled the complex trophic structure and functions *vis-a-vis* the environmental variables in different aquatic ecosystems.

In 1971 the Institute initiated All India Coordinated Projects on "Composite Fish Culture", "Riverine Seed Prospecting", "Airbreathing fish culture" and "Ecology and Fisheries management of Reservoir". One more All India Coordinated Project on "Brackishwater Fish Farming" was

also initiated in 1973. However, the 1st two projects were combined together as "Composite Fish Culture and Seed Production" in 1974. This was the turning point in the history of fish culture in India and the resounding success of Composite Fish Culture and Seed Production project has given the firm support for the development of freshwater aquaculture in the country, on the basis of which the Government of India and the State Governments initiated a number of programmes to raise the aquaculture production in the country.

The Institute has the credit of evolving and popularising the following technologies : (1) Technology for fish seed prospecting from rivers; (2) Technology for fish seed transportation; (3) Technology for induced breeding and nursery management of carp; (4) Technology for bundh breeding of chinese carp; (5) Technology for composite fish culture; (6) Technology for aquatic weed control; (7) Technology for air-breathing fish culture; (8) Fisheries management of small reservoirs; (9) Technology on brackishwater fish farming and (10) Technology for snail farming. The country has witnessed the production from a mere 0.22 million t in 1950-51 to 1.8 million t in 1992-93. The above technologies have contributed immensely towards this achievement.

The Institute focussed on aquaculture research and development in consonance with plan priorities of Government of India and thus established the Freshwater Aquaculture Research and Training Centre (FARTC) at Dhauli, Orissa in 1977, which eventually became Central Institute of Freshwater Aquaculture in 1985. Similarly, Central Institute of Brackishwater Research was also

established and research on brackishwater aquaculture was entrusted to the new Institute in the same year. National Research Centre on Coldwater Fisheries, was also established by the ICAR, which started looking after the research needs of Cold water Fisheries. Thus the Institute gave birth to three major Fisheries Institution. Thereafter keeping in line with emerging trends in fishery science and needs of research in the country, the Institute concentrates on research activities related to capture fisheries resources of India.

Thus the mandate of the Institute was later modified giving added emphasis on capture fisheries resources of the country and the Institute was rechristened as CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE with effect from 1.4.1987. Under the changed set up, the CIFRI is entrusted with the responsibility to conduct research on open water bodies where the fisheries management norms are closely associated with environmental monitoring and conservation.

MANDATE

The mandate involves the following functions :

- (i) To study fish population dynamics of exploitable inland open-water ecosystems and to evolve management systems for optimizing fish production.
- (ii) To investigate causes and effects of population in open-water fishery resources and to provide research support to evolve remedial measures for their conservation and maintenance.

(iii) To study the impact of river-valley projects on the ecology of river basins and productivity of reservoirs and to evolve strategies for their management.

(iv) To act as a repository of information on inland fisheries with a systematic data-base.

(v) To conduct training, education and extension-education programmes.

(vi) To provide consultancy services.

ORGANISATION

In order to achieve the above mandates, the research at CIFRI has been organised under three Divisions, corresponding to the major fishery resources of the country. The *Riverine Division*, with its headquarters at Allahabad, strives to develop systems for effective management of the vast riverine fisheries resources of the country with adequate emphasis on the conservation of riverine environment. The research projects under the Division cover the rivers Ganga, Yamuna, Brahmaputra and Narmada. However, it is mandated to work in all the rivers of the country.

The *Lacustrine Division* has its headquarters at Bangalore with centres in Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Himachal Pradesh and

Maharashtra. The investigations being carried out at the Division aim at developing management norms for optimising fish yield from large tanks, lakes, and reservoirs of the country.

The *Estuarine Division* is based at Barrackpore and it presently works on the entire Hooghly-Matlah estuarine system and the Narmada Estuary. The effluents from a number of industrial units, agricultural wastes, municipal wastes etc. make the Hooghly estuary one of the most polluted stretches of the Ganga river system which is being investigated by the Division. Hilsa, the most important fish of Indian estuaries is being subjected to intensive research.

The Institute also conducts investigations on oxbow lakes of West Bengal, Assam and Bihar. Other areas covered include cage and pen culture systems in open waters, the ecology and production biology of inland molluscs, engineering aspects of cage and pen structures and investigations on fisheries economics and statistics.

The Institute's researches have been organised under 20 research projects and a Central Sector Scheme. The projects are operated from the Headquarters at Barrackpore, 13 Research Centres, 6 Survey Centres and a Krishi Vigyan Kendra covering 11 states of the country. The distribution of research and survey centres and different sections are shown in the organisation chart (Appendix - III).

IMPORTANT ACHIEVEMENTS

Fish health monitoring and control of diseases

Epizootic Ulcerative Syndrome

The Institute continued with the investigations on the fish disease, Epizootic Ulcerative Syndrome (EUS) on a national scale. During the period under report, studies were conducted in the newly affected states of Kerala and Rajasthan. In Kerala, brackishwater species viz., *Etroplus* and *Mugil* were the maximum affected and the most susceptible among freshwater species were *Channa*, *Mastacembelus* and *Puntius* sp. In Rajasthan, the EUS outbreak has been confined to the Mausil dam in Tonk district. Studies on the aetiological agents of EUS-affected fishes revealed the presence of *Micrococcus lutens*, *Staphylococcus* sp. and *Citrobacter freundii*, and fungal species *Saprolegnia* from lesions.

Research studies aimed at developing remedial measures for the epizootic ulcerative syndrome (EUS) were continued during the period under report. Four species of fishes viz., *Channa punctatus*, *Catla catla*, *Cirrhinus mrigala* and *Labeo rohita* were subjected to therapeutic trials. Initially, each species was given a basal dose of lime @ 100 kg ha⁻¹ and bleaching powder @ 0.5 ppm, 1 ppm and 1.5 ppm. Dose of bleaching powder @ 1 ppm was found to be the most effective in healing up of the ulcers within 15 days. Experiments on prophylactic measures were also conducted in three EUS-prone areas during post monsoon period (prior to any outbreak of EUS) applying lime @ 50 kg ha⁻¹ and bleaching powder @ 0.5 ppm. The results were encouraging and no EUS outbreak occurred in the treated areas. Experiments involving lime and bleaching powder were extended to the estuarine wetlands (bheries) affected with the EUS. In the water bodies which had an incidence rate of 20%, application of lime (@ 100 kg ha⁻¹), followed by bleaching powder (@ 1 ppm) after 2 days, were found to be very effective. The ulcers in case of more than 60% of the affected fishes were healed up within a month.

Assessment of exploited, underexploited & unexploited fishery resources

Inland fisheries R & D suffers severely because of poor database. The Central Inland Capture Fisheries Research Institute has identified this problem and taken steps to create a database on inland fisheries resources of the country during the Seventh and Eighth Plan periods. A basic prerequisite for this task has been identified as the development of a standard methodology for inland fisheries resource estimation. As a part of this programme, two types of statistical estimates were worked out in more than forty districts of the country, covering nineteen states and Union Territories. The interim findings indicated that the estimates based on

area per pond were better than those of cluster mean. There was a considerable gain in precision due to the increase in number of cluster in the sample. A standard manual was prepared for the use of various State Governments.

Management of estuarine wetlands

Initial trials conducted to explore the possibilities for rearing the giant freshwater prawn, *Macrobrachium rosenbergii*, in the sewage-fed estuarine wetlands (*bheries*) in Bantala-Kantatala area have yielded encouraging results. The primary objective of the investigation was to see whether these prawns can withstand the ecological stress from the sewage load. A portion of the wetland, measuring 0.053 ha, was stocked with the juveniles of *M. rosenbergii* (average wt. 2.77 g) at a stocking density of 4 000 ha⁻¹. The experiment being the first of its kind to be undertaken in India, the stocking rate was kept low in view of any possible oxygen depletion during the night. Further trials are envisaged to arrive at an optimum stocking density and to standardise the practice. Apart from the giant freshwater prawn, two species of tilapia viz., *Oreochromis niloticus* and *O. mossambicus* were stocked in the *bheri* at the rate of 20 000 ha⁻¹, which helped to control the weeds, in addition to augmenting the yield rate.

Monitoring of ecological parameters and their effects on fishery resources

Water quality monitoring in the River Ganga

Under the ecological monitoring programme, the Institute continues to monitor the water quality of the country's prime river, the Ganga. A Water Quality Index (WQI), based on ten physico-chemical parameters viz., temperature, dissolved oxygen, total alkalinity, total hardness, calcium, specific conductivity, phosphate, nitrate, and biochemical oxygen demand (BOD), is being used for this purpose. WQI values equivalent to 100 have been obtained at Ranaghat (Confluence of Churni river), Baranagar (Industrial zone of Calcutta) and Nurpur (Confluence of River Rupnarain) which indicate a water quality conducive for fisheries. Pesticide residues (HCH and DDT) were detected in sediments all along the River Ganga between Kanauj and Diamond-Harbour. However, their levels of occurrence in water were within permissible limits.

Formulation of strategies to increase production through scientific exploitation, management and conservation

The Institute has finalised a scheme for conducting feasibility studies for fisheries development of Umrong and Khandong reservoirs. The main objectives of the project are to study the environmental parameters relevant to productivity of

the reservoirs; to assess their basic productivity potential; to formulate a package of management for fish yield optimisation; to assess the infrastructure, manpower (technical, non-technical and administrative) and financial requirements for the fisheries development of the reservoirs; and to analyse the input-output ratio for determining the economic cost-benefit of the project. The project will have a built-in Environmental Impact Assessment Component. The scheme envisages to study the biotic communities of the ecosystem with special emphasis on the fish species spectrum. Thus, along with the environmental variables, the study will give valuable clues on the mode of energy transformation from one trophic level to the other enabling the formulation of stocking programme. The stocking policy will lay guidelines on the size and species to be stocked, rate of stocking and the modes of raising the stocking material. The project will formulate the framework of exploitation policy which includes the mode of crop sharing and royalty. The project is being undertaken on the basis of consultancy assignment for the North Eastern Council, Shillong.

IMPORTANT EVENTS

Workshop on Snail Farming

A one-day workshop was conducted by MPEDA in collaboration with CIFRI on "Processing and marketing of frozen snail meat" on 24th September, 1992 at the processing plant M/s. G.A. Randerian Ltd., Calcutta. This was to explore the possibilities of exports of frozen snail meat as a diversified item by the local entrepreneurs. The participants included the officers from Directorate of Fisheries, State Fisheries Development Corporation and representatives of different export houses.

HINDI WEEK

In compliance with the Official Language Implementation Policy of the Indian Union, as a part of the Hindi Week (14-20 September, 1992) a meeting was organised at the Institute.

MEETINGS

The following meetings were arranged during the period under report :

1. Staff Research Council Meeting held on 20th & 21st April, 1992.
2. QRT meeting held at Barrackpore from 30th June 1992 to 2nd July 1992, at Patna on 4th & 5th August, 1992, at Bangalore on 15th & 16th March 1993, and at Coimbatore on 17th & 18th March, 1993.

COLLABORATION

The Institute has finalised a scheme for conducting feasibility studies for fisheries development of Umrong and Khandong reservoirs. This is a consultancy project with the collaboration of North Eastern Council, Shillong.

MANPOWER DEVELOPMENT

Training Overseas

Dr. V.K. Unnithan, Sr. Scientist underwent training in the field of fisheries at Australian Maritime College, Laurcenton, Tasmania, Australia from 4.5.92 to 20.12.92 under Colombo plan.

Dr. (Mrs.) Usha Moza, Sr. Scientist attended training course on Impact of pollution on fisheries of the inland open water system at Faculty of Aquatic Science, Deakin University, Warrnambool, Australia from 1st June 1992 - 28th February 1993. The training programme was sponsored by the Australian International Development Assistance Bureau (AIDAB).

Dr. Krishna Chandra, Sr. Scientist was deputed to undergo a course in Environmental Management Programme at Graduate School, Griffith University, Brisbane, Queensland, Australia. The course commenced from 14.2.92 and ended on 25th December 1992. Dr. Chandra was deputed under AIDAB/Colombo Plan programme.

Dr. K.K. Vass, Principal Scientist attended training in the field of Eutrophication and Fish Management for a period of 6 months from 31.3.1993 under British Technical Cooperation attachment/training programme in the University of Sterling, U.K.

Training in country

Dr. D. Kumar, Sr. Scientist participated in the training programme on 'Carbon tracer techniques' at Bhaba Atomic Research Centre, Trombay, Bombay from April 20 to 25, 1992.

Shri A. Hajra, Scientist underwent a training on C^{14} radioisotopic tracer technique at the Board of Radiation and Isotope Technology, Bhaba Atomic Research Centre, Trombay, Bombay from April 27 to May 2, 1992.

Mrs. A. De, Sr. Librarian participated a course on 'Computer application for information storage and retrieval in Agricultural libraries and information centres' at NAARM, Hyderabad from Sept., 28 to Oct. 9, 1992.

Shri Ch. Gopalakrishnayya, Principal Scientist attended a workshop on 'Planning and Utilization of Manpower in Agricultural System' at NAARM, Hyderabad during 12-16 October 1992.

Dr. M.K. Mukhopadhyay, Sr. Scientist attended DOS sponsored winter school on Remote Sensing in Agriculture' during 2-31 Dec., 1992 at Division of Agricultural Physics, IARI, New Delhi.

Shri M.M. Bagchi, Sr. Scientist attended a training course on 'Pesticide Residue' held at National Institute of Occupational Health, Ahmedabad from 7-18 Dec., 1992.

Dr. H.P. Singh, Sr. Scientist attended ICAR sponsored training programme on 'Pesticide analysis' held at Central Food Technological Research Institute, Mysore during 7-18 December, 1992.

Dr. R.K. Tyagi, Sr. Scientist attended the Conference on 'Current research, problems in agricultural statistics and computer application in agricultural

research held at IVRI, Bareilly, from November 2-4, 1992. He also attended the First Annual Conference of Indian Society of Industrial and Applied Mathematics, at University of Roorkee, from February 4-7, 1993.

Dr. S.N. Singh, Sr. Scientist participated in the deliberations of a workshop on 'Eco-environment and wildlife management' at the invitation of M.S. University, Baroda.

HONOURS, AWARDS, ETC.

Dr. R.K. Tyagi, Sr. Scientist (Statistics) was awarded D. Phil degree from the University of Allahabad.

TRANSFER OF TECHNOLOGY

EXTENSION AND NATION BUILDING ACTIVITIES

Research/Survey

A study was conducted in Sunderbans (Canning to Sunderbans) in West Bengal on the "Perspectives of socio-economic status of the fishermen engaged in fishing". About 29.2% of the fishermen had income between Rs. 901 to Rs. 1000/month during the peak season. During off season 23.4% of them attend net making, net repair, daily labour etc. and most often borrow money from the money lenders. The survey was conducted between the age group 21-70 years and most of them belonged to scheduled caste community. Other extension activities were :

1) Advisory service

Advisory services were given to the following :

through visit :-

Farmers	-	141
Extension Officers	-	28

through letters :-

Farmers	-	58
University	-	7
Entrepreneurs	-	16
State Governments	-	11
Non Govt. organisation	-	2
Foreign Agency	-	1

<i>through farm visit</i>	-	2
<i>Over phone</i>	-	26

2) Trainings

Five need based training courses were organised on various aspects of inland fisheries for the benefit of Extension functionaries of the Department of Fisheries of Rajasthan and NGOS from Bangladesh and inservice officials of the Institute.

3) Talks delivered	-	23
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4) Exhibitions	-	3
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5) Field days	-	5
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6) Other activities :

A total of 23 batches comprising 520 students/trainees and 33 instructors from various colleges and training institutes were briefed of the Institute's activities and the latest advancements in inland fishery field. Arrangements for the supply of fish pituitary glands were made for various state government fisheries departments.

KRISHI VIGYAN KENDRA

The KVK at Kakdwip was engaged in training, extension survey, Lab to Land Programme, 1st line demonstration and adaptive research. The training programmes were conducted in various disciplines like fishery, crop production, horticulture, home science and animal science. The courses were designed mainly on the local needs of the farmers. The details of the programmes are given in the table below :-

Sl. No.	Discipline	Type of Training	No. of courses		No. of trainees	
			Target	Achievement	Target	Achievement
1.	Fisheries	on-campus	8	8	80	78
		off-campus	30	35	450	700
2.	Crop production	on-campus	4	4	40	40
		off-campus	25	26	250	260
3.	Horticulture	on-campus	7	7	70	67
		off-campus	28	30	450	540
4.	Home Science	on-campus	9	9	90	90
		off-campus	17	25	510	630
5.	Animal Science	on-campus	6	1	60	10
		off-campus	17	4	170	117
	Total	On-campus	34	29	340	285
		Off-campus	117	1209	1800	2247
Total training			151	149	2140	2532

KVK has also conducted demonstrations on farming of pulses, and oil seeds in different villages of West Bengal.

LIBRARY & DOCUMENTATION SERVICE

The CIFRI library played a very significant role in the progress of research and developmental activities of the Institute. The library was used fruitfully not only by the scientists of the Institute, but also by the research scholars, teachers and trainees from different universities, institutes and other organizations. The library added 129 books, 54 miscellaneous publications to its collection and subscribed 28 foreign and 59 Indian journals. The library has now a total holdings of 6678 books, 2950 miscellaneous publications, 4197 reprints and 935 maps. Five new exchange relationships were established during the year.

As a part of resource sharing the library lent out 36 publications to other libraries on inter-library loan. The Institute also continued the free mailing of its publications to various research organisations, universities, entrepreneurs and farmers. The total expenditure incurred by the library during the year was Rs. 7,58,765.00.

The section maintains an active unit for photography and reprography services. Photographs, reprints and photocopies were supplied to the scientists of the Institute and of other research institutes and universities free of cost. The section also maintains a duplicating (cyclostyling) and binding unit to serve the various units of the Institute.

Technical reports

More than 23 technical reports on the progress of research activities of the Institute were compiled. Research publications of CIFRI scientists were scrutinised before publication in various journals. Technical queries regarding the activities of the Institute from various quarters of the country and abroad were attended to by the section. The section also assisted the participation of scientists in seminars, symposia, conferences etc.

Research Project Files

Annual progress reports of all the research projects and the contribution made by individual scientists are being recorded in the Primary Project Files and Scientists' Files. Research progress monitoring is done through RPF I, II and III; Activity Milestones; and Monthly. Compilation of the Quarterly and Annual reports is one of the major responsibilities of the Section.

Departmental Publications

- (i) Annual Report 1990-91.
- (ii) Matsya Vigyan ki Hindi Sabdmala angraji hindi. CIFRI Bulletin No. 68, 1992.
- (iii) Occasional publications :
 - (A) ICAR Scheme 'Biomonitoring of heavy metals in the Hooghly estuary using scales and other hard parts of Aquatic organisms as the possible sites for metal accumulation. Annual Reports 1991-92 & 1992-93.
 - (B) Technical brief on activities and achievements of CICFRI (submitted to Study Group of Parliament Committee on Agriculture) May 31, 1992.
 - (C) Feasibility studies for fisheries development in Nongmahir Reservoir, Meghalaya. (A consultancy service of CIFRI for the North Eastern Council, Shillong).
 - (D) Feasibility studies for fisheries development in Kyrdemkulai Reservoir, Meghalaya. (A consultancy service of CICFRI for the North Eastern Council, Shillong).
 - (E) Ten year perspective plan for fisheries development of North Eastern States by M. Sinha.
 - (F) Memorandum submitted to the Quinquennial Review Team (1992), 1986-1991.
 - (G) FAO sponsored Training Programme on Floodplain Fisheries Management, Compendium (1.9.92-31.12.92) Ed. by Y.S. Yadava & V.V. Sugunan, Vols. 1 & 2.

CONFERENCES, SYMPOSIA, ETC.

The scientists of the Institute participated/presented/submitted papers in the Intecol's IV International Wetlands Conference held from 13-17 September 1992 at Columbus, Ohio, USA; National Seminar on Endangered fishes of India, held at National Bureau of Fish Genetics Resources, Allahabad, U.P. from 25-26 April, 1992; Symposium on Water : An Endangered National Resource organized by ANZAAS and Australian Institute of Biology held at Brisbane, Australia; 1st Annual

Conference on Indian Society of Industrial and Applied Mathematics held at University of Roorkee from February 4-7, 1993; National Symposium on Soil resources *vis-a-vis* sustainable land use of National Bureau of Soil Science and Land Use planning, held at Salt Lake, Calcutta from 20-22 January, 1993; First National Meet on Aquafarming system research, held at CIFA, Bhubaneswar from 10-11 February 1993; National Seminar on Indigenous technologies for sustainable agriculture held at IARI, New Delhi from 23-25 March 1993; Workshop on 'Planning and utilization of manpower in Agricultural system' held at NAARM, Hyderabad during 12-16 October, 1992; Conference on 'Current research problems in agricultural statistics and computer applications in agricultural research' held at IVRI, Bareilly from November 2-4, 1992; Workshop on 'Eco-environment and wild life management' held at M.S. University, Baroda on 25.8.92.

A total of 16 papers were presented by the scientists of the Institute in the above mentioned seminars/workshops/meetings etc.

VISITORS

A large number of distinguished personalities visited the Institute's Headquarters and its different centres during 1992-93. They are :-

Agarwal, G.P. (Prof.), Department of Zoology, Banaras Hindu University, Varanasi.

Ahmed, Khadir (Mr.) Principal Scientific Officer, Bangladesh Agricultural University, Mymensingh.

Ahmed, Mesbauddin (Mr.), Project Director, Dept. of Fisheries, Govt. of Bangladesh.

Alam, S.K. (Mr.), Dy. Secretary, Dept. of Fisheries and Livestock Information, Dhaka.

Balan (Mr.), Chairman, Tamil Nadu Fisheries Development Corporation.

Bhattacharya, S.K. (Prof.), Head, Deptt. of Maths. and Statistics, University of Allahabad, Allahabad.

Bolton, P. (Dr.), World Bank Consultant from HR Wallingford, Oxfordshire, U.K.

Chopra, V.L. (Dr.), Director General, Indian Council of Agricultural Research, New Delhi.

Das, P. (Dr.), Director, National Bureau of Fish Genetic Resources, Allahabad.

Davis, John (Dr.), Sr. Technical Officer, Asian Wetland Bureau, University Malaya, Kuala Lumpur, Malaysia.

Dehadrai, P.V. (Dr.), Dy. Director General, Indian Council of Agricultural Research, New Delhi.

Dharmadhikari, A.D.(Prof.), University of Pune, Pune.

Dorairaj (Mr.), Tamil Nadu Fisheries Development Corporation.

Dwivedi, S.N.(Dr.), OSD, ICAR, New Delhi.

Holmgren, Staffan(Dr.), Environment Advisor FAO/BOBP, Limnological Institute, Uppsala University, Sweden.

Jaffry, A.K. (Prof.), Aligarh Muslim University, Aligarh.

Jamatia, S.(Mr.), Executive Member, Dept. of Annual Husbandry, Tripura.

Jauhari, V.K. (Mr.), Managing Director, IU.P. Fish Seed Corporation.

Kamal, M.Y. (Dr.), ADG (Fisheries), Indian Council of Agricultural Research, New Delhi.

Khan, H.A. (Dr.), Principal, Regional Training Centre of CIFE, Chinhat, Lucknow.

Khataruzzam, A.(Mr.), Sr. Scientific Officer of BARC, Dhaka.

Kitta, Shozo (Mr.), Director, LII-2 OECF and Leaer, Japanese Special Review Mission, Tokyo.

Malhotra, S.(Dr.), Reader, Allahabad University. Allahabad, U.P.

Mirza, Mohd.Z.A.(Dr.), Associate of Prof. of Fisheries, Bangladesh Agricultural University, Mymensingh.

Mondal, P.K.(Dr.), Reader, Allahabad University. Allahabad, U.P.

Nassiruddin, A.Z.M.(Mr.), BCS, Secretary, Dept. of Fisheries, Govt. of Bangladesh.

Nuruzzaman, A.K.M.(Dr.), Member Director, BARC, Dhaka, Bangladesh

Padalkar, L.D. (Ms.), Commissioner of Fisheries, Govt. of Tamil Nadu.

Panda, K.K.(Mr.), Director, Lok Sabha Secretariat, Parliament Home Annexe, New Delhi-110 001.

Pati, T.(Prof.), Vice-Chancellor, Sri Jagannath Sanskrit Viswavidyalaya, Puri.

Pinjon, Zulekha(Ms.), Columbia, USA.

Prasad, P.S.(Dr.), Director of Fisheries, Patna, Bihar.

Rao, Chokka(Mr.), Member of Parliament(Chairman), Mr. Anil Basu, Member of Parliament, Mr. R.K. Sharma, Member of Parliament, Mr. U.N. Verma, Member of Parliament, Mr. Som Paul, Member of Parliament, Mr. Kunji Lal, Member of Parliament, Mr. Raghabji, Member of Parliament, Mr. R.R. Pramanik, Member of Parliament, Mr. H. Panwar, Member of Parliament, Mr. K.K. Panda, Secretary, Parliamentary Secretariate, Mr. Harpal Singh, Liaison Officer, Mr. V.K. Pariha, Liaison Officer, Mr. D.K. Singh, Liaison Officer.

Roy Chowdhury, P.(Mr.), Managing Director, West Bengal Dairy and Poultry Development Corporation.

Selvam, L.P.(Dr.), UNDP/World Bank Water & Sanitation Programme, Delhi.

Sen, S.(Dr.), Principal Officer, Dept. of Animal Husbandry, Tripura

Sharma, N.N.(Dr.), Head, Zoology Dept., Bajoli College, Assam

Singh, Bhagat(Mr.), Jt. Secretary, (Fisheries), Ministry of Agriculture, Govt. of India, New Delhi.

Singh, C.S.(Prof.), Aquaculture, Pantnagar University of Agriculture & Technology, Pantnagar.

Srivastava, G.P.(Dr.), Secretary, Indian Council of Agricultural Research, New Delhi.

Srivastava, U.S. (Prof.), President, National Academy of Sciences, Allahabad.

Swarup, K.(Prof.), Emeritus Scientist, National Academy of Sciences, Allahabad.

Tiwari, U.S.(Dr.), Director, Allahabad Museum.

Tripathi, S.D.(Dr.), Director, CIFA, Dhauli, Orissa.

Tripathi, Y.R.(Dr.), former Director of Fisheries, Govt. of U.P.

Uihha, Antomio (Mr.), Columbia, USA.

Vats, V.(Dr.), Addl. Director, Ganga Project Directorate, Ministry of Environment,
New Delhi.

Watson C.E.P.(Dr.), Manager, Environmental Assessments, HR Wallingford Ltd.,
Wallingford, Oxfordshire, U.K.

Watts, A.B.(Dr.), Institute of Freshwater Ecology, Edinburgh, U.K.

FINANCE

For the year 1992-93
(Rs. in lakhs)

	B.E. 1992-93 (Rs.)	R.E. 1992-93 (Rs.)	Actual Expenditure 1992-93 (Rs.)
Plan :	55.00	60.00	66.43
Non-Plan :	246.00	280.00	282.93
Total :	301.00	340.00	349.36

PROGRESS OF RESEARCH

CENTRE-WISE LIST OF OBGOING PROJECTS 1992-93

BARRACKPORE	:	FC/B/11 BF/B/3 BF/A/2	FC/A/4 BF/B/8 BF/A/21	BF/B/2 BF/B/11 AN/A/13
AGRA	:	FC/B/10	FC/B/11	
ALLAHABAD	:	FC/B/7	FC/B/11	FC/A/18
BANGALORE	:	FC/A/7		
CALCUTTA	:	FC/B/11	BF/B/10	
COIMBATORE	:	FC/A/19		
CANNING	:	BF/B/3		
DIAMOND HARBOUR	:	BF/B/3		
DIGHA	:	BF/B/3		
ELURU	:	FC/B/5	FC/A/20	
FARAKKA	:	BF/A/2		
GUWAHATI	:	FC/B/9	FC/A/16	
KANGRA	:	FC/A/7		
LALGOLA	:	FC/B/7		
PATNA	:	FC/B/7	FC/B/11	
PUNE	:	FC/A/7		
RAIPUR	:	FC/A/7		
ULUBERIA	:	BF/B/3		
VADODARA	:	BF/B/9		

PROJECT FC/B/5**STUDIES ON THE ECOLOGY AND FISHERIES OF KOLLERU LAKE ECOSYSTEM AND DEVELOPMENT OF SUITABLE MANAGEMENT MEASURES FOR OBTAINING SUSTAINED FISH PRODUCTION**

Personnel : K.V. Rao, J.B. Rao, T.S. Rama Raju, K. Subba Rao, C.G. Rao

Duration : 1986-1993

Location : Kolleru Lake, West Godavari District, Andhra Pradesh

Fish catch statistics

During the year 1992-93 the fish and prawn yield from the Kolleru lake has been 2932.4 t. Of this, the maximum contribution has come from live fish (63.4%), (*Anabas oligolepis*, *Heteropneustes fossilis* and *Channa striatus*) prawns (25.7%) and carps (3.7%). The cat fishes as a group formed 21.1% while murrels have contributed 32.0% of the lake fishery. Of the three main sampling centres, the yield of fish was maximum from Akividu (46.5%) followed by Eluru (29.8%) and Bhimavaram (23.7%). *O. mossambicus* which has found an accidental entry into the fishery of Kolleru lake has shown a good yield of about 16 tonnes during the current year.

The fish production from Kolleru lake during the year 1992-93 has shown a decline by about 17% over the previous year's yield of 3529 t.

Plankton

It is significant to note that zooplankton was dominant during July in all the centres of freshwater zone, ranging between 0.1 cc to 0.5 cc (volume) per 50 l. Numerical estimation recorded between 31 to 84 ul^{-1} . Zooplankton ranged between 55% to 79%, major contributing genera being *Diaptomus*. Phytoplankton population was represented by Myxophyceae, Chlorophyceae and Bacillariophyceae.

Benthos

In transitional zone bottom living animals ranged between 65 u m^{-2} (December 1992) to 156 u m^{-2} (July 1992).

In the freshwater zone abundance of macrobenthos was observed to be the most dominant, ranging between 286 u m^{-2} (October 1992) to 1248 u m^{-2} (February 1993).

Macrophytes

Kolleru is highly infested with aquatic vegetation and the estimation of biomass during the period under report ranged between 1.3 kg m^{-2} to 21 kg m^{-2} . Average production has been computed to be of 9.3 kg m^{-2} . *Eichhornia crassipes* and *Ipomoea aquatica* are the two dominant species of Kolleru.

Physico-chemical features

The water was more clear in early winter months, ranging between 102 cm to 142 cm compared to 154 cm to 30 cm during monsoon. The pH of Kolleru waters usually ranged between 7.2 to 7.4. The concentration of dissolved oxygen ranged between 3.2 ppm to 10.2 ppm. Free CO_2 has been encountered at all the centres during all the months of observation.

The bicarbonate alkalinity ranged between 124 ppm to 200 ppm. The hardness of Kolleru waters usually ranged between 120-150 ppm. For most part of the year the salinity ranged between 0.5 to 0.9 ppm. The primary production of Kolleru waters ranged between 12.5 mg C m^{-3} per 1 hr to 200 mg C m^{-3} per 1 hr at the surface and 12.5 to 52.0 mg C m^{-3} per 1 hr at bottom.

Biological studies

1035 specimens of *Mystus gulio* collected from Eluru, Akividu and Bhimavaram during different months of the year 1992-93 were examined for their food, feeding habits, maturity, fecundity, etc.

PROJECT : FC/B/7

**INVESTIGATIONS ON FACTORS RELATING TO
DECLINE IN FISHERY OF RIVERS GANGA AND
YAMUNA.**

Personnel : *Allahabad* : Ravish Chandra, S.P. Singh, S.K. Wishard, H.P. Singh, S.N. Mehrotra, D.N. Singh, R.K. Saxena, Balbir Singh, M.A. Khan, R.N. Seth, R.K. Dwivedi, R.K. Tyagi, P.K. Katiha, P.N. Jaitly, N.K. Srivastava, Ram Chandra, D.N. Srivastava, B.D. Saroj, R.C. Singh, L.R. Mahavar, Ramji Tiwari, J.P. Misra, P. Rajani

Patna : G.K. Bhatnagar, V.R. Chitranshi, B.C. Jha, V. Pathak, M.P. Singh

Lalgola : H.C. Banik

Duration : May 1992 to April 1997

Location : Allahabad, Patna, Lalgola.

Sub Project A : Population structure, breeding biology and recruitment of *T. ilisha*.

A total of 331.21 kg of hilsa was estimated to have landed during the period April 1992 to March 1993 as against 970.62 kg estimated for the same period of 1991-92. The reason may be attributed to the unusual failure of monsoon in July. The rains came late in August and remained erratic throughout the rainy season resulting in late flooding of the two rivers viz., Ganga and Yamuna which lead to the poor landing of hilsa during the peak months of September to November.

Table 1

Total *T. ilisha* landings at Allahabad (kg)

	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
Year													
1991-92	1.20	8.37	-	-	-	72.50	706.10	167.44	4.65	3.10	7.26	-	970.62
1992-93	4.75	16.89	1.72	3.10	-	112.50	117.10	68.50	NA	6.65	-	-	331.21

Sub Project B : **Estimation of biological and population parameters of commercially important fish species.**

The fish landings at Sadiapur, Daraganj and Lalgola fish landing centres were estimated at 69.58, 28.57 and 75.79 t respectively. The species-wise breakup is given in Table 2.

Table 2

Fish landings in tonnes at different centres

Species	Centre		
	Sadiapur	Daraganj	Lalgola
<i>C. mrigala</i>	1.30	0.17	1.38
<i>C. catla</i>	0.88	0.18	1.57
<i>L. rohita</i>	0.65	0.11	1.41
<i>L. calbasu</i>	5.19	0.98	1.21
Major carps	8.02	1.44	5.57
<i>M. aor</i>	8.70	1.42	4.47
<i>M. seenghala</i>	10.13	3.49	2.08
<i>W. attu</i>	0.18	0.14	3.90
Selected catfish	19.01	5.05	10.45
<i>T. ilisha</i>	0.31	0.07	11.96
Miscellaneous	42.24	22.01	47.81
Total	69.58	28.57	75.79

Sadiapur fish market was mainly fed by river Yamuna among the riverine catches. The major carp fishery which was already in a very bad shape during the preceding year registered a further decline of 36.5%. Among the important large sized catfishes, *W. attu* fishery suffered a serious set-back with a decline of about 90%. *T. ilisha* fishery showed a decline of 69.7%. The fishery of other group also exhibited a fall of 23.5%. The main reason for this decline may be attributed to the erratic rainfall in 1992.

The catches at Daraganj centre exclusively fed by river Ganga showed an increase of 20.8% over the preceding year, mainly due to the increase in the fishery of other group.

Lalgola centre showed an increase of 10.7% over the preceding year. At this centre fishery of *T. ilisha* registered an increase of 68.2%. A marginal increase of about 20% was recorded in the catches of major carps. The selected catfish group exhibited a decline of 15.3%, mainly in the catches of *W. attu*.

The juvenile major carp fishery at Allahabad, was again conspicuous as on a single sampling day about 300 kg fingerlings of mrigal, catla and rohu were recorded in the market.

Sub Project C : Study on breeding and recruitment of selected commercial and non-commercial species.

Spatio-temporal variations in the availability of fry and fingerlings of Indian major carps at the selected centres on river Ganga and Yamuna.

Investigations were carried out on the river Yamuna at Madhauka centre where 3 floods and 5 spawning spurts were encountered during the season. Belated and erratic rainfall and floods in last two years resulted in poor spawning hence only 1790 ml spawn was collected during this period against 2160 ml of the previous year. The 1st flood contributed maximum spawn (62.7%) followed by 2nd (24.0%) and 3rd (13.3%). Micro-analysis showed greater abundance of desirable spawn in the 1st flood (45.2%) followed by the 2nd (30.5%) and 3rd (21.5%) the average being 32.4%. The indices of quality and quantity as found on rearing, were 41.3% and 448 ml respectively. Among the desirable ones, the most abundant was rohu (16.5%) followed by mrigal (15.4%), catla (7.2%) and calbasu (2.2%).

Estimation of fry and fingerlings

Estimation of fry and fingerlings of major carps was done by operating drag nets in the cut off waters. The availability of fingerlings in river Ganga (Gunti area) was 55/ha and in river Yamuna (Birbal ka Purba) 65/ha by number.

a) Kare centre (River Ganga)

Plankton

The total plankton fluctuated from 2190 u/l in March '93 to 9350 u/l in July '92. Maximum abundance of plankton in July '92 (28.5% in total) was observed soon after the premonsoon local shower and hence attributed to overflowing/drainage of some upstream impoundments into the main river. Phytoplankton consistently dominated comprising 65-97% in total during different months.

Bottom biota

The bottom biota ranged from 779 (July) to 12188 u/m² (March). The average macrobenthic fauna was 2523 u/m² represented by chironomid (58.6%), Oligochaeta (15.4%), *Viviparus bengalensis* (8.5%), odonata (6.5%), Polychaeta (3.2%), *Limnaea* sp. (2.3%), coleoptera (2.1%) and bivalves (2.0%).

Estimation of fish catch

A total of 5385.21 kg of fish was estimated to have been caught from Kare deep pool as against 4383.99 kg estimated for the same period of 1991-92. Maximum catch of 1921.23 kg was recorded in the month of July, which unexpectedly remained dry this year due to delayed monsoon. Minimum catch of 263.50 kg was recorded in the month of October. Catfishes like in the preceding year, dominated the catches forming 65.2% amongst which *M. seenghala* : 1542.63 kg, *M. aor* : 615.75 kg, *R. rita* : 606.81 kg were predominant. The fishing gears, operated were drag net, gill net and hook & lines. The gill nets was the most effective gear catching 3278.98 kg of fish forming 60.9% of the total catch.

b) Buximodha centre (River Yamuna)

Plankton

Percentage of plankton at 1.5 m 3 m and 6 m was recorded as 64.20, 11.15, 12.85 and 11.80 respectively *Synedra* and *Merismopedia* among phytoplankton and *Brachionus* among zooplankton dominated in collections.

Bottom biota

The bottom biota ranged from nil (July) to 1936 u/m² (March) and dominated by chironomid larvae (92.3%).

Estimation of fish catch

The fish catch estimated from this deep pool was to the tune of 3371.85 kg as against 7809.68 kg recorded during the same period of 1991-92. Maximum catch of 1023.00 kg was recorded in the month of July. Catfishes, forming 74.0%, dominated the catches. Among which *M. aor* : 781.76 kg (23.2%), *M. seenghala* : 731.63 kg (21.7%), *C. garua* 451.09 kg (13.4%) and *E. vacha* : 302.02 kg (8.9%) were prominent. The other catfishes recorded were *R. rita* : 158.10 kg (4.7%) and *W. attu* : 69.75 kg (2.1%). The catch from gill nets was 2675.47 kg (79.3%) and from hook & line it was 696.38 kg (20.7%).

Sub Project D : Impact of environmental changes on the biotic communities.

PHYSICO-CHEMICAL FEATURES OF WATER

KANPUR

River Ganga

a) Bhagwatghat (Textile waste) : Water quality improved during the current year showing increased DO value (6.11 mg/l) and decreased conductivity (293.0 μ mhos/cm) at OF. Still higher value of conductivity (293.0 μ mhos/cm) was at OF. Similarly nitrate, phosphate and silicate were also reduced indicating lesser impact of effluent at Bhagwatghat.

b) Tannery : In general, the impact of discharge from tannery was low as apparent by the values of different physico-chemical features. Excepting the values of bicarbonate, sp. conductivity and nutrients remained high at OF and low at AOF.

c) Jajmau (supplied with sewage) : Data revealed that the impact of sewage discharge was very low as compared to previous years. Due to low quantum and treated discharge, the effect on nutrient level was also low. The improvement in water quality showed efficacy of treatment plant at Jajmau. This trend was observed in 1991-92 also.

ALLAHABAD**River Ganga****a) Polluted zone**

i) Mehdaurighat (sewage) : The range of fluctuation was almost similar to last year. Low values of free CO₂, bicarbonate, sp. conductivity and nutrient were observed at AOF as compared to OF. But in monsoon almost all the values were same at OF and AOF due to flooding of river.

i) Mavaiya (supplied with industrial & sewage) : As anticipated, highest values of free CO₂, bicarbonate, sp. conductivity, nitrate, phosphate and silicate were observed at OF due to polluted effluent discharged by different factories. The water at BOF was observed blackish and insects were also seen even 1.5 km below OF. The pollution load continued to increase.

b) Non-polluted zone

i) Fatehpurghat : It has been observed that application of organic manure for the cultivation of water melon and vegetables on the river bed in dry season indicated adverse impact on the water quality specially in terms of decline in dissolved oxygen and increasing by carbonate and sp. conductivity values.

ii) Manaiya : Nutrient concentration was always high in polluted zone as compared to non-polluted zone. Due to impact of pollutants the values of DO, sp. conductivity, bicarbonate and transparency were highly affected.

River Yamuna**a) Polluted zone**

Kakrahaghat (City waste water) : Low values of transparency, pH, DO were observed at OF as compared to BOF. Impact of city waste water was quite low except from April to June. The trend was almost similar in previous year. In the non-polluted zone the trend was almost similar to that of previous year.

VARANASI

- a) **Nagwa (City waste)** : Data revealed that there was slight increase in pollutional load as the values of DO decreased and free CO₂ increased at OF. However, nutrient concentration was slightly less.
- b) **Rajghat (sewage)** : Excepting free CO₂ other values at OF reduced during current year as compared to previous years.

PRIMARY PRODUCTIVITY**KANPUR**

Gross and net production fluctuated between 31.25 and 187.5 mgC/m³/hr and 18.75 and 112.5 mgC/m³/hr respectively showing average production less at AOF and more at BOF.

ALLAHABAD**River Ganga**

Mehdaurighat : Gross and net production fluctuated between 50.0 and 250.0 mgC/m³/hr and 37.5 and 125.0 mgC/m³/hr respectively.

Fatehpurghat : Gross and net production fluctuated between 37.5 and 281.25 mgC/m³/hr and 25.0 and 150.0 mgC/m³/hr respectively. Highest value was observed in March (281.25 mgC/m³/hr) which was due to manuring.

Manaiya : Gross and net production varied between 56.25 and 250.0 mgC/m³/hr and 37.5 and 187.5 mgC/m³/hr respectively showing highest production in May and March and lowest in July.

River Yamuna

Kakrahaghat : Gross and net production ranged between 50.0 and 107.1 mgC/m³/hr and 20.83 and 83.33 mgC/m³/hr respectively reflecting highest value in February/March.

Sujawan : Gross and net production fluctuated between 62.5 and 171.87 mgC/m³/hr and 25.0 and 93.75 mgC/m³/hr respectively indicating highest value in January and lowest in July/August.

VARANASI

Nagawa : Gross and net production ranged between 22.77 and 218.75 mgC/m³/hr and 11.11 and 125.0 mgC/m³/hr respectively.

Rajghat : Gross and net production was observed at AOF which ranged from 31.25 and 109.37 mgC/m³/hr and 18.75 and 62.5 mgC/m³/hr respectively.

OXYGEN DEMAND**Biochemical oxygen demand (BOD)****KANPUR**

BOD was estimated at Bhagwatghat, Tannery and Jajmau which ranged from 4.2 and 38.0 mg/l⁻¹ indicating highest values at OF and lower at AOF.

ALLAHABAD**River Ganga**

Mehdaurighat : It ranged between 4.0 and 40.0 mg/l⁻¹ indicating highest value in the months of June/July.

Mavaiya : BOD ranged between 4.0 and 42.6 mgC/m³/hr indicating highest value in May as was observed last year.

River Yamuna

Kakrahaghat : BOD varied between 5.0 and 42.0 mg/l⁻¹ indicating lower values in monsoon and higher in summer.

VARANASI

BOD was measured at Nagawa and Rajghat in July and January. It fluctuated between 4.2 and 52.0 mg/l⁻¹ indicating higher value at Rajghat in January as compared to Nagawa.

Chemical Oxygen Demand (COD)

KANPUR

COD fluctuated between 5.0 and 41.6 mg l^{-1} showing higher values at Jajmau (OF) which may be due to release of effluent.

ALLAHABAD

River Ganga

Mehdaurighat : COD fluctuated between 4.6 and 42.8 mg l^{-1} indicating same trend of fluctuation like previous year.

Mavaiya : It fluctuated between 4.6 and 49.2 mg l^{-1} indicating highest value in May.

River Yamuna

Kakrahaghat : COD ranged between 6.0 and 47.0 mg l^{-1} showing highest value in June at OF.

VARANASI

COD was measured at both Nagawa and Rajghat centres in July and January which fluctuated between 6.0 and 58.0 mg l^{-1} indicating higher values at Rajghat and lower at Nagawa.

Micro-analysis of Heavy metals

The samples of soil sediments, water, benthos and fish were collected from all the observed centres of rivers Ganga and Yamuna at Kanpur, Allahabad and Varanasi in July '92 and January '93. Fish samples however were not collected from Kanpur or Varanasi.

Soil sediments

Concentration of Zn, As and Cr ranged between 45.0 and 68.0 $\mu\text{g g}^{-1}$, 8.0 and 12.4 $\mu\text{g g}^{-1}$ and traces to 12.8 $\mu\text{g g}^{-1}$ of soil sediment respectively indicating lowest value at Kakraghat (Yamuna) and highest at Tannery in January '93 which was closely followed by Rajghat and Jajmau except Cr, which was highest at Manaiya (12.8 $\mu\text{g g}^{-1}$). Almost similar trend of fluctuation was observed previous year.

Water

Concentration of Zn, As and Cr at OF of the observed centres varied between 11.2 and 33.0 μgg^{-1} , 7.0 and 15.2 μgl^{-1} and 1.5 and 4.2 μgl^{-1} respectively. Lower values were observed at Nagawa (Varanasi) in Ganga and at Kakrahaghat in Yamuna, whereas Zn and Cr was highest at Mavaiya at Allahabad.

Benthos

Bottom biota specially tubifex were sorted out and analysed for Zn, As and Cr which ranged between 10.2 and 14.0 μgg^{-1} , 1.8 and 2.4 μgg^{-1} and 1.8 and 3.4 μgg^{-1} respectively. Lowest value was recorded at Kakrahaghat (Yamuna) and highest at Rajghat (Varanasi-Ganga) except Cr.

Fish

Fish samples were collected from polluted area/fish market at Allahabad. *R. rita* was analysed for Zn, As & Cr. The concentration of Zn, As and Cr ranged from 12.46 and 27.6 μgg^{-1} and 1.8 and 3.4 μgg^{-1} respectively indicating lowest value of Kakrahaghat (Yamuna) and highest at Manaiya (Ganga) except As.

QUALITATIVE AND QUANTITATIVE ESTIMATION OF PLANKTON IN RIVER GANGA AND YAMUNA

KANPUR

Bhagwatghat (Textile waste) : Total average plankton population was found to be 550 u/l, 1325 u/l and 525 u/l at AOF, OF and BOF respectively. The presence of bacteria *Zoogloea ramigera* and *Sphaerotilus* sp. indicated the pollutinal load at this centre.

Tannery : Total average population of plankton was found to be 8545 u/l, 725 u/l and 400 u/l at AOF, OF and BOF respectively. Abundance of bacteria and nematode clearly indicated a pronounced pollutinal load at OF centre.

Jajmau (sewage) : Total average plankton population was found to be 200 u/l, 1550 u/l and 475 u/l at AOF, OF and BOF respectively. An increase in bacterial population was also noticed at this centre.

In general, aforesaid studies revealed that among all the sampling points impact of pollution was pronounced in and around OF only and the total plankton population was not affected by the discharge. This may be attributed to diversion of nallas and setting up of a USAB treatment plant at Kanpur.

ALLAHABAD (River Ganga)

Mehdaurighat (Sewage pollution) : The plankton population averaged 800 u/l, 1164 u/l and 877 u/l at AOF, OF and BOF respectively.

Mavaiya (Industrial & sewage pollution) : Total average plankton population was found to be 424 u/l, 807 u/l and 449 u/l at AOF, OF and BOF respectively.

Non-polluted zone

Fatehpurghat : The plankton population ranged from 100 u/l in July to 800 u/l in January, the average being 508 u/l. It is 1.87 times less when compared to previous year. A biomodal fluctuation with a minor peak in summer and major in winter was observed.

Mavaiya : Total monthly population fluctuated between 150 u/l (August) to 1050 u/l (April). Bimodal pattern of fluctuation was recorded with a major peak in summer and minor in winter.

ALLAHABAD (River Yamuna)

Kakrahaghat (Sewage pollution) : The total average plankton population was found to be 92, 140 and 73 u/l at AOF, OF and BOF respectively. A significant decline in the plankton population was observed when compared to previous year. *Oscillatoria*, *Spirogyra*, *Synedra*, *Brachionus* and *Keratella* indicated mild pollution.

Sujawan (Non-polluted) : Phytoplankton (76.85%) dominated over zooplankton.

VARANASI**River Ganga (Sewage pollution)**

Nagwaghat : The plankton averaged 150 u/l, 700 u/l and 450 u/l at AOF, OF and BOF respectively. A decrease in Chlorophyceae population and increase of about 7 fold in bacterial population at OF when compared to previous year indicated an increase in organic pollution. The zone may also be designated as mesosaprobic.

Rajghat : The plankton population was estimated at 300 u/l, 675 u/l and 674 u/l at AOF, OF and BOF respectively. This was 6.41, 5.19 and 3.53 less at respective centres when compared with that of previous year. Based on the population of sewage bacteria and nematodes, the stretch is moderately polluted and may be designated under mesosaprobic.

QUALITATIVE AND QUANTITATIVE ESTIMATION OF BENTHIC FAUNA

KANPUR

Bhagwatghat : The benthic fauna at OF, AOF and BOF were estimated at 57114, 48 and 696 u/m^2 respectively. The population was observed to be many fold higher at OF as compared to previous year ($220u/m^2$).

Tannery : The benthic fauna at OF, AOF and BOF were estimated as 38.361 and 19 u/m^2 . As compared to last year the population was at lower side at BOF and almost same at OF and AOF.

Jajmau : The benthic fauna at OF, AOF and BOF was estimated at 266, Nil and 76 u/m^2 respectively. As compared to last year the population showed the abrupt decline at all the three points.

ALLAHABAD

River Ganga (Polluted zone)

Mehdaurighat : The average benthic fauna were estimated at 6991, 223 and 2534 u/m^2 at OF, AOF and BOF respectively. As compared to previous year the population increased at OF and BOF.

Mavaiya : The average benthic population at OF, AOF and BOF were estimated at 584, 152 and 481 u/m^2 . When compared to previous year, the population was almost static at OF and BOF.

Non-polluted zone

Fatehpurghat : The benthic fauna population was estimated at 356 u/m^2 which was approx. 2 times higher as compared to previous year. The population was widely distributed and rich in quality and quantity wise.

River Yamuna (Polluted zone)

Kakrahaghat (Sewage pollution) : Molluscs (93.98%), nematodes (2.80%), Polychaetes (2.19%), chironomids (0.97%) and odonata nymphs (0.05%) were recorded in order of their abundance during the period under report. Monthly average was 3506 units. Percentage of organisms at AOF, OF and BOF was recorded at 18, 4.35 and 77.64 respectively. Concentration of chironomids at OF area is indicative of mild pollution.

Non-polluted zone

Sujawan : This centre recorded molluscs (96.34%), polychaetes (2.93%) and nematodes (0.73%). Abundance of gastropods indicated the freshness of the environment.

VARANASI

Nagawa : The average macrobenthic population was observed to be 66 u/m², 330 u/m² and 154 u/m² at AOF, OF and BOF respectively.

Rajghat : The average macrobenthic population was found to be 242 u/m², 66 u/m² and 176 u/m² at AOF, OF and BOF respectively.

The following indicator species of pollution were recorded :

Phytoplankton	:	<i>Oscillatoria</i> sp., <i>Phormidium</i> sp., <i>Asterionella</i> sp., <i>Synedra ulna</i> and <i>Spirogyra condensata</i> .
Zooplankton	:	<i>Brachionus angularis</i> , <i>B. rubens</i> , <i>Keratella</i> spp., <i>Euglena</i> sp. and <i>Polyarthra</i> sp.
Bacteria	:	<i>Zoogloea remigera</i> , <i>Sphaerotilus</i> sp. and <i>Thiodictyon</i> sp.
Macrobenthos	:	<i>Chironomous</i> sp., <i>Tubifex</i> sp., <i>Limnaea</i> sp. and <i>Pisidium</i> sp.

The study conducted during 1992-93 revealed the mild nature of pollution at these centres in and around OF region. Hyper eutrophication was witnessed at OF due to organic load from sewage discharge. This has altered not only the physico-chemical condition of water but has affected diversity of benthic fauna plankton and ichthyofauna as well to some extent. But at Kanpur due to installation of USAB treatment plant considerable improvement in water quality and biotic communities is apparent when compared to previous years.

STUDY OF PATHOGENS AND FISH PARASITE

Epizootic ulcerative syndrom (EUS) : The occurrence of EUS was observed this year again during post-monsoon and winter season. But the incidences were quite low (27.12%) as compared to the pervious year.

Parasites : Natural infection in *Channa punctatus* by the metacercariae *Neascus channi* was observed in river Yamuna at Allahabad.

DIVERSITY INDICES OF MACROBENTHOS AND PLANKTON

During the period of study this year all the centres (sewage and industrial) on river Ganga viz., Bhagwatghat, Tannery, Jajmau (Kanpur), Rajghat, Nagawa (Varanasi) showed the low values of diversity index (H) ranging from 0-0.80 excepting heavy pollution (polysaprobic). But at Allahabad (sewage and industrial) centres polysaprobic conditions were observed at outfall only and β -mesosaprobic conditions were found at AOF and BOF. The index values were higher (1.36-1.90) in non-polluted zone. Similar trends were observed in case of diversity index values in respect of plankton.

PROJECT

FC/B/9

INVESTIGATIONS ON FACTORS RELATING TO DECLINE IN FISHERY OF THE RIVER BRAHMAPUTRA AND ITS TRIBUTARIES

Personnel : K.P. Srivastava, M. Choudhury, R.C. Singh, Alok Sarkar, B.K. Biswas

Duration : October 1985 to March 1994

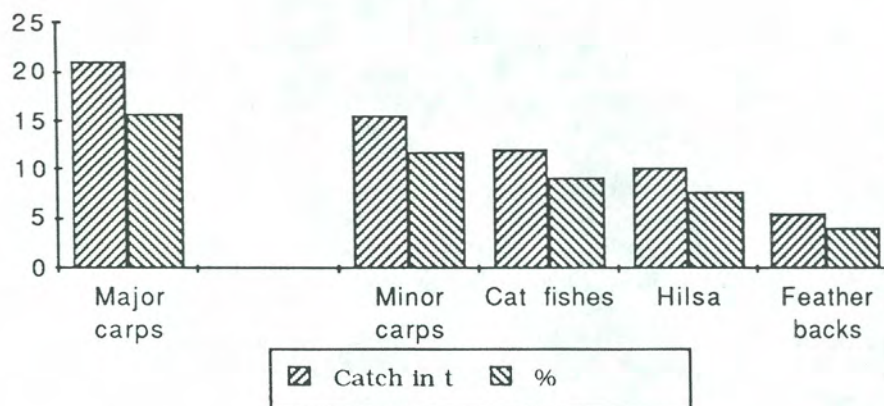
Location : Guwahati

Fish catch statistics : Riverine fish catch statistics was collected and estimated at Uzanbazar fish landing centre, where catch is brought from 30 km stretch of river Brahmaputra.

Fish population structure : A total of 133.05 t (including hilsa) were estimated to have landed, as against the total of 220.40 t during the previous year, indicating a sharp decline of the riverine fishes around Guwahati, to the tune of 39.6%.

The catch was dominated by miscellaneous group of fishes to which large catfishes viz., *B. bagarius* and *P. pangasius* made a significant contribution along with small catfish viz., *A. coila*, *C. garua*, *E. vacha*, and other small fish like clupieds, *G. chapra*, *S. phasa*, etc., carp minnows, *A. mola*, *A. morar*, *L. dero*, etc. The most interesting finding of the year is that this group alone constituted more than half 68.62 t (51.58%). *C. mrigala* was negligible.

Fig. 1 Fish landing of R. Brahmaputra at Uzanbazaar for the year 1992-93



Hydrological Studies : Studies were made on various hydrobiological parameters at three selected sites on river Brahmaputra viz., freshwater zone at Noonmati, sewage polluted zone at Bharalumukh and industrial polluted zone at Saraighat.

Gross and net productivity values, at the Noonmati site, varied from 4.0 to 142.72 and 17.50 to 60.63 mg C m⁻³ hr⁻¹ whereas the respiration was estimated in the range of 6.75 and 122.50 mg C m⁻³ hr⁻¹.

Bharalumukh : Bharalumukh Outfall site has exhibited a highly polluted character of water almost throughout the year, the pollutional load having being observed to be maximum during summer months. However, the effluents get diluted below the outfall region.

Gross and net primary productivity at this site varied from nil to 55.0 and 147.90 to nil, whereas respiration fluctuated in the range of 30.0 to 172.50 mg C m⁻³ hr⁻¹.

At Bharalumukh BOF : Gross and net primary productivity values varied from 10.0 to 56.25 and -38.75 to 41.25 mg C m⁻³ hr⁻¹ respectively, while respiration fluctuated between 35.25 and 73.50 mg C m⁻³ hr⁻¹.

Saraighat OF : Gross and net production and respiration values were estimated in the ranges of 10.0 to 56.25, -38.75 to 41.25 and 35.25 to 73.50 mg C m⁻³ hr⁻¹. At BOF, gross and net productivity values varied from 6.25 to 146.63 and -129.0 to 110.0 mg C m⁻³ hr⁻¹.

It is evident from the observations that the sewage and industrial pollutant, though have their effects on the quality of water and biota at the outfall zone, their effect was neutralised below the outfall zones considerably, due to the heavy influx of water in the river Brahmaputra and its very fast current.

Plankton : Average monthly plankton population at Noonmati, Bharalumukh OF, Bharalmukh BOF, Saraighat OF and Saraighat BOF were estimated at 155, 193, 160, 137 and 149 u l⁻¹ respectively. Qualitatively, the phytoplankters (81.25% to 91.70%) dominated over the zooplankters at every site.

Macrobenthic fauna : The population of benthos was almost negligible at Noonmati and Saraighat sites. However, Dipteran larvae and oligochaets were encountered in the OF zone of Bharalumukh but their number was very few in the collections.

PROJECT**FC/B/10****FISH COMMUNITY STRUCTURE IN THE CONTEST
OF ENVIRONMENTAL MODIFICATIONS IN RIVER
YAMUNA**

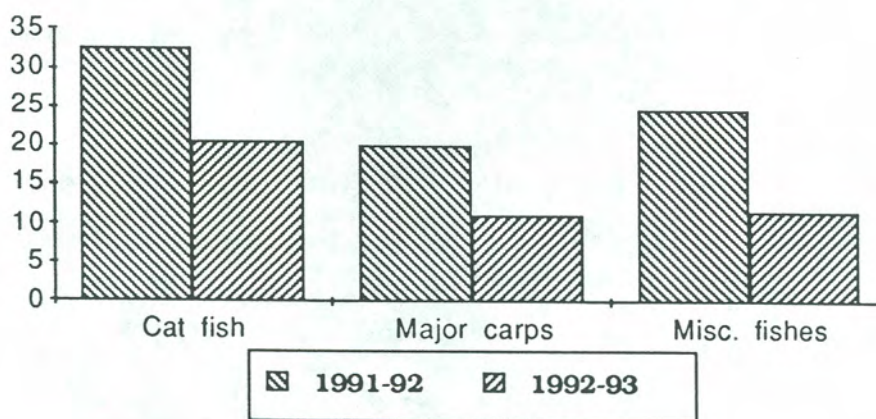
Personnel : R.S. Panwar, D.N. Mishra, Shree Prakash, Mrs. Usha Moza (from June 1992 to February 1993), K. Chandra (February 1992 to December 1992) V. Kolekar (from December 1992)

Duration : May 1988 to March 1994

Location : Agra (Uttar Pradesh)

Sampling was done at Agra for 8 days, fish landings were recorded species-wise and group-wise and were estimated at monthly interval. The total fish landing at Agra from River Yamuna was recorded at 43.62 tonnes as against 64.35 t in 1991-92. The details are given in Fig. 1.

Fig. 1 Total fish landing at Agra from R. Yamuna during 1991-92 & 1992-93 (in tonnes)



Intensive fishing was observed in both the sectors i.e., Kerawali to Strechi bridge and Strechi bridge to border of Etmodpur. The gears used were gill net, drag net, lines and hooks. The average catch/unit efforts ranged from $0.31 \text{ kg man}^{-1} \text{ hr}^{-1}$ to $0.930 \text{ kg man}^{-1} \text{ hr}^{-1}$ showing a direct correlation between water level and catch. This is probably because of breeding and post breeding migration of fishes.

Spawn prospecting investigations have been carried out at Agra at Khaspur during the period from 16.07.1992 to 26.08.1992. A total of 155 ml spawn were collected by operating two shooting nets, at a time. The quantitative index was found to be 2.87 ml h^{-1} . Larger mesh (1/8") gave better spawn catch of larger size (10-15 mm) whereas the smaller mesh gave better catch of small (5-10 mm) size spawn. A better quantitative index of $1.75\text{-}1.25 \text{ ml h}^{-1}$ was recorded during midnight (22 hrs. to 4 hrs.). However, during day time the index varied between 0.5 to 0.6 ml h^{-1} .

The qualitative index of spawn was estimated as follows :

Major carps				Minor carps	Shrimps	Misc.
Catla	Rohu	Mrigal	Calbasu			
19.0%	20.0%	10.3%	1.66%	25.0%	0.6%	23.44%

The minor carps and miscellaneous species were consisted of *Puntius* spp. (64.0%), *Chela* spp. (20.03%), *M. armatus* (9.46%), *Trichogaster* sp. (0.74%), *H. fossilis* (0.22%), *Ambassis* sp. (0.74%), and shrimps (0.04%).

A survey for isolating a purely fresh water zone was conducted and Dak Pathar was identified in the upper stretch. The clarity of river water was very high at Dak Pathar (transparency 120.0 to 130.6 cm). But from Kailash (AOF), pollutional effects started appearing. In upstream of river Yamuna at Wazirabad (Delhi), the physico-chemical characteristics of water indicated narrow variations showing a better trend. The impact of sewage wastes at downstream of river Yamuna at Okhla (Delhi) affected the water quality and aquatic biomass through uptake of oxygen. The BOD values at outfall zone in Delhi was 70.0 to 198.4 mg l^{-1} followed by Agra (39.0 to 166.4 mg l^{-1}). The quality of water at Kailash, the AOF stretch of river Yamuna at Agra, exhibited high buffering capacity throughout the year. The pollutional effect due to combined sewage wastes and industrial effluents from tannery, foundry, steel finishing units etc.) was noticed at Tajghat (Agra).

At down stream of river Yamuna at Shergarh, the quality of water has considerably changed when it meets with Chambal river along with other tributaries. It brings about an improvement in water quality of river Yamuna which undergoes self purification along its course, which is quite ideal condition for aquatic life.

Primary productivity

Significant variation was noticed in the primary production at different centres during different season. The maximum values were recorded during winter followed by summer and monsoon months. The primary productivity values of freshwater zones are in the range of 41.0 to $300 \text{ mg C m}^{-3} \text{ hr}^{-1}$ (Gross production) and 33.3 to 250.0 mg l^{-1} (Net production). The pollutional zones of Delhi, Mathura, Agra and Etawah indicated maximum values of Gross Production (GP) $968.2 \text{ mg C m}^{-3} \text{ hr}^{-1}$ and Net Production (NP) $529.2 \text{ mg C m}^{-3} \text{ hr}^{-1}$, GP $966.6 \text{ mg C m}^{-3} \text{ hr}^{-1}$ and NP $525.0 \text{ mg C m}^{-3} \text{ hr}^{-1}$, GP $249.9 \text{ mg C m}^{-3} \text{ hr}^{-1}$ and NP $212.4 \text{ mg C m}^{-3} \text{ hr}^{-1}$ and GP $501.56 \text{ mg C m}^{-3} \text{ hr}^{-1}$ and NP $187.5 \text{ mg C m}^{-3} \text{ hr}^{-1}$, respectively.

Qualitative and quantitative assessment of plankton in time and space

The surface plankton study of River Yamuna, conducted from Dakpathar to Shergarh, reveal Dakpathar as purely freshwater zone, presenting a plankton population of 144 u l^{-1} (diversity index 3.84). Delhi stretch of river showed polysaprobic pollution due to sewage and industrial waste giving a diversity index of 2.39 and presence of *Euglena*, *Oscillatoria* and *Phormidium*.

Further downward at Vrindaban, the stretch of AOF, OF and BOF Mathura has the biotic abundance dominated by *Ulothrix* and *Oscillatoria* lead to designate this stretch as mesosaprobic. In Agra stretch due to the effect of combined industrial and sewage wastes the plankton population enhanced gradually, showing their abundance as 190 u l^{-1} (AOF), 237 u l^{-1} (OF) and 303 u l^{-1} (BOF) along with biota indicating polysaprobic pollution. The presence of *Cladophora*, *Scendesmus*, *Ulothrix* and *Pediastrum* as dominating forms designate the Etawah stretch as mesosaprobic. The diversity index at Mathura, Etawah and Shergarh were found to be 3.07, 3.26 and 3.84, respectively.

Qualitative and quantitative estimation of macrobenthos in time and space

At Dakpathar no organism was observed due to faster current of the freshwater zone of river. The main observation was the dominance of oligochaetes (tubificids) at OF zones of Mathura and Agra, than the other zones indicating high organic content substratum due to organic effluents, from sewage nallah. Among oligochaetes main organisms present were tubificids and among Dipterans, *Chironomid* sp.

Qualitative assessment of Periphyton in time and space

The periphyton population was mainly constituted by Diatoms. Considering the whole stretch from Dakpathar to Shergarh it contributed maximum at Dakpathar (48.90%). The diversity index was calculated as : Dakpathar 4.66, Wazirabad 3.54, Okhla 3.32, Vrindaban 4.05, Mathura 3.12, Agra 2.67, Etawah 3.51 and Shergarh 4.15.

Macrophytes in time and space

At Wazirabad (Delhi) the total macrophytes were 450 g m^{-2} , comprising *Eichhornia* sp. (50%), *Hydrilla* sp. (40%) and *Vallisneria* sp. (10%), whereas at Shergarh average wet weight was 300 g m^{-2} comprising (70%) *Hydrilla* sp. and (30%) *Vallisneria* sp. In Mathura, Agra and Etawah stretches the macrophytes were absent.

Toxic effect of industrial effluents and sewage waste on fish and fish food organisms

Bio-assay studies : The study conducted tannery effluents, using test fishes *C. mrigala* (fry) for different period of exposures in the laboratory. The LC₅₀ values of the effluent with respect to test fish were calculated at 14.89% (24 hr.) and 10.98% (96 hr.) by volume.

Bio-chemical studies : The test fish *C. mrigala* (fingerlings) exposed to sublethal concentration (8% by volume) of tannery effluent decreased its fat content (27.6%) when kept for a period of 7 days of exposure as compared to untreated fish (fat content 32.5%). The protein content also reduced from 90.0 ug g^{-1} to 80.0 ug g^{-1} dry weight tissue (muscles).

Accumulation of heavy metals in water, sediments and fishes of River Yamuna

Different heavy metals viz., zinc, copper, chromium, mercury, lead and cadmium were determined in water, sediments and fish in river Yamuna in down stream from Delhi to Etawah. Maximum metal levels of Zn, Cu, Cr and Pb in sediments were found in Delhi near Nazafgarh nalla followed by Agra, Mathura and Etawah. But the level of Zn and Cu in water was considerably higher at Mathura than Agra. The heavy metal level of Cu, Cr, Pb and Cd were maximum at Nazafgarh drain and followed by I.T.O. and Okhla at Delhi. Similarly the level of different metals present in city side of Agra were considerably higher than other site i.e., Kailash. Similarly the same trend was observed at Mathura also.

The bio-magnification factor with respect to fish, *C. mrigala* at Delhi (Okhla) for different metals were calculated to be 0.445 (Zn), 0.324 (Cr), 0.289 (Cu) and 0.245 (Pb).

PROJECT FC/B/11**ASSESSMENT OF ECODEGRADATION IN THE
GANGA RIVER SYSTEM AND CHARACTERISATION
OF BIOLOGICAL AND CHEMICAL RELATIONSHIPS
BETWEEN THE MAIN GANGA AND ITS TRIBUTARIES**

- Personnel :** *Barrackpore Centre :* H.C. Joshi (upto 25.1.1993), K.K. Vass (from 26.1.1993), Mrs. K. Mitra, A. Hajra, D.K. Biswas, Mrs. Keya Saha
- Calcutta Centre :* A.C. Nandy, R.K. Banerjee, H.C. Karmakar
- Allahabad Centre :* H.P. Singh, Balbir Singh
- Patna Centre :* B.C. Jha, V. Pathak, V.R. Chitranshi
- Agra Centre :* R.S. Panwar, Mrs. U. Moza
- Duration :** April 1991-March 1996
- Location :** Environmental Monitoring Section (Barrackpore, Calcutta, Allahabad, Patna and Agra)

Environmental monitoring campaigns were organised during summer (June-July) and winter (December-February) in river Ganga at Kaethe, Hardoi, U.P.), Babura, Bihar and Ranaghat, Baranagar and Nurpur in West Bengal. Similar campaigns were also made in rivers Gomti, Ramganga, Sone, Churni and Damodar.

Water quality characteristics

Water quality parameters viz., temperature, pH, DO, alkalinity, hardness, specific conductivity, nitrate, phosphate, BOD and COD were recorded for all the locations in main Ganga and its tributaries. The Water Quality Index (WQI) based on the above parameters indicated values equivalent to 100 at Farukhabad (confluence of Ramganga), Saidabad (confluence of Gomti), Patna (confluence of Sone), Ranaghat (confluence of Churni) and Nurpur (confluence of Rupnarayan). The chemical quality of water as indicated by WQI value is conducive for fisheries.

Biological parameters

Plankton : Moderately high densities of plankton were recorded in Ramganga (2305 UI^{-1}) and Sone (1899 UI^{-1}) while in Gomti (300 UI^{-1}), the concentration was much low. All these tributaries and the main Ganga in upper

stretch showed dominance of Bacillariophyceae. Rivers Churni (102 UI^{-1}) and Damodar (94 UI^{-1}) in lower stretch had different planktonic composition comprising *Phormidium* sp., *Oscillatoria* sp., *Ulothrix* sp., *Spirogyra* sp. etc. In estuarine stretch at Baranagar (141 UI^{-1}) and Nurpur (289 UI^{-1}) the density of plankton increased as compared to the lower stretch of the Ganga river system. The species diversity indices by and large was above "1" indicating normal distribution pattern of the planktonic organisms in all the locations.

Benthic fauna : The values indicate comparatively higher densities of benthic fauna in the main Ganga (741 Um^{-2}) and its tributaries like Sone (1487 Um^{-2}), Ramganga (336 Um^{-2}) and Gomti (176 Um^{-2}) in upper stretch. In this region molluscs constituted the major group except in river Gomti where chironomids were dominant amongst the benthic organisms. In Churni (150 Um^{-2}) the benthic fauna was represented by molluscs, chironomids and oligochaete worms. Damodar showed negligible distribution of benthic fauna, but with a density of 173 Um^{-2} at a single location near Dihika confluence.

Insect population

Insect fauna near Churni-Ganga confluence was mainly represented by *Micronecta proba* (Hemiptera) and *Bealis* sp. (Ephemeroptera). The magnitude of population was comparatively high above the confluence while the faunistic diversity was more (2.896) at confluence during winter. The distribution pattern ($3 = 0.99653$) also reflected congenial condition of the environment near the confluence.

Macrophytes

Study showed *Eichhornia* in both lower stretches of Ganga and in River Churni.

Fish health monitoring

Rita rita a sedentary omnipresent species in Ganga river system was sampled from different locations and analysed for RBC, WBC, Hb and HCT values. The results of blood analysis indicated normal haematological condition of the species in rivers Ramganga and Sone and estuarine environment near Baranagar and Nurpur. Simultaneous histopathological examination of the vital organs viz., liver, kidney and gills also reflected healthy condition of the fish at the respective locations.

Monitoring of hazardous substances in Ganga river system

Heavy metals and pesticide residues have been analysed in water, sediment and fish samples collected from different locations of main Ganga and its tributaries. The soil and water samples did not show any significant violation in heavy metal contents. The metal content in fish *Rita rita* in lower stretch of the

Ganga river system were within permissible limits. Pesticide analysis indicated presence of metabolites of DDT and isomers of BHC in soil and water. However, none of the fish samples showed residues of pesticides in their body tissues.

Biochemical studies

Biochemical studies have been performed for the identification of markers or indices to evaluate the environmental stress. Determinations of the blood glucose and blood serum protein in the samples have been carried out. The observations revealed an increase in blood glucose content of *Rita rita* in Hooghly sample at Baranagar, Calcutta compared to the samples obtained from Saidpur point and Nurpur point. Blood plasma protein values at these points, however, registered no appreciable change.

Fisheries in Ganga river system

The main Ganga and its tributaries in upper stretch have shown comparatively less diversity in fish fauna and dominance of catfish (Bagridae and Schilbeidae) in fish catch.

PROJECT : FC/A/4

ECO-DYNAMICS AND FISHERY MANAGEMENT OF BEEL ECOSYSTEMS IN WEST BENGAL.

Personnel : K.K.Vass, R.A. Gupta, V.V. Sugunan, H.C. Joshi, M.K. Mukhopadhyay, G.K. Vinc (Mrs.), K. Mitra (Mrs.), N.N. Mazumder

Duration : May 1986- April 1994

Location : Barrackpore, West Bengal.

Ten beels (oxbow lakes) located in five districts of West Bengal were surveyed in respect of ecology and fish yield pattern. These beels were morphohydrographically different, some closed beels with varying depth and ecotypes and open beels retaining connection with the river systems. Salient ecological characteristics of these beels were as mentioned below.

Water quality :

The closed deep beels (5.5-11.0 m) showed thermochemical stratification within the systems. Dissolved oxygen and temperature values at bottom were 20% to 40% less than the sub-surface layer. Medium deep (3.0-5.0 m) and shallow beels were free from such thermochemical stratifications.

Biocommunity structure :

Bhandardah beel falling under deep beels registered high density of plankton population (avg. 18224 ul^{-1}) throughout the year. Cyanophyceae represented by *Microcystis* sp., *Anabaena* sp., *Nostoc* sp., etc. contributed 46-72% of the total plankton population in Bhandardah beel. Medium deep and shallow beels sustained balanced plankton population contributed by the groups - Cyanophyceae, Chlorophyceae, Myxophyceae, copepods, cladocerans and rotifers. In shallow beel Chlorophyceae and copepods were the dominant groups. Plankton population in medium deep and shallow beels fluctuated between 56 ul^{-1} and 286 ul^{-1} and 26 ul^{-1} and 48 ul^{-1} respectively.

Benthic fauna in deep beels were represented mainly by the Oligochaeta worms and gastropods (*Limnaea* spp., *Gyraulis* sp., *Indoplanorbis* sp., *Gabia* sp.). In medium deep and shallow beels the benthic fauna comprised gastropods, chironomids, oligochaetes, insect larvae and small prawns.

Macrophyte vegetation in general was dominated by floating *Eichhornia crasipes*, and submerged *Hydrilla verticillata*, *Vallisneria spiralis*, *Najas indica* and *Ceratophyllum demersum* species. Such macrophyte infestation was of very high order in shallow beels spreading over 60-95% of the water area.

Fish and fisheries :

Annual fish yield from the deep beels were reported to fluctuate between $350 \text{ kg/ha yr}^{-1}$ and $500 \text{ kg/ha yr}^{-1}$. The rate of fish production was comparatively higher ($450 \text{ kg/ha yr}^{-1}$ - $700 \text{ kg/ha yr}^{-1}$) in medium deep beels while lowest in shallow beels ($150 \text{ kg/ha yr}^{-1}$ - $350 \text{ kg/ha yr}^{-1}$).

PROJECT : FC/A/7

ECOLOGY AND FISHERIES OF FRESHWATER RESERVOIRS

Personnel : **Bangalore :** Ch. Gopalakrishnayya, M. Ramakrishnalah, A.K. Lal, D.S. Krishna Rao, P. K. Sukumaran, M. Karthikeyan, SK. S.S. Hameed

Raipur : V.R. Desai, D. Kumar, N.P. Srivastava, K.K. Agarwal, S.L. Soni (from M.P. Fisheries)

Kangra : D.K. Kaushal, V.K. Sharma

Pune : P.L.N. Rao, M.D. Pisolkar, B.K. Singh, B.L. Pandey

Eluru : K.V. Rao, J.B. Rao, T.S.R. Raju, K.Subba Rao, P.S.C. Bose, C.G. Rao

Duration : 1987-1994

Location : Bangalore, Raipur, Kangra, Pune, Eluru

Markonahalli reservoir (BANGALORE)

Maximum water level during the period April '92- January '93 (excluding May) was 730.96 m (November) and minimum 721.31 m (September) thus fluctuating by only 1.65 m.

Rainfall occurred throughout the period from April to November. Maximum precipitation was in October and minimum in November. The rainfall during this year was above the average rainfall of 677 mm for the reservoir. The mean temperature fluctuated from 24.7° C (August) to 27.5° C (April & May).

Physico-chemical characteristics of water

The fluctuations in chemical parameters were determined by the inflow pattern. Water transparency was high this year when compared to last two years (215.0 cm). Values of oxygen gradually increased from June to December (6.0-10.9 mg/l). The pH values varied from 7.9 in October to 8.7 (April to September), average for the year being 8.6. Average bicarbonate alkalinity was 109 mg/l, ranging from 63 (February) to 135 mg/l (November). Both specific conductivity and total dissolved solids fluctuated similarly, former ranging from 151 micro mhos/cm (May)

to 211 micro mhos/cm (April) and the latter ranging from 74 kg/l in May to 104 mg/l in April. Total reactive phosphorus and nitrate were recorded in traces. This reflects the presence of phosphorus in particulate form rather than in dissolved form.

Klinograde distribution of oxygen indicating the productivity of the water was observed in March and April, September to November 92 and February 93. Distinct thermocline between 4 and 6 m was observed in February. Orthograde distribution of oxygen was observed upto August, probably due to wind induced turbulence as well as showers resulting in mixing.

Primary productivity

Solar radiant energy ranged from $185.5 \times 10^4 \text{ cal m}^{-2} \text{ d}^{-1}$ (December) to $233.0 \times 10^4 \text{ cal m}^{-2} \text{ d}^{-1}$ (May) Primary productivity ranged from 31.25 (Aug.) to 234.37 mg C $\text{m}^{-2} \text{ h}^{-1}$ (Oct.) with an average of 86 mg C $\text{m}^{-2} \text{ h}^{-1}$. Primary production values were typically bimodal. Phytoplankton density 176 u/l was observed. Net production and respiration ranged from - 146.9 (Nov.) to 312.5 (Aug.) and nil (Feb.) to 337.5 mg C $\text{m}^{-2} \text{ h}^{-1}$ (Aug) respectively.

Plankton

The total counts of plankton in Markonahalli reservoir ranged between 2,312 (intermediate sector) and 2,702 u l^{-1} (lotic sector). The zonal average counts show a predominance of zooplankton particularly copepods (*Diaptomus* spp.) over phytoplankton which indicates that the reservoir exhibits the dominance of zooplankton.

Phytoplankton

The phytoplankton was mainly dominated by *Ceratium hirudinella*. Thirty one genera of phytoplankton belonging to four classes viz., Myxophyceae, Chlorophyceae, Bacillariophyceae, and Dinophyceae were recorded.

Zooplankton

The zooplankton was represented by Rotifera, Cladocera, and Copepoda.

Bottom biota

Bottom biota comprised *Lamellidens marginalis*, *L. corianus*, *Viviparus bengalensis*, *Melania striatella tuberculata*, *Melania* (Blotia) *scabra*, *Melania* (Blotia) *scabra* var. *elagana*, *Bithynia stenothroides*, *Lymnaea luteola*, *L. acuminata*,

Indoplanorbis exustus, *Chironomus* spp. *Tubifex* spp. and *Ephemerella* spp. Mollusca was dominant over other groups. Population of bottom biota and their taxa ranged from 76/3 (April) to 931/7 (Nov.), 76/2 (April) to 152/7 (May) and nil (Aug.) to 399/6 (June) in lotic, intermediate and lentic sectors. Over all population of benthic invertebrates was poor in the reservoir. Population of bottom biota was invariably higher in lotic sector (931 No. m⁻²). Occurrence of *Indoplanorbis exustus* mostly in lentic sector indicated abundance of macrophytes in that sector.

Fish fauna

Twenty seven species have been recorded so far from the reservoir, viz., *Notopterus notopterus*, *Oxygaster clupeoides*, *Chela atpar*, *Puntius ticto*, *P. chola*, *P. dorsalis*, *P. sophore*, *P. sarana*, *Rasbora daniconius*, *Labeo rohita*, *L. bata*, *L. calbasu*, *Cirrhina mrigala*, *C. reba*, *Catla catla*, *Cyprinus carpio*, *Gambusia affinis petruelis*, *Mystus cavasius*, *Ompok bimaculatus*, *Wallago attu*, *Mastacomblus armatus*, *Channa marulius*, *Channa striatus*, *C. punctatus*, *Glossogobius giuris*, *Chanda ranga* and *Chanda nama*.

Breeding and recruitment

Sporadic breeding and recruitment occurred in case of *L. calbasu*, *W. attu* and *C. mrigala*. However, fairly good recruitment has been recorded in respect of miscellaneous species like *N. notopterus*, *O. bimaculatus*, *C. reba*, *M. cavasius*, *P. sarana* etc.

Biology of fishes

Biological studies were conducted on *Notopterus notopterus* and *L. rohita*.

Yield estimation

The stocking of 91,000 fingerlings of major carps (catla and rohu) during Dec., 1990, coupled with increase in fishing effort, has brought out spectacular change in the fish yield of Markonahalli reservoir during 1992-93. The fish catch registered a sharp jump from 5.2 t in 1991-92 to 46.06 t during this year, a nine fold increase from previous year. The yield per hectare during 1992-93 was 62.8 kg, as against 7.01 kg during 1991-92 and 5.5 kg during 1990-91. CIFRI had predicted a potential yield of 140 kg/ha from this reservoir on the basis of morpho-drainage index and sufficient stocking. Stocking was only 91,000 against the recommended 5 lakhs fingerlings. Species-wise stocking figures were not available to assess the performance of individual species. *C. catla* appeared for the first time in the catches during March 1992 i.e., after 14 months of stocking. The details are given in Table 1.

Table 1

Species-wise catch (kg) for different years in Markonahalli Reservoir
(figures in parenthesis are percentages)

	1990-91	1991-92	1992-93
<i>C. catla</i>	-	1030 (19.8)	10736 (23.34)
<i>L. rohita</i>	615 (15.1)	1166 (22.4)	16955 (36.86)
<i>C. mrigala</i>	1190 (29.2)	69 (1.3)	735 (1.60)
<i>L. calbasu</i>	473 (11.6)	223 (4.3)	323 (0.70)
<i>C. carpio</i>	-	573 (11.0)	1046 (2.27)
<i>W. attu</i>	265 (6.5)	272 (5.2)	1124 (2.44)
Misc.	1532 (37.6)	1868 (36.0)	15085 (32.79)
Total catch(kg)	4,074	5,201	46,004
Yield/ha (kg)	5.56	7.01	62.77

Catch and effort during different months

The fishing effort is on the increase from April '92 onwards and it touched maximum during January-March '93 (Table 2).

Table - 2

Effort and catch per unit effort for different months

	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Effort (Units)	240	240	360	750	360	600	720	720	720	780	780	780
Catch (kg)	987	1143	2690	5908	2130	2021	9031	2405	3208	2777	5966	6929
C/U (kg)	4.11	4.76	7.47	7.88	5.92	4.70	2.54	3.34	4.47	3.56	7.65	8.88

Stocking

The stocking rate worked out to be 822/ha and is expected to make its impact in the fishery of 1993-94.

Other investigations

1. As per request of the Karnataka State Fisheries Minister/department, a report on suspected fish mortality in Markonahalli reservoir due to Manaylux paper factory effluents was submitted.
2. Conducted ecological studies of Chikkapadasalgi barrage across river Krishna, Jamkhandi. The report on the feasibility to take up fish culture in the barrage has been submitted.

Ravishankarsagar (RAIPUR)

The reservoir did not attain full water level. The level fluctuated from 342.91 m (December) to 348.27 m in September. The total inflow (68.948 TMC) and the total outflow (68.729 TMC) almost were equal. The average water level from April '92 to January '93 was 344.51 m and was lesser than that of last year 345.65 m.

Based on the values of total alkalinity, total hardness, phosphates and nitrates, the reservoir is classified as 'medium' productive. The high content of Calcium (37.9 ppm) supports greater population of molluscs and *Chara* sp. The water did not show distinct thermal or chemical stratification, due to flow of water for irrigation. Also the reservoir is not deep, showing mean depth of 10 m. Significant diurnal variations in the physico-chemical condition of water were not observed.

Primary productivity

The gross primary production ranged 196.8 C mg C/m³/d or 16 mg C/m³/h (December & September) to 750.0 mg C/m³/d or 62.5 mg C/m³/h (May), while the net primary production ranged from 93.72 mg C/m³/d or 7.81 mg C/m³/h (February) to 516.0 mg C/m³/d or 43 mg C/m³/h (Sept.). The average gross and net production were 524.97 and 284.63 mg C/m³/d or 43.75 and 23.72 mg C/m³/h.

Yield estimation

During the year no fishing was conducted from July to December. The catches were only for 3 months (April to June) and few days (in January). The catch was estimated to be only 12.8 t. Details are given in Table 3.

Table - 3

Monthly fish catch, fish abundance and fishing effort (1992-93) of Ravishankar sagar reservoir.

Month	Fish catch (kg)	Fishing days	Catch/day (kg)	No. of gill nets	Catch/net (kg)	Condition of gates of the dam	Reservoir water level (m)
Apr. '92	5,808.400	30	193.61	12,527	0.46	Closed	343.76
May '92	4,707.750	31	151.86	10,360	0.45	Closed	343.08
June '92	1,573.500	15	104.90	3,665	0.43	Closed	343.04
July '92				NO FISHING			
Aug. '92				-do-			
Sept. '92				-do-			
Oct. '92				-do-			
Nov. '92				-do-			
Dec. '92				-do-			
Jan. '93	712.000	13	54.77	6,117	0.12	Closed	343.63
Feb. '93							
Mar. '93							
Total/av.	12,801.650	89	143.84	32,669	0.39		343.38

Stocking

The reservoir was stocked @ 300 fry/ha/a in 1986-87 resulting an increase in catches from 13 t in 1987-88 to 53 t in 1991-92. However, the stocking rate gradually declined to 100 fry/ha/a by 1991-92. During this year stocking was done @ 288/ha/a (Catla 5,23,500 (28.53%), rohu 9,71,000 (52.92%) and mrigal 3,40,500 (18.55%) of size ranging from 65-75 mm).

Pong reservoir (KANGRA)

The reservoir water level during the period March '92 to January '93 fluctuated by 16.6 m from a minimum of 408.76 m (June) to 423.27 m (September). The average water level during the period was 415.41 m. Total inflow and outflow were 10,271 and 10,555 M m³. Maximum inflow and outflow were in August. The soil of the reservoir is medium productive. Thermal stratification was observed in different depth in different months.

Chemical stratification

Depth studies in lentic sector showed a clear indication of biogenic chemical stratification, an index of productivity of the reservoir, in respect of oxygen, pH, total alkalinity and specific conductivity.

Primary production

The average gross and net production in lentic sector varied between 29.95 and 57.28 mg C/m³/h and 11.72 and 44.26 mg C/m³/h respectively. The average ratio between net and gross production was 0.55 indicating reservoir as a productive water body.

Plankton

The average surface plankton fluctuated from 575 units/l (May) to 5783 u/l (November). A secondary peak was observed in April (1883 u/l). Maximum abundance was observed in intermediate sector (3107 u/l), followed by lentic and lotic sectors. The average plankton by vertical net sampling fluctuated from 1053 u/l (March) to 8,661 u/l (Sept.) almost being similar to last year. Biomass varied from 0.68 ml/m³ (August) to 2.88 ml/m³ (June). Diurnal variation of plankton was studied in September and December. Plankton concentration at different depths was also studied.

Macrobenthos

The average standing crop was estimated at 496/15.90 g/m², showing a marginal decrease over 513/m² in numbers but increased by weight over 3.71 g/m² of last year.

Periphyton

An average concentration of 1540/cm² of periphyton was found. Bacillariophyceae dominated throughout the year (85.71 to 92.45%).

Fish fauna

In addition to 31 fish species earlier reported, three more were recorded from the reservoir and its associated waters. They are *Danio devario* (Ham.), *Puntius sophore* (Ham.) *Barilius barna* (Ham.), all belonging to Cyprinidae.

Stocking

The reservoir was stocked with fingerlings of mirror carp (2.40 lakhs) and Indian major carps (12.35 lakhs), the rate of stocking being 98 fingerlings/ha/a.

PROJECT FC/A/16**ECOLOGY AND FISHERIES MANAGEMENT OF BEEL
IN BRAHMAPUTRA BASIN (ASSAM)**

Personnel : M. Choudhury, K.P. Srivastava, R.C. Singh
(till 7.8.92), A. Sarkar, B.K. Biswas

Duration : April 1989-March 1994

Location : Guwahati (Assam)

Physiography and morphometry

Ghorajan beel, a flood plain lake of river Brahmaputra, is situated near north Guwahati at about a distance of 30 kms on Nh No.31. It is located within the ordinate of 91°81' E longitude and 26°20' N latitude in the Kamrup district of Assam. The water spread area at full and dead storage levels are 117 and 86 ha respectively. It is connected with the river Brahmaputra through a channel which works both as outlet and inlet. Maximum depth of water at full and dead storage levels are 5.0 m and less than 2.0 m respectively.

Physico-chemical characteristics of water

The pH of water has fluctuated around 6.0 while dissolved oxygen is within fair range from 6 to 7. Total alkalinity was estimated at 187.46 mg l⁻¹ which indicates that the beel is productive in nature. Gross productivity, net productivity and community respiration were to the tune of 30.21, -9.37 and 47.50 mg C m⁻³ hr⁻¹ respectively.

Plankton : Total plankton population in the beel was observed to be 1020 ul⁻¹. Zooplankters (54.9%) dominated over the phytoplankters (45.1%).

Aquatic vegetation : The main aquatic plants are floating *Eichhornia crassipes*, sub-merged varieties viz., *Hydrilla* sp., *Ceratophyllum* sp., *Vallisneria* sp., and *Nymphia* sp., and emergent ones such as Reeds. In certain pockets of the beel, cultivation of *Trapa bispinosa* is also practised as in the case of lakes and ponds in northern Bihar.

Fishery : The annual catch is presently to the tune of approx. 10 t yr⁻¹, of which about 60-70% of fish is small-sized only. The contribution of major carps is 25-30% only.

PROJECT : FC/A/18

**PRODUCTION DYNAMICS AND FISHERIES
DEVELOPMENT IN A SMALL RESERVOIR IN M.P.**

Personnel : R.K. Dwivedi, H.P. Singh, D.N. Singh, M.A. Khan, R.K. Tyagi, N.K. Srivastava, Ram Chandra, B.D. Saroj, R.C. Singh, Ramji Tiwari, J.P. Misra.

Duration : July 1991 to June 1995.

Location : Allahabad

Physico-chemical characteristics of soil

On the basis of chemical analysis of soil the productivity of the reservoir is graded as poor.

Physico-chemical characteristics of water

High values of total alkalinity, specific conductivity, nitrate, phosphate and silicate were observed in June. It may be due to application of cowdung manure in low volume of water in the reservoir.

Primary productivity

Gross and net production fluctuated between 104.16 and 158.33 mgC/m³/hr and 50.08 and 133.33 mgC/m³/hr respectively. Average annual gross production was 122.21 mgC/m³/hr and net 89.58 mgC/m³/hr. Average respiration was found to be 35.41 mgC/m³/hr. Highest gross and net production were also observed in June illustrating the influence of manuring.

Plankton

Phytoplankton population (85.95%) outnumbered the zooplankton (14.05%). Dominance of phytoplankton is mainly due to the abundance of *Ceratium* sp. in February.

The periphyton flora fluctuated between 1956 u/cm² to 4800 u/cm². It was dominated by Myxophyceae 65.95%, followed by Bacillariophyceae (27.75%) and Chlorophyceae (6.30%). Qualitatively the flora was poor when compared to other small reservoirs.

Bottom biota

The bottom biota is of low order with less species diversity. It varied from nil (November) to 1276 u/m² in (June) and represented by Oligochaeta (41.9%), Chironomid (24.4%), Chaoborus (23.3%), Polychaeta (5.8%), bivalves and Odonata (2.3%).

PROJECT : FC/A/19

**PRODUCTION DYNAMICS AND FISHERIES
MANAGEMENT IN THIRUMURTHY RESERVOIR,
TAMIL NADU**

Personnel : C. Selvaraj, V.K. Murugesan, V.K. Unnithan, C.K. Vava

Duration : September 1991-March 1996

Location : Coimbatore, Tamil Nadu

Thirumurthy reservoir (COIMBATORE)

The total inflow in different months ranged from 30.34 to 664.09 cusecs. Total outflow dropped from 426.88 cusecs in April '92 to a minimum of 5.26 cumecs in July '92. The maximum rainfall (331.0 mm) was effected during November '92. There was no rainfall during January '93.

Fish fauna and recruitment studies were conducted. There was no record on the natural recruitment of major carps in the reservoir.

Plankton

Surface plankton samples were collected during December '92 and January '93 and depth-wise samples were collected during February 1993. Species were identified constituting the net plankton population. They belong to Chlorophyceae (8 species), Bacillariophyceae (11 species), Myxophyceae (3 species), Rotifera (3 species) and Crustacea (3 species). *Mougeotia* contributed major bulk of the plankton population.

According to the depth-wise distribution of the net plankton population Chlorophyceae was maximum in 2 m, Myxophyceae and Rotifera were maximum in surface layer. Bacillariophyceae was in 8 m and Crustacea was in 4 m depths.

Periphyton

The depth-wise distribution of periphyton population was studied.

Biology of fishes

Food and feeding habits of major carps was studied. All the species were predominantly phytophagous. Only *Catla catla* had significantly higher level of Crustacea (28%) in the gut contents.

Stocking

The seeds were raised in the reservoir nursery upto fingerling size (100 mm) for stocking.

Tagging and fin-clipping of major carps

A few hundreds of fingerlings stocked in the reservoir either tagged or fin-clipped before they were released.

Fish yield from Thirumurthy reservoir

An all time record yield of 26.6 t of fish was harvested from the reservoir in the first year itself. Among the major carps the contribution was maximum by catla (34.15%), followed by rohu (24.44%), mrigal (19.36%), common carp (4.01%) and silver carp (2.44%). The catch per unit effort ranged from 3.04 to 11.7 kg, with an average of 7.01 kg. Altogether, 13,674 fish consisting of 3,737 catla, 5,582 rohu, 3,091 mrigal, 968 common carp and 296 silver carp were harvested during the period. The average weight of catla was the maximum (2.432 kg) followed by silver carp (2.196 kg), mrigal (1.667 kg), rohu (1.165 kg) and common carp (1.102 kg).

PROJECT : FC/A/20

**ECOLOGY AND FISHERIES OF YARRAKALVA
RESERVOIR, ANDHRA PRADESH**

Personnel : K.V. Rao, J.B. Rao, T.S.R. Raju, K.Subba Rao,
P.S.C. Bose, C.G. Rao

Duration : 1992-1998

Location : Eluru, Andhra Pradesh

ELURU (Yerrakalva reservoir)

Preliminary survey of the Yerrakalva Reservoir was undertaken during January and February 1993 with a view to plan regular and detailed investigations from April 1993 onwards. Detailed studies are to be taken up.

PROJECT : BF/B/2

**ECOLOGY AND FISHERIES MANAGEMENT OF
SEWAGE-FED WETLANDS**

Personnel : G.N. Saha, M. Sinha, Amitabha Ghosh, R.K. Das,
P.K. Chakraborti, K.R. Naskar, H.C. Joshi, H.C.
Karmakar, N.N. Mazumder, Sanjoy Bhowmick, T.
Chatterjee.

Duration : July 1986 to September 1993.

Location : Barrackpore, Kantatala, Handipota (if available and
Minakhan in 24-Parganas(N).

A portion of the sewage-fed wetlands, measuring 0.053 ha, was stocked with *Macrobrachium rosenbergii* juveniles of 2.77 g average weight at a stocking

density of 4000/ha to evaluate the possibility of rearing the species in such ecological conditions. The prawns grew to an average size of 122 m/17 g in 3 months with an overall survival of 65.26%.

Effectiveness of *Lates calcarifer* in controlling the recruitment of *Oreochromis mossambicus* and *O. niloticus* was evident.

On farm demonstration on scientific management of wetlands was done by rearing Indian major carps alongwith exotic carps. A production of 3600 kg/ha was obtained by the farmers by continuous harvesting of fishes above 30 gms within a period of about 8 months.

Salinity tolerance experiments on *O. niloticus* and *O. mossambicus* clearly demonstrated that changes in the salinity was not the reason for mortality of tilapia in sewage-fed wetlands.

Macrophytes were studied from the sewage-fed wetlands which indicated distinct differences between freshwater and low saline sewage-fed wetlands.

Benthos of different wetlands viz., Kantatala and Minakhan were studied.

Plankton density at Kantatala (1236.5-2015.0 u/l) was higher with a wider range of fluctuation than that of Minakhan (251.6-1504.0 u/l).

Bacterial load of the important groups of bacteria and nutrient concentration of Kantatala were found to be much higher than those of Minakhan areas.

Various aspects of the biology of *O. niloticus* also was studied.

PROJECT BF/B/3

**ECOLOGY AND PRODUCTION BIOLOGY OF
HOOGHLY-MATLAH AND KULTI ESTUARINE
SYSTEM**

- Personnel :** G.N.Saha (upto 30.6.92), M. Sinha (from 1.10.92), D.K. De (from 1.7.92 to 30.9.92), M.K. Mukhopadhyay, D. Nath, M.M. Bagchi, P.M. Mitra, H.C. Karmakar, R.N. Dey, A.R. Paul, A.K. Roy, N.C. Mondal, T.P. Ghosh, T. Chatterjee, Pintu Biswas, D. Biswas, Miss Meya Saha, D. Sanfui, S. Bandopadhyay, S. Mondal, B.B. Das, A. Mitra, P. Singh
- Duration :** 1983-December 1995
- Location :** Barrackpore, with sampling/survey centres at Canning, Uluberia, Diamond-harbour, Digha and Frazergunj/Namkhana

Hydrology, soil conditions and primary productivity

The study revealed that in main Hooghly estuary, no appreciable variations in the pH, DO, turbidity, alkalinity, hardness, specific conductivity, nitrate and phosphate were observed when compared with the respective values of the past five years from 1988. The distribution of salinity pattern showing maximum incursion upto Uluberia clearly indicated the impact of freshwater dilution from Farakka Barrage. Amongst all the zones, the lowermost zone (saline zone) of the estuary was having maximum salinity (3.125-29.110 ppt).

Soil characteristics in the entire stretch studied indicated a variation of pH from 6.9-8.1, organic carbon (%) from 0.120-0.551, total nitrogen (%) from 0.012-0.116 C/N ratio from 4.5 to 13.8 respectively.

Primary productivity studies conducted in the upper stretch of the Hooghly estuary from Baranagar to Nabadwip showed the GP (gross production) varying from 29.68 to 148.43 mg C m⁻³ hr⁻¹ and the NP (net production) varying from 7.81 to 89.06 mg C m⁻³ hr⁻¹.

In the Matlah estuary, the hydrology, soil conditions and primary productivity were also studied at three selected centres viz., Canning, Basanti and Jharkhalli.

Salinity values show a wide range of seasonal variations. The minimum values were recorded at Canning centre situated in the upper stretch during post

monsoon period (September), while the maximum was observed at Jharkhali centre located down stream of Matlah estuary during summer months.

Poor water transparency hampered the photosynthetic activity of the system thereby reducing the primary production in the ecosystem.

The values of specific conductivity fluctuated greatly according to climate, tide and location. The value was maximum during summer and high tides, whereas minimum were recorded during monsoon season at low tide.

The soil was slightly alkaline (pH 7.98-8.48) throughout the stretch. The percentage of organic carbon in the soil was observed between 0.35 to 0.90. The available nitrogen content in the soil of entire Matlah estuary indicated its poor value and varied from 10.0-19.5 mg/100 g. The total nitrogen content was also poor (0.039-0.092%).

As regards primary productivity, the gross production varied from 31.2 to 208.3 mg C m⁻³ hr⁻¹ and net production from 10.4-114.6 mg C m⁻³ hr⁻¹. The net primary production was observed minimum at all the centres during monsoon months while the highest production was recorded during winter months.

Plankton and benthic fauna

Bacillariophyceae (*Coscinodiscus granii*; *Nitzschia* spp., *Gyrosigma* spp., *Synedra* sp., *Melosira* sp., *Ditylimum* sp.) was the major dominant group consisting of 68.0-91.0% of the total population (18-4199 U l⁻¹) among zoo and phytoplankton in the lower zone of Hooghly estuary. In Matlah estuary, the plankton density was maximum at Jharkhali (saline zone) during winter and summer.

The density of benthic fauna in the lower zone of the Hooghly estuary varied from 60 U m⁻² to 760 U m⁻² with an average distribution of 251.3 U m⁻², 352.5 U m⁻² and 350.0 U m⁻² in monsoon, summer and winter seasons respectively.

Fish yield, catch structure and effort

Fishery resource assessment of the Hooghly-Matlah estuarine system indicated an estimated total fish yield of 39033.7 t during the period February 1992 to January 1993 exhibiting marginal increase of 3679.8 t (10.4%) compared to the corresponding period of last year. The main factor for the increase in total estimated production was because of marginal increase in catch of winter migratory bagnet fishery in lower estuary.

Specise-wise catch structure

Harpodon nehereus, *Setipinna* spp., *Pama pama*, *Tenualosa ilisha*, *Trichurus* spp., *Tachysurus jella*, *Stromateus cteneus* and various prawns and shrimps formed the bulk of catches of the estuary accounting 29805.8 t (76.4%) of the total catch.

Catch and effort of winter migratory bagnet fishery

During November, 1992 to January, 1993 total estimated winter migratory bagnet catch in lower estuary amounted to 26346.3 t accounting 67.5% of the total estuarine catch with an average CPUE of 124.42 kg compared to the catch of 21460.8 t with an average CPUE of 121.2 kg in the last winter.

Hilsa fishery by drift gill nets

An estimated catch of 4051.8 t of hilsa was brought to shore from the estuary which exhibited a marginal increase of 483.3 t (13.5%) compared to corresponding period of last year. About 95% of hilsa was captured by drift gill net.

Estimation of wanton destruction of young ones of *T. ilisha*

Indiscriminate exploitation of young ones (fry and fingerlings) resulting in wanton destruction of hilsa through small meshed nets particularly the bagnets in the upper stretch of the estuary was estimated as 31035 kg during the period under report compared to 39269 kg during February, 1991 to January, 1992.

Fish and prawn seed abundance

Recruitment of commercially important estuarine fish and prawn seed was assessed at five centres of Hooghly estuary viz., Frazergunj, Sagar, Kulpi, Diamond Harbour, Nurpur, one centre each at Matlah (Canning) and Rupnarayan (Kolaghat) estuaries. The present study revealed that there had been considerable decline in the availability of prawn and fish seed in Frazergunj and Sagar as compared to earlier years. The reason may be attributed to the additional discharge of freshwater into the Hooghly estuary which has significantly reduced the salinity of the estuary as well as the extent of tidal ingress.

Biology of estuarine fish

Pama pama within the size range of 140 to 182 mm were collected and studied for their food and feeding habit in the Hooghly-Matlah estuarine environment.

Bore tide fluctuations

Increased level of phosphate, silicate, nitrate, DO, pH, total alkalinity and free CO₂ was observed in the estuary during bore tide period, which remained for three to four days. However, the primary productivity studies conducted during the period indicated only poor to moderate production. As regards plankton, prior to bore tide the concentration of plankton fluctuated between 174 ul⁻¹ and 1005 ul⁻¹. The density went up to 3687 ul⁻¹ with the incoming of bore tide water in the estuary. The plankton density remained high (524 ul⁻¹ to 3687 ul⁻¹) for four days and thereafter the normalisation of the plankton population took place. The benthic fauna showed marginal decrease after the bore tide but revived their population within 2 to 3 days.

PROJECT BF/B/8

ECOLOGICAL STUDIES ON TROPICAL MANGROVE VEGETATION ON WESTERN FRINGE AREA OF THE SUNDERBANS

Personnel : P.K. Chakraborti, Y.S. Yadava, K.R. Naskar, R.K. Das
 A. Hajra, N.N. Mazumder, Sanjay Bhowmick

Duration : 1986-1992

Location : Gosaba-Sajnakhali stretch, Kult and Bakkhali

Floristic study

Phenological studies including flowering, fruiting and vegetative propagations and their details in respect of various mangrove species were continued. So far, 35 mangrove species have been collected for the project. Most of these mangrove flora grow profusely during monsoon and post-monsoon months, while their flowering and fruiting are taking place mainly during late winter and summer months except for a few like *Xylocarpus mekongensis*, *X. granatum* and *Excoecaria agallocha*.

By the end of the year, 700 herbarium sheets and about 300 slides have been prepared to preserve entire or a part of the flowers, fruits, germinating roots, foliages, etc. of several mangrove species for further studies like investigation on eco-variation and other morphological features.

Careful examination of pneumatophores, tree trunks, etc. have revealed presence of various species of epiphytes and periphyton. These floral communities have been collected and preserved in the form of permanent slides for further references. Examining such slides for 50 algal species, their identification and taxonomical studies have been completed.

Plankton

Investigation was continued at selected six centres. In the core and semicore areas i.e., Sudhanyakhal, Sajinakhal and Durgaduani, zooplankters other than crustaceans and rotifers were insignificant and the densities of filamentous algae and diatoms were quite high. Rich population of diatoms was also observed at Malancha where tidal forests were under the influence of Calcutta sewage effluent. Coastally located Bakkhal though exhibited low status of soil quality, the nutrient status of the water was quite good due to manurial effect of the decomposed mangrove litters. The plankton density at Bakkhal was low compared to the other sites of Sunderbans.

Benthos

During October-December when rotifers in the benthos disappeared at Gosaba, the molluscan fauna improved. But inspite of abundance of benthic rotifers in the core and semicore areas during April-December, molluscan fauna did not improve, rather at Sudhanyakhal during July-December and at Sajinakhal during October-December the molluscan fauna dwindled. The maximum abundance of benthic molluscs was noticed at Malancha where the ecosystem was under the influence of sewage effluent.

Microbes and Physicochemical parameters

Bacterial load of different groups of bacteria and physico-chemical characteristics of soil and water indicated that the productivity of mangrove infested water areas increases with the availability of flood water during the rainy season

carrying both decomposed and undecomposed forest organic matter and also some inorganic nutrients. Thus, the productivity of mangrove infested water areas was mostly dependent on the coastal mangrove forest.

Both bacterial load and availability of inorganic nutrients decreased with the receding of the rainy season. Bottom soil of these areas are having C : N ratio in the optimum productive level. Consequently breakdown of the organic matter by the microbes have enough scope of releasing the surplus nutrients into the ambient water. Available phosphate phosphorus and nitrogen are also in the optimum range, in the soil phase.

Biochemical investigation

During the year, one congregated zone of *Sarcolobus carinatus* and one patchy pocket of *Heritiera fomes* in the Sundarbans mangrove in the Sajinakhali-Sudhanyakhali stretch were investigated. Samples of shrimp, fish, mangrove litters and detritus from these two floral niches were collected and analysed for their proximate biochemical composition.

It is observed that in both the shrimp and fish, *Heritiera fomes* provided a better nutrient deposition (protein) than *Sarcolobus carinatus*. The fat (lipid) deposition is also slightly improved in the *Liza parsia* caught from the isolated pocket of *H. fomes*. The chemical composition of the leaves of *H. fomes* indicated better nutritive values of protein, fat and calorie contents, compared to those of *Sarcolobus carinatus* with a higher moisture content (71.2%). The ash per cent is less in *H. fomes* than *S. carinatus*.

During the year three species of fish, each from freshwater, brackishwater and marine resources were analysed for moisture contents and quantitative lipid contents.

PROJECT**BF/B/9****ECOLOGY AND FISHERIES OF NARMADA
ESTUARINE SYSTEM WITH SPECIAL REFERENCE
TO IMPOUNDMENT OF RIVER NARMADA (SARDAR
SAROVAR)**

Personnel : G.N. Saha (upto 30.6.1992), M. Sinha (from
01.10.1992), S.N. Singh, S.K. Sarkar, R.C. Mandi,
C.K. Vava (upto 31.8.1992)

Duration : 1988-1993 (extended for one year)

Location : Vadodara

Ecology of the Narmada Estuarine System

Ecological studies were conducted in eight centres viz., Mahegam, Bhadbhut, Bharuch and Jhanor forming estuarine and transitional extent respectively while Gadher, Vedgam, Poicha and Sisodra represented freshwater stretch. Gadher and Vedgam are the centres located under the proposed submergence of Sardar Sarovar.

Hydrological regime

All the physico-chemical parameters were analysed. Phosphate was low but nitrate and silicate were quite high.

Soil reaction was slightly towards alkaline. Soil texture varied from stretch to stretch being predominantly loam to clay loam.

Biological regime

The average planktonic biomass for the Narmada Estuarine Complex as a single entity varied from 78 (Jhanor) to 241 nos l^{-1} (Gadher).

The average macro-benthic population fluctuated from 93 (Bhadbhut) to 5237 nos m^{-2} (Jhanor). A diversified macro-fauna was experienced at freshwater extent. Gross and net production were recorded high at Gadher. Community respiration also exhibited the similar trend.

Identification of discharge points and hydrobiological monitoring

Environmental monitoring programme pursued at the two identified sites namely Baijalpur, receiving domestic and industrial effluents and Sakarpura receiving composite effluents, revealed organic enrichment at the former site while stress at the latter site.

Artificial fecundation of *Tenuulosa ilisha*

A 'Hilsa hatchery' encompassing recirculation of water coupled with constant aeration designed and effectively used last year, was efficiently operated during this year also.

Three sets of *T. ilisha* were successfully bred during this monsoon season by employing dry stripping method for fertilization followed by water hardening. The water hardened embryos were subjected to hatching in the designed hatchery. The rate of fertilization and hatching varied from 80.55 to 85.71% and 86.90 to 91.53% respectively. About 1.639 lakhs of spawn were produced.

Fishery

Catch per unit effort (CPUE) for drift gillnet was computed based on the observations undertaken during the monsoon season and this varied from 3.46 to 14.64 kg boat⁻¹ haul⁻¹.

PROJECT BF/B/10**INVESTIGATION ON PRODUCTION DYNAMICS OF
SALINE BHERIES IN RELATION TO THEIR
FISHERIES DEVELOPMENT**

- Personnel : G.N.Saha (upto 30.6.92), A.K. Ghosh, A.C. Nandy (upto 28.2.93), R.K. Banerjee, K.R. Naskar, H.C. Karmakar, B.B. Das, S.K. Chatterjee, A. Mitra (upto 20.2.93), Miss Abhijita Sengupta, L.K. Barbat, Debasis Saha, Amoy Barui
- Duration : April 1991-March 1995
- Location : Calcutta (Bheries taken up at Kharibari in North 24-Parganas and Malancha and Basanti in South 24-Parganas)

Soil characteristics

The experimental bheries under the three saline zones have soil alkaline in reaction. They are rich in nutrients.

Water quality

The medium saline bheri showed high primary productivity (529.24 mg C m⁻³ hr⁻¹). The detailed analysis of water revealed that the bheries under study were in general productive.

Statistical analysis of soil and water quantity variable also was done.

Plankton

The density of plankton in the low and medium saline bheries was as high as 0.6 cc. The frequent appearance of *Euglena* sp., *Oscillatoria* sp., *Phacus* sp. indicated sewage pollution. The high saline bheri had the plankton concentration between 50 and 150 units l⁻¹, with the dominance of phytoplankton.

Assessment of production of fish and prawn

The low saline bheri having a water area 11.47 ha had an output of 715.954 kg ha⁻¹ yr⁻¹ where *P. monodon* comprised 262.598 kg (37% of the total output). The other commercial fishes were Indian major carp 226.678 kg, *Tilapia* spp. 87.184 kg,

Liza parsia 13.078 kg, grass carp 74.106 kg, common carp 8.718 kg and miscellaneous prawn 43.592 kg.

The medium saline bheri with a water area 9.3 ha showed a production of only 109.036 kg ha⁻¹ yr⁻¹. *P. monodon* output was very poor (6.056 kg ha⁻¹ yr⁻¹) while the miscellaneous prawn and fish together occupied 66% of the total, and *L. calcarifer* gave an output of 12.433 kg.

The 3.78 ha bheri under high saline zone gave an output of 582.010 kg ha⁻¹ yr⁻¹ in which *P. monodon* was 132.275 kg and the rest comprised miscellaneous prawn and fishes.

Production under controlled condition

All the pens were stocked at a uniform rate of 50,000 nos ha⁻¹. These pens were stocked with *M. rosenbergii* at the rate of 1,500 nos ha⁻¹ at the end of October. The initial stocking size was 124.47 mm/5.2 g in the treated pens and 95.8 mm/9.6 g in control. No positive result was obtained.

In the medium saline bheri the pens were stocked at the first phase in March with *P. monodon* seed sized 37.12 mm/0.26 g. After 81 days the growth was 141.67 mm/16.78 g with supplementary feed, while the control attained 126.80 mm/11.0 g.

In the second phase of stocking during August the size of *P. monodon* seeds was 12.6 mm/0.51 g. In the treated pen, after 100 days the growth was 129.12 mm/17.54 g against 111.92 mm/12.31 g in control. The survival rate was as low as 8.4%.

The pens in the high saline bheri were stocked with 12-14 mm size *P. monodon* which attained 126.66 mm/16.43 g after 123 days with supplementary feeding when the control size was 113.0 mm/10.5 g.

In the second phase the same pens were stocked with 12/15 mm size *P. monodon* and after 91 days the size attained with supplementary feeding 179.66 mm/38.96 g, while in control the size was 107.66 mm/8.03 g.

Parasitic infestation on finfish and shellfish

The study revealed the presence of a few new parasitic species.

Biomass Estimation

The biomass of the herbaceous species was estimated 1.600-2.000 kg m⁻² from the high saline bheries. In the mid saline zone biomass of *Ruppia maritima* was

calculated at 900-1500 g m⁻², while the biomass of *Enteromorpha tubulosa* and *Panicum* spp. was estimated at 650 g-900 g m⁻² and 400-750 g respectively.

Periphytic flora

Nine species of periphytic algae were collected and identified from the serial roots and pens and cages.

PROJECT

BF/B/11

INVESTIGATION ON DISEASES OF FISHES INHABITING ESTUARIES, ESTUARINE IMPOUNDMENTS AND BEELS

Personnel : M.K. Das, R.K. Das, S.P. Ghosh and Sanjay Bhowmick
Duration : July 1991 to March 1995
Location : Barrackpore

For the first time incidence of EUS in Rajasthan in the open water of Maosi Dam and some rearing tanks in Tonk district was recorded. The affected species were *C. mrigala* (1-15%), *Mastacembelus armatus* (10-15%), *Puntius puntius* (10-30%), *N. notopterus* (5-30%) and *Mystus* sp.

Investigation on the pathogens of EUS affected fishes viz., *Channa* sp and *C. mrigala* recorded the presence of *Streptococcus* sp., *Enterobacteria*, *Acinetobacter* sp and *Staphylococcus* sp. as probable secondary invaders along with the fungus *Saprolegnia* sp.

Laboratory experiment in aquarium conducted on EUS affected fishes *Channa punctatus*, *Catla catla*, *Cirrhinus mrigala* and *Labeo rohita* each having a basal doze @ 100 kg ha⁻¹ CaO and bleaching powder at doses 0.5 ppm, 1 ppm and 1.5 ppm showed 1 ppm bleaching powder as the most effective in healing up the ulcers

within 15 days. Application of lime (CaO) @ 50 kg ha⁻¹ and bleaching powder @ 0.5 ppm can be an effective prophylactic dose to prevail EUS outbreak.

Seven hundred estuarine fishes were studied for their parasitic fauna.

Studies on problems of fish disease was conducted in sewage fed bheries (Kantatala) also.

PROJECT BF/A/2

**FISHERIES AND BIOLOGY OF HOOGHLY HILSA,
TENUALOSA ILISHA**

Personnel : A. Mukherjee, D.K. De, Amitabha Ghosh, M.K. Mukhopadhyay,
P. Mitra, M.M. Bagchi, A.B. Mukherjee, A.R. Chowdhury, N.N.
Majumder, T. Chatterjee, D. Sanful, K.P. Singh. A.
Roychowdhury, K.S. Banerjee,

Duration : January 1988 to 1993

Location : Barrackpore and Farakka

Catch structure

a) Hooghly estuary :

The total yield of hilsa, *T. ilisha* from the Hooghly-Matlah estuarine system was estimated to be 4051.5 t during the period from February, 1992 to January, 1993.

Assessment of hilsa (*Tenualosa ilisha*) fishery at Farakka region :

The total hilsa (*Tenualosa ilisha*) catch at Ganga River System at Farakka during the period from April, 92 to March, 93 was estimated at 23.59 t. This contributes 24.62% to the total landing. Among the three sampling centres, Beniagram, located downstream to Farakka barrage, emerged as the most potential hilsa fishing zone contributing 15.61 t to the total hilsa catch followed by Feeder Canal 6.83 t and Taltala 1.14 t.

Larval abundance :

Studies on larval abundance of hilsa were carried out at seven centres of Hooghly estuary viz., Kulpi, Diamond Harbour, Nurpur, Kolaghat, Uluberia, Nawabgunj and Medgachi. All these centres are situated in almost freshwater zone of estuary covering a stretch of about 220 km. It was evident from the study that the species spawn in the entire freshwater zone of the estuary and less saline zone as well around Nurpur, Diamond Harbour and Kulpi centres. The study also revealed that considerable extension of spawning ground has been observed in the estuary while the magnitude of seed/fry abundance had comparatively declined from earlier years.

Biological studies

The age and growth of both male and female hilsa were studied separately by using length-frequency method collected from the lower (less saline zone) of the Hooghly estuary. It was observed that five age groups were involved in male, while four age groups were in female population. The food and feeding habit of young hilsa (20-65 mm) obtained from various centres of Hooghly estuary were also studied.

Physiological investigations :

Observations on the histological features of the testes in the specimens collected from Farakka demonstrated matured condition of the male gonad indicating breeding activities in the months of November-December. Samples collected from Nawabgunj during July also revealed the presence of spermatozoa. Investigations on the lipid and moisture content muscle and gonad of *T. ilisha* were also continued.

Thyroidal activities :

During September and October most of the thyroid follicles are found to be in atrophied stages lying in close proximity to the wall of the blood capillaries.

This nature of thyroid follicles is thus coinciding with the peak breeding season of the species.

Hydrokinematics of river flow :

Flow velocity in the main river near the shore where the shooting nets were operated (about 10.15 m from the banks) was almost similar to flow in alluvial channel. Owing to dissipation of flow energy caused by the bed, side and internal frictions between coarse particles, a stability in the flow velocity ranging from 0.60 to 0.85 m/sec has been observed. No appreciable bed scour has been noticed which is usually found in tidal rivers subjected to stage discharge.

PROJECT BF/A/21

ECONOMICS OF MIGRATORY WINTER FISHERY OF HOOGHLY ESTUARY

Personnel : S. Paul, D.K. De, P.M. Mitra, N.C. Mondal, H.K. Sen,
Prahlaad Singh

Duration : June 1992-December 1994

Location : Barrackpore

One centre namely Kalisthan comprising 26 units/khuties could be covered.

The findings could be briefed as : (i) the fish productivity per fisherman at 12 tonnes is fairly high as crop of 9213 tonnes was netted by 717 fishermen during the season, (ii) catches about 92% mainly comprising Bombay duck and ribbon fish are sold as value-added products after sun drying, (iii) the income of fishermen is more stable in winter fisheries as a result of wage-paid employment as compared to their counterparts in riverine fisheries whose income is uncertain due to fluctuation in production.

PROJECT AN/A/13**PILOT PROJECT ON MASS REARING OF GIANT AFRICAN SNAIL
ACHATINA FULICA**

Personnel : Mrs. G.K. Vinci, V.V. Sugunan, V.K. Unnithan
Duration : June 1990 - September, 1993
Location : CIFRI, Barrackpore.

Snail house was erected at Barrackpore measuring 10 m X 2 m X 0.75 m with 20 compartments.

After experimentation the stocking density of the snail was fixed @ 100 snails per square metre. Density exceeded 200 nos m⁻² snails became inactive, operculum sealed and food consumption became nil. After treating with 40-50 mg sulphadiazine/1 kg body weight, mixed with feed, a good number of the snails recovered.

A comprehensive survey was conducted in the Andaman and Nicobar Islands to probe into the prospects of developing a farming system and trade for *Achatina fulica* in these Islands.

Following a suggestion from Malaysia a review was done on the processing procedure to enhance the quantity of edible portion for export. The snail was dissected upon and separated the shell, alimentary canal, ovary (egg mass), foot and adductor muscles. It was proposed to include the adductor muscles and ovary also under edible parts. This would enhance the exportable portion as high as 50% instead of the 15% reported in the past.

PROJECT AN/A/15

**RESOURCE ASSESSMENT AND DYNAMICS OF FISH
POPULATIONS IN MAJOR INLAND WATER
SYSTEMS**

Personnel : R.A. Gupta, P. Mitra, S.K. Mondal, H.C. Karmakar,
R.K. Tyagi, M. Kartikeyan, M. Choudhury,
Mrs. S. Majumder

Duration : April 1991-March 1995

Location : CIFRI, Barrackpore

Stock assessment and dynamics of two important catfishes namely *Mystus aor* and *M. seenghala* were carried out from catch records of the Ganga fishery. Estimates of mortality rates, exploitation ratio and yield per recruit were worked out and the long term forecasting of yields were undertaken. Combined analysis of these two species were done in order to obtain sustainable yields.

Length based cohort analysis showed that the fish mortality (F) rates in case of *M. aor* increased upto 0.41 at 32 cm and then declined up to 64 cm. It again rose to a maximum of 1.23 at 96 cm. The average rate of F for the fish was 0.3434 (L=34 cm). For *M. seenghala*, F showed ups and downs in different length groups with two to three peaks. The average fishing mortality for the fully recruited length was 0.3792 (L=58 cm). Estimates of maximum sustainable yield for these two species were 13.95 t and 13.08 t at reduced level of fishing effort of 44% and 49% respectively. The combined analysis of mixed fishery of *M. aor* and *M. seenghala* suggested MSY level at 25.17 t with relative effort at 0.48.

PROJECT CSS/1**DEVELOPMENT OF INLAND FISHERIES
STATISTICS**

Personnel : R.A. Gupta, S. Paul, S.K.Mandal, Mrs. S. Majumder
Duration : 1985-March 1994 (extended to VIII Five Year Plan)
Location : Barrackpore.

The resource assessment survey has been carried out with the adoption of developed methodology. Stratified two-stage cluster sampling with clusters of villages as the first stage unit and ponds within clusters as the second stage unit was followed to estimate the area and catch under ponds and tanks.

The sampling design for catch assessment from rivers, streams and estuaries was stratified two-stage sampling with landing centre or fishing village as first stage unit and fishing economic unit as second stage unit.

For reservoirs, lakes and beels the design was a stratified two-stage with landing centre or fishing village as first stage unit and fishing economic unit as second stage one. Here stratification was done on the basis of area of the waterbody. Ten days interval has been selected for frequency of sampling.

Three computer programmes were developed for classification and estimation of area and catch with the help of Indian Statistical Institute, Calcutta.

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Management(1.9.92-31.12.92), Compendium, **Vol. 2**, ed. by Y.S.
Yadava & V.V. Sugunan : 207-212.

PERSONNEL

The following scientists rendered their services to the Institute during the period April 1992 to March 1993.

Dr. Y. Rama Rao, Director
(upto 31.7.92)

Dr. V.R. Desai, Director
(from 17.8.1992-24.12.1992)

Dr. S.P. Ayyar, Director
(from 25.12.1992)

RIVERINE DIVISION

Allahabad Centre

Shri Ravish Chandra, Pr. Scientist
Shri S.P. Singh, -do- (Retd. on 31.10.1992)

Shri S.K. Wishard, Scientist (S.G.)

Shri S.N. Mehrotra, -do-

Dr. H.P. Singh, Sr. Scientist

Dr. D.N. Singh, -do-

Dr. Balbir Singh, -do-

Dr. R.K. Tyagi, -do-

Shri R.N. Seth, Scientist (S.G.)

Shri R.K. Dwivedi, -do-

Shri R.K. Saxena, Scientist (S.G.)

Shri G.N. Srivastava, -do- (Retd. on 30.4.1992)

Shri P.K. Katiha, Scientist

Dr. P.N. Jaitly, -do-

Lalgola Centre

Guwahati Centre

Shri K.P. Srivastava, Scientist (S.G.)

Dr. M. Choudhury, Scientist (Sr. Sc.)

Dr. B.C. Jha, Sr. Scientist

Patna Centre

Dr. G.K. Bhatnagar, Pr. Scientist

Dr. V. Pathak, Sr. Scientist

Agra Centre

Dr. R.S. Panwar, Pr. Scientist

Shri D.N. Mishra, Scientist (S.G.)

Dr. Shree Prakash, Sr. Scientist

Dr. (Ms.) Usha Moza, -do-

Dr. K. Chandra, -do-

LACUSTRINE DIVISION

Bangalore Centre

Shri Ch. Gopalakrishnayya,
Pr. Scientist

Dr. M. Ramakrishnaiah, Sr.
Scientist

Dr. A.K. Laal, -do-

Dr. M.A. Khan, -do-

Dr. D.S. Krishna Rao, Scientist (S.G.)

Dr. P.K. Sukumaran, Scientist
(Sr. Sc.)

Shri M. Karthikeyan, Scientist

Eluru Centre

Shri K.V. Rao, Scientist (S.G.)

Shri J.B. Rao, -do-

Coimbatore Centre

Shri C. Selvaraj, Pr. Scientist
 Shri V.K. Murugesan, Scientist (S.G.)
 Dr. V.K. Unnithan, Sr. Scientist

Pune Centre

Shri P.L.N. Rao, Scientist (S.G.)
 Dr. M.D. Pisolkar, Sr. Scientist
 Dr. B.K. Singh, Scientist (Sr. Sc.)
 Dr. B.L. Pandey, Scientist

Raipur Centre

Dr. D. Kumar, Sr. Scientist
 Shri N.P. Srivastava, Scientist
 (Sr. Sc.)

Kangra Centre

Dr. D.K. Kaushal, Sr. Scientist
 Dr. V.R. Chitranshi, -do-
 Dr. V.K. Sharma, Scientist (Sr. Sc.)

ESTUARINE DIVISION

Barrackpore Centre

Shri G.N. Saha, Pr. Scientist (Retd. on 30.6.1992)
 Dr. M. Sinha, Pr. Scientist (from 31.7.1992)
 Dr. M.K. Mukhopadhyay, Sr. Scientist
 Dr. H.C. Joshi, -do-
 Dr. R.K. Das, -do-
 Dr. D. Nath, -do-
 Dr. M.K. Das, -do-
 Dr. D.K. De, -do-
 Shri A. Mukherjee, -do-
 Shri M.M. Bagchi, Scientist (S.G.)
 Shri P.M. Mitra, -do-
 Shri A. Hajra, Scientist (Sr. Sc.)

Vadodara Centre

Dr. S.N. Singh, Sr. Scientist
 Shri G.C. Laha, Scientist (Sr. Sc.)
 Shri S.K. Sarkar, -do-
 Shri V. Kolekar, Scientist

Farakka Centre

Shri A.R. Chaudhury, Scientist

Calcutta Centre

Shri A.C. Nandy, Scientist (S.G.) (Retd. on 28.2.1993)
 Dr. A.K. Ghosh, Sr. Scientist
 Dr. R.K. Banerjee, -do-
 Dr. K.R. Naskar, -do-
 Shri H.C. Karmakar, Scientist (S.G.)
 Dr. A.B. Mukherjee, Pr. Scientist

Canning Centre

BRACKISHWATER IMPOUNDMENT SECTION, Barrackpore

Dr. Y.S. Yadava, Sr. Scientist
 Dr. Amitabha Ghosh, -do-
 Shri P.K. Chakraborty, Scientist (S.G.)

OTHER CENTRES/SECTIONS AT BARRACKPORE**Inland Molluscs Section**

Dr. V.V. Sugunan, Sr. Scientist
 Ms. G.K. Vinci, Scientist (S.G.)

Beel Fisheries Section

Dr. K. K. Vass, Pr. Scientist
 Dr. (Ms.) Krishna Mitra, Sr. Scientist

Extension Section

Shri U. Bhaumick, Scientist (S.G.)
Dr. P.K. Pandit, Sr. Scientist

Engineering Section

Shri A. B. Mukherjee, Pr. Scientist

Economics Section

Shri S. Paul, Scientist (S.G.)

Central Sector Scheme for Inland Fisheries Statistics

Shri R.A. Gupta, Scientist (S.G.)
Shri S.K. Mondal, -do-

Krishi Vigyan Kendra, Kakdwip

Shri J.G. Chatterjee, Sr. Scientist

Scientists & staff on Deputation/Lien

Shri U.K. Ghosh, Senior
Stenographer on lien for 2 years
from the afternoon of 25th February
1992 at Income-Tax Appellate
Tribunal, Calcutta.

The following members of
staff (Technical/Auxiliary) rendered
their services during the year.

T-7

Dr. A.K. Chattopadhyaya
Smt. Mira Sen

T-6

Shri S.K. Sadhukhan

T-5

Shri Ramchandra
Shri P.S.C. Bose
Shri R.N. De
Shri R.C. Singh
Shri A.R. Mazumder
Ms. Anjali De
Shri P.K. Ghosh
Shri S.K. Das
Shri N.K. Srivastava,
Shri K.S. Rao
Shri T.S. Rama Raju
Shri R.C. Satapati
Shri K.K. Agarwal
Shri R.C. Mandy
Shri Sanjoy Bhowmick
Md. S.K. Syed Shakul Hameed
Shri R.R. Mukherjee
Shri M.F. Rahaman
Shri A.R. Paul
Shri K.S. Banerjee
Shri D.N. Srivastava
Shri B.D. Saroj
Shri Alok Sarkar
Shri N.N. Mazumdar
Shri S.P. Ghosh
Shri N.C. Mondal
Shri H.K. Sen
Shri A.R. Paul
Shri K.S. Banerjee
Shri D.N. Srivastava
Shri B.D. Saroj

Shri Alok Sarkar
 Shri N.N. Mazumdar
 Shri S.P. Ghosh
 Shri N.C. Mondal
 Shri H.K. Sen
 Shri Sukumar Saha

T-4

Shri P. Dasgupta
 Shri C.N. Mukherjee
 Ms. Satnam Kaur
 Shri Ladu Ram Mahabhar
 Shri H. Chaklader
 Shri Amiya Kr. Banerjee
 Shri Fatik Manna
 Shri Camil Lakra

T-II-3

Shri J.P. Mishra
 Shri Ramji Tiwari
 Shri M.P. Singh
 Shri S.K. Srivastava
 Shri D.K. Biswas
 Shri T. Chatterjee
 Shri Pintu Biswas
 Shri B.K. Biswas
 Shri H.C. Banik
 Ms. Keya Saha
 Ms. K. Sucheta Majumder
 Shri B.B. Das
 Shri Swapan Kr. Chatterjee
 Shri Sushil Kumar
 Ms K. Jacqueline

T-I-3

Shri D. Sanfui
 Shri Donald Singh
 Shri M.M. Das
 Shri S.N. Sadhukhan
 Shri Swapan Chatterjee
 Shri K.P. Singh
 Shri R.K. Halder

T-2

Shri D. Chatterjee
 Ms. Rina Basak

Shri B.N. Das
 Shri P. Rajani
 Shri Bhai Lal
 Shri A. Mitra
 Shri C.K. Vava
 Ms. Abhijita Sengupta
 Shri L.K. Parbat
 Shri C.G. Rao
 Shri S. Kottaiah
 Shri N.K. Saha

T-I

Shri Prahlad Singh
 Shri D. Saha
 Shri S. Bandopadhyay
 Shri Atanu Das
 Shri H.L. Biswas
 Shri A.K. Barui
 Shri Hiralal Biswas
 Shri K.K. Das
 Shri H.K. Routh
 Ms. Shuvra Saha
 Shri S.K. Chakraborty
 Shri Rajesh Kumar Sah
 Shri S.G. Biswas
 Shri Ashis Roy Chowdhury
 Shri C.P. Singh

Auxiliary

Shri P.R. Rao, Hindi Translator
 Shri Swapan Kr. Das, Time Keeper
 Shri S.K. Biswas, Carpenter
 Shri S.K. Dev, Plumber
 Shri K.L. Chakraborty, Sr. Gestetner Operator
 Shri S.C. Bhowmick, Sr. Gestetner Operator
 Shri M. C. Raikwar, Sr. Gestetner Operator
 Shri D. Bergyoary, Driver
 Shri K. Ganesan, Driver
 Shri K.L. Das, Driver
 Shri Kanchan Datta, Driver
 Shri U.K. Chatterjee, Driver
 Shri R.L. Balmiki, Driver
 Shri S. Bahadur, Driver
 Shri Badal Lal Singh, Driver

Shri V.G. Dhindore, Driver
 Shri N.C. Biswas, Driver
 Shri K.R. Deb, Driver
 Shri Ranjit Singh, Driver
 Shri M.C. Paul, Driver
 Shri Virendra Kumar, Driver
 Shri Ram Prasad, Driver
 Shri Sunder Singh, Driver
 Shri Arun Kumar Mondal, Driver
 Shri Subhendu Mondal, Boat Driver
 Shri Saradindu Chakraborty, Ssrang
 Shri A.K. Goswami, Driver
 Shri P. Ramalingeswara Rao, Driver
 Shri Suklal Bairagi, Pump Man
 Shri B. Bhattacharjee, Carpenter
 Shri T.P. Ghosh, Lunch Driver
 Shri C.R. Das, Pump Man
 Shri A.K. Majumder, Driver

The following members of staff
 (Administrative) rendered their
 services during the year.

Senior Administrative Officer

Shri A.C. Ghosh

Accounts Officer

Shri J.R. Verma

Assistant Administrative Officer

Shri M.R. Roy
 Shri S.C. Roy

P.A. to Director

Shri G. Lahiri

Senior Stenographer

Shri U.K. Ghosh (from 22.2.92)

Superintendent

Shri T.P. Das
 Shri Ranjit Kr. Ghosh (A & A)

Assistant

Shri S. Dasgupta
 Shri B.C. Bhattacharjee
 Shri M.M. Neogi
 Shri D.C. Bose
 Shri I.N. Kodandaraman
 Ms. Bani Roy
 Ms. Namita Choudhury
 Ms. S. Majumder
 Shri D.K. Banerjee
 Shri S.P. Sastry
 Shri C.C. Das
 Shri R.C.P. Singh
 Shri N.K. Mitra
 Shri S.K. Kar
 Shri M. Kachhap
 Shri L.P. Misra

Stenographer

Shri T.K. Roy
 Shri S. Bhattacharjee

Senior Clerk

Shri J.C. Patra
 Shri T.K. Sreedharan
 Shri L.P. Mishra
 Shri Baij Nath
 Shri Keshab Prasad
 Shri H.K. Nath
 Shri J.N. Banerjee
 Shri S.K. Sarkar
 Shri D.N. Baidya
 Shri S.R. Halder
 Shri H.L. Sarkar
 Shri B.B. Mukherjee
 Shri B.C. Mazumdar
 Shri S. Bhowmick
 Shri M.K. Das
 Shri D.K. De Sarkar
 Shri A.B. Biswas

Shri Samir Kr. Roy
 Shri S.B. Roy
 Shri H.B. Sutar
 Shri T.K. Mazumder
 Shri Kalu Singh
 Shri S.S. Sinha
 Shri Surendra Kumar
 Shri M.L. Biswas
 Ms. Sikha Mazumder
 Shri Biswanasth Sah

Junior Stenographer

Ms. G. Vinoda Lakshmi
 Ms. Jolly Saha

Junior Clerk

Ms. N. Banerjee
 Ms. G. Mazumder
 Ms. M. Banerjee
 Ms. Anita Mazumder
 Ms. Bulbul Mallick
 Ms. A. Neogi
 Ms. A. Chakraborty
 Ms. Jayasree Pal
 Ms. Swapna Chattopadhyay
 Ms. Sefali Biswas
 Ms. Shyamali Mitra
 Ms. Arati Panigrahi
 Shri S.P. Mondal
 Shri K. Majhi
 Shri Paras Ram
 Shri S.K. Maranappan
 Shri Kunja Behari
 Shri Chotte Lal
 Shri Ambika Lal
 Shri P. Lahiri
 Shri P.K. Dutta
 Shri B.K. Das
 Shri S.K. Bose
 Shri N.R. Kundu
 Shri J. Roy
 Shri S.K. Tikadar
 Shri U. Bhattacharjee
 Shri P.K. Ghosh
 Md. Quasim
 Shri C.K. Pandey

Shri C.K.N. Sahi
 Shri K.S. Rao
 Shri Debesh Chowdhury
 Shri Brahmapal Balmiki
 Shri S. Karmakar
 Shri Sukumar Sarkar
 Shri A.K. Dey
 Shri M.K. Joardar
 Shri S.K. Ghosh
 Smt. S. Sumithra Devi
 Shri Santosh Sarkar
 Shri Rajesh Khandelwal
 Shri C.D. Parmer

The following members of staff of supporting grade rendered their services during the period.

Supporting Grade IV

Shri R.L. Raikwar
 Shri J.M. Kujur
 Shri Antiram Das
 Shri H.K. Das
 Shri T.K. Biswas
 Shri Sunil Kr. Das
 Shri M.S. Burman
 Shri H.K. Pramanick
 Shri Nar Bahadur
 Shri Sitaram Balmiki (upto 30.6.63)
 Shri A.M. Patra
 Shri B. Prakash
 Shri D.D. Poudel
 Shri S.C. Balmiki
 Smt Parmila Taman

Supporting Grade III

SShri P. Sayalu
 Shri S.P. Yadav
 Shri B.N. Mondal
 Shri R.N. Tar
 Shri B.B. Das
 Shri S.N. Burman

Shri G.C. Mondal
 Shri Jungli
 Shri Jugal Kishore
 Shri S.K. Borai
 Shri Tek Bahadur
 Shri H.S. Burman
 Shri S.S. Burman
 Shri L. Samulu
 Shri Bhim Bahadur
 Shri K.L. Balmiki
 Shri N.L. Das
 Shri H.K. Burman
 Shri Ram Sunder
 Shri J. Khalko
 Shri C.P. Singh
 Shri Khemchand Balmiki
 Shri Gulab Shaw
 Shri A. Murugasan
 Shri S.K. Burman
 Shri Nar Bahadur
 Shri P.C. Kachari

Supporting Grade II

Shri Munnalal Mallah
 Shri Maha Singh
 Shri Dukhharan Sahani
 Shri Laxmi Ram
 Shri Suraj Bahadur
 Shri B.N. Mondal
 Shri Rajendra Ram
 Shri A. Sahani
 Shri K.D. Raju
 Shri P. Seshanna
 Shri P.C. Bez
 Shri D.C. Das
 Shri B.C. Das
 Shri B. Hazarika
 Shri A.L. Yadav
 Shri M.L. Saha
 Shri J. Mukhia
 Shri A.K. Biswas
 Shri L.K. Halder
 Shri A.C. Ghosh
 Shri J.N. Mallah
 Shri Subrahmani
 Shri M. Mahadeva
 Shri G.C. Paramanick
 Shri R.U. Muchi

Shri K. Ningigowda
 Shri S.T. Gavate
 Shri S. Mahendran
 Shri V. Mariappan
 Shri A. Ramaswamy
 Shri M.V. Krishnan
 Shri K. Kallanan
 Shri Ram Prasad
 Shri Karam Raj
 Shri Satyendra Burman
 Shri Lalita Prasad
 Shri Sita
 Shri Rajdhari Mallah
 Shri Sukchand Biswas
 Shri Bideshi Lal
 Shri B. Pugalendhi
 Shri Om Prakash
 Shri M.P. Bind
 Shri A. Gangalah
 Shri K. Bahadur
 Shri A. Biswas
 Shri R. Palaneswami
 Shri K.K. Dhir
 Shri A. Murugesan
 Shri S.S. Bondre
 Shri B.N. Krishnappa
 Shri Gunadhar Dhibar,
 Shri Sankar Bose
 Shri G.J. Roundale

Supporting Grade I

Shri Lakshmi Ram
 Md. Yusuf Dar
 Shri Suresh Kumar
 Shri Umesh Chowdhury
 Shri Kuldeep Singh
 Ms. Bimla Devi
 Shri Kawalpati Ram
 Shri Mahadev Panika
 Shri N. Rajak
 Shri Suresh Rajak
 Shri A. Kistalah
 Shri U. Satyanarayana
 Shri P. Atchalah
 Shri S. Kalita
 Shri N. Deka
 Shri Khagen Ch. Das
 Shri Bhabalu Boro

Shri Jai Ram Prasad
 Ms. Godhuli Mondal
 Ms. Mina Rani Bahadur
 Ms. Mina Biswas
 Ms. B. Balmiki
 Shri K.C. Malakar
 Shri H.P. Bhanja
 Shri T. Ghosh
 Shri Sankar Bose
 Shri Muktipada Das
 Shri Kharban Kumar
 Shri Man Bahadur
 Shri Bhaskar Sardar
 Shri Pasupati Ghosh
 Shri Jagdish Balmiki
 Shri S. Banerjee
 Shri Sibulal Das
 Shri S.C. Sadhukhan
 Shri Dipak Chakraborty
 Shri Biswanath Bose
 Shri Ananta Kr. Bhanja
 Shri Rabi Kr. Sardar
 Shri Lal Bahadur
 Shri Dilip Kr. Das
 Ms. B. Sakuntala
 Shri Mohan Lal Sarkar
 Ms. Hemlata Halder
 Shri Balkishen Balmiki
 Shri S.N. Nan
 Shri Mahendra Balmiki
 Shri Ullas Naik
 Ms. Rupali Chatterjee
 Shri Ashok Kr. Dey
 Shri Iswararam Balmiki
 Ms. Anjali Dutta
 Shri Bharat Kr. Halder
 Shri Anil Ch. Das
 Shri S. Guin
 Shri P. Singh
 Shri D. Singh
 Shri Atiullah
 Shri Sitla Prasad
 Ms. Kamal Devi
 Shri M.S. Bhoi
 Shri T.H. Ghume
 Shri K. Subbatya
 Shri R. Nagraj
 Shri S. Govindarajan
 Shri K. Subramahnaian
 Shri Gopal Chand

Ms. Kalosasi Mondal
 Shri G. Lal
 Shri Sree Nath
 Shri A.C. Biswas
 Shri R.D. Chaudhury
 Sk. Monsur Ali
 Shri S.K. Chakraborty
 Shri Prasidh Sahani
 Shri Amar Nath Prasad
 Shri Umashankar Ram
 Shri P.C. Paramanick
 Shri Prakash Ch. Paramanick
 Shri N.K. Das
 Shri Joydev Patra
 Shri A. Bhattacharjee
 Ms. Dharamaya
 Shri M. Mutta
 Shri Basudev Gharami
 Shri T.K. Gayen
 Shri B.P. Samanta
 Shri B.P. Mishra
 Shri R.P. Halder
 Shri N.T. Dolui
 Shri Gour Gharami
 Shri M. Mari
 Shri Satya Prakash
 Shri Ganesh Bhanja
 Smt. N.K. Chaki
 Shri S. Saida
 Shri M.C. Gharami
 Shri C. Muniappa
 Shri T.K. Halder
 Shri Ganesh Chandra Burman
 Shri R. Rajendran
 Smt. Suvra Chakraborty
 Shri Kamlesh Kumar
 Shri Ranjit Kumar Roy
 Shri M.C. Das
 Shri P.N. Rao
 Shri Sitaram Nisad
 Shri M. Pannappa
 Shri K. Mohanan
 Shri Bablu Mondal
 Sk. Abdullah
 Ms. Sibani Roy

PROMOTIONS

The following members of staff were promoted on recommendation by the Assessment Committee/Departmental Promotion Committee during the period.

Name	Designation	Promoted to	With effect from
Shri S.C. Roy	Superintendent	Asstt. Adm. Officer	30.8.93
Shri R.K. Ghosh	Senior Clerk	Supdt. (A & A)	30.8.93
Smt. Dipti Sett	T-4	T-5	1.7.1990
Shri C.N. Mukherjee	T-4	T-5	1.1.1993
Smt. Satnam Kaur	T-4	T-5	1.1.1993
Shri H. Chaklader	T-II-3	T-4	1.1.1992
Shri A.K. Banerjee	-do-	-do-	-do-
Shri Fatik Manna	-do-	-do-	-do-
Shri Camil Lakra	T-II-3	-do-	1.7.1992
Shri D. Bergayary	T-2	T-I-3	1.7.1992
Shri Santosh Kr. Biswas	-do-	-do-	1.1.1992
Shri Manik Ch. Pal	-do-	-do-	1.7.1991
Shri N.K. Saha	T-I	T-2	1.7.1993
Shri S. Kataiah	T-I	T-2	1.7.1993
Shri Ch. G. Rao	T-I	T-2	1.7.1993
Shri L.K. Parbat	T-1	T-2	1.7.1993
Shri S.C. Balmiki	SSG III	SSG IV	1.4.1993
Shri Khemchand Balmiki	SSG II	SSG III	4.11.92
Shri Gulab Shaw	SSG II	SSG III	1.4.93
Shri A. Murugasan	SSG II	SSG III	12.7.93
Shri Sankar Bose	SSG I	SSG II	4.11.92
Shri G.J. Runadala	SSG I	SSG II	1.4.93
Shri R.U. Muchi	SSG I	SSG II	12.7.93
Shri G.C. Paramanick	SSG I	SSG II	1.11.93

The following members were granted merit increments/advance increments as below on the recommendation of the Assessment Committee.

Name	Designation	Merit increments	With effect from
Shri R.C. Satapathy	T-5	Two	1.1.1992
Shri S.K. Das	T-5	Two	1.1.1991
Shri P.K. Ghosh	T-5	Two	1.1.1991
Shri N.K. Srivastava	T-5	Two	1.7.1992
Shri R.N. De	T-5	One	1.1.1991
Shri K.L. Das	T-I-3	One	1.1.1991
Shri K.P. Singh	-do-	One	1.7.1992
Shri Badal Lal Singh	-do-	One	1.7.1992
Shri K.R. Deb	-do-	One	1.7.1992
Shri Kanchan Dutta	-do-	Three	1.7.1992
Shri U.K. Chatterjee	-do-	Two	1.7.1992
Shri N.C. Biswas	-do-	Two	1.7.1992
Shri Suraj Bahadur	-do-	Three	1.7.1992
Shri K. Ganesan	-do-	One	1.7.1992
Shri Kishan Deo	-do-	One	1.1.1991
Shri T.P. Ghosh	-do-	Three	1.7.1991

Retirement during the period

Name	Designation	Date of Retirement
Shri G.N. Srivastava	Scientist (S.G.)	30.4.92
Shri G.N. Saha	Principal Scientist	30.6.92
Dr. Y. Rama Rao	-do-	31.7.92
Shri S.P. Singh	-do-	31.10.92
Shri A.C. Nandy	Scientist (S.G.)	28.2.93
Shri S.N. Sar	Sr. Res. Asstt.	31.3.92
Shri Kishan Deo	T-I-3	30.9.92
Shri J. Ghosh	T-6	31.10.92
Shri A.K. Roy	T-5	28.2.93
Shri B.C. Dutta	Asstt. Adm. Officer	31.5.92
Shri M.R. Roy	-do-	31.7.92
Shri S.K. Pramanick	Assistant	31.7.92
Shri L.P. Mishra	Senior Clerk	30.11.92
Shri J.N. Biswas	SSG III	31.12.92

Resignation

Name	Designation	Date of Retirement
Shri A.D. Shinde	Junior Clerk	30.10.1992

Appointments

Following appointments were made during the period

Name	Designation	Place of posting	Date of appointment
Shri A.C. Ghosh	Sr. Adm. Officer	Barrackpore	31.5.93
Shri Ganesh Bhanja	SSG I	Barrackpore	22.5.92
Smt. Parmila Taman	SSG IV	Agra	3.8.92 (Inter Institutional Transfer)
Smt. N.K. Chaki	SSG I	Barrackpore	20.2.93
Shri C.P. Singh	T-1	Barrackpore	30.6.1992
Shri Sayyad Khasim Saida	SSG I	Eluru	16.11.1992

Transfers

The following members of CICFRI were transferred during the period April 1992 to March 1993.

Name	Designation	From	To
Dr V.R. Desai	Pr. Scientist	Barrackpore	Raipur/Bangalore
Shri A.B. Mukherjee	-do-	Barrackpore	Calcutta
Dr. B.C. Jhah	Scientist (S.G.)	Patna	Guwahati
Shri K.V. Rao	-do-	Eluru	Vijyawada
Shri J.B. Rao	-do-	-do-	-do-
Shri P.N. Jaitly	Sr. Scientist	Patna	Allahabad
Dr. M.A. Khan	-do-	Allahabad	Bangalore
Dr. D. Nath	-do-	Canning	Barrackpore
Shri V. Kolekar	Scientist	Agra	Vadodara
Shri R.C. Singh	T-5	Guwahati	Allahabad
Shri K.S. Rao	T-5	Eluru	Vijyawada
Shri P.S.C. Bose	T-5	-do-	-do-
Shri L.R. Mahavar	T-4	Allahabad	Agra
Shri Ladu Ram Mahavar	T-4	Allahabad	Agra
Shri S.K. Srivastava	T-II-3	Pune	Agra
Shri C.K. Vava	T-2	Vadodara	Coimbatore
Shri Arunabha Mitra	T-2	Calcutta	Barrackpore
Shri S. Kotaiah	T-1	Bangalore	Eluru
Shri R.K. Sah	T-1	Bangalore	Patna
Shri Ch. G. Rao	T-1	Eluru	Vijyawada
Shri S. . Sastry	Supdt.(ad-hoc)	-do-	-do-
Shri Ambika Lal	Senior Clerk	Bangalore	Allahabad
Shri S.S. Sinha	Senior Clerk	Patna	Allahabad
Shri K.S. Rao	Junior Clerk	Eluru	Vijyawada
Shri S.K. Tikadar	Junior Clerk	KVK, Kakdwip	Barrackpore
Shri C.N. Shahi	Junior Clerk	Barrackpore	Patna
Shri P.R. Rao	Driver	Eluru	Vijyawada
Shri Subhendu Mondal	Boat Driver	Canning	Barrackpore
Shri L. Samolu	SSG III	Eluru	Vijyawada
Shri P. sayalu	-do-	-do-	-do-
Shri K.D. Raju	SSG II	-do-	-do-
Shri P. Sayalu	-do-	-do-	-do-

contd.....

Name	Designation	From	To
Shri A. Gangaih	-do-	-do-	-do-
Shri P.N. Rao	SSG I	-do-	-do-
Shri A. Krishtaih	-do-	-do-	-do-
Shri U. Satyanarayan	-do-	-do-	-do-
Shri Sayedjaan	-do-	-do-	-do-
Shri P. Atchaiah	-do-	-do-	-do-
Sk. Abdullah	SSG I	Kangra	KVK, Kakdwip
Shri Kamlesh Kumar	SSG I	Agra	Allahabad
Shri Shitala Prasad	SSG I	Kangra	Allahabad
Shri Dipak Chakraborty	SSG I	Barrackpore	Farakka
Shri T.K. Halder	SSG I	Farakka	Barrackpore

APPENDIX-I

Statement showing the total number of employees in the CIFRI, Barrackpore pertaining to the employees under Scheduled Castes and Scheduled Tribes categories. (Period from 1. 4.1992 to 31.3.1993)

Sl. No.	Class of Posts	Total No. of posts sanctioned	Total No. of employees in position	Total No. of Sch. castes among them	% of total employees	Total No. of Sch. Tribes among them	% of total employees	Remarks
1. SCIENTIFIC POSTS								
	Experimental Scientist	-	-	-	-	-	-	* This includes 2(two) Scientists. Sanctioned under C.S.S. on Inland Fisheries Statistics.
	Scientist	*53	37	2	5.4%	-	-	
	Sr. Scientist	31	31	-	3.23%	-	-	
	Pr. Scientist	18	9	-	-	-	-	
	RMP Scientist	1	1	-	-	-	-	
		103	78	3				
2. TECHNICAL POSTS								
	Category-I	34	31	7	22.58%	1	3.22%	*This includes 2(two) T-II-3 posts under C.S.S.
	Category-II	*52	47	11	23.4%	2	4.24%	
	Category-III	3	-	-	-	-	-	
		89	78	18		3		
3. ADMINISTRATIVE POSTS								
	Sr.A.Os/A.Os/Accounts Officer etc.	2	1	-	-	-	-	*This includes 1(one)
	AAOs/Supdt.(A/cs)/Supdt./	6	6	1	16.67%	-	-	Assistant, 1(one)

Hindi Officer/S.C./Jr. Analyst/Desk Officer	-	-	-	-	-	-	Stenographer and
Assistants	*16	16	3	18.75%	1	6.25%	1(one) Jr. Clerk posts
Stenographers(Sr. & Jr.)	*7	6	2	33.33%	-	-	under C.S.S.
Sr. Clerks/U.D.Cs	28	28	9	32.14%	1	3.47%	
Jr. Clerks/Hindi	*44	35	7	20%	-	-	
4. SUPPORTING STAFF	103	92	22		2		
Grade-I	*99	95	23	24.2%	4	4%	*This includes 1(one)
Grade-II	53	53	18	34%	2	3.77%	SG.I post sanctioned
Grade-III	23	23	10	43.48%	2	8.70%	under C.S.S.
Grade-IV	13	13	6	46.15%	1	7.7%	
5. SUPPORTING STAFF (SAFAIWALA)	16	16	11	68.75%	-	-	
6. AUXILIARY POSTS	45	33	7	21.21%	2	6%	
	204	200	68		9		

Note : The other posts available may also please be shown in the respective class of posts mentioned above and the posts, if any, do not come under the above mentioned categories may be shown separately.

APPENDIX - II

CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE (I.C.A.R.) : BARRACKPORE : WEST BENGAL

Address List of Research/Survey Centres

Telegramme/Telephone/
Telex

- | | | |
|---|--|---|
| 1 | Central Inland Capture Fisheries Research Institute
Barrackpore-743 101
WestBengal | FISHSEARCH
BARRACKPORE/

(033) 556-1190
556-1191

021 8552 CIFI IN
FAX (033) 5560388 |
| 2 | Allahabad Research Centre
Central Inland Capture Fisheries Research Institute
24, Pannalal Road
Allahabad-211002, Uttar Pradesh | FISHSEARCH
ALLAHABAD-2/
(0532) 600531 |
| 3 | Bangalore Research Centre
Central Inland Capture Fisheries Research Institute
No.22 (Old No.1031-C & D),
80 ft, Road, 1st Main, IV Block,
Rajajinagar,
Bangalore - 560 010 | FISHSEARCH
BANGALORE/
(080) 357213 |
| 4 | Central Inland Capture Fisheries Research Centre,
Ujjain, Tikanther,
Zamanabad Road,
Kangra-176 001,
Himachal Pradesh. | CENTRAL FISHERIES
KANGRA
HIMACHAL PRADESH/
5049 |

Research/Survey Centres**Telegram/Telephone**

- | | | |
|-----------|---|--|
| 5 | Calcutta Research Centre
Central Inland Capture Fisheries Research Institute
M.S.O. Building (2nd Floor, 'C' Block)
DF Block, Salt Lake City,
Calcutta - 700 064 | (033) 379444 |
| 6 | Canning Survey Centre
Central Inland Capture Fisheries Research Institute
R.N. Tagore Road,
Canning - 743 329, West Bengal | |
| 7 | Diamond Harbour Survey Centre
Central Inland Capture Fisheries Research Institute
House of Bidhu Bhushan Bhuiya,
New Madhavpur, P.O. Diamond Harbour,
24 Parganas (South), West Bengal | |
| 8 | Digha Survey Centre
Central Inland Capture Fisheries Research Institute
Digha, Midnapur Dist.,
West Bengal | |
| 9 | Eluru Research Centre
Central Inland Capture Fisheries Research Institute
24-B/10-53 Panugantivari Street,
P.O. RAMACHANDRARAO PET,
West Godavari District,
ELURU - 534 002, Andhra Pradesh | FISHSEARCH
ELURU - 534 002/
(08812) 22520 |
| 10 | Vadodara Research Centre
Central Inland Capture Fisheries Research Institute
Gaikwad Building
(Opposite Bhimnath Mahadev Temple),
Sayajiganj,
Vadodara - 390 005 | (0265) 31717 |
| 11 | Guwahati Research Centre
Central Inland Capture Fisheries Research Institute
Natun Sarania,
Guwahati - 781 003,
Assam | (0361) 548757 |

Research/Survey Centres**Telegram/Telephone**

- | | |
|--|-----------------------------|
| <p>12 Agra Research Centre
Central Inland Capture Fisheries Research Institute
E-27, New Agra
Agra-282 005</p> | |
| <p>13 Lalgola Survey Centre
Central Inland Capture Fisheries Research Institute
Lalgola-742 148,
Dist. Murshidabad,
West Bengal</p> | |
| <p>14 Patna Research Centre
Central Inland Fisheries Research Institute,m
1st Floor, Shambey House,
Kankarbagh,
Patna - 800 020, Bihar</p> | <p>(0612) 51894</p> |
| <p>15 Pune Research Centre
Central Inland Capture Fisheries Research Institute
Flat No.6, Indraprasta House Society,
Godital-Hadapsar P.O.,
Pune - 411 028
Maharastra</p> | <p>(0212) 51894</p> |
| <p>16 Raidighi Survey Centre,
Central Inland Capture Fisheries Research Institute,
Raidighi, 24 Parganas (South),
West Bengal</p> | |
| <p>17 Raipur Research Centre
Central Inland Capture Fisheries Research Institute
326, 'Ashirwad',
Shankar Nagar, Near Bottle House,
Raipur - 492 007,
Madhya Pradesh</p> | <p>(0771) 424312</p> |

Research/Survey Centres**Telegram/Telephone**

- 18 Uluberia Survey Centre**
Central Inland Capture Fisheries Research Institute
Uluberia,
Dist. Howrah,
West Bengal
- 19 Coimbatore Research Centre**
Central Inland Capture Fisheries Research Institute
No. 68, Rajunaidu Road,
Tatabad,
Coimbatore - 641 012 Tamil Nadu
- 20 Krishi Vigyan Kendra**
Central Inland Capture Fisheries Research Institute
Kakdwip,
24 Parganas (South),
West Bengal
- 21 Maldah Research Centre**
Central Inland Capture Fisheries Research Institute
House of Sri S.K. Pal, Subhas Pally,
Station Road, Maldah, West Bengal

**FISHSEARCH
COIMBATORE**

(031732) 572

CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE
BARRACKPORE - 743 101, WEST BENGAL

ORGANIZATION CHART, 1992 - 1993

