वार्षिक प्रतिवेदन 1992-93

हिन्दी खण्ड

संपादक : विश्वेंद्र राय प्रताप सिंह
बक्कम चंद्र झा
पी. आर. राव

सामग्री कम्पोजिंग / : मो. कसिम
लेजर प्रिंटिंग

केंद्रीय अंतर्द्वारीय प्रगति मात्रविकी अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद्)
बैराकपुर: पश्चिम बंगाल
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‘अंतर्राष्ट्रीय खान्द एवं कुल संगठन रोम, इटली के प्रतिनिधित्व के पश्चात् 9 जनवरी 1995 को केंद्रीय अंतर्जातीय मत्स्य प्रमाण अनुसंधान संस्थान’ बैकपुर, पश्चिम बंगाल में इस अनुसंधान संस्थान का कार्य भार प्रदान किया। प्रारम्भिक दौर में संस्थान में चल रहे अनुसंधान कार्यों के समीक्षा के दौरान यह ज्ञात हुआ कि वर्ष 1992-93 का वार्षिक प्रतिवेदन, असीमित कारणों से, अभी तक प्रकाशित नहीं हो पाया है। अतः इस दिशा में तुरंत कार्यवाही की गई एवं जिसके परिणामस्वरूप आज यह प्रतिवेदन आपको सामने आया है। केंद्रीय अंतर्जातीय मत्स्य प्रमाण अनुसंधान संस्थान, देश के जलसंपत्ति के जलसंपत्ती के मददे में बढ़े जल संसाधन जैसे कि नदियों, जलवायु, शीतल ज्वारसंपत्ति आदि में मुख्यतः का उत्पादन और इसके प्राकृतिक स्वरूप के परिवर्तन की दिशा में प्रयासतम है। परंतु आज के परिप्रेक्ष्य में यह तब तक सम्भव नहीं है जब तक पर्यावरण सर्वनिष्ठ विकास का उचित उपचार न हो। अतः हमारा संस्थान जलीय प्रदूषण के रूप-रूपान्तर की दिशा में भी ठोस काम कर रहा है एवं हमें बहत ही उपयोगी आंकड़ों इकट्ठा किया है।

जलीय प्रदूषण की समस्या ने आज एक गंभीर स्वरूप धारण कर लिया है एवं हमारे जल संसाधन, विशेषकर हमारी नदियों के जल काफी दृष्टि हो गए हैं, जो मत्स्य पालन एवं आँखें के लिए ठीक सिद्ध हो रहे हैं। जल में फलने व बढ़ने वाले जीव-जन्तुओं के प्रकार तथा मात्रा में निरंतर घिरकर आ रहे हैं, जो देश वित्त में नहीं है। इस संदर्भ में ‘गंगा परियोजना निदेशालय’, भारत सरकार, इवारा कर रहे कार्यों की, जिनमें हमारे संसाधन का भी महत्वपूर्ण योगदान है, हम सशक्त करते हैं। यह मुख्य का वात है कि आज गंगा नदी का जल हार्दिक दृष्टिकोण से लेकर वाराणसी तक विशेषकर अति प्रदूषित कानपुर क्षेत्र में, भूगोलक विशेषज्ञता के साथ निपटने की अपेक्षा काफी स्वतंत्र हो गया है जिसका श्रेय गंगा परियोजना को ही जाता है।
आज हमारा संस्थान भूलभूत शीष कार्यों के अतिरिक्त परामर्शदाता के रूप में भी कार्य कर रहा है और इस संदर्भ में हमारे पास कई संस्थाओं के आग्रह आते रहे हैं जैसे कि 'उत्तर-पूर्व सत्यावलय', शिलांग 'राष्ट्रीय लाप विध्युत निगम', भारत सरकार, आदि मुख्य हैं।

इस प्रतिवेदन के विषय में प्रकाशन के लिए और इसके चलते यह माना जाए तो हमें हेड है। भविष्य में और भी उत्तम कार्य के साथ प्रतिवेदन प्रस्तुत किया जाएगा।

युक्ति आशा है आप यह प्रतिवेदन पसंद करेंगे।

शुभकामनाओं के साथ,

विश्व रमण प्रसाद सिन्हा

1 जुलाई, 1995
वार्षिक प्रतिवेदन 1992-93
केंद्रीय अंतर्वेत्रीय प्रामाण मात्रकी अनुसंधान संस्थान
(भ. कृ. अनु. प) : बैरकपुर : पशिय बंगाल

संबिधित इतिहास

केंद्रीय अंतर्वेत्रीय मत्त्य प्रामाण अनुसंधान संस्थान मात्रकी शोध एवं प्रबन्ध में आग्रही स्थान रखता है। यह संस्थान अब अपने स्थापना के 46वें वर्ष में प्रवेश कर चुका है। इसकी स्थापना 17 मार्च 1947 को कलकत्ता में ‘केंद्रीय अंतर्वेत्रीय मत्त्य अनुसंधान केंद्र’ के रूप में भारत सरकार के खाते एवम् कृषि संचालन के अंतर्गत हुई थी। यह भारत सरकार के 1943 के उस शासन का परिणाम था जिसमें मात्रकीय संस्थानों के विकास पर अधिक उर्जा वाना करने पर बल दिया गया था। तदुपरांत, कृषि, मात्रकी तथा मात्रकीय से सम्बन्धित उप-समूह ने इसका जोरदार श्रद्धा में अनुमोदन किया था।

इस संस्थान के छोटे से इतिहास काल में कई महत्त्वपूर्ण पद्धतियों के अनुसार प्राप्त हुए। सबसे पहले पद्धति था वर्ष 1959 का जब कलकत्ता में रखा गया ‘अनुसंधान केन्द्र’ की ‘अनुसंधान संस्थान’ का पूर्व दर्जा प्राप्त हुआ एवं बैरकपुर में हुए अन्य के तट पर जननिधि भारत भवन तथा मनोरंजन परिषद की स्थापना हुआ।

इस संस्थान के इतिहास में दूसरा महत्त्वपूर्ण पद्धति था वर्ष 1967 का जब यह संस्थान भारतीय कृषि अनुसंधान परिषद को सफलता दिलायी और इस प्रकार मात्रकीय शोध कार्य को सही मानना एवम् अधिक स्वाभाविक प्राप्त हुए।

1970 का इस संस्थान के इतिहास में अत्यंत ही फलदायी एवम् नीतीश्वरी रहा है। 1971 में शुरू हुए वारे अविभिन्न और समयभर नमूना दर्शाव्य परियोजनाओं ने मात्रकीय अनुसंधान को नई दिशा दी जिसे दिया अपना नया तट पर जननिधि का भी सृत था। ये परियोजनाएं थीं ‘मिश्रित मत्त्य पालन’, ‘लोक लक्ष्य नियंत्रण’, ‘बंद कारोबारी मत्त्य पालन’ तथा ‘जलजल परंपरा’ की अवधियों एवं प्रकृतियों। एक और समन्ता राष्ट्रीय परियोजना 1973 में ‘बाहरी इंडस्ट्री तथा मत्त्य पालन’ के नाम से शुरू की गई थी। तथा 1974 में दूसरे दिन परियोजनाओं का एकाकित्व होकर ‘मिश्रित मत्त्य पालन एवम् मत्त्य जीव उपस्थान’ को सुनाया। मत्त्य पालन के कार्यों का समय नए सार्वजनिक कृषि अनुसंधान परिषद 1977 में ‘सार्वजनिक मत्त्य पालन अनुसंधान एवम् प्रकृति परिवर्तन केंद्र’ के नाम से स्थापित किया जो वर्तमान काल में इसके नाम से जाना जाता है। जिसमें के बाद में भी कार्य किया गया। मिश्रित मत्त्य पालन एवम् मत्त्य जीव उपस्थान परियोजना ने विशेषता, मत्त्य अनुसंधान एवम् उपस्थान में आमतौर पर फलस्वरूप आम तौर पर प्राप्त हुआ। इस प्रकार मात्रकीय उपस्थान के अन्य में एक नये शिक्षक का उद्देश्य हुआ। केंद्रीय मत्त्य पालन के
संस्थान के इतिहास ने एक और करकेट लिया वर्ष 1985 में जब इस संस्थान ने हीन के वाल्टर्स्कीय अनुसंधान संस्थानों को जन्म दिया और वे हैं— केंद्रीय भीषण जल जीव पालन अनुसंधान संस्थान, गोरखेड़, उड़ीसा, केंद्रीय खाद्रा तथा जलजन्तु पालन अनुसंधान संस्थान, मद्रास एवं राष्ट्रीय शीतजल मल्टर्स्कीय अनुसंधान केन्द्र, हलदवानी। अब, 1987 को इस संस्थान का पुनः नामकरण ‘केंद्रीय अल्पस्तरीय मल्टर्स्कीय प्रशासन द्वारा’ हो गया एवं इसे उन्मुक्त जलीय संस्थानों में शीष का कार्यकारी सीधा गया ताकि इन संस्थानों का मल्टर्स्कीय प्रशासन पर्यावरण की अनुपबन हो सके और साथ ही इनका संस्थान भी हो सके।

प्रारंभ से ही संस्थान के शीष कार्यक्रम का प्रमुख उद्देश्य था मल्टर्स्कीय संस्थानों का सही मूल्यांकन, उचित संस्थान तथा उद्देश्यपूर्ण उपयोग। अतः इस संस्थान ने अपने शीष कार्यक्रमों का मात्र मिश्र नहीं किया अपित कई कीर्तिमान भी स्थापित किए। विभिन्न ग्राहक के जलीय संस्थानों तैते कि नदी, जलाशय, धारा, पोखर, तालाब, स्नातकोत्तर आदि के पारिवर्तनों के गुणीयों की समझने वाले प्रवास के साथ-साथ मल्टर्स्कीय प्रशासन और प्रशासन प्रक्रियाओं में भी समुचित समाप्त लाया है। इस संस्थान ने जलीय पर्यावरण का भी गहन अध्ययन एवं शीष किया है ताकि ‘भौतिक विविधता’ के स्तर को बनाए रखने के उपाय खोजे जा सके और स्तरत्व महत्त्वपूर्ण तकनीकी एवं प्रशासन प्रणालियों उपलब्ध हो जो भी निम्न हैं—

1) नदीय संस्थानों से मल्टर्स्कीय संस्थान प्रणाली।
2) मल्टर्स्कीय शीर्ष प्रविधि संविधान प्रविधि।
3) कार्य महासाठियों का प्रशिक्षित प्रविधि एवं नवीन प्रविधि।
4) चार्टिज्ञान कार्य का बंध प्रविधि।
5) जलीय अपनूका का नियम विधि।
6) विशेषत मल्टर्स्कीय प्रशासन।
7) भागी-क्षेत्रीय महासाठियों का प्रशासन प्रणाली।
8) थोड़े जलाशयों में मल्टर्स्कीय प्रशासन।
9) जलजन्तु मल्टर्स्कीय प्रशासन।
10) धीरज्ञ उपासन प्रणाली।

आज देश के अल्पस्तरीय मल्टर्स्कीय प्रशासन कीवर्ष 20.0 लाख टन है जो 1950-51 के 2.2 लाख
टन से लगभग नी गुणा अधिक है। यह अपने आप में एक कीर्तिमान है। इसमें उत्पादकता कीकर्णीक एवं
शीष प्रणालियों का ही संगीत द्वारा है।
संस्थान के उद्देश्य

इस संस्थान के निम्नलिखित मुख्य उद्देश्य हैं:

1) अंतर्द्वीपीय जलीय संसाधनों में मल्टी समुदाय की संख्या एवं प्रकार पर शोध कर समृद्धि प्रबन्ध प्रणाली का विकास तथा उत्पादन में वृद्धि।

2) मल्टीवेडीय जल संसाधनों में सिद्धान्त प्रकार के जीव-जंतुओं का प्रभाव पर शोध द्वारा उत्पन्न वैज्ञानिक प्रणाली का विकास कर इनका संरचना और प्रबन्ध।

3) नदी-याती परियोजनाओं का नदी तल क्षेत्र एवं जलस्रोतों के पारिस्थितिक पर विपील प्रबन्ध का समृद्धि अध्ययन तथा इनके प्रबन्ध के लिए उत्पन्न वैज्ञानिक पद्धति का विकास।

4) अंतर्द्वीपीय मल्टीवेडीय से सम्बन्धित जोड़कुंड का क्रम-विचार संरचना एवं प्रसार।

5) मल्टीवेडीय शिवाय, प्रशिक्षण एवं प्रसार कार्यक्रमों का आयोजन।

6) मल्टी प्रगति तथा प्रतिष्ठा, जलीय प्रशिक्षण, संरचना, आदि पर परामर्श सेवाएं।

संगठन

उपरोक्त उद्देश्यों की प्राप्ति हेतु संस्थान के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात प्रमुख और विभिन्न संस्थानों के अनुसार सात
यह शरि अध्ययन कर उसके संस्करण की दिशा में कार्यरत है साथ ही साथ इन जल संसाधनों में पल रहे जैविक विविधता के स्वरूप को योगदान देने रखकर मत्स्य उत्पादन में बड़िया के लिए प्रवाह के नये प्रणालियों के निर्माण के लिए प्रयासकर है। हिल्टा मत्स्यकी भ्रामण, मल्लह डिल्टा मछली पर शोध कर रहा है एवम् प्रयास कर रहा है कि गंगा नदी में इसके पुनः स्थापना हो सके। मत्स्य संसाधन मुल्यांकन प्रभाव बेकार पुर मुख्यालय से देस के मत्स्य संसाधन का मुहूर्तक, वर्तमान एवम् मत्स्य संस्थान पर शोध कर के मत्स्य उत्पादन एवं पालन के लिए नए आयामों को विकसित करने में मदद कर रहा है।

मुख्य उपादानों

मत्स्य उत्पादन एवं रोग नियंत्रण

संस्थान से जनतापेशी के लिए संल्पण मत्स्य रोग (इन्फ्लू) से सब अन्य अनेकों को व्यापक है। इन अध्ययन से इस रोग के प्रभाव नये राज्य, नये किस्मत और राजस्थान में अध्ययन किये गये। केंद्र में लवणीय जल क्षेत्र के मत्स्य प्रजातियों में 'स्ट्रोवस', 'मुक्कल' मछलियां अथवा प्रभावित पानी गईं जबकि अलवणीय क्षेत्र में 'चन्द्रा', 'मस्तसंबंधित' और 'पुर्नदिय' प्रजातियां आतंक संदर्भों में पानी गई। राजस्थान में इस रोग सीमित तौर पर केंद्र टॉक जिलों के बीमार जलाशयों में हो उठी। जनतापेशी के संल्पण रोग प्रकार मछलियों के अध्ययन से पता चला कि ब्राह्मणीक क्षेत्र, टेंडरलीकक एवं साइटवेक्टर कुशांबी तथा सेंक्रोवियेनियां कक कैसे रोगीय कारक होते है।

इस अध्ययन में शोध की दिशा उपादानक संस्थानों के निकट की और रही। मछलियों के चार प्रजातियों, बन्ध पक्कलों, कत्सा कत्सा, निगराना ब्रिगना और लेविफु रोहिता पर रोग संबंधी प्रयोग किये गये। प्रारम्भ में इस रोग से प्रभावित जलाशयों में 100 कि. ग्राम प्रति है। इसे दूर करने के लिए प्रयोग किया गया, तब ही 1 पी.पी.एम. के दर से वित्तियों पादर का भी इलेक्ट्रॉनिक किया गया।

तत्कालीन दैनिक पत्रीं थे जिन्होंने इस रोग के प्रचार पादर का (1 पी.पी.एम. प्रति लीटर) रोग के निदान में अस्वस्थ प्रभावकारी है, क्योंकि 15 दिनों के अंतर इसमें विशेष उत्पाद काम गया। इस रोग से पहले प्रभावित तीन जलीय क्षेत्रों में रोग न उत्पन्न हैं। ऐसा संशय नहीं किया गया कि इन क्षेत्रों में इस रोग का प्रकोष्ठ नहीं हुआ। इस प्रयोग की जानकारी उपयोगी थे क्योंकि इन क्षेत्रों में इस मछली का प्रकोष्ठ नहीं हुआ। इस प्रयोग की जानकारी उपयोगी थे क्योंकि इन क्षेत्रों में इस मछली का प्रकोष्ठ नहीं हुआ।
समुपयोजित, निन समुपयोजित और असमुपयोजित मत्तय संसापनों का मूल्यांकन

अत्यधिक समय संसापनों के ऑक्सीजन तुलनात्मक दृष्टिकोण से टोस नहीं हैं, कारण संसापनों का विस्तार एवं प्रारूप तथा मत्तय केंद्रों का फैलाव बहुत अधिक है। के. अ. प्र. मां. अनु. संसापन ने इस समस्या को सुलझाने हेतु अवश्यक कदम उठाये। ताकि 7वीं व 8वीं विश्वविद्यालयों योजनाओं में टोस ऑक्सीजन प्राप्त हो सके। इस कार्य के लिए एक मानक कार्य प्राप्त का होना अत्यधिक आवश्यक समझा गया। अतः इस कार्य के संदर्भ में देश भर में 19 राज्यों व केंद्र शासित प्रदेशों के 40 जनसाधारणों के आकलन इंते दो प्रकार के साक्षात्कार संगठियों का विकल्प किया गया। अंतर्गत परिचय से यह ऐतिहासिक है कि क्षेत्र के आधार पर संसापनों का आकलन गुणात्मक उपस्त की तुलना में अधिक ठोस है। राज्य सरकारों के उपयोग हेतु एक मानक प्राप्त की संगठन संविधा को भी विक्रिय राज गया है।

व्याप्तनबूझ आई क्षेत्र का प्रवाहन

अवस्थीत जल क्षेत्र के बढ़ी झील शेसिकेविकल रोजनकर्ष मछलियों मछलियों को बनता व कान्तताल के मलजल पोषित ज्यानदूःही आई क्षेत्र (भैरी) में संभाल करने हेतु किए एक प्रयोगों से उत्तराधिकार परिणाम प्राप्त हुए है। इस अप्रयोग का प्राविधिक उद्देश्य यह देखना या कि झील मछलियों मलजल से उत्तर परिस्थितिक दरवर को हेट पायें या नहीं। एक आई क्षेत्र के लगभग 0.053 है। ये किसी अवस्था वाली में: रोजनकर्ष मछलियों को (अवस्था भार 2.77 प्रति है) 4000 प्रति है। के दर से संघार किया गया। प्रयोग में संग्रहण दर को कम रखा गया ताकि रात्र के समय जल क्षेत्र में आक्रोबन कम होने की समाधान न हो। भूली दर के अप्रयोग इस अप्रयोग से प्रारम्भ किया गया कि अवस्था संग्रहण दर दर प्राप्त किया जा रहे। दर दर के प्रकार प्राप्त मछलियों को भी मानक बनाया जा सके। बढ़ी झील मछलियों के अनितित लिस्टिक मछली को दो-प्रातिक व गुणात्मक मिलों और ऑ. मोमनादिक को भी उसी भैरी में 20,000 प्रति है। ये संघार किया गया जिससे उपज्य दर में दृढ़ता के अनितित, खरपस सिमन में भी सहायता मिली।

पारिस्थितिक प्राप्लां (सिरामीटा) का अनुप्रयोग एवं मत्तय संसापनों पर इनका प्रभाव

पारिस्थितिक प्राप्लां का अनुप्रयोग के केरल, संस्थान ने देश की प्रमुख शंघा नदी में जलीय गुणवत्ता का अनुप्रयोग किया। इस अनुप्रयोग के केरल 10 भौगोलिक व राज्यात्मक प्राप्लां जैसे तापामान, पूर्वी आवस्थान, कुल आवश्यकता, कैलोरिया, बिशिष्ट काचल, पालघाट, नरघाट तथा जैसे-राज्यात्मक आवस्थान मैं पर आधारित एक जलीय गुणवत्ता सूचकांक का उपयोग किया गया।

रुपनायद (पूर्वी नदी का सेंम खंड), नारनाय (कलकत्ता शहर का आधुनिक क्षेत्र) नुपुर (पूर्वांग नदी का सेंम खंड) में जलीय गुणवत्ता सूचकांक का स्तर 100 पाया गया जो उसके के लिए
उपयुक्त है। गंगा नदी में कन्नौज और ढायंगढ हार्बर के बीच के पुरे क्षेत्र के तलछोटों में विश की टीनालक तत्व पाये गए हैं, किन्तु इनकी मात्रा लघु सीमाओं के अंतर्गत थी।

वैज्ञानिक सुनस्योजन, प्रबंधन एवं संरक्षण द्वारा मल्लप उपवन में वृद्धि हेतु प्रणालियों का विकास

संस्थान ने उपसंग्रह तथा खानदान जलाशयों में मल्लप की विकास की समाधानाओं के आयोजन हेतु एक योजना तैयार किया। इस परीक्षण जल उद्योग का उद्योग संस्थान सब्जियों परीमन संचारियों का अध्ययन, मल्लप की भौगोलिक उपयोग भवन का मुद्दांकन, मल्लप उपज में वृद्धि हेतु प्रबंधन शिष्टिता तैयार करना, अनुसंधान, अभ्यास (तकनीकी, पर-तकनीकी और विशालनिक) तथा संगठनीय आवश्यकताओं और परीक्षण का आर्थिक लाभ संबंधी विशेष आदि है। इस परीक्षण में पर्यवेक्षण संबंधी आकलन समाहित है। इस योजना में जलीय परित्र भाग करने-साई समता और संधियां जलीय प्रजातियों के अध्ययन पर जोर दिया गया। इस तरह पर्यावरणीय, विभिन्न संचारण के साथ-साथ इस अध्ययन से एक सत्र से दूसरे सत्र में उत्पाद तथा स्थानांतरण की दिशा का भी पता चलेगा।

बाड़ बहुल आई शेषों में मल्लपकी के नये आयाम

प. बंगाल और असम में बाड़ बहुल शेषानी श्रील मल्लपकी के मुख्य स्थान हैं, जिनमें संस्थान ने मल्लप उपज की अधिकार करने हेतु श्रील कार्य किया। प्राथमिक प्रयोग के नीति पर अधारण मल्लप में स्थापना पर पंप संचारण में दे-दे व बिदेशी कार्य मल्लपों तथा अनेकांश क्षेत्र के बहु-श्रील मल्लपों में रोजनार्थन को ध्यानाधिक किया गया। अंतरिक्ष परिणामों से हीत होता है कि इस पद्धति मल्लप जल शेषों की मल्लप उपज को बढ़ाने में बड़ी मापदंड करेगी।

मुख्य घटनाएँ

वणिक प्रयोग पर कार्यालय

इस संस्थान के संग्रहण से समूही उपवन नियतविकास प्राधिकरण ने शी. ए. रेड्डीर्नकोर्पोरेशन की क्रिया में दिनवार 24 सितंबर 1992 को एक एककुलस्थ वणिक प्रयोग का प्राधिकरण एवं विकास वृद्धि विविध विविध पर आयोजित किया। इस कार्यालय में स्थानीय उद्योगियों द्वारा वणिक मांग का विविध नियम संस्थानों पर विविध किया। मल्लप वित्तीय, राज्य मल्लप विकास नियम तथा विविध नियम संस्थानों के अधिकारियों ने इस कार्यालय में भाग लिया।
हिन्दी सप्ताह

भारत संघ के राज्याधी कार्यालय नीति के अनुसार के तहत हिंदी सप्ताह (14 से 20 सितम्बर 1992) के अवसर पर संस्थान में एक समारोह का आयोजन किया गया।

मुख्य बैठकें

इस वर्ष संस्थान में निम्नलिखित बैठकें का आयोजन किया गया—

1. कर्मचारी अनुसंधान परिषद् (टॉप सिगर अफिलिटेशन) 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. पंचण्डिय समीक्षा दल (किवन किविनियल रिसीर्च टीम) की बैठक 30 जून से 2 जुलाई तक बैरकपुर में, 4 व 5 जुलाई, 1992 को पदना में, 15 व 16 मार्च, 1993 को बनगाहों में तथा 17 व 18 मार्च, 1993 को कोयमुक्तासौर में सम्पन्न हुई।

सहयोगिक अनुसंधान परियोजनाएँ

संस्थान ने उपरोक्त तथा खानदान जलाशयों में मात्रविक विकास की समयसमय अवधि प्राप्त करने का उद्देश्य किया। उल्लेखनीय रूप से शिलांक के सहयोग से एक अन्य परियोजना का अंतिम फल कलर रहा है।

प्रमुख मंत्री इत्यादि

प्रसार व राष्ट्रीय निर्माण कार्य

1. अनुसंधान/संचार

परिषद बंगाल के सुदर्शन बैठक (सर्विस के सुदर्शन तक) में मात्रविक कार्य से जुड़े मूल्यों की सामाजिक व अर्थव्यतिरिक्त का अनुसरण किया गया। लगभग 29.2 प्रतिशत मूल्यों की मात्रक आय मात्रविक के व्यवसाय काल में 901 से 1000 रुपये तक होती है, मन्दी के समय इनमें से 23.4 प्रतिशत मूल्यों जाता बना जाता है तथा साहुतियों से अपवाद रुपये लेते रहते हैं। यह संस्थान कार्य 21 से 70 वर्ष के आपूर्ति वाले मूल्यों के बीच किया गया, जिनमें से अधिकतर अनुसंधित जाते हैं।
अन्य प्रसार कार्य निम्नलिखित है

सलाहकारी सेवाएँ
सलाहकारी सेवाएँ निम्नलिखितों को दी गयी हैं—

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2. प्रशिक्षण कार्यक्रम

राजस्थान राज्य सरकार के प्रत्यावर्धन अधिकारियों, बंगालदेश के गैर सरकारी संगठन तथा संस्थान में कार्यकर्ता अधिकारियों के लिए अंतर्देशीय मात्रकी के विभिन्न पहलुओं पर कुल पाँच प्रशिक्षण कार्यक्रमों का आयोजन किया गया।

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अन्य कार्य

संस्थान के कार्य कलाप तथा अंतर्वर्तीय मात्रत्वकी 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 मत्य विभागों को मत्य विपुल प्रभियां प्राप्त करने में सहायता प्रदान की गई।

कृषि विश्लेषण केंद्र

कृषि विश्लेषण केंद्र, काशीदीय उद्योग: प्रशिक्षण, प्रति सर्वेक्षण 'प्रयोगशाला से भूमि की ओर' कार्यक्रम, आड़ी कार्यों में सहायता रहा। प्रशिक्षण कार्यक्रम विभिन्न विषयों से संबंधित थे, जैसे— मात्रत्वकी, फसल उत्पादन, बागवानी, गृह-विश्लेषण तथा पत्रिका विश्लेषण। इन प्रशिक्षण कार्यक्रमों का पाद्यक्रम स्थानीय किसानों की आवश्यकताओं के अनुसार बनाया गया। प्रशिक्षण कार्यक्रमों का विवरण निम्नलिखित हैः—

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<td>34 29</td>
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</table>
कृपया विजयन केन्द्र ने परिचय बांग्ला के विभिन्न जन्मदों में दलहरों व तिलहरों की खेती संबंधि
प्रदर्शियों का भी आयोजन किया।

पुस्तकालय व प्रलेखन सेवाओं

केन्द्रीय अंतर्राष्ट्रीय प्रगति मात्रक की अनुसंधान संस्थान के पुस्तकालय ने संस्थान के अनुसंधान
tथा विकास कार्यों में महत्त्वपूर्ण भूमिका निभाया है। इस पुस्तकालय का उपयोग न केवल संस्थान के
वैज्ञानिक वैक्सिन विद्वानों, संस्थानों था अन्य संगठनों के शौककारों, अध्यापकों एवं
प्रशिक्षणार्थियों ने सार्वजनिक रूप से किया। पुस्तकालय ने अपने पंडार में 129 पुस्तक तथा 54 विचार
प्रकाशित की जिनमें 28 विदेशी तथा 59 भारतीय लेखकों ने लेख। इस समय संस्थान के
पुस्तकालय में 6678 पुस्तकें, 2950 विचार प्रकाशित के अन्य प्रकाशित, और 4197 पुस्तकें लेख तथा 935
मानविक संबंधि उपलब्ध हैं। इस वर्ष के दौरान पीएच नए भिनिमत संरचना स्थापित किए गए हैं।

अन्तर-पुस्तकालय स्रोत के रूप में 36 पुस्तकें अन्य पुस्तकालयों को भेजी गईं। यह पुस्तकालय
इस वर्ष भी विभागीय प्रकाशितों को विभिन्न अनुसंधान संगठनों, विद्वानों, उद्योगपतियों तथा
मत्स्य-पालकों को वित्तीय नैवेद्य रहा। नांदकों के अंतर्राष्ट्रीय मात्रक की प्रगति की जानकारी
सार्वजनिक रूप से दी। इस वर्ष के दौरान पुस्तकालय हेतु $5,58,765/- की राशि खर्च की गई।

इस अनुमान में फोटोग्राफी तथा रेडियो-टेलीविजन सेवाओं के लिए एक क्रिया एकक बना है। संस्थान
के वैज्ञानिकों के अहिल्लिव विभिन्न अनुसंधान संस्थानों और विद्वानों को फोटोग्राफ्र, पुस्तकालय लेख
tथा फोटोग्राफिक क्षेत्र में सहायता दी गई। इस अनुमान ने एक साइटेटेडिंग और बिन्दसाब एकक को
भी संस्थान के विभिन्न अनुमान के सेरव्य सार्वजनिक रखा।

हकीकी रिपोर्ट

संस्थान के अनुसंधानात्मक प्रगति के रूप से संस्थान 13 से भी अधिक तकनीकी रिपोर्ट का संकलन
किया गया। संस्थान के वैज्ञानिकों के अनुसंधानात्मक परिसरों को विभिन्न वैज्ञानिक बत्तियों में प्रकाशित
करने से पूर्व उनका संस्थान निर्माण किया गया। समस्याओं और प्रश्नों का ज्ञान भी अनुमान के वैज्ञानिकों
द्वारा प्रस्तुत किया गया। इस अनुभव ने संस्थान के वैज्ञानिकों का संस्थान समिति, संस्थान आदि
में मान लेने से संबंधि कार्य का भी परवर्तन किया।

***************
This report includes unprocessed or semiprocessed data which would form the basis of scientific papers in due course. The material contained in the report, therefore, may not be made use of without the permission of this Institute, except for quoting it as scientific reference.

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APPENDIX - II ADDRESS LIST OF RESEARCH/SURVEY CENTRES

APPENDIX - III ORGANISATION CHART
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-à-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 first 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 Institutions. 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 Mausi dam in Tonk district. Studies on the aetiological agents of EUS-affected fishes revealed the presence of Micrococcus lutens, Staphylococcus sp. and Citrobacter breundt, 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 (bheris) 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 Rupnaratna) 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. Randrian 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.


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.


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:

通过访问:
- 农民: 141
- 伸展官员: 28

通过信件:
- 农民: 58
- 大学: 7
- 企业家: 16
- 状态政府: 11
- 非政府组织: 2
- 外国机构: 1

通过电话访问:
- 2

2) 培训

五门课程按照不同方面的需求在内陆渔业领域进行了培训，该课程由Rajasthan渔业部的延伸功能官员和来自Bangladesh的NGOS以及内部官员的Institute进行了培训。

3) 讲座 - 23
4) 展览 - 3
5) 场地日 - 5
6) 其他活动:

总共23个批次的520名学生/学员和33名教师来自不同学院和训练机构，进行了培训，介绍了Institute的活动和内陆渔业领域的最新发展。

为各州政府渔业部门供应鱼脑准备工作已作出安排。
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:

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<tr>
<th>Sl. No.</th>
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<th>Type of Training</th>
<th>No. of courses</th>
<th>No. of trainees</th>
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<td>30</td>
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<td>Home Science</td>
<td>on-campus</td>
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<td>9</td>
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<td></td>
<td>off-campus</td>
<td>17</td>
<td>25</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>90</td>
<td>510</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>90</td>
<td>630</td>
</tr>
<tr>
<td>5.</td>
<td>Animal Science</td>
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<td></td>
<td></td>
<td>off-campus</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>60</td>
<td>170</td>
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<td>10</td>
<td>117</td>
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<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>On-campus</strong></td>
<td><strong>34</strong></td>
<td><strong>29</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Off-campus</strong></td>
<td><strong>117</strong></td>
<td><strong>1209</strong></td>
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<td></td>
<td><strong>285</strong></td>
<td><strong>2247</strong></td>
</tr>
</tbody>
</table>

**Total training** 151 149 2140 2532

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


(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.


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 wildlife 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, Varanast.

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.

Dehadrat, 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.

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

Jauhart, V.K. (Mr.), Managing Director, I.U.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, Chhinhat, Lucknow.

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

Kitta, Shozo (Mr.), Director, LII-2 OECF and Leader, 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.

Patt, 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. K.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. Partha, 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.

Ulha, 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)

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<td>280.00</td>
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<td><strong>Total</strong></td>
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### Centre-Wise List of Ongoing Projects 1992-93

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<td>BF/B/3</td>
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<td>VADODARA</td>
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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


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 *Ipomoes aquation* 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 gutio* collected from Eluru, Aklvidu 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 GANGLAND YAMUNA.


Duration : May 1992 to April 1997
Location: Allahabad, Patna, Lalgola.


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.
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

<table>
<thead>
<tr>
<th>Species</th>
<th>Centre</th>
<th>Sadiapur</th>
<th>Daraganj</th>
<th>Lalgola</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. mrigala</td>
<td></td>
<td>1.30</td>
<td>0.17</td>
<td>1.38</td>
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<tr>
<td>C. catla</td>
<td></td>
<td>0.88</td>
<td>0.18</td>
<td>1.57</td>
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<tr>
<td>L. rohita</td>
<td></td>
<td>0.65</td>
<td>0.11</td>
<td>1.41</td>
</tr>
<tr>
<td>L. calbasu</td>
<td></td>
<td>5.19</td>
<td>0.98</td>
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</tr>
<tr>
<td>Major carps</td>
<td></td>
<td>8.02</td>
<td>1.44</td>
<td>5.57</td>
</tr>
<tr>
<td>M. aor</td>
<td></td>
<td>8.70</td>
<td>1.42</td>
<td>4.47</td>
</tr>
<tr>
<td>M. seenghala</td>
<td></td>
<td>10.13</td>
<td>3.49</td>
<td>2.08</td>
</tr>
<tr>
<td>W. attu</td>
<td></td>
<td>0.18</td>
<td>0.14</td>
<td>3.90</td>
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<td>Selected catfish</td>
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<td>19.01</td>
<td>5.05</td>
<td>10.45</td>
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<tr>
<td>T. ilisha</td>
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<td>0.31</td>
<td>0.07</td>
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<td>Miscellaneous</td>
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<td>42.24</td>
<td>22.01</td>
<td>47.81</td>
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<tr>
<td>Total</td>
<td></td>
<td>69.58</td>
<td>28.57</td>
<td>75.79</td>
</tr>
</tbody>
</table>
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. tilapia 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. tilapia 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 (Guni 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 bengalensts* (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 umhos/cm) at OF. Still higher value of conductivity (293.0 umhos/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

1) 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.

1) 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

1) 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.

1) Manalya: 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 CO$_2$ increased at OF. However, nutrient concentration was slightly less.

b) Rajghat (sewage): Excepting free CO$_2$, 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/m$^3$/hr and 18.75 and 112.5 mgC/m$^3$/hr respectively showing average production less at AOF and more at BOF.

ALLAHABAD

River Ganga

Mehdaurlghat: Gross and net production fluctuated between 50.0 and 250.0 mgC/m$^3$/hr and 37.5 and 125.0 mgC/m$^3$/hr respectively.

Fatehpurghat: Gross and net production fluctuated between 37.5 and 281.25 mgC/m$^3$/hr and 25.0 and 150.0 mgC/m$^3$/hr respectively. Highest value was observed in March (281.25 mgC/m$^3$/hr) which was due to manuring.

Manalya: Gross and net production varied between 56.25 and 250.0 mgC/m$^3$/hr and 37.5 and 187.5 mgC/m$^3$/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/m$^3$/hr and 20.83 and 83.33 mgC/m$^3$/hr respectively reflecting highest value in February/March.

Sujawan: Gross and net production fluctuated between 62.5 and 171.87 mgC/m$^3$/hr and 25.0 and 93.75 mgC/m$^3$/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/m$^3$/hr and 11.11 and 125.0 mgC/m$^3$/hr respectively.

Rajghat: Gross and net production was observed at AOF which ranged from 31.25 and 109.37 mgC/m$^3$/hr and 18.75 and 62.5 mgC/m$^3$/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/m$^3$/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

**Mehdaurlghat**: 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 μg/g\(^{-1}\), 8.0 and 12.4 μg/g\(^{-1}\) and traces to 12.8 μg/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 Mavaiya (12.8 μg/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 μg/l, 7.0 and 15.2 μg/l and 1.5 and 4.2 μg/l 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 μg/l, 1.8 and 2.4 μg/l and 1.8 and 3.4 μg/l 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 μg/l and 1.8 and 3.4 μg/l respectively indicating lowest value of Kakrahaghat (Yamuna) and highest at Mavaiya (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 remigera and Sphaerotilus sp. indicated the polutional 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 pollutional 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.

**Mavalya (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 bimodal fluctuation with a minor peak in summer and major in winter was observed.

**Mavalya**: 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/m² respectively. The population was observed to be many fold higher at OF as compared to previous year (220u/m²).

Tannery: The benthic fauna at OF, AOF and BOF were estimated as 38,361 and 19 u/m². 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/m² 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/m² at OF, AOF and BOF respectively. As compared to previous year the population increased at OF and BOF.

Mavalya: The average benthic population at OF, AOF and BOF were estimated at 584, 152 and 481 u/m². 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/m² 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: Oscillatoria sp., Phormidium sp., Asterionella sp., Synedra ulna and Spirogyra condensata.
- Zooplankton: Brachionus angularis, B. rubens, Keratella spp., Euglena sp. and Polyarthra sp.
- Bacteria: Zoogloea remigera, Sphaerotilus sp. and Thiodictyon sp.
- Macrobenthos: Chironomous sp., Tubifex sp., Limnaea sp. and Pisidium 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 syndrome (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 previous year.

Parasites: Natural infection in Channa punctatus by the metacercarial 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., Bhagwaigath, Tannery, Jajmou (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 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


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. colia*, *C. garua*, *E. vacha*, and other small fish like clupeds, *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](image)

**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 Saraihat.

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


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 kg m\(^{-1}\) hr\(^{-1}\) to 0.930 kg m\(^{-1}\) 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 1.75-1.25 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:

<table>
<thead>
<tr>
<th>Major carps</th>
<th>Minor carps</th>
<th>Shrimps</th>
<th>Misc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catla</td>
<td>Rohu</td>
<td>Mrigal</td>
<td>Calbasu</td>
</tr>
<tr>
<td>19.0%</td>
<td>20.0%</td>
<td>10.3%</td>
<td>1.66%</td>
</tr>
<tr>
<td>25.0%</td>
<td>0.6%</td>
<td>23.44%</td>
<td></td>
</tr>
</tbody>
</table>

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. fossili (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, foundary, steel finishing units etc.) was noticed at Tajghat (Agra).
At downstream 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 mg C m\(^{-3}\) hr\(^{-1}\) (Gross production) and 33.3 to 250.0 mg l\(^{-1}\) (Net production). The polluted zones of Delhi, Mathura, Agra and Etawah indicated maximum values of Gross Production (GP) 968.2 mg C m\(^{-3}\) hr\(^{-1}\) and Net Production (NP) 529.2 mg C m\(^{-3}\) hr\(^{-1}\), GP 966.6 mg C m\(^{-3}\) hr\(^{-1}\) and NP 525.0 mg C m\(^{-3}\) hr\(^{-1}\), GP 249.9 mg C m\(^{-3}\) hr\(^{-1}\) and NP 212.4 mg C m\(^{-3}\) hr\(^{-1}\) and GP 501.56 mg C m\(^{-3}\) hr\(^{-1}\) and NP 187.5 mg C m\(^{-3}\) 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, Scenedesmus, 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 in substratum due to organic effluents, from sewage nallah. Among oligochaetes main organisms present were *tubificids* and among Diptera, *Chironomidae* 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 downstream 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., Kallash. 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:
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, Hardot, 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 Ul⁻¹) and Sone (1899 Ul⁻¹) while in Gomti (300 Ul⁻¹), the concentration was much low. All these tributaries and the main Ganga in upper
stretch showed dominance of Bacillariophyceae. Rivers Churni (102 Ul⁻¹) and Damodar (94 Ul⁻¹) in lower stretch had different planktonic composition comprising Phormidium sp., Oscillatoria sp., Ulothrix sp., Spirogyra sp. etc. In estuarine stretch at Baranagar (141 Ul⁻¹) and Nurpur (289 Ul⁻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 analyses 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.

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**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. Vinct (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., *Gyraulus* 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 demersium* 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 kg/ha yr⁻¹ and 500 kg/ha yr⁻¹. The rate of fish production was comparatively higher (450 kg/ha yr⁻¹ - 700 kg/ha yr⁻¹) in medium deep beels while lowest in shallow beels (150 kg/ha yr⁻¹ - 350 kg/ha yr⁻¹).
ECOLOGY AND FISHERIES OF FRESHWATER RESERVOIRS

Personnel:


**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


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 up to August, probably due to wind induced turbulence as well as showers resulting in mixing.

**Primary productivity**

Solar radiant energy ranged from 185.5 x 10^4 cal m^-2 d^-1 (December) to 233.0 x 10^4 cal m^-2 d^-1 (May) Primary productivity ranged from 31.25 (Aug.) to 234.37 mg C m^-2 h^-1 (Oct.) with an average of 86 mg C m^-2 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 m^-2 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 hirundinella*. 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, Viliparus bengalensis, Melania striatella tuberculata, Melonia (Blotia) scabra, Melonia (Blotia) scabra var. elagana, Bithynia stenothrooides, Lymnaea luteola, L. acuminata,*
Indoplanorbis exustus, Chironomus spp. Tubifex spp. and Ephemera 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 petruells, Mystus cavastus, Ompok bimaculatus, Wallichio attu, Mastacomblius armatus, Channa maruitus, Channa striaius, 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. cavastus, 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)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C. catla</td>
<td>-</td>
<td>1030 (19.8)</td>
<td>10736 (23.34)</td>
</tr>
<tr>
<td>L. rohita</td>
<td>615 (15.1)</td>
<td>1166 (22.4)</td>
<td>16955 (36.66)</td>
</tr>
<tr>
<td>C. mrigala</td>
<td>1190 (29.2)</td>
<td>69 (1.3)</td>
<td>735 (1.60)</td>
</tr>
<tr>
<td>L. calbasu</td>
<td>473 (11.6)</td>
<td>223 (4.3)</td>
<td>323 (0.70)</td>
</tr>
<tr>
<td>C. carpio</td>
<td>-</td>
<td>573 (11.0)</td>
<td>1046 (2.27)</td>
</tr>
<tr>
<td>W. attu</td>
<td>265 (6.5)</td>
<td>272 (5.2)</td>
<td>1124 (2.44)</td>
</tr>
<tr>
<td>Misc.</td>
<td>1532 (37.6)</td>
<td>1868 (36.0)</td>
<td>15085 (32.79)</td>
</tr>
<tr>
<td>Total catch (kg)</td>
<td>4,074</td>
<td>5,201</td>
<td>46,004</td>
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<tr>
<td>Yield/ha (kg)</td>
<td>5.56</td>
<td>7.01</td>
<td>62.77</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Effort (Units)</td>
<td>240</td>
<td>240</td>
<td>360</td>
<td>750</td>
<td>360</td>
<td>600</td>
<td>720</td>
<td>720</td>
<td>760</td>
<td>780</td>
<td>780</td>
<td>780</td>
</tr>
<tr>
<td>Catch (kg)</td>
<td>987</td>
<td>1143</td>
<td>2690</td>
<td>5908</td>
<td>2130</td>
<td>2021</td>
<td>9031</td>
<td>2405</td>
<td>3208</td>
<td>2777</td>
<td>5966</td>
<td>6929</td>
</tr>
<tr>
<td>C/U (kg)</td>
<td>4.11</td>
<td>4.76</td>
<td>7.47</td>
<td>7.88</td>
<td>5.92</td>
<td>4.70</td>
<td>2.54</td>
<td>3.34</td>
<td>4.47</td>
<td>3.56</td>
<td>7.65</td>
<td>8.88</td>
</tr>
</tbody>
</table>

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.

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

The reservoir was stocked @ 300 fry/ha/a in 1986-87 resulting in 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 m$^3$. 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/m$^3$/h and 11.72 and 44.26 mg C/m$^3$/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/m$^3$ (August) to 2.88 ml/m$^3$ (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.
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. 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, submerged varieties viz., Hydrilla sp., Ceratophyllum sp., Vallisneria sp., and Nymphaea 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.
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 cumeecs in Jule '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


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


Duration: July 1986 to September 1993.

Location: Barrackpore, Kantatala, Handlpota (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-MATLAHAND AND KULTI ESTUARINE SYSTEM


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 Jharkhali.

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 downstream 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., *Ditylum* sp.) was the major dominant group consisting of 68.0-91.0% of the total population (18-4199 Ul⁻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, Tenulosa ilisha, Trichurus spp., Tachysurus jella, Stromateus cinereus 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


Duration: 1986-1992

Location: Gosaba-Sajnakhali stretch, Kulti 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 Exceocaria 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.*, Sudhanyakhali, Sajinakahl and Durgaduant, 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. Coastaly located Bakkhal though exhibited low status of soil quality, the nutrient status of the water was quite good due to manural 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 Sudhanyakhali during July-December and at Sajinakahl 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 congregrated zone of *Sarcolobus carinatus* and one patchy pocket of *Heritiera fomes* in the Sundarbans mangrove in the Sajinakhal-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 parsta* 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.
<table>
<thead>
<tr>
<th>PROJECT</th>
<th>BF/B/9</th>
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<tbody>
<tr>
<td>ECOLOGY AND FISHERIES OF NARMADA ESTUARINE SYSTEM WITH SPECIAL REFERENCE TO IMPOURDMENT OF RIVER NARMADA (SARDAR SAROVAR)</td>
<td></td>
</tr>
</tbody>
</table>

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, Baitalpur, receiving domestic and industrial effluents, and Sakkarpura receiving composite effluents, revealed organic enrichment at the former site while stress at the latter site.

Artificial fecundation of Tenualosa 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


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.

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**PROJECT BF/B/11**

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


*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 dose @ 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


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., Kulti, Diamond Harbour, Nurpur, Kolaghat, Uluberta, 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 Kulti 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, Prahlad 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.
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 up to 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.
The resource assessment survey has been carried out with the adoption of developed methodology. Stratified two-state 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.
PUBLICATIONS 1992-93


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. 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.)
Dr. D. N. Singh, -do-
Dr. B. 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.)
Dr. G. N. Srivastava, -do- (Retd. on 30.4.1992)
Shri P. K. Kattha, 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-

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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

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Shri K. V. Rao, Scientist (S.G.)
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Coimbatore Centre
Shri C. Selvaraj, Pr. Scientist
Shri V.K. Murugesan, Scientist (S.G.)
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Dr. B.K Singh, Scientist (Sr. Sc.)
Dr. B.L. Pandey, Scientist

Raipur Centre
Dr. D. Kumar, Sr. Scientist
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Kangra Centre
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Dr. V.R. Chitranshi, -do-
Dr. V.K. Sharma, 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)
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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
-----------

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Shri G.N. Saha, Pr. Scientist (Retd. on 30.6.1992)
Dr. M. Sinha, Pr. Scientist (from 31.7.1992)
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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.)

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
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
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Shri R.C. Satapati
Shri K.K. Agarwal
Shri R.C. Mandy
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Md. S.K. Syed Shakul Hameed
Shri R.R. Mukherjee
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Shri D.N. Srivastava
Shri B.D. Saroj
Shri Alok Sarkar
Shri N.N. Mazumdar
Shri S.P. Ghosh
Shri N.C. Mondal
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Shri K.S. Banerjee
Shri D.N. Srivastava
Shri B.D. Saroj
Shri Alok Sarkar
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Shri H.K. Sen
Shri Sukumar Saha

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Shri Fatik Manna
Shri Camil Lakra

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Shri Ramji Tiwari
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Shri Swapan Kr. Chatterjee
Shri Sushil Kumar
Ms K. Jacqueline

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

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Ms. Rina Basak

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Shri P. Rajani
Shri Bhai Lal
Shri A. Mitra
Shri C.K. Vava
Ms. Abhijitita Sengupta
Shri L.K. Parbat
Shri C.G. Rao
Shri S. Kottalaah
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. Barul
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 Ashtis 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. Berlyoary, 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
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
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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

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)

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)
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. Sushma Mazumder  
Shri Biswanand Sah  

Shri C.K.N. Sahi  
Shri K.S. Rao  
Shri Debesh Chowdhury  
Shri Brahmapal Balmiki  
Shri S. Karmaker  
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

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  
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Ms. Jayasree Pal  
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Shri Paras Ram  
Shri S.K. Maranappan  
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Shri Ambika Lal  
Shri P. Lahiri  
Shri P.K. Dutta  
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Shri S.K. Bose  
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Shri J. Roy  
Shri S.K. Tikadar  
Shri U. Bhattacherjee  
Shri P.K. Ghosh  
Md. Quasim  
Shri C.K. Pandey

Ms. G. Vinoda Lakshmi  
Ms. Jolly Saha

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

Shri 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. Boral
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. Murugasen
Shri S.K. Burman
Shri Nar Bahadur
Shri P.C. Kachari

**Supporting Grade II**

Shri Munnilal 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. Bex
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. Malliah
Shri Subrahmaniy
Shri M. Mahadeva
Shri G.C. Paramanick
Shri R.U. Muchi

Shri K. Ningigowda
Shri S.T. Gavale
Shri S. Mahendran
Shri V. Marilappan
Shri A. Ramaswamy
Shri M.V. Krishnan
Shri K. Kalianan
Shri Ram Prasad
Shri Karam Raj
Shri Satyendra Burman
Shri Lalla Prasad
Shri Sita
Shri Rajdhari Mallah
Shri Sukchand Biswas
Shri Bideshi Lal
Shri B. Pugalendhi
Shri Om Prakash
Shri M.P. Bind
Shri A. Gangalal
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. Kistalal
Shri U. Satyanarayana
Shri P. Atechal
Shri S. Kalita
Shri N. Deka
Shri Khagen Ch. Das
Shri Bhabalu Boro
Shri Jai Ram Prasad
Ms. Godhul1 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 Sibu Lal 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 Iswarram Balmiki
Ms. Anjali Dutta
Shri Bharat Kr. Halder
Shri Anil Ch. Das
Shri S. Guin
Shri P. Singh
Shri D. Singh
Shri Attilah
Shri Sital Prasad
Ms. Kamal Devi
Shri M.S. Bhoi
Shri T.H. Ghume
Shri K. Subbratya
Shri R. Nagraj
Shri S. Govindarajan
Shri K. Subramahmalyan
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 Prasiddh 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. Bhattcharjee
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. Chak
Shri S. Saida
Shri M.C. Ghrarami
Shri C. Munappa
Shri T.K. Halder
Shri Ganesh Chandra Burman
Shri R. Rajendran
Smt. Suvar 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.

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>Promoted to</th>
<th>With effect from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shri S.C. Roy</td>
<td>Superintendent</td>
<td>Asstt. Adm. Officer</td>
<td>30.8.93</td>
</tr>
<tr>
<td>Shri R.K. Ghosh</td>
<td>Senior Clerk</td>
<td>Supdt. (A &amp; A)</td>
<td>30.8.93</td>
</tr>
<tr>
<td>Smt. Dipti Sett</td>
<td>T-4</td>
<td>T-5</td>
<td>1.7.1990</td>
</tr>
<tr>
<td>Shri C.N. Mukherjee</td>
<td>T-4</td>
<td>T-5</td>
<td>1.1.1993</td>
</tr>
<tr>
<td>Smt. Satnam Kaur</td>
<td>T-4</td>
<td>T-5</td>
<td>1.1.1993</td>
</tr>
<tr>
<td>Shri H. Chakrader</td>
<td>T-II-3</td>
<td>T-4</td>
<td>1.1.1992</td>
</tr>
<tr>
<td>Shri A.K. Banerjee</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td>Shri Fatik Manna</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td>Shri Camil Lakra</td>
<td>T-II-3</td>
<td>-do-</td>
<td>1.7.1992</td>
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<tr>
<td>Shri D. Bargayary</td>
<td>T-2</td>
<td>T-I-3</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri Santosh Kr. Biswas</td>
<td>-do-</td>
<td>-do-</td>
<td>1.1.1992</td>
</tr>
<tr>
<td>Shri Manik Ch. Pal</td>
<td>-do-</td>
<td>-do-</td>
<td>1.7.1991</td>
</tr>
<tr>
<td>Shri N.K. Saha</td>
<td>T-I</td>
<td>T-2</td>
<td>1.7.1993</td>
</tr>
<tr>
<td>Shri S. Kataiah</td>
<td>T-1</td>
<td>T-2</td>
<td>1.7.1993</td>
</tr>
<tr>
<td>Shri Ch. G. Rao</td>
<td>T-1</td>
<td>T-2</td>
<td>1.7.1993</td>
</tr>
<tr>
<td>Shri L.K. Parbat</td>
<td>T-1</td>
<td>T-2</td>
<td>1.7.1993</td>
</tr>
<tr>
<td>Shri S.C. Balmiki</td>
<td>SSG III</td>
<td>SSG IV</td>
<td>1.4.1993</td>
</tr>
<tr>
<td>Shri Khemchand Balmiki</td>
<td>SSG II</td>
<td>SSG III</td>
<td>4.11.92</td>
</tr>
<tr>
<td>Shri Gulab Shaw</td>
<td>SSG II</td>
<td>SSG III</td>
<td>1.4.93</td>
</tr>
<tr>
<td>Shri A. Murugasan</td>
<td>SSG II</td>
<td>SSG III</td>
<td>12.7.93</td>
</tr>
<tr>
<td>Shri Sankar Bose</td>
<td>SSG I</td>
<td>SSG II</td>
<td>4.11.92</td>
</tr>
<tr>
<td>Shri G.J. Runadala</td>
<td>SSG I</td>
<td>SSG II</td>
<td>1.4.93</td>
</tr>
<tr>
<td>Shri R.U. Muchi</td>
<td>SSG I</td>
<td>SSG II</td>
<td>12.7.93</td>
</tr>
<tr>
<td>Shri G.C. Paramanick</td>
<td>SSG I</td>
<td>SSG II</td>
<td>1.11.93</td>
</tr>
</tbody>
</table>
The following members were granted merit increments/advance increments as below on the recommendation of the Assessment Committee.

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>Merit increments</th>
<th>With effect from</th>
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<tr>
<td>Shri R.C. Satapathy</td>
<td>T-5</td>
<td>Two</td>
<td>1.1.1992</td>
</tr>
<tr>
<td>Shri S.K. Das</td>
<td>T-5</td>
<td>Two</td>
<td>1.1.1991</td>
</tr>
<tr>
<td>Shri F.K. Ghosh</td>
<td>T-5</td>
<td>Two</td>
<td>1.1.1991</td>
</tr>
<tr>
<td>Shri N.K. Srivastava</td>
<td>T-5</td>
<td>Two</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri R.N. De</td>
<td>T-5</td>
<td>One</td>
<td>1.1.1991</td>
</tr>
<tr>
<td>Shri K.L. Das</td>
<td>T-1-3</td>
<td>One</td>
<td>1.1.1991</td>
</tr>
<tr>
<td>Shri K.P. Singh</td>
<td>-do-</td>
<td>One</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri Badal Lal Singh</td>
<td>-do-</td>
<td>One</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri K.R. Deb</td>
<td>-do-</td>
<td>One</td>
<td>1.7.1992</td>
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<tr>
<td>Shri Kanchan Dutta</td>
<td>-do-</td>
<td>Three</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri U.K. Chatterjee</td>
<td>-do-</td>
<td>Two</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri N.C. Biswas</td>
<td>-do-</td>
<td>Two</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri Suraj Bahadur</td>
<td>-do-</td>
<td>Three</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri K. Ganesan</td>
<td>-do-</td>
<td>One</td>
<td>1.7.1992</td>
</tr>
<tr>
<td>Shri Kishan Deo</td>
<td>-do-</td>
<td>One</td>
<td>1.1.1991</td>
</tr>
<tr>
<td>Shri T.P. Ghosh</td>
<td>-do-</td>
<td>Three</td>
<td>1.7.1991</td>
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</table>

Retirement during the period

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>Date of Retirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shri G.N. Srivastava</td>
<td>Scientist (S.G.)</td>
<td>30.4.92</td>
</tr>
<tr>
<td>Shri G.N. Saha</td>
<td>Principal Scientist</td>
<td>30.6.92</td>
</tr>
<tr>
<td>Dr. Y. Rama Rao</td>
<td>-do-</td>
<td>31.7.92</td>
</tr>
<tr>
<td>Shri S.P. Singh</td>
<td>-do-</td>
<td>31.10.92</td>
</tr>
<tr>
<td>Shri A.C. Nandy</td>
<td>Scientist (S.G.)</td>
<td>28.2.93</td>
</tr>
<tr>
<td>Shri S.N. Sar</td>
<td>Sr. Res. Asstt.</td>
<td>31.3.92</td>
</tr>
<tr>
<td>Shri Kishan Deo</td>
<td>T-1-3</td>
<td>30.9.92</td>
</tr>
<tr>
<td>Shri J. Ghosh</td>
<td>T-6</td>
<td>31.10.92</td>
</tr>
<tr>
<td>Shri A.K. Roy</td>
<td>T-5</td>
<td>28.2.93</td>
</tr>
<tr>
<td>Shri B.C. Dutta</td>
<td>Asstt. Adm. Officer</td>
<td>31.5.92</td>
</tr>
<tr>
<td>Shri M.R. Roy</td>
<td>-do-</td>
<td>31.7.92</td>
</tr>
<tr>
<td>Shri S.K. Pramanick</td>
<td>Assistant</td>
<td>31.7.92</td>
</tr>
<tr>
<td>Shri L.P. Mishra</td>
<td>Senior Clerk</td>
<td>30.11.92</td>
</tr>
<tr>
<td>Shri J.N. Biswas</td>
<td>SSG III</td>
<td>31.12.92</td>
</tr>
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</table>
## Resignation

<table>
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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Shri A.D. Shinde</td>
<td>Junior Clerk</td>
<td>30.10.1992</td>
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</table>

## Appointments

Following appointments were made during the period

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>Place of posting</th>
<th>Date of appointment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shri A.C. Ghosh</td>
<td>Sr. Adm. Officer</td>
<td>Barrackpore</td>
<td>31.5.93</td>
</tr>
<tr>
<td>Shri Ganesh Bhanja</td>
<td>SSG I</td>
<td>Barrackpore</td>
<td>22.5.92</td>
</tr>
<tr>
<td>Smt. Parmila Taman</td>
<td>SSG IV</td>
<td>Agra</td>
<td>3.8.92 (Inter Institutional Transfer)</td>
</tr>
<tr>
<td>Smt. N.K. Chaki</td>
<td>SSG I</td>
<td>Barrackpore</td>
<td>20.2.93</td>
</tr>
<tr>
<td>Shri C.P. Singh</td>
<td>T-1</td>
<td>Barrackpore</td>
<td>30.6.1992</td>
</tr>
<tr>
<td>Shri Sayyad Khasim Saida</td>
<td>SSG I</td>
<td>Eluru</td>
<td>16.11.1992</td>
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The following members of CICFRI were transferred during the period April 1992 to March 1993.

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
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<th>To</th>
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<tbody>
<tr>
<td>Dr V.R. Desai</td>
<td>Pr. Scientist</td>
<td>Barrackpore</td>
<td>Raipur/Bangalore</td>
</tr>
<tr>
<td>Shri A.B. Mukherjee</td>
<td>-do-</td>
<td>Patna</td>
<td>Calcutta</td>
</tr>
<tr>
<td>Dr. B.C. Jhah</td>
<td>Scientist (S.G.)</td>
<td>Eluru</td>
<td>Guwahati</td>
</tr>
<tr>
<td>Shri K.V. Rao</td>
<td>-do-</td>
<td>T-5</td>
<td>Allahabad</td>
</tr>
<tr>
<td>Shri J.B. Rao</td>
<td>-do-</td>
<td>T-5</td>
<td>Allahabad</td>
</tr>
<tr>
<td>Shri P.N. Jaitly</td>
<td>Sr. Scientist</td>
<td>T-5</td>
<td>Bangalore</td>
</tr>
<tr>
<td>Dr. M.A. Khan</td>
<td>-do-</td>
<td>T-4</td>
<td>Vadodara</td>
</tr>
<tr>
<td>Dr. D. Nath</td>
<td>Scientist</td>
<td>T-4</td>
<td>Allahabad</td>
</tr>
<tr>
<td>Shri V. Kolekar</td>
<td>T-5</td>
<td>Guwahati</td>
<td>Agra</td>
</tr>
<tr>
<td>Shri R.C. Singh</td>
<td>T-5</td>
<td>Allahabad</td>
<td>Agra</td>
</tr>
<tr>
<td>Shri K.S. Rao</td>
<td>T-5</td>
<td>Allahabad</td>
<td>Agra</td>
</tr>
<tr>
<td>Shri P.S.C. Bose</td>
<td>T-4</td>
<td>Allahabad</td>
<td>Agra</td>
</tr>
<tr>
<td>Shri L.R. Mahavar</td>
<td>T-2</td>
<td>Pune</td>
<td>Agra</td>
</tr>
<tr>
<td>Shri Ladu Ram Mahavar</td>
<td>T-2</td>
<td>Vadodara</td>
<td>Coimbatore</td>
</tr>
<tr>
<td>Shri S.K. Srivastava</td>
<td>T-II-3</td>
<td>Calcutta</td>
<td>Barrackpore</td>
</tr>
<tr>
<td>Shri C.K. Vava</td>
<td>T-2</td>
<td>Bangalore</td>
<td>Eluru</td>
</tr>
<tr>
<td>Shri Arunabha Mitra</td>
<td>T-1</td>
<td>Patna</td>
<td>Vijayawada</td>
</tr>
<tr>
<td>Shri S. Kotalah</td>
<td>T-1</td>
<td>Allahabad</td>
<td>-do-</td>
</tr>
<tr>
<td>Shri R.K. Sah</td>
<td>T-1</td>
<td>Allahabad</td>
<td>Bangalore</td>
</tr>
<tr>
<td>Shri Ch. G. Rao</td>
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<td>Allahabad</td>
<td>Bangalore</td>
</tr>
<tr>
<td>Shri S. S. Sastry</td>
<td>Supdt.(ad-hoc)</td>
<td>Allahabad</td>
<td>Eluru</td>
</tr>
<tr>
<td>Shri Ambika Lal</td>
<td>Senior Clerk</td>
<td>Allahabad</td>
<td>Vijayawada</td>
</tr>
<tr>
<td>Shri S.S. Sinha</td>
<td>Senior Clerk</td>
<td>Allahabad</td>
<td>KVK, Kakdwip</td>
</tr>
<tr>
<td>Shri K.S. Rao</td>
<td>Junior Clerk</td>
<td>Eluru</td>
<td>Barrackpore</td>
</tr>
<tr>
<td>Shri S.K. Tikadar</td>
<td>Junior Clerk</td>
<td>Eluru</td>
<td>Patna</td>
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<tr>
<td>Shri C.N. Shahi</td>
<td>Driver</td>
<td>Eluru</td>
<td>Vijayawada</td>
</tr>
<tr>
<td>Shri P.R. Rao</td>
<td>Boat Driver</td>
<td>Canning</td>
<td>Barrackpore</td>
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<tr>
<td>Shri Subhendu Mondal</td>
<td>SSG III</td>
<td>Eluru</td>
<td>Vijayawada</td>
</tr>
<tr>
<td>Shri L. Samolu</td>
<td>-do-</td>
<td>Eluru</td>
<td>-do-</td>
</tr>
<tr>
<td>Shri P. Sayalu</td>
<td>SSG II</td>
<td>Eluru</td>
<td>-do-</td>
</tr>
<tr>
<td>Shri K.D. Raju</td>
<td>-do-</td>
<td>Eluru</td>
<td>-do-</td>
</tr>
<tr>
<td>Shri P. Sayalu</td>
<td>-do-</td>
<td>Eluru</td>
<td>-do-</td>
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contd........
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<tr>
<td>Shri A. Gangaih</td>
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<tr>
<td>Shri P.N. Rao</td>
<td>SSG I</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td>Shri A. Krishtalh</td>
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<td>Shri U. Satyanarayan</td>
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<td>Shri Sayedjaan</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td>Shri P. Atchalah</td>
<td>-do-</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td>Sk. Abdullah</td>
<td>SSG I</td>
<td>Kangra</td>
<td>KVK, Kakdwip</td>
</tr>
<tr>
<td>Shri Kamlesh Kumar</td>
<td>SSG I</td>
<td>Agra</td>
<td>Allahabad</td>
</tr>
<tr>
<td>Shri Shitala Prasad</td>
<td>SSG I</td>
<td>Kangra</td>
<td>Allahabad</td>
</tr>
<tr>
<td>Shri Dipak Chakraborty</td>
<td>SSG I</td>
<td>Barrackpore</td>
<td>Farakka</td>
</tr>
<tr>
<td>Shri T.K. Halder</td>
<td>SSG I</td>
<td>Farakka</td>
<td>Barrackpore</td>
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</table>
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)

<table>
<thead>
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* This includes 2(two) Scientists. Sanctioned under C.S.S. on Inland Fisheries Statistics.

*This includes 2(two) T-II-3 posts under C.S.S.
| Hindi Officer/S.C./Jr. Analyst/Desk Officer | *16 | 16 | 3 | 18.75% | 1 | 6.25% |
| Stenographers(Sr. & Jr.) | *7 | 6 | 2 | 33.33% | - | - |
| Sr. Clerks/U.D.Cs | 28 | 28 | 9 | 32.14% | 1 | 3.47% |
| Jr. Clerks/Hindi | *44 | 35 | 7 | 20% | - | - |

**4. SUPPORTING STAFF**

| Grade-I | *99 | 95 | 23 | 24.2% | 4 | 4% |
| Grade-II | 53 | 53 | 18 | 34% | 3 | 3.77% |
| Grade-III | 23 | 23 | 10 | 43.48% | 2 | 8.70% |
| 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% |

**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.
## Address List of Research/Survey Centres

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Centre</th>
<th>Address</th>
<th>Telephone Numbers</th>
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<tbody>
<tr>
<td>1</td>
<td>Central Inland Capture Fisheries Research Institute</td>
<td>Barrackpore-743 101, West Bengal</td>
<td>(033) 556-1190</td>
<td>FISHSEARCH BARRACKPORE/</td>
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<td>FAX (033) 5560388</td>
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<td>Allahabad Research Centre</td>
<td>Central Inland Capture Fisheries Research Institute, Allahabad-211002, Uttar Pradesh</td>
<td>(0532) 600531</td>
<td>FISHSEARCH ALLAHABAD-2/</td>
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<td>Bangalore Research Centre</td>
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<td>(080) 357213</td>
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<td>Ujjain, Tikanther, Zamanabad Road, Kangra-176 001, Himachal Pradesh</td>
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<td><strong>5 Calcutta Research Centre</strong></td>
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<td>326, 'Ashirwad', Shankar Nagar, Near Bottle House, Raipur - 492 007, Madhya Pradesh</td>
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### Research/Survey Centres

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