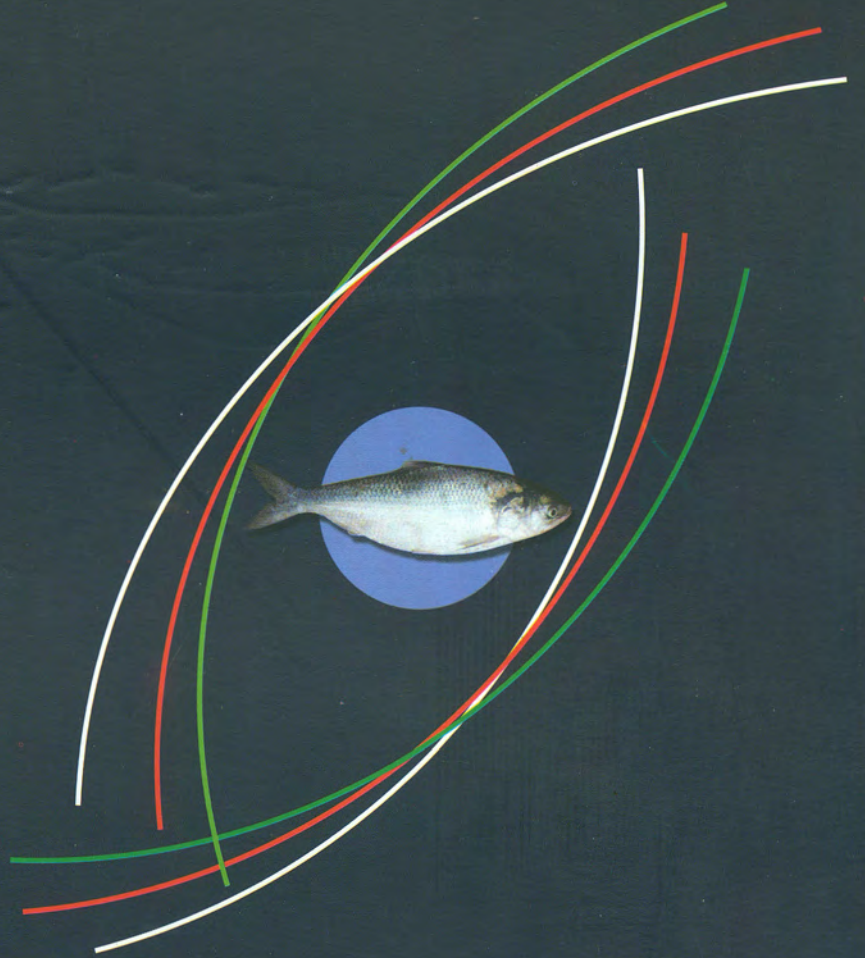


वार्षिक प्रतिवेदन
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केन्द्रीय अंतर्स्थलीय मात्स्यकी अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद्)
बैरकपुर , कोलकाता-७००१२० , पश्चिम बंगाल

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वार्षिक प्रतिवेदन 2003-2004

हिन्दी खण्ड

हिन्दी अनुवाद : श्री पी. आर. राव

सामग्री कम्पोजिंग/लेजर प्रिंटिंग : मो. कासिम



केन्द्रीय अंतर्स्थलीय मात्स्यकी अनुसंधान संस्थान
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बैरकपुर, कोलकाता-700120, पश्चिम बंगाल



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प्रस्तावना

संस्थान की वार्षिक रिपोर्ट 2003-2004 में विभिन्न अनुसंधान परियोजनाओं की उपलब्धियों तथा अन्य कार्यकलापों का व्यापक चित्रण है।

इस अवधि के दौरान संस्थान ने निम्नलिखित क्षेत्रों में उल्लेखनीय कार्य किया है :

- i) गंगा, बिआस और ब्रह्मपुत्र नदियों, जलाशयों, आर्द्र की मात्स्यकी स्रोतों एवं उत्पादन क्षमताओं का आंकलन।
- ii) हुगली, नर्मदा तथा अन्य ज्वरनदमुखों की पारिस्थितिकी तथा मात्स्यकी का मूल्यांकन।
- iii) गंगा, एवं यमुना के पर्यावरण एवं मात्स्यकी स्तर का अनुमापन।
- iv) हिल्सा मछलियों की अनुवांशिकी का अध्ययन।
- v) मछलियों एवं झींगों के स्वास्थ्य अनुमापन एवं मत्स्य रोगों के प्रादुर्भाव के नियंत्रण हेतु विभिन्न प्राचलों का मानकीकरण।
- vi) अंतर्स्थलीय मात्स्यकी संसाधनों का मूल्यांकन।

आर्थिक संसाधनों के विकास के लिए संस्थान ने परामर्शक सेवाओं का कार्य जारी रखा तथा विशिष्ट विषयों पर प्रशिक्षण कार्यक्रमों द्वारा भी आर्थिक संसाधनों में वृद्धि की। इनके अलावा तदर्थ योजनाओं के तहत परिषद एवं अन्य संगठनों से भी आर्थिक संसाधनों को प्राप्त किया।

संस्थान ने अनेक राष्ट्रीय व अंतर्राष्ट्रीय संगठनों से संबंध बनाकर अपने अनुसंधान कार्य को और भी अधिक सुदृढ़ बनाया है। विकसित की गई तकनीकी प्रणालियों को सफलतापूर्वक हस्तांतरित भी किया गया।



उल्लेखनीय उपलब्धियाँ

- गंगा नदी की मत्स्य उपज एवं मत्स्य संख्या गतिकी के अध्ययन से ज्ञात होता है कि कानपुर (88.54 टन) से इलाहाबाद (94.6 टन) होते हुए लालगोला (101.36 टन) तक के नदीय क्षेत्रों की मत्स्य उपज में कमी आई है। भारतीय मेजर कार्प, विदेशी कार्प एवं हिल्सा उपज में बढ़ोत्तरी देखी गई है।
- बिआस नदी की मत्स्य उपज के अनुपात के अध्ययन से देखा गया है कि वहाँ मेजर कार्प (27.8%) की बहुलता है। कॉमन कार्प दूसरे स्थान पर लगभग 26.36% है। इन प्रजातियों की पूरे नदीय क्षेत्र में मौजूदगी यह दर्शाती है कि वे इस जलीय तंत्र में बस गई हैं। माइन कार्प एवं बड़े आकार के कैटफिश क्रमशः 15.7% एवं 7.0% उपलब्ध हैं।
- यमुना, ब्रह्मपुत्र नदियों एवं हुगली-मातलह ज्वारनदमुख से एकत्रित आंकड़ों का विश्लेषण कर डाटाबेस इनफरमेशन सिस्टम हेतु संग्रहित किया गया एवं मत्स्य उपज के उतार-चढ़ाव का भी अध्ययन किया गया।
- राजस्थान के उर्मिला सागर एवं जग्गर जलाशयों की पारिस्थितिकी का अध्ययन किया गया है। उर्मिला सागर से 44 कि.ग्रा. प्रति हेक्टेयर एवं जग्गर जलाशय से 26.7 कि.ग्रा. प्रति हेक्टेयर की मत्स्य उपज प्राप्त हुई है, जबकि आकलित उत्पादन क्षमता के अनुसार 220 कि.ग्रा. प्रति हेक्टेयर उर्मिला सागर से एवं जग्गर जलाशय से 225 कि.ग्रा. प्रति हेक्टेयर उपज प्राप्त की जा सकती है। ये जलाशय उत्पादन क्षमता की दृष्टि से मध्यम स्तर के हैं। अतः इनमें 500 अंगुलिकाएँ प्रति हेक्टेयर की दर से संग्रहण का सुझाव दिया गया है।
- हेमावती जलाशय की पारिस्थितिकी एवं मात्स्यिकी के अध्ययन से यह ज्ञान होता है कि इसकी वर्तमान उपज दर 20 कि.ग्रा. प्रति हेक्टेयर प्रति वर्ष जिसमें कॉमन कार्प और रोहू की बहुलता है, को उचित प्रबन्धन से 100 कि.ग्रा. प्रति हे. प्रति वर्ष तक बढ़ाया जा सकता है। इसी प्रकार आन्ध्र प्रदेश के वाइरा जलाशय में एम. मालकॉमसोनी की प्रचुरता है। हेमावती और वाइरा जलाशयों की मात्स्यिकी के लिए राज्य सरकारों को 100 मि.मि. आकारवाली कार्प अंगुलिकाओं को 300 प्रति हे. प्रति वर्ष की दर से संग्रहित करने का सुझाव दिया गया है।
- हुगली-मातलह ज्वारनदमुख की मात्स्यिकी स्रोतों के अध्ययन से ज्ञान होता है कि वर्ष 2003-04 के दौरान हुगली ज्वारनदमुख एवं दीघा का कुल आकलित मत्स्य उपज 83433.6 टन पिछले वर्ष की तुलना में 33.4% अधिक है। यह कुल मत्स्य उपज ज्वारनदमुख की अब तक की सर्वाधिक उपज है। इस वृद्धि का मुख्य कारण है हिल्सा (5540 टन एवं 13%) और शीतकालीन बैगनेट मत्स्य उपज (3456 टन एवं 12.77%) में विशेष बढ़ोत्तरी है।
- हुगली, गंगा, नर्मदा एवं ताप्ती नदियों से हिल्सा मछलियों के नमूनों को प्राप्त कर RAPD पद्धति से बेनडिंग पैटर्न हेतु विश्लेषण किया गया। प्राथमिक आंकड़ों से ज्ञान होता है कि हुगली एवं गंगा नदी की हिल्सा मछलियों में भिन्नता है।
- कायमकुलम झील एवं अन्य महत्वपूर्ण खारा जलीय परितंत्रों की पारिस्थितिकी एवं जैव-विविधता का अध्ययन



- किया गया। इस झील से 75 मत्स्य प्रजातियाँ, झींगों की आठ प्रजातियाँ, केकड़ों की दो प्रजातियाँ पाई गई हैं। इसकी कुल उपज में इट्रोप्लस सुरातेनसिस और ई. माक्युलेट्स प्रजातियाँ की उपज अधिकतम (12.3 टन एवं 25.16%) पाई गई है, जबकि दूसरे स्थान पर लिजा प्रजाति एवं वलामुगिल उप-प्रजाति (12.43 टन एवं 6.67%) रहा है। सीन नेट से प्रति युनिट प्रयास से प्राप्त उपज (CPUE) दर अधिक रहा है क्योंकि छोटे छिद्रों वाले जाल का अनुचित प्रयोग किया जा रहा है।
- उत्तर प्रदेश की झीलों के सर्वेक्षण से यह ज्ञात होता है कि इन झीलों में पोषक तत्वों की कमी होने पर भी ये उत्पादन योग्य हैं। कुल प्राथमिक उत्पादन 410 से 1031 मि.ग्रा. कार्बन प्रति वर्गमीटर प्रति दिन के दर के बीच विचरण करते पाया गया एवं इसका 62.71% भाग वनस्पति पलवक के द्वारा निर्मित होते देखा गया। इन झीलों में उच्च अपरद ऊर्जा उपलब्ध है। इनकी मत्स्य उपज 31-476 कि.ग्रा. प्रति हेक्टेयर प्रति वर्ष है जिसे उचित संग्रहण एवं मैक्रोफाइट के प्रबंधन से 1 टन प्रति हे. प्रति वर्ष कर दर तक वृद्धि की जा सकती है।
 - असम में किए गए केज कल्चर मत्स्य पालन से माइन एवं मेजर कार्प मछलियों को पोनो से अंगुलिकाओं की आकार, (दो महीनों की अवधि में 10 से. मी. एवं 12-18 ग्रा.) तक पालने में सफलता मिली। अतिजीविता दर 68-77% रही और यह पालन प्रणाली मानसून के दौरान की गई। मानसून के पश्चात् इन पिंजरों में माइनर कार्प मछलियों को टेबुल साइज (4 महीनों में 50-100 ग्रा.) तक पालन किया गया। इस पालन से देखा गया है कि सर्वाधिक बढ़ोतरी लेबियो गोनीयस में एवं क्रमशः सिरहिनस मिगाला, एल. रोहिता तथा एल कालबसु में देखी गई है।
 - पश्चिम बंगाल के कुछ चयनित बीलों में पेन बनाकर मत्स्य पालकों को दिखाया गया। इस पेन पालन प्रणाली से 130 दिनों की पालन अवधि में 675 कि.ग्रा प्रति हेक्टेयर मैक्रोब्रेकियम रोजनबर्जी, 120 दिनों की कार्प पालन से 55 कि.ग्रा. कतला, रोहू और मिगल पाया गया जबकि केज पालन प्रणाली से 730 दिनों की अवधि में कतला व होड रोहू की कुल उपज 38 कि.ग्रा. प्राप्त हुई।
 - चूर्णा नदी में पर्यावरणीय प्रभाव के मूल्यांकन हेतु बायोइन्डीकेटरस के मानकीकरण के लिए अध्ययन किया गया। कम्युनिटी पैरामीटरों के बायोकेमिकल, फिजियोलोजिकल, हिस्टोपैथोलोजिकल स्तरों का अध्ययन, उचित स्तरों का निर्धारण किया गया।
 - प्रदूषण (फेनाल एवं निम्न ऑक्सीजन) प्रभावित मछलियों में होने वाली बीमारियों की पहचान हेतु ट्राइकोडिमासी, डेक्टाइलॉजीरोसिस एवं बाइक्यूमूलेटिव से ग्रसित मत्स्य प्रजातियों का अध्ययन, बाह्य लक्षण हिस्टोपैथोलॉजिकल बदलाव तथा रक्त गुणवत्ता के आधार पर किए गए।
 - 20 एरोमानास कल्चर से प्राप्त बैक्टेरिया पलासमिड्स का वर्गीकरण RAPD-PCR के आधार पर किया गया ताकि इनके शारीरिक बदलाव पर अध्ययन किया जा सके।
 - राजस्थान के पाँच जिलों का डिजिटल आधारित मानचित्र तैयार किया गया है। भौगोलिक सूचना प्रणाली को विकसित कर बिहार के दस जिलों से संबंधित सूचनाओं का अद्यतन किया गया। राजस्थान के 26 जल निकायों से मानसून त्रतु से पूर्व, जलीय गुणवत्ता एवं मृदा अभिलक्षण संबंधी सूचनाओं को एकत्रित किया गया।



3. परिचय

भारत सरकार ने सन् 1943 के अपने एक ज्ञापन में देश के मात्स्यकीय संसाधनों के विकास के लिए एक केन्द्रीय विभाग की स्थापना पर विशेष बल दिया था। तत्पश्चात्, केन्द्रीय सरकार की कृषि, वानिकी तथा मात्स्यकी से संबंधित उप-समिति ने भी इस प्रस्ताव का पृष्ठांकन किया था। फलस्वरूप, भारत सरकार के खाद्य तथा कृषि मंत्रालय के अन्तर्गत केन्द्रीय अन्तःस्थलीय मात्स्यकी अनुसंधान केन्द्र की स्थापना 17 मार्च 1947 को कलकत्ता में हुई। एक अंतरिम योजना के रूप में प्रवर्तित यह केन्द्र अब देश की अन्तःस्थलीय मात्स्यकी क्षेत्र में एक प्रमुख अनुसंधान संस्थान का रूप ले चुका है तथा यह संस्थान 16 मार्च 1999 को 53 वर्ष पूरा किया। वर्ष 1959 में इस केन्द्र को केन्द्रीय अन्तःस्थलीय मत्स्य अनुसंधान संस्थान का पूर्ण दर्जा प्राप्त हुआ तथा पश्चिम बंगाल के बैरकपुर स्थित नवनिर्मित भवन में इसका स्थानान्तरण हुआ। वर्ष 1967 में यह संस्थान भारतीय कृषि अनुसंधान परिषद् का विधिवत् सदस्य बना।

संस्थान का मुख्य उद्देश्य देश के अन्तःस्थलीय मात्स्यकी संसाधनों का उचित मुल्यांकन एवम् इनके संरक्षण तथा अधिकतम समुपयोजन के लिए उपयुक्त प्रणालियों को विकसित करना था। इन उद्देश्य की पूर्ति के लिए संस्थान ने देश में उपलब्ध अन्तःस्थलीय जल संसाधनों जैसे नदी, झील, पोखर, टैंक, जलाशय तथा बाढ़कृत आर्द्र-क्षेत्र आदि के पारिस्थितिकी तथा इनकी उत्पादन क्षमताओं का अध्ययन किया तथा इन अध्ययनों द्वारा विभिन्न प्रकार के जलीय परितंत्रों की जटिल पोषी संरचना एवम् पर्यावरणीय प्रकार्यों को सुलझाया।

1970 के दशक में संस्थान ने चार अतिविशिष्ट समन्वित राष्ट्रीय परियोजनाओं का कार्य आरंभ किया ये परियोजनाएँ थीं, मिश्रित मत्स्य पालन व मत्स्य बीज उत्पादन, वायुश्वासी

मत्स्य पालन, अलवणीय जलाशयों की पारिस्थितिकी एवम् मात्स्यकी प्रबंधन तथा लवणीय जल मत्स्य पालन।

इस संस्थान को निम्नलिखित मत्स्य पालन तकनीकों के विकास करने एवम् उन्हें लोकप्रिय बनाने का श्रेय प्राप्त है।

- नदीय संसाधनों से मत्स्य बीज संचयन
- मत्स्य बीज परिवहन संबंधित तकनीक,
- कार्प मछलियों का प्रेरित प्रजनन एवम् नर्सरी प्रबंधन प्रणाली,
- चाईनिज कार्प मछलियों का बंध प्रजनन,
- मिश्रित मत्स्य पालन,
- जलीय खरपतवारों का नियंत्रण,
- वायु-श्वासी मछलियों का पालन,
- एकीकृत मत्स्य पालन,
- मलजल पर आश्रित मत्स्य पालन,
- छोटे जलाशयों में मात्स्यकीय प्रबंधन,
- लवणीय जल में मत्स्य पालन,
- घोंघा का पालन आदि।

उपर्युक्त तकनीकों एवम् शोध प्रणालियों के फलस्वरूप ही आज देश का अन्तःस्थलीय मत्स्य उत्पादन 2.2 लाख टन (1950-51) से बढ़कर 28 लाख टन (1999-2000) हुआ है।



7वीं पंचवर्षीय योजना के आरंभ में ही इस संस्थान ने तीन अन्य संस्थानों (केन्द्रीय अलवणीय जलीय कृषि संस्थान, केन्द्रीय खाराजल कृषि संस्थान और राष्ट्रीय शीतजल मात्स्यकी केन्द्र) को जन्म दिया तथा इस मूल संस्थान का पुनर्नामकरण 1.4.87 से केन्द्रीय अन्तःस्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान हुआ। इस परिवर्तित व्यवस्था में केन्द्रीय अन्तःस्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान का दायित्व उन विवृत जल संसाधनों में शोध कार्य करना है, जिनमें मत्स्य प्रबंधन कार्य पर्यावरणीय अनुमापन तथा उसके संरक्षण से संबद्ध है।

अधिदेश

केन्द्रीय अन्तःस्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान का अधिदेश निम्नलिखित है :

1. 10 हेक्टर क्षेत्रफल से बड़े जलीय संसाधनों में मत्स्य संख्या गतिकी का अध्ययन।
2. उक्त प्रकार के जलीय संसाधनों से अधिकतम मत्स्य उत्पादन प्राप्त करने हेतु प्रबंध प्रणालियों को विकसित करना।
3. इन जलीय संसाधनों में अपकर्षण, प्रदूषण के कारण एवम् उनके प्रभाव का अध्ययन कर इन जलीय संसाधनों के संरक्षण के लिए अनुसंधानात्मक कार्य करना।
4. नदीय परियोजनाओं के कारण संबंधित बेसिन की मात्स्यकी पर पड़ने वाले दुष्प्रभावों का अध्ययन के लिए प्रणालियों को विकसित करना।
5. अन्तःस्थलीय मात्स्यकी से संबंधित आंकड़ों के संदर्भ में राष्ट्रीय केन्द्र के रूप में कार्य करना।
6. प्रशिक्षण कार्यक्रमों का आयोजन, परामर्शक सेवाएँ उपलब्ध कराना आदि।

संगठन

उपर्युक्त अधिदेश की पूर्ति एवम् देश के मात्स्यकीय विकास हेतु केन्द्रीय अन्तःस्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान के अनुसंधान कार्यों को प्रमुख मात्स्यकीय स्रोतों के अनुरूप सात प्रभागों के अन्तर्गत संगठित किया गया है।

नदीय प्रभाग का मुख्यालय इलाहाबाद में स्थित है और यह प्रभाग नदीय पर्यावरण के संरक्षण पर पर्याप्त ध्यान देते हुए देश के नदीय मात्स्यकीय संसाधनों के प्रभावशाली प्रबंधन हेतु तकनीकी प्रणालियों को विकसित करने का प्रयास कर रहा है। इस प्रभाग के अनुसंधान प्रकल्प गंगा, ब्रह्मपुत्र, महानदी एवम् नर्मदा नदियों तथा उनके मुख्य परितंत्रों से संबंधित है।

बैंगलोर स्थित जलाशय प्रभाग की कार्य दिशा छोटे, मध्यम तथा बड़े जलाशयों में मत्स्य उत्पादन की वृद्धि हेतु प्रबंधन प्रणालियों को विकसित करने की ओर है।

बैरकपुर स्थित ज्वारनदमुखी प्रभाग इस समय हुगली-मातलह तथा नर्मदा ज्वारनदमुखी परितंत्रों पर कार्य कर रहा है। अनेक औद्योगिक इकाईयों से प्रवाहित वहिःस्त्राव, कृषि एवम् नगरपालिकाओं के अपरद् आदि ने गंगा नदीय तंत्र के हुगली ज्वारनदमुख को एक अति प्रदूषित क्षेत्र बना दिया है। यह प्रभाग इसका अध्ययन कर रहा है। सुन्दरवन के ज्वारनदमुख परितंत्रों एवम् मंगलो का जैविक एवम् अजैविक अध्ययन भी यह प्रभाग कर रहा है।

हिल्सा मछलियों की जैविकी, स्वभाव तथा आचरण आदि पर भी अनुसंधान कार्य करना है जिससे गंगा नदीय क्षेत्र से कम हुई इन मछलियों की पुनर्स्थापना के उपाय किए जा सकें। इनकी अनुवांशिकी का भी अध्ययन किया जा रहा है ताकि इनकी संख्या का आंकलन किया जा सके।

बैरकपुर स्थित पर्यावरणीय अनुमापन एवम् मत्स्य स्वास्थ्य परिरक्षण प्रभाग को यह अधिदेश दिया गया है कि नदीय,



जलाशय एवम् ज्वारनदमुखी परितंत्रों में मानवीकृत परिवर्तनों का अनुमापन करे, एवम् उपयुक्त सुधारात्मक उपायों को विकसित करें। प्राकृतिक स्रोतों से प्राप्त सूचनाओं के निर्धारण के लिए प्रयोगशाला स्थितियों में भी अन्वेषण कार्य किया जा रहा है। प्रभाग द्वारा किए गए अध्ययनों से मत्स्य निवास स्थान की विभिन्नता, जैव-विविधता तथा ज्ञात सूचकों के माध्यम से दुष्प्रभाव की पहचान करना, नियंत्रित स्थितियों में विषैले पदार्थों को परखना, जलीय पर्यावरण में कार्बनिक पदार्थों के परिमाण के लिए सूक्ष्म जैविकी का अध्ययन और मत्स्य रोगों की पहचान तथा इनके उपचार से संबंधित मौलिक सूचनाएँ भी सम्मिलित हैं। इस प्रभाग को जलीय परितंत्रों के सुधार के लिए एक कार्य योजना तैयार करने का दायित्व भी सौंपा गया है।

बाढ़कृत मैदानी आर्द्र-क्षेत्र प्रभाग का मुख्यालय बैरकपुर में स्थित है। इस प्रभाग के अन्तर्गत गंगा तथा ब्रह्मपुत्र बेसिन के आर्द्र-क्षेत्रों की पारिस्थितिक गतिकी का अध्ययन किया जा रहा है, ताकि इनके विकास के लिए उपयुक्त प्रणालियों को विकसित किया जा सके। गंगा तथा ब्रह्मपुत्र बेसिन के आर्द्र-क्षेत्र अपनी जैव-विविधता के कारण महत्वपूर्ण ही नहीं, बल्कि बिहार, पश्चिम बंगाल तथा असम राज्यों के मात्स्यिकी का प्रमुख अंग हैं। यह प्रभाग इन पारिस्थितिक परितंत्रों की प्रक्रिया एवम् इनकी मत्स्य उत्पादन क्षमता का अध्ययन करता है, जिससे इनकी जैव-विविधता को नुकसान पहुँचाए बिना पर्यावरण के अनुकूल तकनीकी प्रणालियों को विकसित किया जा सके।

मत्स्य स्रोत मूल्यांकन प्रभाग बैरकपुर में है और इस प्रभाग का लक्ष्य मत्स्य सम्पदा और मात्स्यिकीय स्रोतों से संबंधित आंकड़ों को एकत्रित करना है। इस प्रभाग को विभिन्न जलीय स्रोतों में उपलब्ध मछलियों की संख्या निर्धारण कार्य का दायित्व सौंपा गया है, ताकि इन अन्तःस्थलीय मत्स्य स्रोतों का वैज्ञानिक समुपयोजन किया जा सके।

मानव संसाधन विकास एवं प्रौद्योगिकी हस्तांतरण प्रभाग बैरकपुर स्थित है। संसाधन ने अपने अधिकारियों एवं कर्मचारियों को अपने कार्यों में दक्ष बनाने हेतु प्रशिक्षण एवं मात्स्यिकी शिक्षा पर विशेष बल दिया। प्रौद्योगिकी हस्तांतरण के अंतर्गत अंतर्स्थलीय मात्स्यिकी के विभिन्न प्रौद्योगिकियों का प्रशिक्षण, प्रदर्शनी, सलाहकार सेवा, मत्स्य पालक दिवस, फिल्म शो आदि के माध्यम से निरंतर मत्स्य पालकों, मछुओं, उद्यमियों, विस्तार अधिकारियों तक पहुँचाया जाता है।

संस्थान का अनुसंधान कार्य कुल 14 अनुसंधान परियोजनाओं में विभाजित किया गया है। इन अनुसंधान परियोजनाओं का कार्य मुख्यतः के अलावा 10 राज्यों में फैले संस्थान के 12 अनुसंधान एवम् 6 सर्वेक्षण केन्द्र तथा एक कृषि विज्ञान केन्द्र से किया जा रहा है।

पुस्तकालय सेवाएँ

संस्थान का पुस्तकालय मुख्यालय एवम् अनुसंधान केन्द्रों में कार्यरत वैज्ञानिक की आवश्यकताओं के अलावा अन्य संगठनों के शोधकर्ताओं, अध्यापकों, विद्यार्थियों तथा अधिकारियों को भी अपनी सेवाएँ प्रदान कराती है। इस रिपोर्ट की अवधि के दौरान पुस्तकालय ने अपने भंडार में 553 पुस्तकें, 85 विविध प्रकाशनों तथा जरनलों के 650 अंक संग्रहित किये तथा 20 विदेशी एवम् 62 भारतीय जरनलों के लिए शुल्क जमा दिया। इस समय पुस्तकालय में कुल 9849 पुस्तकें, 4278 पुनर्मुद्रित लेख, 1252 मानचित्र, 4222 विविध प्रकाशन तथा 53 शोध प्रबन्धों का भंडार है।

इस वर्ष पुस्तकों व अन्य पठन सामग्री हेतु 2572270/- रूपए खर्च हुए हैं। पुस्तकालय द्वारा इंडियन फिशरीज एब्सट्रैक्ट तथा करेंट कंटेंट्स भी प्रकाशित किया गया है।



परियोजना अनुमापन व प्रलेखन सेवाएँ

यह अनुभाग संस्थान के विभिन्न अनुसंधान परियोजनाओं का अनुमापन तथा स्टाफ रिसर्च काउंसिल की बैठकों का आयोजन करता है। विभिन्न प्रकार के रिपोर्ट, लेख, बुलेटिन, परियोजना कार्यक्रमों के प्रकाशन के अलावा यह अनुभाग निर्देशक महोदय को अनुसंधान योजनाओं के निर्धारण में सहायता प्रदान करता है। वैज्ञानिकों द्वारा लिखे गए लेखों को विभिन्न देशी-विदेशी जर्नलों में प्रकाशित करवाने या किसी सेमिनार, वर्कशाप आदि में प्रस्तुत करने के लिए आवश्यक प्रक्रिया इसी अनुभाग से होती है।

अनुसंधान कार्य से संबंधित तकनीकी प्रगति रिपोर्ट इस अनुभाग द्वारा परिषद के मुख्यालय, कृषि मंत्रालय तथा अन्य अभिकरणों को भेजा जाता है। देश, विदेश से भेजे गए अनेक तकनीकी प्रश्नों का समाधान भी इसी अनुभाग द्वारा प्रस्तुत किया जाता है।

प्रकाशन

अवधि के दौरान संस्थान द्वारा निम्नलिखित विभागीय प्रकाशनों को प्रकाशित किया गया है।



1. वार्षिक प्रतिवेदन 2002-2003

न्यूज लेटर

1. इनलैंड फिशरीज न्यूज (खण्ड 8, सं. 1, जनवरी 2003 से जून 2003)
2. इनलैंड फिशरीज न्यूज (खण्ड 8, सं. 2, जुलाई 2003 से दिसम्बर 2003)

बुलेटिन

1. बुलेटिन संख्या 116 : Fish culture in pens (In Assamese)
2. बुलेटिन संख्या 117 : Ecology and fisheries of selected reservoirs in Tamil Nadu
3. बुलेटिन संख्या 118 : Ecology and fisheries of selected reservoirs in Madhya Pradesh
4. बुलेटिन संख्या 119 : River Cauvery-Environment and fishery
5. बुलेटिन संख्या 120 : Ecology and fisheries of Morni Tals, Haryana
6. बुलेटिन संख्या 121 : Ropar Wetland
7. बुलेटिन संख्या 122 : Harike Wetland
8. बुलेटिन संख्या 123 : Eco-dynamics and fishery status of upper stress of river Yamuna and associated canals
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12. बुलेटिन संख्या 127 : Impact study on introduction of green gram (*vigna radiata L.*) cultivation in Sunderban, West Bengal
13. बुलेटिन संख्या 128 : Ecology Krishivigyan Kendra, Kakkdwp—In service of Sunderbans

विविध प्रकाशन

Hand book on Pen culture of Fish and Prawn



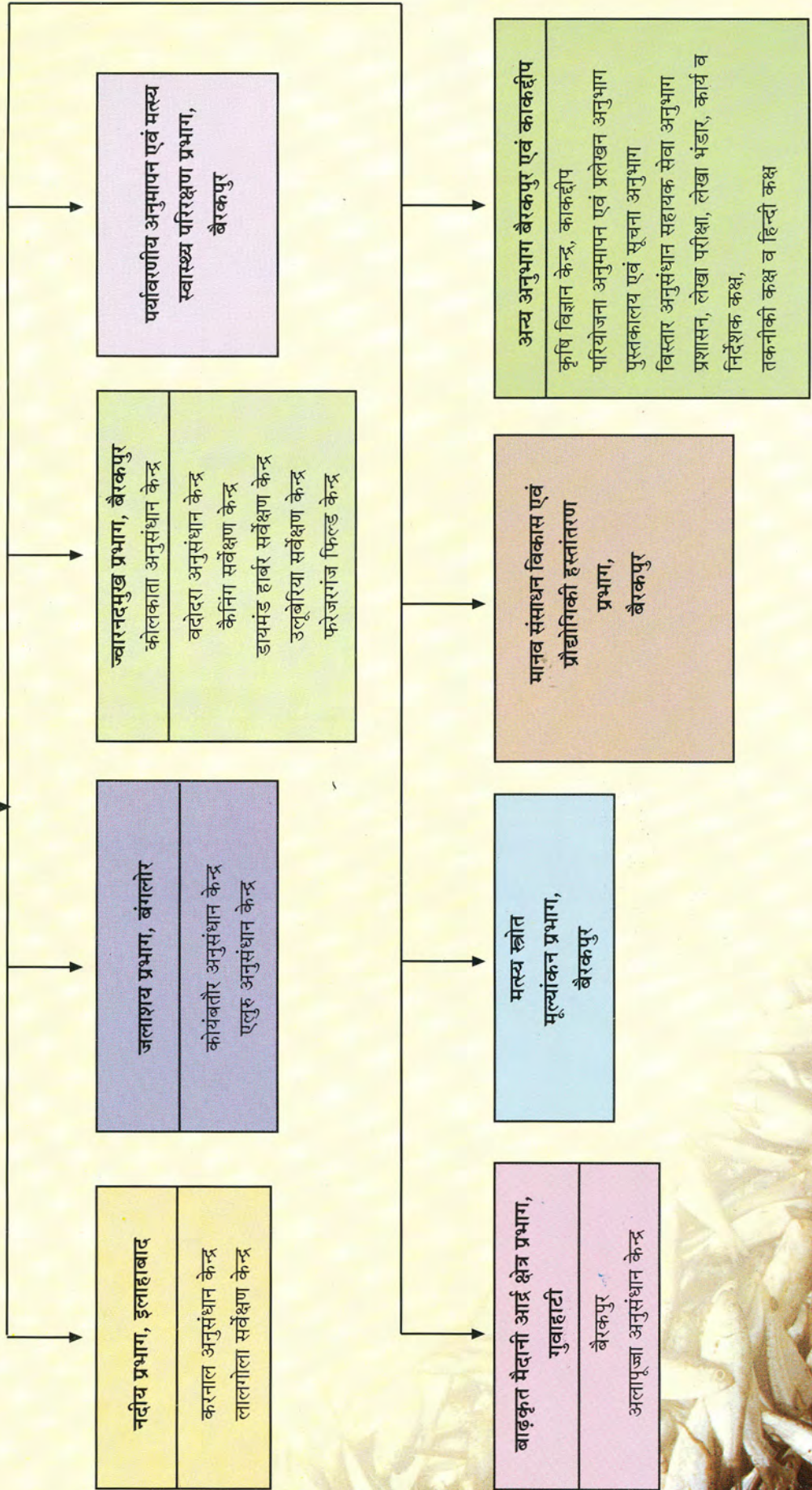
करन्ट कन्टेनट्स
जनवरी-दिसम्बर 2003

वित्तीय विवरण (रुपये लाख में)			
वर्ष 2003-2004			
	बी. इ.	आर. इ.	वास्तविक खर्च
योजना	300.00	300.00	300.02
एन. इ. कम्पोनेन्ट	140.00	165.00	165.01
गैर योजना	790.00	813.48	813.76
कुल	1,230.00	1,278.48	1,278.79



के. अ. मा. अनु. संस्थान का संगठनात्मक ढांचा

निर्देशक



ANNUAL REPORT

2003-2004

English Section



CENTRAL INLAND FISHERIES RESEARCH INSTITUTE

(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)

BARRACKPORE-700120 : WEST BENGAL : INDIA



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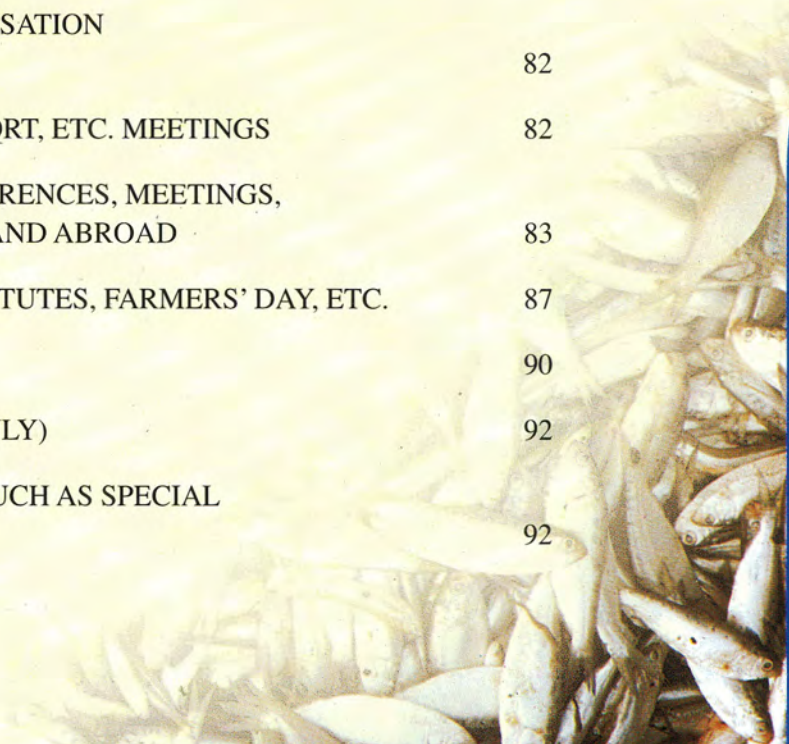
- ❑ The activities and achievements reflected in this Annual Report covers the period April 2003 to March 2004 only.
- ❑ This report includes unprocessed or semiprocessed data which would form the basis of scientific papers in due course. The material contained in the report, therefore, may not be made use of without the permission of this Institute, except for quoting it as a scientific reference.
- ❑ Central Inland Fisheries Research Institute (CIFRI) Annual Report is not a priced publication. Recipients of complimentary copies are not permitted to sell the photocopies of the report in part or in full.





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PREFACE

The Annual Report of Central Inland Fisheries Research Institute (CIFRI) for the year 2003-2004 contains comprehensive information on the achievements of the various research projects and other activities undertaken by the Institute.

Major emphasis of the Institute during the period has been on i) assessing the production potential and fisheries resources of reservoirs, floodplain wetlands and rivers viz. Ganga, Beas and Brahmaputra, ii) assessment of the ecology and fisheries of the Hooghly, Narmada and other estuaries along with the associated wetlands, iii) monitoring the environmental and fishery status of river Ganga and Yamuna, iv) genetic study of hilsa population, v) monitoring of aquatic pollutants and standardization of various parameters for monitoring fish and prawn health and controlling disease outbreak and vi) assessment of inland fisheries resources.

Consultancy assignments were taken up regularly by the Institute for resource generation. Resources were also generated by organizing training programmes on various specialized topics. External funds were mobilized through ad-hoc schemes supported by ICAR and other agencies.

The Institute further strengthened its research activities through linkages with other national/international organizations. The technologies developed by the Institute were effectively transferred.

Director



2 EXECUTIVE SUMMARY/SALIENT ACHIEVEMENTS

Estimation of fish catch and population dynamics of important fishes in River Ganga revealed a decline in catch from Kanpur (88.54 t) to Lalgola (101.36 t) through Allahabad (94.6 t). Indian major carps, exotic carps and Hilsa showed an increasing trend.

The fish composition of River Beas showed that the major carps were dominant forming 27.8% of the total population. Common carp represented by the next highest group forming 26.36% of the population. Its presence throughout this river depicts its establishment within the system. Minor carp and large sized catfishes represented 15.7% and 7.0% of total population respectively.

Data collected in respect of Hooghly-Matlah estuary, Yamuna and Brahmaputra river have been analysed and stored to update the database information system and trends in fish catch fluctuations were studied.

Ecological investigation in Urmila Sagar and Jaggar reservoir in Rajasthan were conducted. Fish yield of 44 kg ha⁻¹ for Urmila Sagar and 26.7 kg ha⁻¹ for Jaggar reservoir was obtained. The projected production potential is 220 kg ha⁻¹ for (Urmila Sagar) and 225 kg ha⁻¹ for (Jaggar reservoir). These reservoirs are medium productive where stocking @ 500 fingerlings ha⁻¹ is suggested.

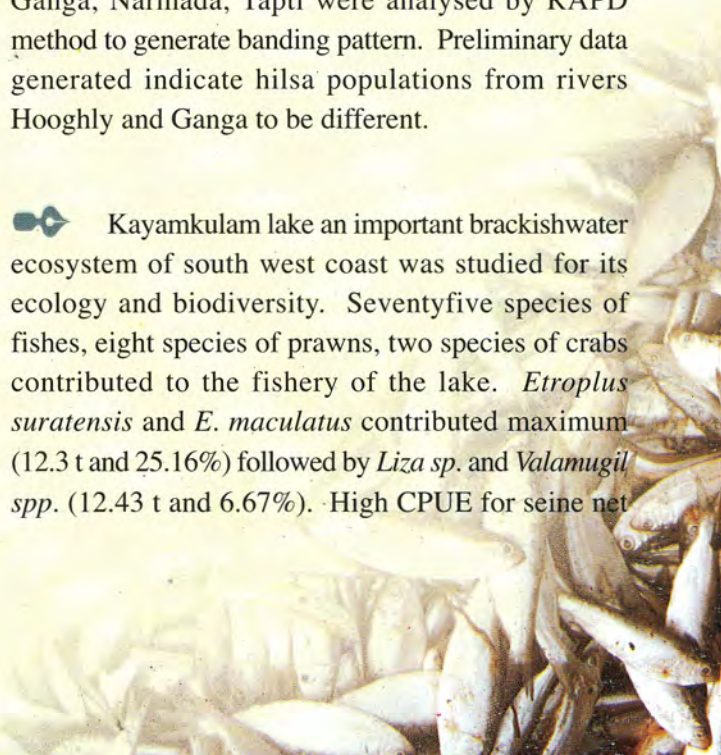
Ecology and fisheries of Hemavathi reservoir show the present yield dominated by common carp

and rohu to be 20 kg ha⁻¹yr⁻¹ which can be enhanced to 100 kg ha⁻¹yr⁻¹ through proper management measures. Similarly Wyra reservoir in Andhra Pradesh is dominated by *M. malcolmsonii*. Management measures suggested to state government for Hemavathi and Wyra reservoirs were for stock enhancement through stocking carps 100 mm size @ 300 fingerlings ha⁻¹yr⁻¹.

Investigations on the fishery resources of Hooghly estuarine system revealed that estimated total fish yield from the Hooghly estuary and Digha was 83433.6 t during (2003-04) showing an increase of 33.4% compared to previous year. This combined catch is the highest total catch of the estuary recorded so far. Major factor for increased yield were due to increase in Hilsa catch (5540 t and 13%) and winter migratory bagnet fish catch (3456 t and 12.7%).

Samples of *H. ilisha* from rivers Hooghly, Ganga, Narmada, Tapti were analysed by RAPD method to generate banding pattern. Preliminary data generated indicate hilsa populations from rivers Hooghly and Ganga to be different.

Kayamkulam lake an important brackishwater ecosystem of south west coast was studied for its ecology and biodiversity. Seventyfive species of fishes, eight species of prawns, two species of crabs contributed to the fishery of the lake. *Eetroplus suratensis* and *E. maculatus* contributed maximum (12.3 t and 25.16%) followed by *Liza sp.* and *Valamugil spp.* (12.43 t and 6.67%). High CPUE for seine net





(16.99) was due to the indiscriminate fishing with fine meshes of the gear.

➤ Jheels of central Uttar Pradesh were surveyed and indicated that though they were poor in nutrients but were productive. The gross primary production ranged from 410 to 1031 mgC m⁻² d⁻¹ and 62-71% of the production was assimilated by phytoplankton. Rich detritus energy is present. Poor fish yield ranging from 31-476 kg ha⁻¹ yr⁻¹ were obtained and it can be enhanced to 1 ton ha⁻¹ yr⁻¹ through judicious stocking and regulating macrophyte infestation.

➤ Cage culture in beels of Assam could grow minor and major carp fry to ideal fingerlings size (10 cm, 12-18 g) in 2 months. The survival ranged from 68-77%. This was done in monsoon months. In post-monsoon the same cages were used for raising table size minor carp of 50-100 g in 4 months. Highest growth was observed in *Labeo gonius* followed by *Cirrhinus mrigala*, *L. rohita* and *L. calbasu*

➤ Pen culture was designed and demonstrated to beneficiaries in adopted beels of West Bengal. A production rate of 675 kg ha⁻¹ of *Macrobrachium rosenbergii* was obtained in 130 days of culture period, while in 120 days of culture a crop of 55 kg of catla,

rohu and mrigal was harvested. Through cage culture a production of 38 kg of catla + rohu was obtained in 730 days.

➤ Preliminary field studies on standardizing bioindicators for environmental impact was conducted in River Churni. Levels of various biochemical, physiological, histopathological and community parameters were assessed and determined.

➤ Morphological symptom, histopathological changes and blood profiles of fishes affected by Trichodiniasis. Dactylogyrosis and by cumulative stress of phenol and low dissolved oxygen were determined for disease diagnosis.

➤ Bacterial plasmids from 20 *Aeromonas* culture were isolated and were further characterised using RAPD-PCR to observe polymorphism. Results indicated genomic variability of all these isolates. Amplified *Aeromonas* DNA product were used for preparation of specific DNA probe for screening of bacterial sample for detection of aerolysin specific *A. hydrophila* and virulent (enterotoxigenic, hemolysin).

➤ Digital base maps have been prepared for five districts of Rajasthan.



3 INTRODUCTION

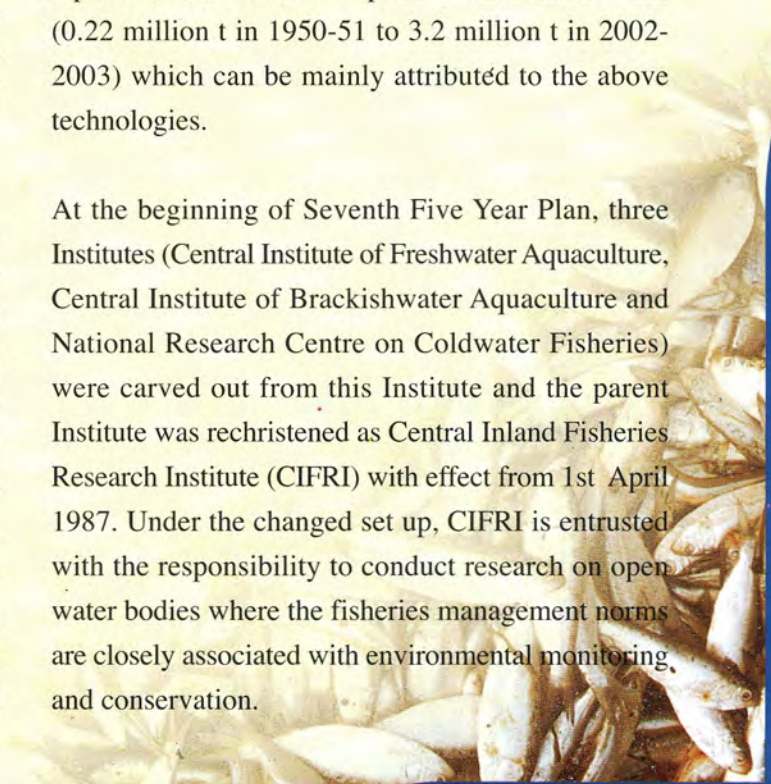
The Government of India, in a memorandum brought out in 1943, stressed the need for having a separate central department in the best interest of the development of fisheries resources of the country. This memorandum was later endorsed by the Fisheries Sub-Committee of the Central Government Policy Committee on Agriculture, Forestry and Fisheries. Based on this, the Central Inland Fisheries Research Station was formally established on 17th 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 and has completed 54 years of its service to the nation on March 17, 2001. By the year 1959, the Station acquired its status as Central Inland Fisheries Research Institute (CIFRI) and moved to its own building at Barrackpore, West Bengal. Since 1967, the Institute is under the administrative fold of Indian Council of Agricultural Research (ICAR).

The main objectives of the Institute 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 utilization. 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 floodplain wetlands. These studies have unravelled the complex trophic structure and functions vis-a-vis the environmental variables in different aquatic ecosystems. During the

early 1970s, the Institute expanded its activities by initiating various All India Coordinated Research Projects; such as composite fish culture and fish seed production, airbreathing fish culture, ecology and fisheries management of freshwater reservoirs and brackishwater fish farming.

The Institute has the distinction of evolving and popularising technologies on fish seed prospecting from rivers; fish seed transportation; induced breeding and nursery management of carps; bundh breeding of Chinese carps; composite fish culture; aquatic weed control; air-breathing fish culture; integrated fish farming; sewage fed fish culture; fisheries management of small reservoirs; brackishwater fish farming and farming of edible snails. The country has witnessed a phenomenal increase in production of inland fish (0.22 million t in 1950-51 to 3.2 million t in 2002-2003) which can be mainly attributed to the above technologies.

At the beginning of Seventh Five Year Plan, three Institutes (Central Institute of Freshwater Aquaculture, Central Institute of Brackishwater Aquaculture and National Research Centre on Coldwater Fisheries) were carved out from this Institute and the parent Institute was rechristened as Central Inland Fisheries Research Institute (CIFRI) with effect from 1st April 1987. Under the changed set up, 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 CIFRI is presently mandated to :

- 1 study fish population dynamics of exploitable inland water bodies exceeding 10 ha in water area;
- 2 evolve management systems for optimising fish production from such water bodies;
- 3 investigate causes, effects and remedies of their degradation/pollution and provide research support for mitigation and for conservation of such resources;
- 4 study the impact of river valley projects on the fisheries of the basins concerned and evolve strategies for their management;
- 5 act as national data centre on inland fisheries; and
- 6 conduct training and provide extension/consultancy services.

Organizational set-up (chart)

In tune with the above mandate, the research activities of CIFRI have been organized under seven divisions, corresponding to the major fishery resources and other research needs of the country related to fisheries development.

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 river Ganga and their important tributaries.

The **Reservoir Division** is based at Bangalore with centres in Tamil Nadu and Andhra Pradesh. The investigations being carried out at the Division are aimed at developing management norms for optimising fish yield from large, medium and small reservoirs of the country.

The Barrackpore-based **Estuarine Division**, presently works on the Hooghly- Matlah and Narmada Estuarine systems. Biotic and abiotic features of estuarine tributaries and mangroves of Sunderban region are also being studied. Research on biology and migratory behaviour of hilsa is being conducted. It is also undertaking study on genetic characteristics of hilsa from different stretches to know its population structure.

Fish Health and Environment Division, stationed at Barrackpore, is mandated to monitor the man-made changes in the riverine, reservoir, estuarine and wetland ecosystems and to evolve suitable amelioration measures. The studies under the Division include collection of basic information on habitat variables, assessment of its impact on biodiversity and fishery through known indicators, fish and prawn stress and disease diagnosis and control. Development of mitigating action plan for ecosystem restoration is also the responsibility of this Division.

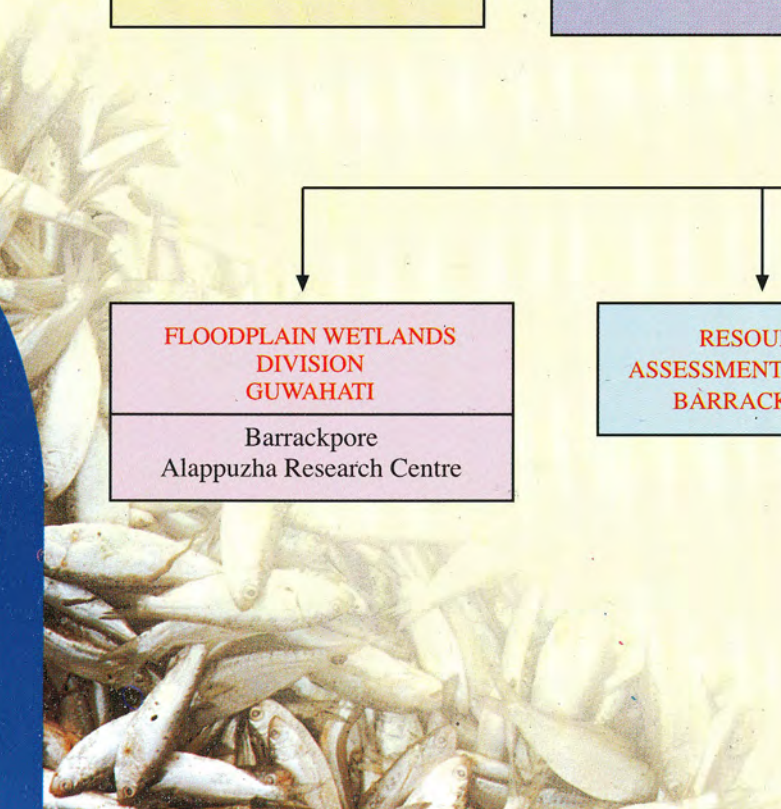
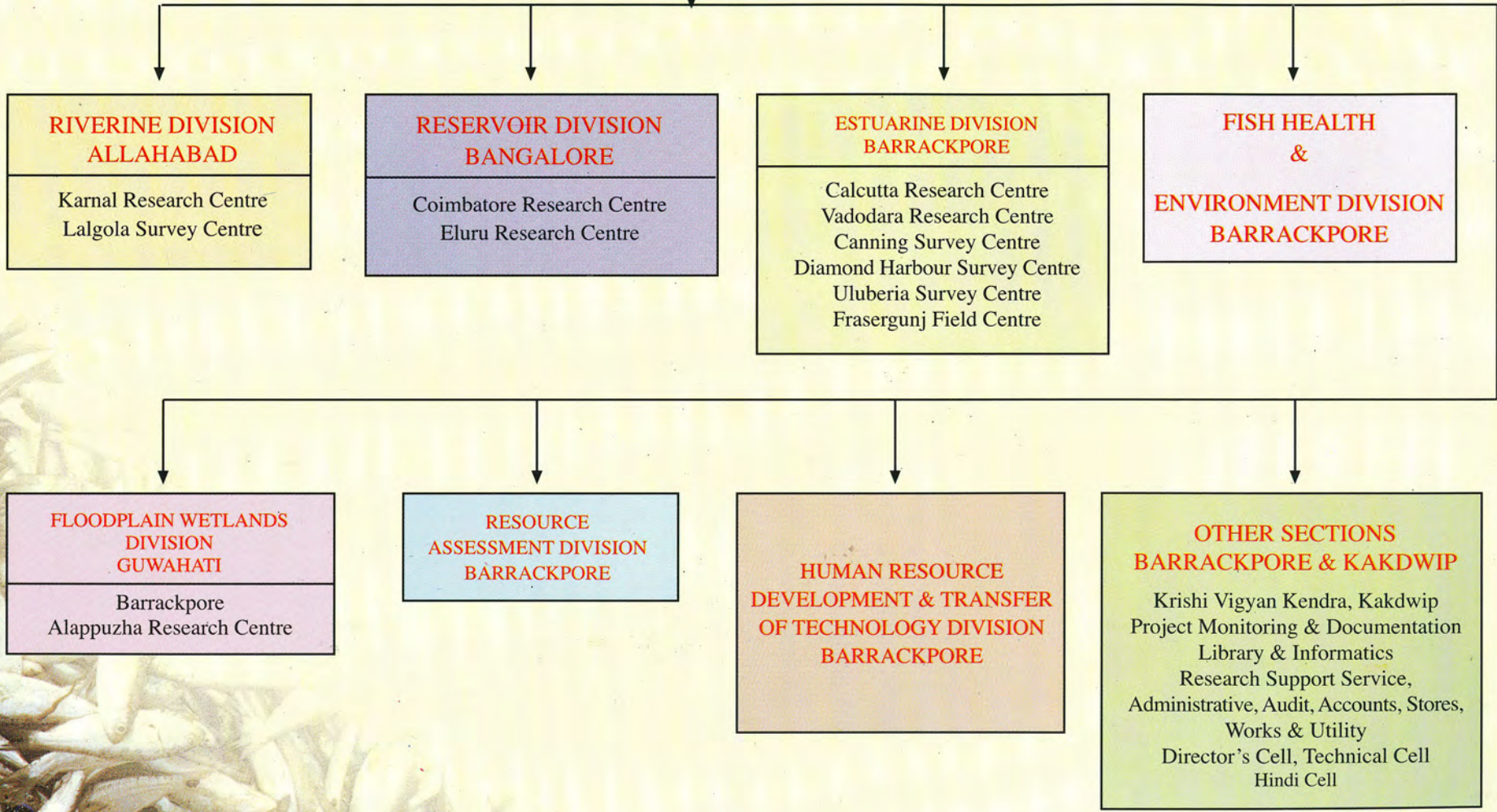
The **Floodplain Wetlands Division** has its headquarters at Guwahati. The ecodynamics of wetlands spread over the floodplains of Ganga-Brahmaputra basins are being studied in order to evolve management norms for their sustainable development. The wetlands associated with the floodplains of Ganga and Brahmaputra rivers are not only unique in their rich biodiversity, but also constitute an important fishery resource in the states of Bihar, West Bengal and Assam. The Division carries out research on the ecosystem processes and fish productivity from this resource with special attention on protection of biodiversity and development of environment-friendly technologies.

The **Resource Assessment Division** is located at Barrackpore and conducts research aimed at creating a database on the fish stocks and fishery resources. The Division is geared up to develop various population models that can lead to scientific exploitation of inland fisheries resources. Mapping the various inland aquatic resources of the country by GIS is also the responsibility of the division.



ORGANIZATIONAL SET-UP OF CIFRI

DIRECTOR



DIVISIONS RESEARCH CENTRES & SURVEY CENTRES of Central Inland Fisheries Research Institute





The **Human Resource Development and Transfer of Technology Division** is located at Barrackpore.

The institute has aimed at manpower training and education of fisheries personnel under Human Resource Development for producing qualified persons.

The Transfer of Technology wing undertakes on regular basis the dissemination of various technologies of inland fisheries to the fish farmers, fishermen, entrepreneurs, extension functionaries through training, demonstration, advisory service, fish farmers' day, camp discussion, film show, exhibition, etc.

The Institute's research activities are organised under 14 research projects which are operated from the Headquarters at Barrackpore, 12 Research centres, 6 Survey Centres and a Krishi Vigyan Kendra covering 10 states of the country. The distribution of research and survey centres and different sections are shown in the organization chart.

Library services

CIFRI library provides its services to the scientists of the Headquarters and Centres as well as to the research scholars, teachers, students and officials from other organizations. The library added 553 books, 85 miscellaneous publications and 650 loose issues of journals to its collection and subscribed 20 foreign and 62 Indian journals during the year. The current total holding of the library comprises 9849 books 4278 reprints 1252 maps and 4222 miscellaneous publications.

The library maintained free mailing of the Institute's publications to various research organizations, universities, entrepreneurs and farmers to keep them abreast with the latest developments in fisheries research. As a part of resource sharing it extended inter-library loan to other libraries. Rs.2572270.00 was spent during the year 2003-04 for procuring library books, journals, CD-ROM and other reading materials. The publication of Indian Fisheries Abstracts

was continued. Library has brought out current contents for the period Jan.-Dec., 2003.

Project Monitoring and Documentation Section

The section monitored the progress of Research Projects of the Institute and organized Staff Research Council Meeting. It also assisted the Director in policy formulation and technical guidelines on plan preparations, apart from publishing reports, write-ups, bulletins, project programmes, and newsletters. The section processed the research papers submitted by the scientists for their publications in different journals and for presentation in symposia/workshops/summer school, etc. Participation of scientists in seminars, symposia, conferences, etc. was also monitored by the section. The section maintains an active DTP, photocopy, lamination, duplicating (cyclostyling), and binding units to cater to the needs of the Institute.

Research Project Files

Annual progress reports of all the research projects and the contribution made by individual scientists are being maintained and monitored through the Primary Project Files and Scientists' Files. Monitoring of research progress through RPF I, II and III. Activity Milestones and Monthly, Quarterly and Annual Reports are some of the major responsibilities of the section.

Technical Reports/queries

More than 20 Technical reports highlighting the progress of research under various projects were compiled and sent to the Council, Ministry of Agriculture and other agencies. Technical queries regarding the activities of the Institute from various quarters of the country and abroad were attended to by the section.



Personal Information System (PIS)

During the reported period, biodata of 75 scientists of the Institute have been updated in the PIS based database which is being maintained at the Institute and ICAR.

Publications

The following departmental publications were brought by CIFRI during the year.

Annual Report

- 1 Annual Report 2002-2003

Newsletter

- 1 The Inland Fisheries News (Vol.8, No.1, January 2003 to June 2003)
- 2 The Inland Fisheries News (Vol.8, No.2, July 2003 to December 2003)

Bulletin

- 1 Bull. No.116 : Fish culture in pens (In Assamese)
- 2 Bull. No.117 : Ecology and fisheries of selected reservoirs in Tamil Nadu
- 3 Bull. No.118 : Ecology and fisheries of selected reservoirs in Madhya Pradesh
- 4 Bull. No.119 : River Cauvery – Environment and fishery

- 5 Bull. No.120 : Ecology and fisheries of Morni Tals, Haryana
- 6 Bull. No.121 : Ropar Wetland
- 7 Bull. No.122 : Harike Wetland
- 8 Bull. No.123 : Eco-dynamics and fishery status of upper stretch of river Yamuna and associated canals
- 9 Bull. No.124 : Ecology-based fisheries management in Chamera reservoir (Himachal Pradesh)
- 10 Bull. No.125 : Fisheries Management of floodplain wetlands in India (Summer School)
- 11 Bull. No.126 : Ecology and fisheries of Ravishankar Sagar Reservoir
- 12 Bull. No.127 : Impact study on introduction of green gram (*Vigna radiata* L.) cultivation in Sunderban, West Bengal
- 13 Bull. No.128 : Krishivigyan Kendra, Kakdwip – In service of Sunderbans

Miscellaneous Publication

Hand book on Pen culture of Fish and Prawn

Current Contents

January-December, 2003



Financial statement
(Rs. In lakhs)
For the year 2003-2004

	B.E.	R.E.	Actual expenditure
Plan	300.00	300.00	300.02
NE Component	140.00	165.00	165.01
Non-Plan	790.00	813.48	813.76
TOTAL	1,230.00	1,278.48	1,278.79





Staff Position

Statement showing the total number of employees in CIFRI, Barrackpore and pertaining to the employees under Scheduled Castes and Scheduled Tribes categories (Period from 1.4.2003 to 31.3.2004)

Sl No	Class of Posts	Total No. of posts sanctioned	Total No. of employed in position	Total No. of Sch. Caste among them	S.C in % of total employed	Total No. of Sch. Tribe among them	S.T. in % of total employees	Remarks
1	SCIENTIFIC POSTS							
	Experimental Scientist							
	Scientist	74	61	6	9.84	1	1.64	
	Sr. Scientist/Scientist (Sel. Grade)/ Scientist (Sr. Scale)	16	8	-	-	-	-	
	Principal Scientist	8	1	-	-	-	-	
	RMP Scientist	1	-	-	-	-	-	
	TOTAL	99	70	6	-	1	-	
2	TECHNICAL POST							
	Category - I	51	50	10	20.00	3	6.0	This include 6 posts under KVK
	Category - II	50	45	10	22.22	4	8.88	
	Category - III	5	5	-	-	-	-	
	TOTAL	106	100	20		7		

Sl No	Class of Posts	Total No. of posts sanctioned	Total No. of employed in position	Total No. of Sch. Caste among them	S.C in % of total employed	Total No. of Sch. Tribe among them	S.T. in % of total employees	Remarks
3	ADMINISTRATIVE POSTS							
	Sr. A.O.s/A.Os/Accounts Officer etc.	2	2	–	–	–	–	
	A.A.Os/A.F. & A.O.	6	5	1	20%	–	–	
	Assistant (Director (O.L.))	1	1	–	–	–	–	
	Assistants	21	17	2	11.76%	1	–	
	P.S., P.A.	4	4	1	25%	–	–	
	Jr. Steno., Sr. Clerk/U.D.s	42	42	11	26.19%	1	–	
	L.D. Cs/Hindi/Time Keeper	13	10	1	10%	–	–	
	TOTAL	89	81	16		2		
4	SUPPORTING STAFF							
	Grade – I	80	72	28	38.88%	5	6.94%	
	Grade – II	58	57	18	31.58%	4	7.02%	
	Grade – III	35	34	11	32.35%	2	5.88%	
	Grade–IV	18	18	6	33.33%	4	22.22%	
	TOTAL	191	181	63		15		





4 RESEARCH ACHIEVEMENTS

PROJECT : RI/A/2

BREEDING BIOLOGY AND FISHERY OF SILVER CARP, *Hypophthalmichthys molitrix* (VAL.) IN SUTLEJ RIVER

- Personnel** : Scientific :
V.V. Sugunan (up to 9.6.03), D.K. Kaushal (up to 5.10.03), V.K. Sharma
Technical :
C. Lakra, Sushil Kumar, Kuldeep Singh
- Duration** : April 2002-March 2004
- Location** : Karnal

Observations on different parameters of breeding biology and fishery of silver carp, *H. molitrix* from Gobindsagar were made during the year 2003 and 2004.

Water quality

The range of various hydrological parameters were alkalinity (54.0-76.0 mg l^{-1}), calcium (18.0-42.0 mg l^{-1}), phosphate (0.10-0.26 mg l^{-1}) and electric conductance (245.0-279.0 μ mhos cm $^{-1}$), indicated that potentiality of higher productivity exist in Gobindsagar.

Fishery

Silver carp after its accidental entry into Gobindsagar in 1971 has established as natural breeding population and entered into its fishery with dominance. The fish formed 79.10% of the total catch during 2003 (772.61 t). Condition factor (Kn) varied from 0.8358-1.3363 for females and 0.7043-1.3942 for males. Low values of condition factor for males and females exhibited mature condition of fish. After spawning the Kn value increased. Overall sex ratio was 1 : 0.92 which oscillated around normal values of 1 : 1. The total fecundity ranged 1.19167 to 8.49350 eggs per females with an average of 3.01396 eggs. Occurrence of mature specimen in landing during August-September reflected prolonged breeding. Ova diameter, % frequency reflected.



PROJECT : RI/B/2

ASSESSMENT OF ECOLOGY, BIODIVERSITY AND PRODUCTION POTENTIAL OF INDUS RIVER SYSTEM

- Sub-project** : (a) Evaluation of ecology and fish community structure of river Beas.
(b) Ecology and Fish production status of Kanjli Wetland
- Personnel** : Scientific :
D.N. Mishra, Usha Moza
Technical :
C. Lakra, Sushil Kumar, Kuldeep Singh
- Duration** : April 2002-March 2005
- Location** : Karnal

River Beas a tributary of Indus system has total run of 470 km, out of which 305 km is in Himalayan region and 165 km in plains. This 165 km of potamoan zone of river was currently studied under the project from Talwara to Harike.

Characterisation of Effluent Load

Chakwala Nalla (entering river Beas) :- The average values of different parameters showed Nalla effluents were alkaline, pH 7.13 having medium dissolved organic matter, 1.891 mg l^{-1} and dissolved solids, 258.75 mg l^{-1} . Total alkalinity, 61.0 mg l^{-1} , B.O.D. 21.5 mg l^{-1} were not high but C.O.D. values of 97.5 mg l^{-1} and total hardness of 210.6 mg l^{-1} indicate presence of pollutants.

Kali/West Bein (a tributary) :- The water within Kalibein was alkaline, pH 7.48 having B.O.D., 19.15 mg l^{-1} and C.O.D. 59.5 mg l^{-1} . But high dissolved solids and conductance of $332.5 \text{ mhos cm}^{-1}$ indicate heavy load of organic matter.

Fish biomass

Total fish biomass for the current year was 25.50 t/month. The overall composition of various groups in total fish population of river Beas show that major carps formed mostly by *C. mrigala*, *C. catla*, *L. rohita* and *L. calbasu* were dominant forming 27.8% of total population. Common carp represented by both species formed next highest group forming 26.36% of population. Its presence throughout this river depict its establishment within the system. Minor carp and large sized catfishes represented 15.76% and 7.02% of total population respectively.



Beas Ecology

Soil phase : Studied stretch of Beas was generally alkaline in nature, pH 7.5-7.7 except at Talwara, pH 5.5.

Chemical characteristics like available nitrogen $5.18-9.3 \text{ mg l}^{-1} 100\text{g}^{-1}$ and phosphorus $1.2-2.1 \text{ mg l}^{-1} 100\text{g}^{-1}$ show gradual increase from Talwara onwards except that effluent loaded sites present in between (OF, BOF Chakwal) have high availability of nitrogen ($9.31-8.57 \text{ mg l}^{-1} 100\text{g}^{-1}$) due to fertilization of water by organic compounds along with effluents.

Water phase : River water is alkaline having low amplitude of variation (pH 7.03 to 7.70).

Alkalinity values of $62.5-89.5 \text{ mg l}^{-1}$; availability of major nutrients like calcium, $23.0-33.25 \text{ mg l}^{-1}$; magnesium, $11.70-14.85 \text{ mg l}^{-1}$; chloride, $11.75-16.50 \text{ mg l}^{-1}$ and inorganic phosphate $0.21-0.35 \text{ mg l}^{-1}$ denote it medium productive. The nutrient values were high in the stretch subjected to induction of effluents especially that of Chakwal Nalla.

The values showed enhancement in total alkalinity from 48.5 to 62.5 mg l^{-1} (2002-03) to $62.5-89.5 \text{ mg l}^{-1}$ (2003-04).

River water was well oxygenated, DO, 8.2 to 7.3 mg l^{-1} , had reasonable B.O.D. ($10.6-12.0 \text{ mg l}^{-1}$), C.O.D. ($36.5-42.0 \text{ mg l}^{-1}$) and conductance values ($185.7-215.5 \text{ mhos cm}^{-1}$) except at induction points (OF-BOF Chakwal) which had low DO, 6.8 ppm ; high B.O.D. ($16.5-33.88 \text{ mg l}^{-1}$), C.O.D. ($80.5-63.5 \text{ mg l}^{-1}$) and conductance values ($235.7 \text{ mhos cm}^{-1}$) depicting the stretch organically rich. Slight high values of B.O.D. (13.0 mg l^{-1}) and C.O.D. (44.0 mg l^{-1}) at Beas Harike depict that nutrient load of Kali or Westbein do not have much impact on river or the effect does not last long so to be visible at Harike end. Non persistence of effect may be due to (i) heavy infestation of macrophytes at this site and also (ii)

due to fact that Bein meets river Beas at its conjuncture with Sutlej.

Primary Productivity : Gross production ranged between $167.0-281.25 \text{ mgCm}^{-2} \text{ h}^{-1}$. The production increased from Talwara onwards.

Biotic Components

Plankton : Standing crop of plankton within Beas ranged between $92-119 \text{ ul}^{-1}$ except at OF Talwara, where the density decreased to 66 ul^{-1} under the negative impact of effluents.

The plankton composition of river was mainly formed of Bacillariophyceae (54-83%) at non induction points, thereafter the composition changes under the effluence of effluents.

Periphyton : Periphyton density ranged between $125-712 \text{ ucm}^{-2}$, highest at Talwara and lowest at OF Mukerian. The periphyton density showed direct correlation with substratum, to some extent with transparency of river water.

The low density between $125-217 \text{ ucm}^{-2}$ from Mukerian to Beas bridge may be due to negative impact of effluents, fast current, lack of suitable substratum.

Macroenthos : Total density during the tenure showed minimum fluctuation between Talwara to Beas bridge ($266-57 \text{ um}^{-2}$) being highest at AOF and lowest at OF Mukerian. Great fluctuation in density was observed at Beas Harike having 1574 um^{-2} .

Macrophytes : Macrophytes along Beas were present only at Talwara and Harike. Talwara had minimum biomass of 0.005 gm^{-2} mainly formed by Vallisneria, 90% and Azolla 9%, Chara, 1%.

Harike was almost choked with weeds having dry biomass of $149-265 \text{ gm}^{-2}$ at various sites, comprised by both submerged and emergent type.

Population composition at Beas end at Harike comprised of *Eichhornia sp.* (75%), *Lemna* (5%),



Nelumbia (5%), *Alternanthera* (2.5%) and emergent type (12.5%), while Sutlej end and confluence site had dominance of *Eichhornia sp.* (80-100%).

Kanjli Wetland

Ecology

Soil Phase : Kanjli wetland has alluvial soil comprising of 56.7% sand, 28.9% silt and 14.4% clay. Soil is alkaline, pH 7.80 having sufficient available phosphate 2.73 and nitrogen 17.60 mg 100g⁻¹ conducive for fish as well as macrophyte growth. Specific conductance of 310.5 $\mu\text{mhos}^{-1}\text{cm}$ show its richness in organic debris.

Water phase : Water within wetland is alkaline, pH 7.70 has sufficient DO, 7.2 mg l⁻¹, but has large number of dissolved solids, 195.25 mg l⁻¹ making water very hard, 187.5 mg l⁻¹. Specific conductance of 392.50 mhos cm⁻¹ show water organically rich as is exhibited by high B.O.D. and C.O.D. values, 36.0 and 69.0 mg l⁻¹ respectively.

Biotic components

Plankton : Average plankton density was 176 u l⁻¹ mostly formed by phytoplankton (142 u l⁻¹) constituting 76% of total population. Zooplankton density being 34 u l⁻¹ forming 24% of total population. Population mainly comprising of bacillariophyceae (42%), myxophyceae (28%), chlorophyceae (105), copepods (10%) and protozoans (10%).

Periphyton : Concentration was 377 u/cm² mainly formed by myxophyceae (57%) followed by bacillariophyceae (38%) and green algae (5%). The main forms present were *Navicula*, *Nitzschia*, *Phormidium*, *Cyclops*.

Macrobenthos : Average benthic density of wetland was 524 u/m². Community composition formed by 3 groups, dipteran larvae mainly Chironomid larvae, Tubificids mainly *Branchiura sp.* and molluscans mainly *Planorbis sp.*

Macrophytes : Kanjli wetland is full of macrophytes. The average dry biomass at survey point was 245 gms/m², formed mainly by *Eichhornia crassipes*, 86.96%; *Potamogeton netans*, 3.6%; *Lemna*, 7.0%; *Hydrilla*, 1.70% and *Sagittari spp.*

Macrophyte associated fauna : Average concentration of 32 uk g⁻¹ m²-1 of insects were present in Kanjli wetland comprised of diverse forms mayfly nymphs (4.46%), beetle larvae (16.13%), odonate nymphs (6.25%), Bugs (1.96%) alongwith tubificids (15.95%), molluscans (39.61%), cladocerans (12.5%) and shrimps (3.10%). The dominant forms were *Baetis sp.*, *Chironomous sp.*, *Tubifex tubifex*, *Planorbis*, *Daphnia spp*

Fishery : Kanjli wetland along with Kalibein sustained good fishery and used to form good breeding ground for local migrants of Harike fishery mainly Indian major carps. But with eco-degradation of the Bein as well as wetland the utility of Bein has decreased considerably.

Fish biomass : In Bein the total fish catch was 3.10 t/m, constituted mainly by miscellaneous group, 36.77% followed by common carp, 27.10%, IMC, 26.45%, catfishes 5.16% and minor carps 4.51%.

Fish diversity : A total of 15 fish species were recorded from this source during experimental fishing. These are *C. mrigala*, *C. reba*, *C. straitus*, *Ambassis ranga*, *M. tengra*, *L. calbasu*, *C. carpio*, *N. nandus*, *Ompok pabda*, *N. notopterus*, *L. bata*, *C.marulius*, *Puntius ticto*, *M. cavasius*, *W. attu*.



PROJECT : RI/B/3

EVALUATION OF HABITAT DEGRADATION IN THE CONTEXT OF FISHERIES ECOLOGY IN RIVER GANGA

- Personnel** : Scientific :
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R.K. Tyagi, V. Pathak, B.K. Singh, P.N. Jaitly, R.S. Srivastava,
B.P. Mohanty, D. Karunakaran
- Technical** : B.D. Saroj, L.R. Mahavar, S.K. Srivastava, Ramji Tiwari,
J.P. Mishra, Kalpana Srivastava, H.C. Banik
- Duration** : April 2001-March 2006
- Location** : Allahabad/Karnal

About 2000 kms stretch of River Ganga, from Deoprayag to Farakka, have been studied by selecting 13 observation centers.

Soil Quality

Silt load showed a downward trend from Deoprayag/Rishikesh (514 g m^{-3}) to Farakka (77 g m^{-3}) barring Kanpur (564 g m^{-3}) and Allahabad (597 g m^{-3}) where abrupt enhancement was recorded. The river bed was sandy in upper stretch and sandy loam in lower stretch. Leaving aside the nutrient contents, which showed an increasing trend from Deoprayag to Farakka, other chemical factors have shown no definite trend.

Copper (0.059 mg l^{-1}) and Zinc in sediment have shown an upward trend from upper centers to lower centers, with maximum value at Varanasi (368 mg l^{-1}) and again declining downwards.

Accumulation of pesticides in Sediment

Total accumulation of organochlorines were 32.19, 56.739, 35.438 and 113.038 (ng g^{-1}) at Kanpur, Allahabad, Varanasi and Farakka, respectively.

The molluscan tissues examined showed accumulation of heavy metals like Copper, (1.511 mg l^{-1}) Zinc (11.83 mg l^{-1}), Chromium (0.495 mg l^{-1}) and Cadmium at varying levels at different centers.

Water Quality

Temperature showed a definite increasing trend from Deoprayag to Allahabad. Among the dissolved gases oxygen was quite high throughout the stretch (6.5 to 10 mg l^{-1}).

Dissolved organic matter was quite high in all the stretches, ranging from 1.14 to 2.58 mg l^{-1} but both the nutrients viz. nitrate (0.06 to 0.14 mg l^{-1}) and phosphate (0.04 to 0.09 mg l^{-1}) were very poor.



The average value of physico-chemical parameters of water from Varanasi to Farakka showed that water temperature ranged between 23.0 and 27.55°C.

Dissolved organic matter was quite high showing definite decreasing trend from Varanasi to Farakka (2.65-1.43 mg l⁻¹), nutrient like nitrate (0.11-0.05 mg l⁻¹) and phosphate (0.06-0.042 mg l⁻¹) were quite low which decreased from Varanasi to Farakka. Silicate concentration was also low (3.8-4.63 mg l⁻¹).

Primary production

The rate of carbon synthesis by phytoplankton studied between Deoprayag and Farakka in Ganga show gross and net productions (mg C m⁻² d⁻¹) ranged from 210.5 to 626.3 and 143.3 to 417.9, respectively. The production rates were minimum either at Deoprayag or Rishikesh and maximum at Kanpur. In general the rate of carbon production showed a definite increasing trend from Deoprayag upto Kanpur but between Allahabad and Farakka it showed many ups and downs.

Heavy metals (water, sediment)

The concentrations of heavy metals, Copper and Zinc in the water phase were minimum (0.059-0.287 mg l⁻¹) at Deoprayag and increased (0.104-1.04 mg l⁻¹) at Kanpur. At Allahabad the values were comparatively low (0.078-368 mg l⁻¹) but at Varanasi the values increased suddenly (0.151-0.611 mg l⁻¹). At Farakka the values of the two metals were 0.124 mg l⁻¹ and 0.415 mg l⁻¹, respectively. Chromium was detected only at Kanpur (0.248 mg l⁻¹) and Allahabad (0.076 mg l⁻¹). Other metals were within the non-detectable limits.

In the sediment phase also both Copper and Zinc were minimum (0.072 mg l⁻¹ and 0.57 mg l⁻¹) showing increasing trend at lower stretch centres reaching maximum at Varanasi (0.424 mg l⁻¹ and 1.069 mg l⁻¹). In the lower stretch at Rajmahal and Farakka their concentration were 0.159 mg l⁻¹ and 0.66 mg l⁻¹, respectively.

The concentration of heavy metals like Zinc, Copper and Chromium in water phase have shown an increasing trend with peak values at Varanasi (0.611 mg l⁻¹).

Biotic Communities

The rate of carbon synthesis by phytoplankton showed a definite increasing trend from Deoprayag to Kanpur and thereafter upto Farakka the erratic primary production was recorded.

In plankton the diatoms dominated at Deoprayag/Rishikesh (88 ul⁻¹) and the green algae dominated from Kannauj to Allahabad with an increasing trend of zooplankton percentage from upper to lower centers comprising significant percentage of ciliates (Kanpur). A gradual decline in total plankton population was recorded from Allahabad (990 ul⁻¹) to Farakka (132 ul⁻¹), mostly because of enhancement in water volume (with added impact of sewage and anthropogenic pollution).

The periphyton abundance showed a regular downward trend from Deoprayag (390 U cm⁻²) to Kanpur (253 U cm⁻²) and thereafter an increasing trend from Varanasi (481 U cm⁻²) to Farakka (1430 U cm⁻²) barring to that at Allahabad where the maximum assemblage was observed. Dominance of Diatoms was followed by green and blue-green algae.

The macrobenthic community abundance has shown a gradual increasing trend from Deoprayag (96 U m⁻²)/Rishikesh (105 U m⁻²) to Varanasi (821 U m⁻²) and thereafter a decreasing trend upto Farakka. The molluscan forms were dominating throughout the stretch.

Fish Biology

The studies on biological characteristics of *Cirrhinus mrigala*, *Rita rita*, *E. vacha* and *A. seenghala* revealed that the environment is conducive as estimated on the basis of length-weight relationship, age and growth,



condition factor, food & feeding habits, maturation and breeding.

Biochemical Studies

Electrophoretic profile of muscle/serum proteins of fish and mollusc by 2D-PAGE and generation of 2-D reference maps have been done in order to study their suitability for 2-D zymogram analysis and proteomics study. Protein profile of different fishes and different places gave almost similar appearance. Stress protein of gill, kidney and liver of *Rita rita* showed hsp 70 induction. Specific protein bands have been observed in analysis of tissue of various organs.

Fishery

Estimation of fish catch and population dynamics of important fishes revealed a decline in catch from

Kanpur (88.54 t) to Lalgola (101.36 t) through Allahabad (94.67 t). Major carps, exotic carps and Hilsa show an increasing trend. The mean length of carps and catfishes showed low standard deviation.

Carp Spawn Prospecting

Carp spawn prospecting investigations in upper stretch revealed 17.3% desirable quality comprising *L.rohita*, *C. mrigala* and *L.calbasu*. However, in lower stretch the desirable spawn was constituted by *L. rohita*, *L. calbasu*, *C. carpia*, *C. mrigala* and *C. catla*.

In database management 'Data entry module' and 'Report module' have been developed on ecology and fisheries of River Ganga.





PROJECT : ES/B/4

STUDIES ON THE ESTUARINE ECOSYSTEMS AND SALINE WETLANDS OF EASTERN INDIA IN RELATION TO THEIR PRODUCTION POTENTIALITY

- Sub Project – 1** : Ecology, biodiversity and production potentiality of Hooghly estuary
- Sub Project – 2** : Ecology and production potentiality of saline Impoundments
- Sub Project – 3** : Ecology and production potentiality of Mahanadi estuary

Personnel : *Scientific* :

D. Nath, R.N. Misra, A. Mukherjee, M.K. Mukhopadhyay, Amitabha Ghosh, H.C. Karmakar, B.C. Jha, U. Bhaumik, J.G. Chatterjee, P.K. Katiha, B.B. Satpathi, Debabrata Das

Technical :

Sukumar Saha, M.P. Singh, B.K. Biswas, T. Chatterjee, Arunava Mitra, D. Sanfui, B.N. Das, A. Sengupta, A. Choudhury, S. Mondal, C.P. Singh, K.P. Singh, Ashim Jana, S.P. Ghosh, B.B. Das (up to 31.1.2004), Pintu Biswas, Debasis Saha. A.K. Barui

Duration : April 2003-March 2008

Location : Barrackpore

Sub Project – 1 : Ecology, biodiversity and production potentiality of Hooghly estuary

Estimation of catch statistics of Hooghly estuarine system and Digha centre

Total catch

The estimated total fish yield from the Hooghly estuary and Digha centre was 50024.4 t and 33409.2 t

(combined catch being 83433.6 t) during the period February, 2003 to January, 2004 as compared to 40339.8 t and 22214.9 t (combined catch being 62554.7 t) respectively during the corresponding period of the previous year, thereby showing an increase in catch by 9684.6 t (24.0%) from the Hooghly estuary and 11194.3 t (50.4%) from Digha centre. This combined catch is the highest total catch of the estuary ever recorded.

The lower zone of the estuary, like previous years, contributed major share of 96.9 % and 94.8 % of the total of the estuary excluding and including Digha centre respectively.



Species-wise catch structure

Harpodon nehereus, *Tenuulosa ilisha*, *Setipinna spp.*, *Pama pama*, prawns, *Trichiurus spp.*, *Arius jella*, *Pampus argenteus*, *Coilia spp.* dominated the catches of Hooghly estuary constituting 41517.2 t (83 %) of the total yield of the Hooghly estuary.

The dominant species in order of abundance at Digha centre were: Prawns, *Pama pama*, *Arius jella*, *Pampus argenteus*, *Tenuulosa ilisha*, *Trichiurus spp.*, *Ilisha megaloptera*, *Setipinna spp.*, *Harpodon nehereus*, *Chirocentrus dorab*, comprising of 25075.3 t (75.1 %) of the total catch of Digha centre.

Fresh water species in the upper estuary contributed 459.4 t amongst which the dominant were *Gobids* (307.1t), *Aorichthys aor* (40.8 t), *Rita rita* (33.8t), *Clupeisoma garua* (36.5t), *Eutropiichthys vacha* (8.7t), *Macrobrachium rosenbergii* (2.9t), *Labeo calbasu* (3.5 t), *Labeo rohita* (2.0 t), *Glossogobius giuris* (1.2t).

Estimated catch of winter migratory bagnet fishery (WMBF)

Total catch of WMBF of lower estuary was estimated to be 30622.2 t during November,2003 to January, 2004 contributing 38% of total catch of Hooghly estuary with an average CPUE of 50.27 kg as compared to 27165.8 t with an average CPUE of 44.0 kg during corresponding period of previous year, thus, displaying a moderate increase of catch by 3456.4 t (12.7 %) and CPUE by 6.27 kg (14.2%). The augmentation of catch of WMBF was mainly due to higher abundance of some of the species particularly, *P.pama* (2759.0 t), *Setipinna spp.* (1403.6 t), *P.argenteus* (177.8 t), prawns (324.9 t), *A.jella* (105.5 t), *P. paradiseus* (99.8

t), *I. megaloptera* (47.5 t), compared to the catches of the species during similar period of last year.

Hilsa catch from the estuarine system by selective gears, estimation of (CPUE) for hilsa and wanton destruction of juvenile Hilsa

An estimated catch of 9757.3 t (19.5% of total catch) of Hilsa was netted out from the Hooghly estuary, while at Digha centre it amounted to 2633.3 t (7.9% of total catch of Digha centre) (combined Hilsa catch being 12390.6 t, 12.9% of total catch) during February,2003 to January,2004 as compared to 4217.0 t and 2280.5 t respectively during February,2002- January,2003 (total Hilsa catch being 6497.5 t), exhibiting a sharp increase in catch by 5540.3 t (131.4 %) from the Hooghly estuary and by 352.8 t (15.5%) at Digha centre. The combined Hilsa catch showed an increase of 5893 t (90.7%).

In Zone-I, Zone-II and Zone-IV the CPUE of drift-gill nets, principal gear for catching hilsa, varied from 0.49 to 0.97 kg, 0.20 to 1.60 kg and 0.40 to 2.77 kg respectively. In Zone-I the CPUE of purse nets and set-gill nets fluctuated from 0.12 to 0.69 kg and 0.40 to 1.73 kg respectively. These two gears were not operated in the other two zones. Average CPUE of drift-gill net in a centre of lower zone during monsoon of 2003-04 was 160.43 kg.

Indiscriminate exploitation of young Hilsa (fry & fingerlings) through small meshed nets particularly bag nets and seine nets in the upper estuary resulting in wanton destruction of hilsa was estimated as 53.2 t during the period Feb., 03 to Jan.,04 as compared to 73.6 t during Feb,02 to Jan.,03, a decrease of 28%.



Gear-wise composition of catch

Bag net and drift-gill net are the major gears for both Hooghly estuary and Digha centre accounting 70.3% and 25.5%; 71.7% and 26.1% of the total catch

respectively during Feb.,03-Jan.,04 as compared to 77.2% and 19.9%; 71.9% and 27.3% from the Hooghly estuary and Digha centre respectively during the corresponding period last year.



Haul of Hilsa



Wanton destruction Hilsa juveniles near farakka



HYDROLOGY AND POLLUTION STATUS OF DAMODAR RIVER AND HOOGLHY ESTUARY

Hydrology of the rivers

The Damodar river was investigated for ecology and pollution status with a bearing on its possible impact on Hooghly estuarine system in the state of West Bengal. The river at the upper stretch between Kalyaneswari and Mabela was under continuous influence of high organic load and the water quality also distinctly differed from the uncontaminated stretch.

The high values of BOD (61.78 – 66.76 mg^l⁻¹), total alkalinity (128.66 – 256.66 mg^l⁻¹), total hardness (131.33 – 294.33 mg^l⁻¹), free carbon dioxide (5.26 – 6.53 mg^l⁻¹) and pH (8.08 – 8.13) and moderately low dissolved oxygen (5.26 – 6.53 mg^l⁻¹) revealed eutrophic status in the river environment of the stretch.

Consequent upon the high gradient flow and dilution effect, the environment status improved and the water quality recovered to normalcy in the system (BOD 1.92 – 2.06 mg^l⁻¹; TA 86.0 – 92.0 mg^l⁻¹; TH 82.0 – 95.33 mg^l⁻¹; Free CO₂ 3.80 – 4.93 mg^l⁻¹; pH 8.78 – 7.88 and DO 7.53 – 8.04 mg^l⁻¹). The environmental conditions remain apparently unaltered except for at the sites of contamination and a few kilometers downstream.

The incidence of organic contamination was much less between Durgapur and Burdwan city. However, the river water in the vicinity of Durgapur industrial area was laden with high BOD (31.73 – 91.46 mg^l⁻¹), total alkalinity (126.0 – 216.0 mg^l⁻¹), total hardness (122.66 – 182.66 mg^l⁻¹), free CO₂ (8.08 – 9.93 mg^l⁻¹) and moderate dissolved oxygen (7.85 – 8.05 mg^l⁻¹) at 1200 Hrs indicating the impact of the city sewage drained from Tamnala gate, DSP maingate and the Tamnala discharge point.

In the Hooghly estuary the BOD was level was quite low (0.73 - 2.86 mg^l⁻¹) and showed no sign of any pollution effect on the environment. The water pH was neutral to slightly acidic (7.36 - 8.00) all through the course. The dissolved oxygen (7.63 - 8.80 mg^l⁻¹)

and total alkalinity (100.00 - 130.83 mg^l⁻¹) parameters remained within the moderately productive range in the system. However, total hardness, chlorinity and salinity levels were significantly high in the gradient zone (602 mg^l⁻¹, 0.58 mg^l⁻¹ and 1.06 ppt) and highest in the marine zone (2833 mg^l⁻¹, 6.35 mg^l⁻¹ and 11.48 ppt) compared to the freshwater stretches of the river system.

Primary productivity

It is important to note that the gross primary productivity was significantly low near the thermal effluent discharge point at Chinakuri and Disharghar.

The low productivity was due to high temperature of the effluent water and resultant dispersion of the thermally sensitive organism from the thermally affected areas of the river. Productivity in Hooghly estuary was comparatively low and thus indicated the possibility of low impact of Damodar river on the productivity of the Hooghly estuarine system.

Metal concentration

Concentration of heavy metals both in Damodar river and Hooghly estuary generally remained low, but also showed the sign of surpassing the permissible limits in a few cases. Zinc maximum (0.073 mg^l⁻¹), Chromium maximum (0.05 mg^l⁻¹), Iron maximum (35.38 mg^l⁻¹). Cadmium 0.023 at Harwood.

Soil characteristics

The pH of soil in Damodar river and Hooghly estuarine stretch, in general ranged between 7.07 and 9.8 with the only exception of being acidic (pH 2.61) at Manbera discharge point. Specific conductance of soil fluctuated between 0.99 and 1.63 μ mhos cm⁻¹. The total nitrogen was at the higher side near all the effluent discharge points and highest at Gagalpuri (0.21 mg^l⁻¹) followed by Manbera (0.155 mg^l⁻¹), Ramnagar (0.131 mg^l⁻¹) and Tamnala gate (0.125 mg^l⁻¹). Available nitrogen



followed a similar trend as that of total nitrogen in respect of sediment concentration. Percentage of organic carbon was comparatively high at the upper stretch between Kalyaneswari and Manbera.

Plankton

River Damodar

The spatio-temporal fluctuations were evident in plankton population structure of the river system. The annual average of the plankton density ranged between 128 u l^{-1} and 147 u l^{-1} with maximum in winter (147 u l^{-1}) followed by summer (134 u l^{-1}) and monsoon season (128 u l^{-1}). Density of the organisms was maximum at the upper reaches near Majia Bridge (200 u l^{-1}) in winter, which declined at the lower reaches near Burdwan (156 u l^{-1}) at the peak of monsoon. Phytoplankton (50.8 – 70.7 %) constituted the bulk with the dominance of *Melosira*, *Oscillatoria*, *Anacystis*, *Nitzschia*, *Anabaena* etc., while zooplankton (29.3 – 49.2 %) mostly represented by rotifers was the follow up group.

River Hooghly

River Hooghly harboured higher population of planktonic organisms ($198 - 427 \text{ u l}^{-1}$) compared to the Damodar river ($128 - 147 \text{ u l}^{-1}$). The density of the free floating organisms was $298 - 372 \text{ u l}^{-1}$ beyond the tidal reach, $285 - 427 \text{ u l}^{-1}$ in the freshwater tidal zone, $198 - 258 \text{ u l}^{-1}$ in the gradient zone and $345 - 465 \text{ u l}^{-1}$ at the marine zone of the system. Population percentage of phytoplankton was consistently higher in the system except at the gradient zone, showing dominance of zooplankton in the plankton population.

Benthos

River Damodar

A trimodal pattern of annual fluctuation was evident in distribution of macro benthic invertebrates of the river system. The average community size ranged from 419 Nos./m^2 to 6559 Nos./m^2 . Molluscs were dominant.

River Hooghly

The community size of the benthic population dominated largely by the gastropods to the tune of 66.7 to 100 % in the freshwater and 88.7 to 100% in the saline zone of the system.

Socio-economic status of fishermen

The socio-economic status of fishermen representing four villages on the bank of river Damodar was evaluated. The fishermen have low income and most of them abandoned fisheries in favour of agricultural labour and other professions.

Sub Project – 2 : Ecology and potentiality of saline wetland impoundments

Kulti wetland

Physico-chemical parameters

The water of wetland had a mean salinity of 1.795 ppt with a maximum during February, 2004 (3.65 ppt). The mean salinity in this wetland was found to be lower than the Malancha wetland situated about 10 km down stream on Kulti-gung. The water temperature, transparency, D.O. and free CO_2 ranged as $18.0 - 32.5^\circ \text{C}$; 4.0 - 16.0 cm; 4.65 - 11.0 mg l^{-1} and nil - 8.30 mg l^{-1} respectively. The pH of water ranged between 8.0 and 8.4. The total alkalinity had a mean value of 141.40 mg l^{-1} while that of primary production was of the order of $147.04 \text{ mg C m}^{-3} \text{ h}^{-1}$. The $\text{NO}_3 - \text{N}$, $\text{PO}_4 - \text{P}$ and $\text{NH}_4 - \text{N}$ had mean values of 2.8 mg l^{-1} , 0.26 mg l^{-1} and 2.87 mg l^{-1} respectively.

The pH of soil was found to be on the alkaline side. Available N ranged as 18.48 - 22.96 $\text{mg } 100 \text{ g}^{-1}$ (August - December). Average P was lower in the Kulti wetland compared to Malancha.



Biological parameters

There had been an overall dominance of zooplankton over phytoplankton in the wetland. The mean plankton density was found to be 319.42 u l^{-1} with zooplankton contributing 62.09 and phytoplankton 37.91%. Plankton concentration ranged as 202 u l^{-1} to 518 u l^{-1} .

Benthic macro-fauna was found to be represented mainly by tanaisids, amphipods, gastropods etc.

The mean concentration of macro-zoobenthos was of the order of 6048.75 u/m^2 , the prime contributors being gastropods (46.46%) constituted mainly of *Thiara* spp.

Malancha wetland

Physico-chemical parameters

The mean water salinity in the wetland, situated about 10 km down stream, was found to be 4.86 ppt. The pH ranged between 7.6 and 8.4. The mean transparency was found to be 10.67 cm while the D.O. and free CO_2 were of the order of 5.64 to 18.87 mg l^{-1} and nil - 3.32 mg l^{-1} respectively. Though the total alkalinity was almost same as that of Kulti wetland, Malancha wetland had lesser concentration of $\text{PO}_4 - \text{P}$ (mean value 0.19 mg l^{-1}), $\text{NO}_3 - \text{N}$ (1.03 mg l^{-1}) and $\text{NH}_4 - \text{N}$ (mean value - 1.96 mg l^{-1}). The pH of soil was found to be on the alkaline side. The available N (August - December '03) ranged as 17.36 to $23.52 \text{ mg } 100 \text{ g}^{-1}$ of soil while the range available P was of the order of 4.0 - $6.4 \text{ mg } 100 \text{ g}^{-1}$ of soil.

Biological parameters

The mean concentration of plankton was observed to be 188.33 u l^{-1} with zooplankton contributing 59.5% and phytoplankton 40.5%.

The macro-zoobenthos was constituted mainly of tanaisids, amphipods, molluscs and insect larvae etc.. Mean concentration of macro-benthic fauna in this wetland was found to be 2106.67 u/m^2 with amphipods being the prime contributor contributing 31.90% followed by insect larvae and nymphs.

Radhakantapur Wetlands

Physico-chemical parameters

The wetland I (12 ha) had a mean salinity of 10.58 ppt while wetland II (31.33 ha) had a mean water salinity of 9.858 ppt. Lowest salinity (1.30 ppt) in both the wetlands was recorded during November, 2003 while highest salinity to the tune of 21.93 and 19.58 ppt in the month of March, 2004. The pH ranged between 7.4 and 9.2 in the two wetlands while the range alkalinity was $90.00\text{-}156.8 \text{ mg l}^{-1}$ in wetland I and $70\text{-}190.12 \text{ mg l}^{-1}$ in wetland II. $\text{PO}_4\text{-P}$ and $\text{NO}_3\text{-N}$ ranged as trace-0.08 in wetland I and trace-0.2 in wetland II, and 1.04-3.08 in wetland I and 0.63-3.08 in wetland II. Primary production in wetland I was $241.8 \text{ mgC m}^{-3} \text{ h}^{-1}$ and in wetland II $215.0 \text{ mgC m}^{-3} \text{ h}^{-1}$. Diurnal studies conducted during Nov., 03 revealed the fall of 45.5% in ambient oxygen and 100% rise in free CO_2 levels with the decrease in light intensity between 10.30 and 04.30 hrs. Alkalinity was found to be the lowest at 10.30 hrs and highest during 16.30 hrs. The pH of soil ranged between 7.30 and 7.69 in wetland I 7.00 and 7.90 in wetland II. The available N ranged as 20.16-23.52 $\text{mg } 100 \text{ g}^{-1}$ of soil in wetland I and 17.080-19.04 $\text{mg } 100 \text{ g}^{-1}$ in wetland II. Available P ranged as 1.6-4.2 & 1.6-8.0 $\text{mg } 100 \text{ g}^{-1}$ soil in wetland I and wetland II respectively.

Biological parameters

Phytoplankton dominated over zooplankton in both the wetlands. Diurnal studies indicated in wetland I concentrations to be the highest (525 u l^{-1}) during mid day (11.30 hrs) when phytoplankton constituted 45.30% while lowest concentration was obtained during 22.15 hrs when the contribution of phytoplankton was only 16.46%.

The concentration of benthic macro fauna was recorded as $2859.9 \text{ nos. m}^{-2}$. The concentration in wetland I was found to be higher ($4286.25 \text{ nos. m}^{-2}$) than wetland II ($1433.54 \text{ nos. m}^{-2}$). The tanaisids were the prime contributors contributing 80.31 and 45.54% respectively in wetland I and II.



Ecology of rivers

The river Sakha Bidyadhari had a salinity range of 0.39 (October, 03) to 3.83 ppt (Feb. 04) near its confluence with Kulti estuary. The salinity increased at Malancha (on Kulti estuary) which is about 10 km down stream ranging from 0.75 (Oct. 03 to 7.46 ppt (Feb. 04). The Moni river had a salinity range of 0.94 (Nov. 03 to 20.66 ppt (March, 04) during the period of observation. The total alkalinity was highest in the Bagjola canal (Mean : 175.26 mgl⁻¹) followed by Kulti estuary at Malancha (Mean : 157.58 mgl⁻¹ while river Moni at Radhakantaopur had lowest value (Mean : 124.25 mgl⁻¹). Primary productivity was higher in Bagjola canal (Mean value - 142.12 mg C m³⁻¹ hr⁻¹) followed by Moni river (Mean 90.21 mgC m³⁻¹ hr⁻¹) while Kulti estuary at Malancha demonstrated lowest primary production. The PO₄-P and NO₃-N had respective values of 0.29 & 2.1 mgl⁻¹, 0.31 & 1.96 mgl⁻¹, and 0.16 & 1.75 mgl⁻¹ for low, medium and high saline zones. The NH₄-N was highest in Bagjola canal (Mean 3.99 mgl⁻¹) followed by Kulti estuary (2.59 mgl⁻¹) and river Moni (1.52 ppm). The soil pH was on slightly alkaline side ranging from 7.05 to 7.65 in Bidyadhari; while in Kulti estuary it ranged between 7.13 and 7.90. In the high saline, however, it ranged as 6.95 - 7.58. Available N (mg 100 g⁻¹ soil) was higher in river Bidyadhari compared to Kulti estuary and river Moni. Available P though had similar values in Bidya and Kulti it was lower in river Moni.

The plankton concentration was found to be highest in river Moni (374.4 u l⁻¹) followed by river Sakha Bidyadhari and Kulti estuary.

The macrobenthic fauna had higher concentration (4023 nos.m²⁻¹) in Kulti estuary compared to Sakha

Bidyadhari (2052.5 nos.m²⁻¹). Tenaids contributed as high as 63.86% in Kulti estuary, where as in Sakha Bidyadhari its contribution was 22.09%. The gastropods, principally represented by Thiara spp., had higher percentage contribution (33.73) in Sakha Bidyadhari river compared to Kulti estuary (7.51%). In Moni river the concentration of macro benthic fauna was found to be much lower compared to the other rivers. Tanaids contributed more than 82% of the macro-zoobenthos in the month of September and 63.35% in November, Gastropods in this river is principally represented by Telescopium sp.

Production from wetlands

The estimated production in the Kulti-Malancha region was to the tune of 931,44 kg ha⁻¹ 10 months⁻¹ and 912.3 kg ha⁻¹ 11 months⁻¹ the average estimated production per ha in this region being 922.85 kg. The contribution of *P. monodon* ranged as 14.55% (Malancha) to 22.083% (Kulti). In Radhakantapur (High Saline) the average production has been found to be 210.54 kg/ha/9 months but the contribution of *P. monodon* to the total production was higher (29.40%) compared to Kulti-Malancha.

Sociological Survey on Fisher Community

With a view to conducting survey and identification of saline wetland impoundments of North and South 24-Parganas District of West Bengal, an investigation was carried out. A total of 50 fish farmers were personally interviewed with a structured schedule in the villages namely Kulti, Kulti Lock-gate, Ghushighata, Malancha which constituted the sample of study.

Sub Project – 3 : Ecology and production potentiality of Mahanadi estuary

Hydrological characteristics



Salinity : The chloride level and saline incursion were directly influenced by the extent of freshwater efflux by Zobra anicut in the downstream. In monsoon the salinity was felt only at the sea face near Paradip (1.62 ppt). Under declining freshwater efflux controlled by the barrage at different times of the year, the salinity tended to rise. This led to the salinity incursion zone to extend up to Atharbanki, 5 km upstream in December 2003 on one side and further up to Chaumani 10 km away from the sea face in February 2004 on the other side.

Utilizing the salinity distribution pattern and the nature of freshwater efflux the 89 km stretch could be delineated to

- a) Upper freshwater zone (89-25 km : Zobra & Ayatpur)
- b) Freshwater tidal zone (25 – 10 km : Tikhiri & Bhutmundai)
- c) Brackishwater tidal zone (10 – 0 km : Chaumani, Atharbanki & Paradip)

The upper freshwater zone was further divided into

- (i) Deep freshwater zone (89 – 70 km : Zobra & Ayatpur) and
- (ii) Shallow freshwater zone (70 –25 km : Rahama).

Turbidity : Due to recurrent high floods, the greater part of the system was highly turbid (Transparency 19.5 – 35.0 cm) during monsoon season.

Dissolved oxygen : High turbidity and resultant photosynthetic inhibition caused low oxygenation (6.32 – 7.00 mgl⁻¹) of the river water during monsoon. With post monsoon improvement in transparency, the level of dissolved oxygen increased significantly (8,00 – 10.00 mgl⁻¹) all through the riverine stretch.

Dissolved nutrients : By and large the nutrient level were comparatively high in the deeper freshwater and brackishwater tidal zones. Sulphate and silicate were

inversely related to nitrate and phosphate contents in respect of seasonal fluctuations.

Productivity

Productivity varied seasonally as indicated from the gross production level (GPP) ranging between 158.35 mgC m⁻³h⁻¹ and 333.33 mgC m⁻³h⁻¹ (monsoon), 104.17 mgC m⁻³h⁻¹ and 354.84 mgC m⁻³h⁻¹ (winter) and 219.00 mgC m⁻³h⁻¹ and 666.67 mgC m⁻³h⁻¹ (post winter) during the study.

Biological characterization Plankton

The mean annual plankton density remained 150 ul⁻¹, 103 ul⁻¹ and 162 ul⁻¹ in the upper freshwater, freshwater tidal and brackishwater tidal zones respectively. Phytoplankton shared 63% while 37% was shared by the zooplankton in overall plankton population of the system.

Benthic fauna

The annual population density of macrobenthic fauna estimated to 177 u m⁻², 49 u m⁻² and 227 u m⁻² for upper freshwater, freshwater and brackishwater tidal zones respectively.

Fish and fisheries

The important commercial species for the entire system consisted 96 species of fin and 10 species of shellfishes. The species spectrum markedly differed with the variations in salinity and depth of river habitats. In comparatively deeper upper freshwater zones 40 fresh and 6 euryhaline species of finfishes were encountered in commercial catches with the dominance of Indian major carps, large and small size catfishes and miscellaneous groups. The catch in shallow freshwater and freshwater tidal zones constituted mainly of miscellaneous groups of small freshwater fin fishes, perches, mullets and prawns, while in the brackishwater tidal zones 75 fin fishes mostly of uryhaline species and 10 species of shell fishes formed the bulk of landings.



The fish catch in deeper freshwater zone comprised mainly the Indian major carps, catfishes, minor carps, minnows, snakeheads, featherbacks, mullets, perches and prawns. Per-boat/day fish catch was observed to be fluctuating between 20 kg and 25 kg. Small mesh gillnets, castnets and pocket dragnets were mainly deployed for day-time fishing only.

Fish seed potentiality

The 98 km stretch of the river under study possess a unique combination of seed resources. Down below

the anicut in about 10 km of the upper freshwater zone, a large number of IMC fry were caught from the depressed riverbed areas for a brief period after receding of recurrent floods. Post larvae of mullets were caught in the experimental townetting from the freshwater and brackish water tidal zones. Post larvae of *Penaeus monodon* are caught in a commercial scale in tidal influenced estuary stretch round the years. Prawn seed collection is a major activity for fisherfolk especially the women in Chaumani, Bhutmundai and Paradip.





PROJECT : ES/B/5

DYNAMICS OF BIOTIC COMMUNITIES OF CERTAIN ESTUARINE SYSTEMS FROM ENVIRONMENTAL PERSPECTIVES

Personnel : Scientific :
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Technical :
R.C. Mandi, R.K. Sah, Subrata Das, T.K. Halder

Duration : April 2003-March 2006

Location : Vadodara

Sabarmati and Damanganga Estuarine Systems were explored from eco-status perspective.

Assessment of Water Quality

Sabarmati estuarine system

The transparency was poor and ranged from 1.1 to 54.5 cm at sites extending from Paladi to Anandpura.

The water reaction was alkaline and pH varied from 7.42 to 8.77.

The dissolved oxygen content was low occasionally due to influx of effluents and the varied from negligible to 8.0 mg l⁻¹.

The total alkalinity levels (82.0 to 180.0 mg l⁻¹) were however, congenial for biological productivity. The T.D.S. and conductance exhibited parallel trend (Conductance – 0.21 to 26.21 mS cm⁻¹, T.D.S. – 0.12 to 14.08 ppt).

Phosphate content (0.002 to 0.174 mg l⁻¹) and nitrate levels (0.18 to 1.41 mg l⁻¹) indicated fair productive

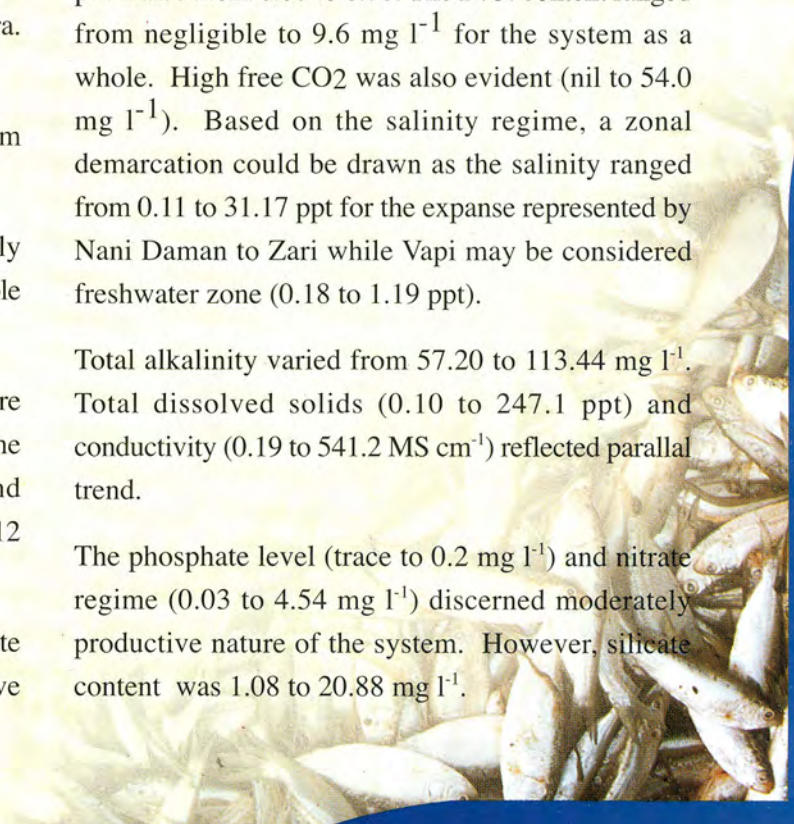
nature while silicate regime (4.68 to 20.28 mg l⁻¹) reflected rich status.

Damanganga estuarine system

The transparency of the water ranged from 2.5 to 107.0 cm. The water reaction was alkaline and the pH varied from 6.80 to 8.70. The D.O. content ranged from negligible to 9.6 mg l⁻¹ for the system as a whole. High free CO₂ was also evident (nil to 54.0 mg l⁻¹). Based on the salinity regime, a zonal demarcation could be drawn as the salinity ranged from 0.11 to 31.17 ppt for the expanse represented by Nani Daman to Zari while Vapi may be considered freshwater zone (0.18 to 1.19 ppt).

Total alkalinity varied from 57.20 to 113.44 mg l⁻¹. Total dissolved solids (0.10 to 247.1 ppt) and conductivity (0.19 to 541.2 MS cm⁻¹) reflected parallel trend.

The phosphate level (trace to 0.2 mg l⁻¹) and nitrate regime (0.03 to 4.54 mg l⁻¹) discerned moderately productive nature of the system. However, silicate content was 1.08 to 20.88 mg l⁻¹.





Sediments Quality

Sabarmati estuarine system

The soil pH varied from 7.47 to 8.34. The conductance ranged from 16.31 to 22.20 mS cm⁻¹. Organic Carbon ranged from 0.03 to 1.73% and total nitrogen from 0.08 to 1.11%. The C : N ratio varied from 0.09 to 18.88. The free calcium carbonate ranged from (2.0 to 20.25 %). The available phosphate ranged from 1.14 to 1.80 mg 100 g⁻¹. Sand (84.25 to 92.50%) was invariably the major component of the soil.

Damanganga estuarine system

Average pH ranged from 7.29 to 7.74. The conductance varied from 0.41 to 32.8 mS cm⁻¹. Organic carbon (0.03 to 20.56%), total nitrogen (0.05 to 1.59%) and free calcium carbonate (7.14 to 9.63%), qualitative texture of the soil showed sand (63.95 to 88.80%).

Spatio-temporal variations of net- plankton

Sabarmati estuarine system as a single entity, experienced average net- plankton abundance varying from 313 to 1573 nos. l⁻¹, Phytoplankton (72.05 to 95.68%) excelled as the major group. Regarding the qualitative spectrum of this abundance, Myxophyceae (44.79 to 88.75 %) was the most conspicuous floral component, while Bacillariophyceae and Chlorophyceae were the groups of importance. The zoo-plankton assemblage was by and large represented by rotifera and copepoda. However, cladocerans (16.15%) were abundantly represented at Vataman.

Spatio-temporal variations of macro-benthos

The average macro-benthos abundance of Sabarmati estuarine system fluctuated from 5 to 745 nos. m⁻². Diptera (7.69 to 100%) was by and large the eminent faunal elements. Molluscans and Annelids were other groups of secondary importance.

Daman estuarine system experienced macro-benthos abundance, varying from 3 to 1013 nos. m⁻². Dipterans

(65.83 to 91.52%) and annelids (58.53 to 94.58%) were the prominent faunal components.

Organic production

The negative net production (-312.5 to 85.94 mg C^mhr⁻¹) at most of the representative sites of Sabarmati estuarine system indicated prevalence of stressed conditions. Higher respiration rate (25.0 to 375.0 mgC^mhr⁻¹) corroborated the above. The Damanganga estuarine system also experienced negative net production (-85.65 to 8.33 mgC^mhr⁻¹) which is indicative of environmental degradation. The respiration rate (113.75 to 140.0 mgC^mhr⁻¹) was also observed to be higher and this is indicative of high organic load being dumped into the system.

Fisheries Spectrum and Fish Yield Estimation

23 numbers of fish species have been encountered from Damanganga estuarine system and *Harpodon nehereus* (48.75%) followed by *Liza parsia* (22.35%) formed the major fishery of the system.

Length and weight relationship fo *Harpodon nehereus* indicated $\text{Log } W = -6.0335 + 3.3258 \text{ Log } L$ and the condition factor was highest during September (1.41). The length and weight relationship for *Liza parsia* indicated $\text{Log } W = -3.9969 + 2.5408 \text{ Log } L$.



PROJECT : RS/A/1

ECOLOGY AND FISHERIES OF FRESHWATER RESERVOIRS

- Sub Project** : 1 Ecology and fisheries management of Hemavathi reservoir (Karnataka)
2 Ecology and fish yield potential of selected reservoirs of Karnataka to evolve management strategies
3 Ecology and Fisheries of Mettur Reservoir in Tamil Nadu
4 Monitoring of fish catch, recruitment and effort in selected reservoirs of Andhra Pradesh
- Personnel** : Scientific :
D.N. Singh, D.S. Krishna Rao, P.K. Sukumaran, M. Feroz Khan, M. Karthikeyan, A.K. Das, V.K. Murugesan, Rani Palanisamy
Technical :
S. Manoharan
- Duration** : Sub-project 1 August 2000-March 2004
Sub-project 2 April 2003-March 2005
Sub-project 3 August 2002-March 2007
Sub-project 4 August 2000-March 2004
- Location** : Bangalore/Coimbatore/Eluru

Sub Project 1 : Ecology and fisheries management of Hemavathi reservoir (Karnataka)

Soil Quality

Soil reaction was slightly acidic (pH 6.08) to moderately acidic (pH 5.49). Organic carbon content was low to moderate (0.98-1.60%, mean: 1.23%). C/N ratio maintained its moderate productive trend (7.6-

11.1, mean:9.0%) with total nitrogen content ranging from 0.089 to 0.174 % (mean : 0.136 %) . On most occasions, Secchi depth was more than 2.0 m, suggesting moderate productivity of this water body.

Water Quality

Surface water was near neutral to slightly alkaline (pH 7.20 -7.56, mean: 7.34). Specific conductance ranged from 50-88 $\mu\text{S}/\text{cm}$. Dissolved oxygen was moderate (6.8-9.1, mean: 7.9 mg l^{-1}). Fluctuation in



TA values (24-40, mean: 30.6 mg l⁻¹) was not drastic with the fluctuations in water level due to the fact that most of the water was drawn for hydel purpose and not evaporation loss, restricting dilution effect on TA. Nitrate-N (µg l⁻¹) was noticed more in this year (4-390, mean: 168 µg l⁻¹) and might be due to its release from the basin soil. Available-P was observed up to 200 µg l⁻¹ with its mean at 24 µg l⁻¹ in the surface water. Total-P registered a low of only 44 µg l⁻¹ and a high of 144 µg l⁻¹. Silicate-silicon, the basic constituent of diatoms showed low values with an overall range of 0.9-4.8 mg l⁻¹ (mean : 2.83 mg l⁻¹).

Primary Production

The daily integral production varied from 2000 to 2960 mgC m⁻² hr⁻¹ signifying that the reservoir is moderately productive. Gross production to community respiration ratio (P:R) exhibited wide fluctuations (1.9-5.0) on an average basis indicating that the reservoir is in the medium productive category.

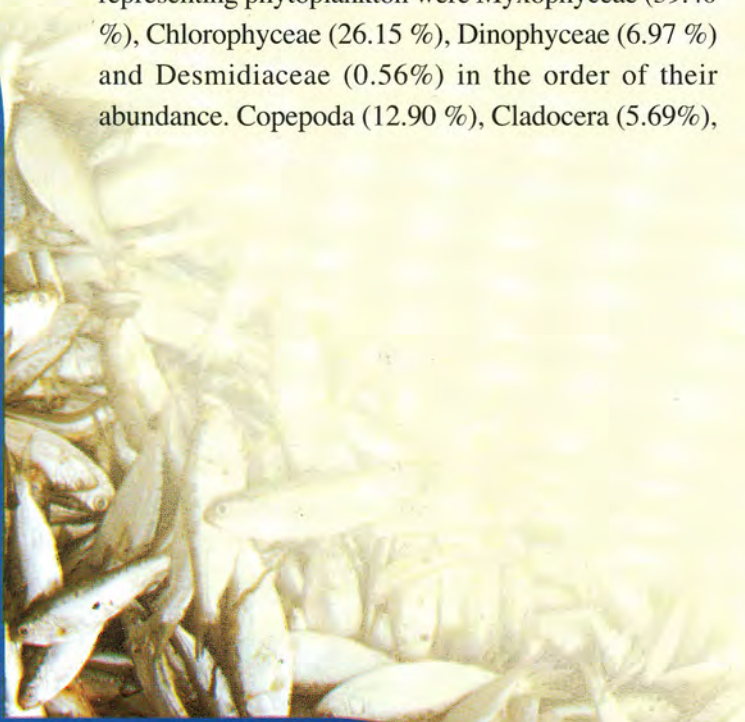
Biotic Communities

Dominance of phytoplankton (78.08%) over zooplankton was recorded during this year. Groups representing phytoplankton were Myxophyceae (39.40%), Chlorophyceae (26.15%), Dinophyceae (6.97%) and Desmidiaceae (0.56%) in the order of their abundance. Copepoda (12.90%), Cladocera (5.69%),

nauplii (4.59%) and Rotifera (3.75%) were encountered in zooplankton. The benthic population ranged from 100 to 887 No./m². Chironomus larvae and Mayfly nymphs along with gastropod *Brotia costula* occurred almost in all the months. Gastropods contribution accounted 42.67%, chironomus 29.50% and the other miscellaneous forms (Mayfly nymphs, Dragonfly nymphs and fish fry) contributed 27.83%.

Fishery

During the period April 2003 – February 2004, an estimated fish catch of 89.64 t was recorded at Hemavathi reservoir giving an average annual catch of 16.3 kg ha⁻¹. The fish catch during this year was 25.5% lower as compared to fish catch (120.40 t) during the last year (April 2002 – February 2003). *M. cavasius* dominated the catch and accounted for 37.7% of the total catch. This was followed by *C. carpio* (30.8%), *O. bimaculatus* (9.3%), *W. attu* (5.6%) and *L. rohita* (4.5%). Miscellaneous fishes (*O. mossambicus*, *C. reba*, etc.) accounted for 12.1% of the total catch. Though the catch of *M. cavasius* during this year increased substantially (272%) as compared to last year, a declining trend in catches was noticed this year in other species – *C. carpio* (59% less), *O. bimaculatus* (72% less) and *L. rohita* (34% less). The catch per unit effort (CPUE) of 8.90 kg during this year (2003-04) was higher than last year's CPUE (7.36 kg).





Sub Project 2 : Ecology and fish yield potential of selected reservoirs of Karnataka to evolve management strategies

An exploratory survey was initiated in November 2003 and six reservoirs were covered in different districts of Karnataka viz. Thippagonahalli (Bangalore rural district) Bethmangala (Kolar District), Jampadahalla (Chickmagalur district), Yagachi, Vothole, (Hassan district) and Kanwa (Bangalore rural). In most of the reservoirs the fishery was mainly supported by Indian major carps and also exotic fish species such as common carp and tilapia.

Thippagonahalli : This reservoir is located in Bangalore rural district, has a water spread area of 163.5 ha.

The major species include *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Mystus sp.* and *Ompok bimaculatus*.

Bethamangala : This reservoir is having a water spread area of 317 ha.

The major species which support fishery here are: *C. catla*, *L. rohita*, *C. mrigala*, *C. carpio*, *Etroplus suratensis*, *E. maculatus*, *M. malcolmsonii*, *Puntius sophore*, *O. mossambicus*, *Mystus cavasius*, *Puntius ticto* etc. Apart from this species such as *Garra mullya*, *G. gotyla*, *Nemacheilus sp.*, *Chanda nama*, *Channa marulius*, *C. punctatus*, *C. striatus*, *Glossogobius giuris*, *Rasbora daniconius*, *Mastacembelus armatus* etc are also recorded from here.

Jampadahalla : Jampadahalla is located in Chickmagalur district of Karnataka. The water spread area is 3890 ha.

Major species : *C. catla*, *L. rohita*, *Garra gotyla*, *O. mossambicus*, *Mystus cavasius* and *Puntius ticto*

Yagachi reservoir : This reservoir is located in Hassan district. The reservoir is under construction and ideally suited for pre impoundment studies. The water spread area is 1350 ha.

Major species : *C. catla*, *L. rohita*, *C. mrigala*, *Cyprinus carpio*, *Garra gotyla*, *O. mossambicus*, *Mystus cavasius*, *Puntius ticto*, *Channa marulius*, *C. punctatus*, *C. striatus*

Vothole : This reservoir is also located in Hassan district. This has a water spread area of 534 ha.

Major species : *C. catla*, *L. rohita*, *C. mrigala*, *C. carpio*, *O. mossambicus*, *Mystus cavasius*, *Puntius ticto*, *Channa marulius*, *C. punctatus*, *C. striatus*, *Ompok bimaculatus*

Kanwa : This reservoir is also located in Bangalore (rural) district. This has a water spread area of 440 ha.

Biotic communities

Plankton : Plankton population was observed to be very poor in the reservoirs surveyed and varied between 12 to 80 u/l. *Cyclops*, *Diaptomus* & *Brachionus* in zooplankton and *Pediastrum*, *Gomphonema*, *Hormidium*, *Synedra* and *Ceratium* in phytoplankton were recorded in order of their abundance.

Periphytic population was mainly dominated by diatoms. The main benthic forms were *Gyraulax convexisculus*, *Bellamaya crassa* and *Lymnea accuminata*.

Some reservoirs like *Yagachi*, *Jampadahalla* and *Bethmangala* were observed to be infested with aquatic weeds like *Hydrilla* and *Potamogeton*.



Sub Project 3 : Ecology and Fisheries of Mettur Reservoir in Tamil Nadu.

Hydrology : Due to drought conditions prevailing in the catchment area of the Cauvery basin, the inflow to the reservoir was very low affecting the reservoir level. As against the maximum depth of 36.4 m, the reservoir level was ranging from 8.5 m to 21.9 m in the lentic zone. While the daily inflow ranged from 394 to 7332 cusecs, the outflow ranged from 804 to 11435 cusecs.

Soil quality : Soil samples collected from lentic, intermediate and lotic zones in Mettur reservoir were in alkaline nature irrespective of the seasons registering pH in the range of 7.41 to 8.09. The electrical conductivity measured very low values (0.074 to 0.101 mmhos cm^{-1}). Hundred grams of soil contained 28.21 to 31.08 mg of available nitrogen. The available phosphorous was also low which varied from 0.167 to 0.875 mg 100 g^{-1} of soil.

Water quality : The surface temperature of water was high during May 2003 (31.7 $^{\circ}\text{C}$) and low (26.7 $^{\circ}\text{C}$) in January 2004. Seechi depth measured 82.8, 85.5 and 53.0 centimeters at lentic, intermediate and lotic zones respectively. Surface water at lentic, intermediate and lotic zone contained an average Dissolved Oxygen of 7.01, 7.55 and 6.13 mg l^{-1} respectively. D.O. showed a distinct decline in their level as the depth in the lentic and intermediate zone decrease. Oxycline was prominent in certain months (May, June, January and February) and they were feeble during other months. The D.O. in bottom waters depleted to 0.45 mg l^{-1} (lentic) in February 2004 and to 5.4 mg l^{-1} during May 2003. Specific conductivity of the reservoir water ranged between 205.0 and 363.0 mhos cm^{-1} . Methyl Orange alkalinities were estimated as 206.5, 209.0 and 219.7 mg l^{-1} at the surface, middle and bottom layer in the lentic zone. In the intermediate zone also similar values were recorded with negligible difference. At lotic zone the acid neutralizing capacity was 191.10 mg l^{-1} while at bottom water it was 256.94 mg l^{-1} . Carbonate

alkalinity was ranging between 17.04 mg l^{-1} and 20.29 mg l^{-1} and the differences in carbonate alkalinity values between different layers were minimal. At lotic zone the bicarbonate alkalinity was low at surface (17.04 mg l^{-1}) compared to that of bottom (25.14 mg l^{-1}).

Nutrients : The entire survey period showed that the PO₄- P content was only in traces whereas the NO₃ N content was also low ranging between 0.088 and 0.277 mg l^{-1} . Silicate content recorded 4.66 to 6.9 mg l^{-1} .

Plankton : In general the plankton population was very low in this reservoir. Among the phytoplankton myxophyceae were the dominant one in all the months. The zooplankton was mainly contributed by protozoans and copepods. Species of *Microcystis*, *Spirulina*, and *Nostoc* shared the maximum proportion of the myxophyceae family. Whereas, *Arcella* sp., *Centraphyxis* sp., Amoeba and *Paramaecium* sp., represented the protozoans.

Benthic fauna : Bottom fauna in Mettur reservoir varied from a low of 825 nos. m^{-2} in September to a high of 31450 nos. m^{-2} in April. Chironomid larvae contributed the bulk of the benthic fauna in all the months except during September followed by *Bellamyia bengalensis* and the earth worms.

Primary production : The gross production of carbon was estimated to be 179.3, 137.6 and 138.6 $\text{mgC m}^{-3} \text{hr}^{-1}$ at surface, 1m and 2 m depths of lentic zone respectively. Net carbon synthesis was 158.9, 78.5 and 79.8 while respiration was 76.3, 77.8 and 110.5 $\text{mgC m}^{-3} \text{hr}^{-1}$. In intermediate zone the carbon synthesis was 198, 145 and 115.5 $\text{mgC m}^{-3} \text{hr}^{-1}$ and net production was 96.5, 88.1 and 67.9 $\text{mgC m}^{-3} \text{hr}^{-1}$ respectively. In lotic zones gross production at surface layer was high 148.5 $\text{mgC m}^{-3} \text{hr}^{-1}$ compared



to the 1m ($99.9 \text{ mgC m}^{-3} \text{ hr}^{-1}$) and 2m ($27.7 \text{ mgC m}^{-3} \text{ hr}^{-1}$) depths.

Fish yield : The licensed fishermen do fishing and daily fish catch was acquired by the Fishermen cooperative Society. Fish catch was segregated into four groups primarily depending upon the weight of the fish and groupwise their rates are fixed. The first group comprised Catla, Mrigal and Rohu. *Wallago attu*, weighing more than 1 kg, *Notopterus notopterus* of more than 200 gm. *Mystus spp*, eels, *Etroplus spp*,

Puntius sarana are some of the fishes fall under group II. Group I fishes are caught more to the tune of 7801.150 kg during the month of August followed by 3958.100 kg in July and 3791.850 kg in June. During July 2003, the total catch registered to 14223.800 kg followed by 13309.250 kg in August 2003. Group II and III also contributed significantly to the total catch. Group IV fishes are less represented in the total catch ranging monthly landings of 5.300 to 42.900 kg.

Sub Project 4 : Monitoring of fish catch, recruitment and effort in selected reservoirs of Andhra Pradesh

Wyra reservoir: During 2003-2004, an estimated catch of 126.5 tonnes of fishes and prawns were recorded from Wyra reservoir with a CPUE of 4.59 kg. The landing has reduced by 32.9 % when compared to the previous year (188.5 tonnes). The fishing was confined to July – October 2003. The bulk of the landings were observed during July - August with

maximum landings in August (54 tonnes). The lowest catch was recorded in October (15.1 tonnes). *Labeo rohita* dominated the catch forming 22.02 % of the total catch followed by *Catla catla* (18.51 %), *E. suratensis* (9.41%), *N. notopterus* (8.54 %), *Glossogobius giuris* (7.73%), *Macrobrachium malcolmsonii* (7.15 %) and other miscellaneous groups.





PROJECT : RS/A/3

ECO-STATUS AND PRODUCTION POTENTIAL OF SELECTED RESERVOIRS OF UTTAR PRADESH

Personnel : Scientific :

A.K. Laal, R.S. Panwar, H.P. Singh, R.N. Seth, R.K. Tyagi, B.K. Singh, P.N. Jaitly, R.S. Srivastava, D. Karunakaran

Technical :

B.D. Saroj, S.K. Srivastava, J.P. Mishra, K. Srivastava

Duration : May 2002-March 2005

Location : Allahabad

Dhandhraul Reservoir

Soil

The percentage of sand, silt and clay was 57-58, 24-25 and 18.0 respectively. Alkaline in nature (7.41-7.74) it had specific conductivity (68.0-142.0 $\mu\text{mhos cm}^{-1}$) and organic carbon (0.28-0.65%).

Water

Temperature was highest (29.5 °C) in June and lowest in December (21.0 °C). D.O. was moderately high (7.1-10.1 mg l^{-1}). Total alkalinity and hardness were moderate (46.5-61.0 mg l^{-1}) and (36.0-56.0 mg l^{-1}). Dissolved organic matter was moderately high (1.5-2.06 mg l^{-1}) and silicate was low (2.3-3.55 mg l^{-1}). Nutrients range were phosphate (0.034-0.05 mg l^{-1}) and nitrate (0.05-0.056 mg l^{-1}).

In this reservoir, gross production ranged from 459.36 to 637.8 $\text{mg C m}^{-3} \text{ day}^{-1}$ whereas net was only 177.88 to 281 $\text{mg C m}^{-3} \text{ day}^{-1}$. The respiration was 225.0 to 561 $\text{mg C m}^{-3} \text{ day}^{-1}$.

Plankton

Phytoplankton population ranged between 200 ul^{-1} (summer) and 625 ul^{-1} (March) and zooplankton 15.7%. It is a medium productive reservoir.

Periphyton

The periphytic population recorded at Dhandhraul ranged between 470 (June) and 1210 (March) Ucm^{-2} . The highest density was recorded during summer and lowest during monsoon in their seasonal distribution. The periphytic community showed wider biodiversity which was dominated by Diatom followed by blue green and green algae; *Synedra*, *Navicula*, *Gyrosigma*, *Tabellaria*, *Ankistrodesmus*, *Cosmarium*, *Oscillatoria* and *Anabaena* were the important algal genera.

Benthos

The population ranged between 220 nm^{-2} to 836 nm^{-2} (Av. 594 nm^{-2}). The mollusc population (44.4%) dominated over dipteran (38.9%), annelida (10.3%) and insect larvae.



Hinauti reservoir

Soil

Bed was sandy loam and the portion which are not covered is used for agricultural purpose. The soil pH was towards alkaline side (7.33-7.49). Calcium carbonate was low 90.63-2.5%, Nutrients status was moderately low. Organic carbon was low (0.35-0.43%).

Water

Water temperature ranged between 24.0 and 29.0 °C and D.O. was very high (9.31-11.76 mg l^{-1}) and it was moderate in June (5.55 mg l^{-1}). Total alkalinity was observed in the range of 47.0 to 144.0 mg l^{-1} , dissolved organic matter (1.35-3.18 mg l^{-1}) were in the range of moderate to high. The reservoir also showed the highest conductance in March (352.0 μ mhos cm^{-1}), total alkalinity (144.0 mg l^{-1}) and hardness (130.0 mg l^{-1}).

GPP ranged between 600 and 656.16 mgC $m^{-3} day^{-1}$ and net production varied from 187.44 to 459.36 mgC $m^{-3} day^{-1}$. Respiration was in the range of 225.0 to 561.6 mgC $m^{-3} day^{-1}$.

Plankton

Phytoplankton ranged between 70 ul^{-1} (summer) and 665 ul^{-1} (winter) and zooplankton population ranged between 30 ul^{-1} (monsoon) and 145 ul^{-1} (winter).

Periphyton

The periphytic population recorded at Hinauti ranged between 85 (June) and 1565 (March) U cm^{-2} . Bacillariophyceae 82.3% was the dominant form followed by Chlorophyceae 16.0% and Myxophyceae 1.7%.

Benthos

The numerical abundance of macrobenthic organism ranged from 308 nm^{-2} to 858 nm^{-2} (Av. 644 nm^{-2}).

The contribution of different groups revealed that dipteran larvae (chironomus) was maximum (49.6%) followed by gastropoda (17.0%) and annelida (14.6%).

Tanda reservoir

Soil

Soil was sandy loam in nature. Soil was alkaline showing pH value in the range of 7.24 to 7.63. Free CaCo₃ was very low (0.50-2.88%). Available N and P were low.

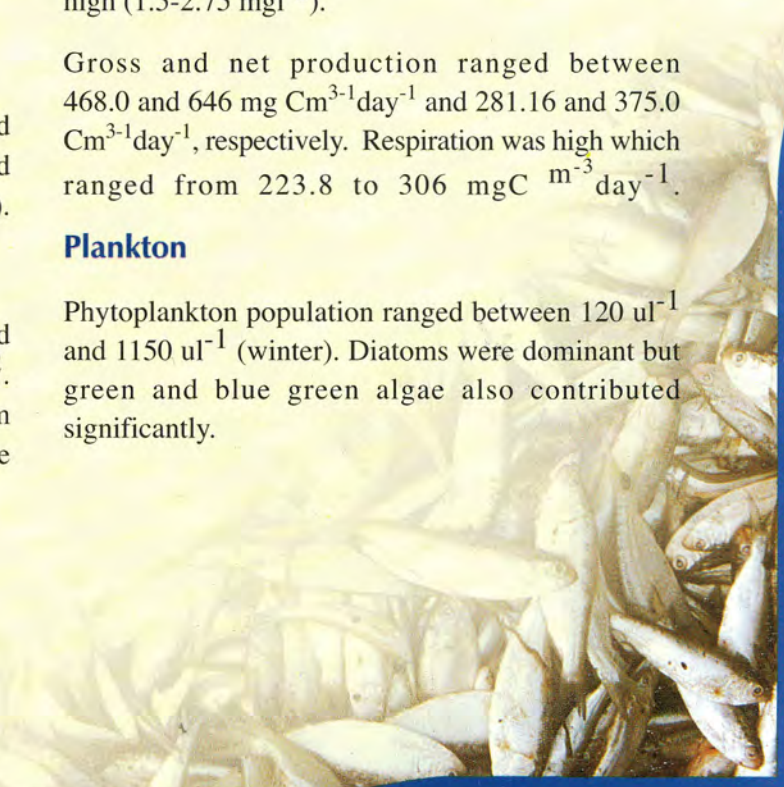
Water

Water temperature showed seasonal variation which ranged from 22.0 to 29.0 °C and it was quite transparent except in June. D.O. was moderately high (6.3-10.4 mg l^{-1}) and CO₂ was absent. Total alkalinity was moderately good (56.5-78.5 mg l^{-1}). Specific conductivity was observed in the range of 1300150.5 umhos/cm. Silicate (1.8-3.65 mg l^{-1}), phosphate (0.02-0.4 mg l^{-1}) and nitrate 0.035-0.046 mg l^{-1}) were low whereas dissolved organic matter was moderately high (1.5-2.75 mg l^{-1}).

Gross and net production ranged between 468.0 and 646 mg C $m^{-3} day^{-1}$ and 281.16 and 375.0 $m^{-3} day^{-1}$, respectively. Respiration was high which ranged from 223.8 to 306 mgC $m^{-3} day^{-1}$.

Plankton

Phytoplankton population ranged between 120 ul^{-1} and 1150 ul^{-1} (winter). Diatoms were dominant but green and blue green algae also contributed significantly.





Periphyton

The periphytic assemblage recorded between 120 (June) and 805 (March) Ucm^{-2} being highest during summer and lowest during monsoon. As usual Diatom was the dominant group. Dominance of *Synedra*, *Navicula*, *Cymbella*, *Gomphonema*, *Scenedesmus*, *Cosmarium*, *Phormidium* and *Merismopedia* as algal genus present in all seasons.

Benthos

Benthic population recorded between 132 nm^{-2} during monsoon and 2222 nm^{-2} in post monsoon (Av. 1089 nm^{-2}). The composition of different groups revealed that gastropods (39.9%) was maximum followed by dipteran larvae (25.9%) and insect larvae (13.55). The crustaceans (16.1%) were recorded during monsoon season. The dominant benthic genera comprised of *Bellamyia bengalensis*, *Pila globosa*, *Gyraulus sp.*, *Chironomus sp.*, *Belostoma sp.*, *Culicoides*, *tabanus*, *Notonecta* and *Nois*.

Chandraprabha reservoir

Soil

Soil was sandy loam in nature showing 55 to 65% sand, 22.5 to 29% silt and 12.5 to 16.0% clay. The sediment was alkaline (7.18-7.50). Nutrient was low. It is observed from the data the value of pH, free $CaCO_3$ organic matter, available nutrients were low in December as compared to June which may be due to shrinkage of water area in summer thereby showing an increase.

Water

Water temperature varied between 21.5 and 28.0 °C. The water was turbid in June and September and transparent in rest of the month. Water was alkaline reflecting pH value in the range of 7.5 to 8.2. Free CO_2 was present in June and December and absent in other months of observation. Total alkalinity was

low (30.0 mgL^{-1}) in June and high in March (63.0 mgL^{-1}). The amount of chloride (13.25-19.5 mgL^{-1}), hardness (34.0-62.0 mgL^{-1}), silicate (2.1-3.6 mgL^{-1}), phosphate 0.03-0.08 mgL^{-1}) and nitrate (0.04-0.086 mgL^{-1}) were low whereas dissolved organic matter was moderate (1.45-2.9 mgL^{-1}).

Gross and net primary production fluctuated between 271.8 and 468.72 $mgC m^{-3} day^{-1}$ and 103.08 and 281.16 $mgC m^{-3} day^{-1}$, respectively. Respiration ranged from 202.44 to 225.0 $mgC m^{-3} day^{-1}$.

Plankton

Phytoplankton population ranged between 505 ul^{-1} (monsoon) and 660 ul^{-1} (March). Phytoplankton percentage contribution was 94.4% with dominance of diatoms in all seasons and blue green algae were present only in monsoon. Zooplankton population contribution was only 5.3%.

Periphyton

The periphytic density ranged between 95 (June) and 1925 (March) Ucm^{-2} being highest during summer and lowest monsoon. Members of Bacillariophyceae was dominant followed by Chlorophyceae and Myxophyceae and their percentage wise composition was 77.0, 17.3 and 5.7 respectively. The dominant genera were *Navicula*, *Synedra*, *Gomphonema*, *Tabellaria*, *Ankistrodesmus*, *Protococcus*, *Cosmarium*, *Oscillatoria* and *Anabaena*.

Benthos

The benthic density was poor during monsoon and winter month and ranged between 220 nm^{-2} to 1320 nm^{-2} the populations dominated by dipteran larvae (66.0%) followed by gastropoda (26.6%) and anelida (6.5%).



PROJECT : RS/A/4

ECOLOGY AND FISHERIES OF SMALL RESERVOIRS OF RAJASTHAN

Personnel : *Scientific :*

D.K. Kaushal (up to 5.10.2003), V.K. Sharma

Technical :

C. Lakra, Sushil Kumar, Kuldeep Singh

Duration : *April 2002-March 2005*

Location : *Karnal*

Ecological investigations on rapid survey basis of two small reservoirs namely Urmila Sagar and Jaggar reservoir were conducted during 2003-2004.

The ecological investigations with major thrust on the evaluation of production potential of two small reservoirs viz. Urmila Sagar (500 ha) in Dholpur district and Jaggar reservoir (936.87 ha) in Karauli district of Rajasthan were conducted on seasonal basis.

These reservoirs were constructed mainly for flood control measures and irrigation purposes and are surrounded by the Aravali ranges.

Soil and Water quality

Both these impoundments are shallow in nature, the mean depth varies from 3.20 m (Urmila Sagar) to 4.30 m (Jaggar reservoir). The basin soil is sandy to loamy in both these reservoirs with pH range of 7.4-7.9.

The organic carbon was in moderate range varying between 0.35% (Urmila Sagar) and 0.29% (Jaggar reservoir). The available phosphorus was moderate.

The water was slightly alkaline 7.67-7.82. Total alkalinity was 121.0 mg/l (Urmila Sagar) and 116.34 mg/l (Jaggar reservoir). The productive status of these impoundments is also evident from values of electric conductance 294 μmhoscm^{-1} (Urmila Sagar) and 318.34 μmhoscm^{-1} (Jaggar reservoir).

Biotic communities

Plankton : The observations on the planktonic biomass and its composition are presented in Table. The density of plankton was lowest 1007 u/l in Jaggar reservoir while it was maximum 2443 u/l in Urmila Sagar. Phytoplankton were dominant in both these reservoirs with 76.08 in Urmila Sagar and 51.21% in Jaggar reservoir.



Percentage composition of plankton in small reservoirs of Rajasthan

Reservoir Period	Total (u/l)	Urmila Sagar						Total (u/l)	Jaggar Reservoir					
		CH	MY	BA	DI	RO	CO		CH	MY	BA	DI	RO	CO
Pre-Monsoon	4136	7.5	19.8	66.5	-	4.4	1.8	1104	15.5	1.4	19.8	19.0	26.80	22.5
Post-Monsoon	2263	17.47	42.16	14.45	-	6.02	19.90	1020	7.27	15.45	21.81	1.01	18.18	35.45
Winter	930	15.87	-	26.98	17.46	20.63	19.05	898	18.5	1.85	25.92	11.11	1.85	40.74
Average	2443	13.61	20.65	35.98	5.82	10.35	13.58	1007	13.76	6.23	22.51	8.71	15.61	32.89

Periphyton : The mean periphytic population varied from 3739 in Urmila Sagar to 4241 u/cm² in Jaggar reservoir. Bacillariophyceae formed 40.85% in Urmila Sagar and 69.86% in Jaggar reservoir.

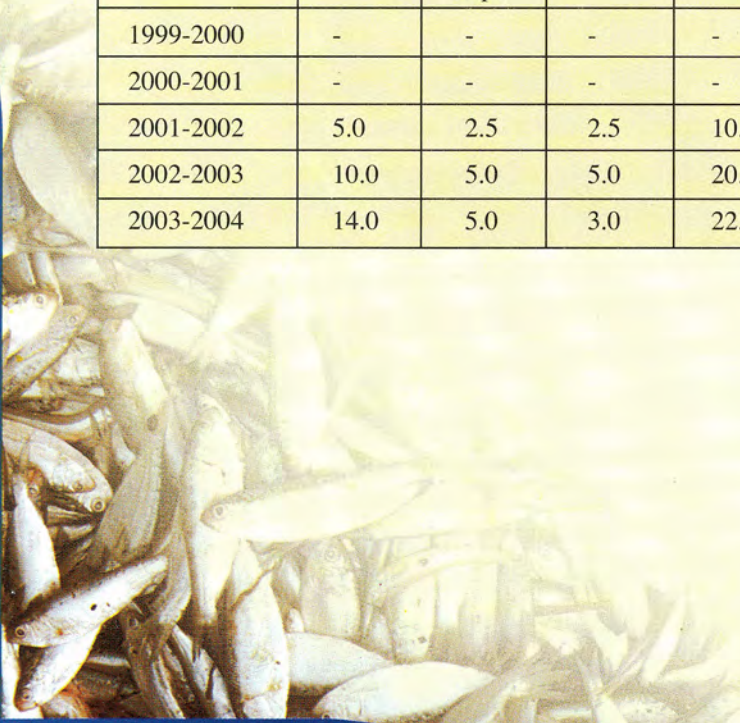
Macrobenthos : The standing crop of benthic organisms was maximum in Urmila Sagar with 2617 organisms/m² being maximum during post-monsoon 3050 No./m² and least in summer being 1850 nos./m². Jaggar reservoir was poor in benthic organisms barring an average of 983 nos./m². Winter showed maximum population of benthos being 2150 nos./m².

Fishery

The fish yield for the period April 2003-March 2004 was maximum for Urmila Sagar 44 kg ha⁻¹ while least for Jaggar reservoir 26.73 kg ha⁻¹. Indian major carps dominated the catch in both the reservoirs during 2003-2004 (Table 2). The productive potential is projected for Urmila Sagar reservoir at 220 kg ha⁻¹ and for Jaggar reservoir 225 kg ha⁻¹. These reservoirs are categorized as medium productive reservoirs where in stocking of Indian major carps @ 500 fingerlings ha⁻¹ is suggested.

Catch composition of fish from small reservoirs of Rajasthan (t)

Reservoir Variety/year	Urmila Sagar				Jaggar reservoir			
	IMC	Minor carps	Others	Total	IMC	Minor carps	Others	Total
1999-2000	-	-	-	-	42.42	8.87	23.81	75.11
2000-2001	-	-	-	-	21.40	3.99	7.21	32.60
2001-2002	5.0	2.5	2.5	10.0	11.20	0.70	1.00	12.91
2002-2003	10.0	5.0	5.0	20.0	57.25	12.10	15.5	84.85
2003-2004	14.0	5.0	3.0	22.0	15.17	6.81	3.05	25.03





PROJECT:FW/A/7

DEVELOPMENT OF ECO-FRIENDLY MANAGEMENT NORMS FOR ENHANCING FISH PRODUCTION IN FLOODPLAIN WETLANDS OF INDIA IN RELATION TO THEIR RESOURCE CHARACTERISTICS

Sub-project : 1 Guwahati, Assam
2 Barrackpore, West Bengal

Personnel : Scientific :

V.V. Sugunan (up to 9.6.2003), P.K. Saha (upto 5.8.2003),
M. Choudhury, N.P. Srivastava, A. Hajra, M.A. Hassan,
B.K. Bhattacharjee, Md. Aftabuddin, N. K. Barik, R.K. Manna,
G.K. Vinci, K. Mitra, M.K. Bandopadhyay, P.K. Katiha, V.R. Suresh, Utpal Bhaumik

Technical :

Alok Sarkar, Sukumar Saha, K.K. Sarma, N.N. Majumder, D.K. Biswas,
A. Mitra, S. Saha, B. Naskar

Duration : April 2002-March 2007

Location : Guwahati, Assam
Barrackpore, West Bengal

Sub Project - 1 Assam Centre

Stock enhancement

Impact of stock enhancement in the form of supplementary stocking in two beels viz. Samaguri (open) and Haribhanga (closed) was monitored in 2003-04. Haribhanga is stocked regularly with seed of major Indian and exotic carps, whereas, supplementary stocking in Samaguri beel is irregular and done only during post-monsoon. In Haribhanga, larger part of the catch (58%) is contributed by stocked species (catla, rohu, mrigal, silver and grass carp). Even in Samaguri, an open beel receiving considerable natural fish stocks, a sizeable part of the landings (47%) was contributed by stocked species (rohu, mrigal and catla).

Cage culture

A battery of 8 cages each in three different beels, viz., 46-Morakolong and Damal beels in Morigaon district and Samaguri beel in Nagaon district of Assam were installed for fish seed rearing during 2003-04. Fry could be grown to fingerling size in just two months.

In two months, fry attained a length of more than 10 cm and weight of 12-28 g, which is the ideal size for stocking in beels. High stocking density @ 30 fry/m² were maintained and were fed with traditional feed mixture of mustard oil cake and rice bran (1:1) fortified with vitamin and mineral premix. Wheat flour was used as binder. Survival ranged from 68 to 77%. Rearing of less than four months resulted preferred size range (50-100 g) of fish. The highest growth rate



was observed in case of *Labeo gonius* followed by *Cirrhinus mrigala*. However, *Labeo rohita* and *L. calbasu* registered comparable growth. On the other hand, *Catla catla* performed poorly in cages. During post monsoon, same cage was utilized for table fish production using carry-over seeds till the availability of fish fry during next April. It was observed that, compared to monsoon months, fish grew slowly but attained advanced fingerling size in two months. *Puntius gonionotus* registered the highest growth followed by *Hypophthalmichthys molitrix*, *Labeo gonius* and *L. calbasu*. Compared to these fishes, the growth



Fishes reared in cages installed in beels of Assam



of major carps was slower.

Ornamental fish

A total of 30 potential indigenous ornamental fish species collected from Dikhu river, Dimapur, Nagaland;



Khamti beel and Dibru river in Tinsukia district and Kulshi river (including Bildora beel) in Kamrup district of Assam were identified and catalogued. This included the following ten potential species (six have export value) recorded during the year : *Chaca chaca*, *Glyptothorax cavia*, *Mystus tengara*, *Wallago attu*, *Clarias batrachus*, *Pangio pangio*, *Puntius gelius*, *Ompok pabo*, *Gagata cenia* and *Chandramara chandramara*. A number of indigenous ornamental fish species were acclimatized in cement cisterns and reared in glass aquarium.

Economic study

To determine optimum size of harvest, prices available at beel for disposal was considered. Prices vary with species, sizes, and seasons. Advanced fingerling size IMC fetches wholesale prices of Rs. 35-45 per kg, whereas exotic carps don't get proper market value at this size. Price range for IMC and catfishes between 200-500 g is Rs.45 to 70. Among management levels, there is an increase in beel productivity with increase in management levels, the highest with restoring connectivity.

Survey of pats in Manipur

A survey pertaining to ecology and fisheries of two new pats of Manipur – Ikop Pat and Kharung Pat was conducted during 2003-04. Both the beels are large, open and weed choked. The morpho-ecological characteristics revealed that these pats are gradually turning into swamps with human interference and



encroachment. Small ponds and agricultural farms are being created in these wetlands. Only during peak monsoon, the pats get sufficient water. Soil texture in both the pats was predominantly sandy (93-95%) in nature. Soil was acidic, organic C (%) ranged between 1.40-1.55, PO₄-P between 1.40-1.56 mg kg⁻¹. Depth of both the pats was 1-2 m. pH ranged from 7.4-7.9. High dissolved oxygen and moderate total alkalinity values were contributed by dominant submerged macrophytes. Available NO₃-N (mg l⁻¹) in Ikop pat (0.39-0.46) is higher in both the seasons as compared to Kharung pat (0.04-0.05). Available phosphate content is always low. Low BOD values (1.5-3.3 mg l⁻¹) may be attributed to cleaner environment caused by submerged macrophytes. Autotrophic planktonic primary productivity is much lower as compared to macrophyte productivity as evidenced by Gross Primary Production (GPP) and Net Primary Production (NPP) values. Lower density of biotic communities excepting macrophytes was observed in both the beels. Plankton (20-48 ul⁻¹) was poor in both beels. Zooplankton was dominant indicating the prominence of detritus food chain in these beels. Macro-benthic population ranged from 81 to 205 org. m⁻². Periphyton was poor in both the beels. Macrophyte biomass on wet weight basis varied from 3.5 to 6.0 kg m⁻² with peak infestation in summer. During monsoon, around 250-300 fishermen practice capture fisheries using different gears. Dug out canoe and a few small boats are fishing crafts. Period between November-January is peak fishing season and fishers catch an average of 5 kg fish during this period spending 8-10 hrs a day. Drastic shrinkage of water during post-winter reduced the number of fishermen with very low average catch of 1-2 kg. Catfishes, exotic carps, major carps, minnows and murrels represented the fishery of these pats.

Biochemical composition

Proximate biochemical composition and nutritive value of fishes from Brahmaputra and beels of Assam were assessed. Moisture content, protein, lipid (fat), minerals and carbohydrate of 22 fishes were

determined in 2003-04. Moisture contents varied from 70.5 to 79.0%, excepting a low percentage of 55.0 as recorded in *Tenulosa ilisha*. Protein content ranged from 15.0 to 20.5% on a fresh weight basis. Lipid contents varied between 0.5-9.0% except in hilsa having a very high fat content (19.0%). *Barbus sarana* (Sarputi) showed the second highest lipid content (9.0%). The mineral contents were recorded in the range 1.5-3.5%. Carbohydrate levels were low (1.0 to 5.5%).

Fish catch

Total fish landing at Uzanbazar fish assembly centre of Brahmaputra River was estimated at 544.8 tonnes as compared to 954.2 tonnes during the corresponding period of the previous year thereby showing 42.9% decline in the catch. Bulk of the landings was recorded during July-October mainly consisting of juveniles (60-80%). Decline in the catch may be attributed to the ban imposed by the Govt. of Assam on juvenile fishing during June-August, which is evident from the fact that catch during July-October substantially reduced from 78.48% in 2002-03 to 67.05% in the corresponding period of the current year. Minor carps (38.32%) dominated the catch followed by miscellaneous group (33.89%), major carps (22.42%), catfishes (3.38%), Hilsa (1.41%) and featherbacks (0.58%). Length-weight relationship of Indian major carps was also attempted.

Sub-Project - 2 West Bengal Centre

During the period the fishing methods, species composition and fishery practices of two beels from Bihar and two beels from West Bengal have been studied. The species stocked constituted mainly Indian major carps and Chinese carps. Growth of Indian major carps (*Catla catla*, *Labeo rohita* and *Cirrhina mrigala*) from the Saguna beel in West Bengal was studied through observing their length and weight and establishing length weight relationship. The equations derived are :



Catla : Log W = 2.2911 Log L - 3.0783 (R² = 0.6437)

Rohu : Log W = 3.3168 Log L - 5.7803 (R² = 0.679)

Mrigal : Log W = 2.8174 Log L - 4.6459 (R² = 0.6789)

Cage culture

To raise stocking material for beels, cage rearing of early fingerlings up to the releasable size of 10 cm were tried in Kulia beel in West Bengal. The candidate species chosen for this was *Labeo gonius*. The target growth of 100 mm in nylon net cages have been achieved within 90 days with a survival of 64 to 82% and proved that stocking material of the species can be successfully raised in nylon net cages in beels.

Cataloging of ornamental fishes

A total of 23 species of fishes were catalogued in ornamental category from Muzaffarpur district of Bihar, of which eight belonged to Cyprinidae, four to Ambassidae, three to Belontiidae, two to Cobitidae and one each to Notopteridae, Bagridae, Siluridae, Sisoridae, Belontiidae, Tetradontidae.

Feeding habit and breeding of ornamental fishes

The food of *Puntius sophore* mainly consisted of phytoplankton, comprising Bacillariophyceae (49.19%), Chlorophyceae (28.84%), Myxophyceae (18.32%), zooplankton (2.91%) and insects (0.74%).

The dominant components of these were *Nitzschia*, *Navicula*, *Diatoma*, *Penium*, *Chlorella*, *Closterium*, *Ulothrix*, *Nostoc*, *Mycrocystis*, etc. The value of relative length of gut (RLG) ranged from 1.62-3.60 mm with an average of 2.5 mm indicating that the fish is an omnivore. There was no major change in this pattern from the results of previous year.

P. conchonius, popularly known as 'Rosy barb' was successfully bred under simulated natural environment

in laboratory aquaria. Two successful natural spawning (6.2.2004 and 12.2.2004) of the species have been achieved in the simulated laboratory aquarium (60 x 30 x 30 cm). The eggs hatched out within 48 hours.

The hatchlings were reared for a period of 28 days in the aquarium with filtered pond water and plankton as feed. On an average 145 fry (av. T. 1>18 mm) were obtained. The embryonic development was studied at different intervals.

The studies on the food and feeding, length weight relationship and reproductive biology of *A. mola* from Saguna beel was continued.

Ecology and fisheries of beels in Bihar

Studies on the fisheries and ecology of selected beels in Bihar have been continued this year also, which included hydrological parameters, soil parameters, plankton, and macrophytes and primary productivity from Motipur and Manika beels. Heavy metal content in these beels have also been studied. The average water temperature for the lakes was 28.7 °C (Manika) and 30.6 °C (Motipur). Depth was 4.15 and 4.25 m and transparency was 2.44 m and 2.18 m in Manika and Motipur beel respectively. Dissolved oxygen 2.87 and 2.39 mg l⁻¹, free CO₂ 5.0 and 2.5 mg l⁻¹, chloride content 12.96 mg l⁻¹ each in Manika and Motipur lake respectively. Water reaction in both the lakes was slightly alkaline. The total alkalinity in Manika and Motipur beel was 310 and 290 mg l⁻¹ respectively, indicating productive nature of both the lakes. Amongst dissolved nutrients, nitrate-N was moderate and phosphate-P was encountered to the tune of 0.022 and 0.030 mg l⁻¹ while silicate-Si was in substantial amounts in these two beels respectively.

Specific conductance, carbonate, bi-carbonate and hardness were also in moderate amount in both the lakes. Concentration of calcium was higher than that of magnesium in both the lakes. The soil of both the lakes (Manika and Motipur) was of sandy loam in nature with sand, silt and clay content (%) was 64.39,



31.62 and 3.99 in Monika and 78.99, 18.42 and 2.59 in Motipur maun respectively. The soil reaction was near neutral with slightly higher pH recorded in Monika (7.7) than in Motipur (7.5). Organic carbon and total nitrogen contents (%) in both the lakes were 1.47 and 4.12 and 0.13 and 0.303 in Manika and Motipur beel respectively. C/N ratio of Monika was higher (11.31) than in Motipur (13.6) indicating accelerated decomposition rate of bottom organic load in both the lakes. The heavy metal concentrations (mg l^{-1}) in water of both the beels were within permissible limit and the values were : Cu (0.006 and 0.007), Zn (0.026 and 0.016), Cd (0.0002 and 0.0005), lead (0.016 and 0.02), Na (21.85 and 21.73) and potassium (3.58 and 5.34). The gross production, net production and respiration ($\text{mg Cm}^{-3}\text{h}^{-1}$) were 93.00, 58.24 and 41.88 at Manika and 67.71, 41.67 and 31.25 at Motipur respectively. The infestation of macrophyte of both the beels were 80% during summer reaching to 100% during winter. Both the beels were dominated by submerged macrophytes like *Najas* and *Hydrilla* while in addition to these; *Nelumbo* (emergent) was also present in Motipur. Besides, *Potamogeton nodosus*, *Nymhpoides indicum*, *Lemna trisulca*, *Eichhornia crassipes*, *Ipomoea aquatica* and *Eleocharis sp.* the associated fauna represented by gastropods, insects, prawns, leaches arachnids etc. However, the population was dominated by gastropods (*Gyraulus convexiusculus* and *Gabia orcula*) followed by insects.

Socio-economic studies

Socio-economic and econometric studies were conducted in beels in Bihar and West Bengal. The institutional environment was better in West Bengal beels than those in Bihar, due to better awareness among fishers about their rights and welfare. The cooperative spirit was higher in West Bengal than Bihar. The fishers in Bihar were still dependent on the rich personnel (fishers or non-fishers) for overall

fisheries management and investments in the beels. The better yield in West Bengal beels was due to adoption of culture-based fisheries enhancements, particularly the stocking enhancements. The stocking rate was comparatively low in Bihar beels and they were dependent on private or government agencies for quality fish seed. In West Bengal, the fishers purchased the spawn/fry and reared them to advanced fingerlings in seed rearing ponds. Therefore, the quantity and quality of fish seed stocked was much better.

Sub Project - 3 Pen culture technology its adoption in beels

Pen and cage culture in Mathura beel

Field trials on pen and cage culture of prawns and carp were taken up in Mathura beel, 24 Parganas (North) district of West Bengal, during the period of this report.

Pen culture

The pen culture programme was designed to demonstrate the packages of practices step by step to the beneficiaries of the adopted beel to convince and motivate them towards adoption of the said technologies.

Prawn

Seeds of *Macrobrachium rosenbergii* weighing 6-8 g (40-50 mm) was stocked in a pen of 0.04 ha area, @ 25,000 ha⁻¹ density. The harvested size of prawn varied between 195 and 250 mm weighing 80 and 105 g respectively. A production of 675 kg ha⁻¹ was obtained in 130 days of culture period.

Carp

Fingerlings of Catla, Rohu and Mrigal were stocked at a density of 10,000 ha⁻¹ at a ratio of 40 : 30 : 30 weighing 40, 35 and 27 g respectively in a pen of 0.04



ha area. The fishes were fed with pelleted feed containing 30% protein @ 2% of the body weight per day. In 120 days of culture a crop of 550 kg fish was harvested. The growth of the fishes was between 375 and 750 g for Catla, 250 and 550 g for Rohu and 500 and 1000 g for Mrigal. This received appreciation from the Fishermen Cooperative Society in the beel.

Cage culture

The cage culture experiment was carried out using *Catla catla* and *Labeo rohita* as candidate species.

Cage 1 : Cage culture experiments were taken up in Mathura beel. Three cages of six cubic meter sizes were stocked with Indian major carps. The cage was stocked with 50 Catla (37.5 g av.), 40 Rohu (40 g av.) at a density of 15 m³-1. The fishes were fed with pelleted feed containing 30% protein. The production

obtained from the cages was 38 kg in 130 days. The growth of the fishes ranged between 400 g (280 mm) for Catla and 450 g (260 mm) for Rohu.

Cage 2 : The cage was stocked with 70 Catla (37.5 g av.) and 50 Rohu (40 g av.) fingerlings at a stocking density of 20 m⁻³. The fishes were fed on the same diet as in the previous experiment. The production within 130 days was 28.5 kg. The average growth of the fishes was 300 g (240 mm) for Catla and 150 g (180 mm) for Rohu.

Cage 3 : A cage was stocked with 70 Catla (37.5 g av.) and 70 Rohu (40 g av.) at a density of 23 m⁻³. The feeding regime was same as in previous experiment. A production of 28 kg was obtained in 130 days. Average growth of the fishes was 300 g (245 mm) for Catla and 100 g (170 mm) for Rohu.





PROJECT:FW/A/8

ECOLOGY AND BIODIVERSITY OF KAYAMKULAM LAKE

Personnel : Scientific :

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Technical :

C.K. Vava, Usha Unnithan

Duration : May 2002-March 2005

Location : Alappuzha, Kerala

Water & Sediment quality

The Kayamkulam lake.(Lat. 90 09 & 90 15' N Long. 760 02' & 760 28' E), is an important brackish water ecosystem on the south west coast of India.

The average depth of the lake varied from 0.32 m in AYT (M) to 4.49 m in the Choolatheru station (CHT) NTPC zone. The transparency values have further declined (average 1.10m) during the present study as compared to the previous year (1.13 m). The thermal plant zone (CHT) and the

adjacent station (PKU) were indicative of higher temperature reaching up to 30.64 0C. pH was on the alkaline side in all the study sites, except in Pulikkezhu (St. 7), where it was slightly acidic (6.72) in July – Aug 2003 period. The salinity regime of the lake fluctuated from 15.59 ppt in CHT to 26.75 ppt. in the marine zone, VHL. The salinity in the lake was mixo-mesohaline in nature. The dissolved oxygen was the lowest in CHT (av. 1.84 mg l⁻¹) and the highest in KCJ (av.5.26 mg l⁻¹), whereas the mean for the lake was 4.09 mg l⁻¹. This indicates that the dissolved oxygen concentration for the current study has declined as compared to the studies in 2002-03 period where 4.24 mg l⁻¹ was recorded. The total sulphide and BOD5 was highest in the thermal discharge zone, CHT with 5.45 mg l⁻¹ & 5.09 mg l⁻¹ respectively, whereas the average BOD5 for the lake was 3.93 mg l⁻¹ and that for COD was 45.13 mg l⁻¹. The intense retting activity as well as the impact from the thermal

plant at CHT may have led to the depletion in dissolved oxygen concentration with the concomitant rise in H₂S values. The nutrients represented by nitrate-nitrogen, phosphate-phosphorus were low, whereas the silicate-silicon values was comparatively higher in all the study zones.

The acidic sediment was a characteristic feature of all the stations in the present study except inVHL. The average for the lake as a whole was 6.32, which was lower than the previous period (2002-03), when an average of 6.88 was recorded. The thermal dissolved zone and the adjacent zones had highly acidic values (4.65-4.69). The impacted nature at St. 6 and adjacent regions due to CO₂ and H₂S, along with the depleting dissolved oxygen trend could be the reason for the acidic pH observed in the present study. The free CaCO₃ values were generally very low in all the zones as compared to the previous year in the same stations. The average for the lake was 2.52 %, whereas that for 2002-03 period was 12.93 %. The comparatively lower clam shell mining during the current period may have led to lower CaCO₃ in the sediment during the present study. The sediment organic carbon and available nitrogen was higher towards the northern stations due to the intense organic enrichment and loading due to thermal discharge and retting activity in the region. The sediment texture indicated that the fine sand fraction showed the highest mean percentage in the backwater followed by coarse sand, clay fraction, and silt.



Primary Production & Chlorophyll

The average gross primary production in the lake was $1.45 \text{ gC mgCm}^{-3}\text{day}^{-1}$ and the net productivity was $1.22 \text{ gC mgCm}^{-3}\text{day}^{-1}$ in the surface and bottom waters from the 7 stations during 2003-04. The mangrove zone (AYT- M) a shallow enclosed system with virtually very little tidal influx and the impact of thermal discharge in the NTPC zone (CHT) could have led to low productivity trends in these stations.

The mean chlorophyll a values varied from of 0.735 mgm^{-3} in AYT to 3.88 mg m^{-3} in KRJ and the average for the lake was 2.41 mg m^{-3} .

Biodiversity – Plankton, Benthos

The biomass of plankton was generally low in the seven stations of the Kayamkulam backwater. The phytoplankton population was composed of green algae (av. 7.96%), blue green algae (av. 13.20%), desmids (7.40%), diatoms (48.54%) and dinoflagellates (21.18) Green algae were dominated by *Microspora sp* (av. 4.87%) in all the zones followed by *Draparnaidia sp.*(1.05%). Desmids formed the biggest share of plankton in the lake contributed mainly by *Nitzschia sp.*, *Melosira sp.*, *Coscinodiscus sp.*, *Stepanodiscus sp.* and *Diatoma sp.*

The Kayamkulam lake was represented by 16 major groups of zooplankton from the 7 stations, of which the copepods were contributed by the calanoids, cyclopoids and harpacticoids. Rotifers contributed the highest mean incidence (44.43%), followed by the copepod nauplii (25.70%), protozoa (6.16%) and cyclopoid copepod (5.71%) through out the year in the lake. Nematoda, Polychaete larvae, Cladocera, Ostracoda, Insecta, Insect larvae, Gastropod larvae, Fish larvae and Medusa also contributed to the zooplankton biomass during the present investigation. Rotifers were represented by 16 species in the present study.

The benthic fauna were formed of 12 groups, dominated by polychaetes (29.06%) followed by Gastropoda (24 %), Oligochaeta (21.39%), Bivalvia (12.55%) and Amphipoda (7.09%). Ploychaetes

forming the biggest component of the benthos were represented by 31 species, from 12 families, having the peak biomass in KCJ (750 no. m^2 -1) and the minimum in AYT (M) (122 no. m^2 -1). Amphipods formed a dominant group in six of the stations whereas tanaeids were present in two stations

Fishery Landings, Catch composition, Effort and CPUE.

From the survey undertaken, seventy five species of fishes, eight species of prawns two species of crabs and six species of clams, contributed to the fishery of Kayamkulam lake during the Feb 2003-04 period. *Etroplus sp* represented by *E.surentensis*, and *E.maculates*, contributed to the highest landings (123.02 t & 25.16%), followed by Mulletts (*Liza spp*, *Valamugil spp.*) with landings of 120.43 t (6.67%) and *Ambassis sp* by *A.commersoni*, *A.nama* having 117.75 t & 5.5%. The annual total for the Kayamkulam lake and crabs accounted to about 1110.31 t. Studies by CIFRI in the same lake during 1997-99 and 2000-02 reported a total landings of 1647.9 t and 2478.75 t respectively. The total catch obtained during the present study was lower, when compared to the earlier studies by CIFRI. Bivalves mainly contributed by the clams formed a major commercial fishery in the lake. They were represented by 6 species viz. *Crassostrea madrasensis* (18.87%) *Marsia opima* (13.86%), *Meretrix casta* (34.03%), *Paphia malabarica* (3.93%) and *Villorita cyprinoids* (22.35%). *Meretrix casta* formed the biggest share of clams contributing to 46.88 t during the present study. The total landings of all the bivalve species accounted to 137.78 t in the Kayamkulam lake for the period 2003-04. Gear wise analysis indicated that the seine net contributed the maximum catch (698.97t) followed by the gill net (219.16t), stake net (75.48t), cast net (46.89 t) and dip net (38.80 t). The CPUE exhibited wide fluctuations between the different gears for fishes and prawns during the present study. The high CPUE for seine net (16.99) was due to the indiscriminate fishing with fine meshes of the gear harvesting the juveniles of prawn and fishes.



PROJECT: FW/A/9

ASSESSMENT OF ECOLOGICAL STATUS AND ENERGY DYNAMICS OF FLOODPLAIN WETLANDS IN CENTRAL AND WESTERN UTTAR PRADESH

Personnel : Scientific :

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Technical :

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Duration : May 2002-March 2005

Location : Allahabad, U.P.

Jheels of different districts of central U.P. were extensively surveyed and four jheels namely Mawai (16.22 ha), Akhnai (80.11 ha), Rampur Narvi (43.60 ha) and Itaily (105.18 ha) located in Banda, Fatehpur, Kanpur Nagar and Kanpur Dehat districts, respectively were finally selected for research studies under the project during 2003-04.

These jheels are shallow in nature, as their maximum depth during post-monsoon do not exceeds from 10-12 feet. All the jheels are infested with macrophytes and specially Akanai jheel at Fatehpur district is almost completely choked with water hyacinth (*Eichornia* sp.). Source of recharging of water in jheels is rain water from catchment areas. During monsoon overflowing water of Mawai jheel oftenly being discharged to river Ken through small drainage. Likewise during monsoon Rampur Narvi jheel develops connection with irrigation canal. Itaily jheel of Kanpur Dehat during over flooded condition in monsoon, discharges water to river Rind through nala and thus jheel gets auto stocking of fishes from the river.

Soil Quality

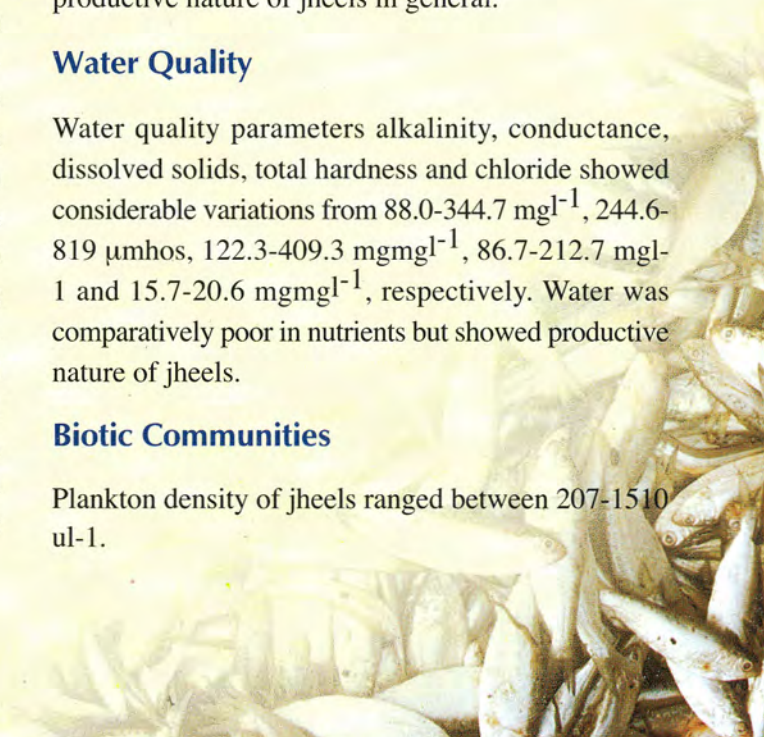
Sediment of all the four jheels was near neutral to alkaline in reactions (pH 6.53-6.76), moderately rich in organic carbon (1.54-2.03%) and available nutrients (nitrogen 32.7 to 55.27 mg 100g⁻¹) and phosphorus (4.5-11.6 mg 100g⁻¹). Sediment quality reflects productive nature of jheels in general.

Water Quality

Water quality parameters alkalinity, conductance, dissolved solids, total hardness and chloride showed considerable variations from 88.0-344.7 mg l⁻¹, 244.6-819 µmhos, 122.3-409.3 mg mg l⁻¹, 86.7-212.7 mg l⁻¹ and 15.7-20.6 mg mg l⁻¹, respectively. Water was comparatively poor in nutrients but showed productive nature of jheels.

Biotic Communities

Plankton density of jheels ranged between 207-1510 ul⁻¹.





Benthic communities varied from 88-6456 nm². Periphyton density of jheels ranged from 679-2482 ucm⁻².

The abundance of associated flora and fauna of jheels were in the range of 2140-17220 and 101-532 ucm²⁻¹, respectively.

Jheels were infested with macrophytes (40-90%) and the biomass ranged from 0.19 Kg m⁻³ to 145.62 Kg m⁻³ (Wet weight).

Primary Productivity

Gross and net primary production of jheels ranged from 410.9 to 1031.2 mgCm⁻²d⁻¹ and 258.7 to 718

mgCm⁻²d⁻¹, respectively and almost 62.5 to 71.5% of gross production was assimilated by phytoplankton.

Jheels were very rich in detritus energy 10.8 x 10⁴ to 18.6 x 10⁴ Cal m²⁻¹.

Fishery

Poor fish yield ranging from 31-476 Kg ha⁻¹yr⁻¹ has been obtained from jheels which may be enhanced upto a level of 1 ton ha⁻¹yr⁻¹ through judicious stocking management and control on infestations of macrophytes. Important production constraints of jheels were weed infestation, lack of judicious stocking support and improper leasing policy.





PROJECT : HE/B/1

HOLISTIC ASSESSMENT OF HEALTH AND RELATED BIOLOGICAL ASPECTS OF FISH AND INLAND AQUATIC ECOSYSTEMS

- Sub Project (a) :** Standardization of bioindicators in selected aquatic ecosystems for environmental impact assessment
- Sub Project (b) :** Studies on the clinical pathology of stress and some major disease of fish for establishing disease diagnostic standards
- Sub Project (c) :** Development of immunological and molecular techniques for rapid diagnosis of bacterial and viral diseases of fish and shell fish
- Sub-Project (d) :** Genetic Characterization and migration related biochemical changes of Indian shad, *Tenulosa ilisha*
- Personnel :**
- Scientific :*
Manas Kr. Das, P.K. Saha, K. Mitra, U. Bhaumik, S. S. Mishra, S. Samanta, P. Maurya, M. P. Brahmane
- Technical :*
L. Mahavar, Keya Saha, S. Banerjee, Ranjana Sinha, A. Ghosh, R. Sheik, A. Mitra.
- Duration :** April 2000-March 2005
- Location :** Barrackpore

Sub Project (a) : Standardization of bioindicators in selected aquatic ecosystems for environmental impact assessment.

Investigation were conducted in River Churni at Shiv Nibas (S1), Hanskhali (S2), Aranghata (S3), Ranaghat (S4) and Shivpore (S5) and two beels – Bansdah and Saguna.

Soil and Water Quality

Soil texture in River Churni showed little variation among sites. Sand Dominant : 78-80%, Av. 80%. Silt : 14-19.5% (Av. 18%), and Clay 1.0-3.0% (Av. 2.0%).

The soil was alkaline, pH 8.0-8.5, (mean 8.2) with maximum values during post monsoon and minimum early monsoon.

Calcium carbonate was high 7.2-10%, (mean 8.5%) and reflected impact of sugar mill effluent and domestic sewage release.

Specific conductivity varied from 118 to 250 $\mu\text{mhos cm}^{-1}$ (mean 187) and was maximum early monsoon and minimum post monsoon.

Organic Carbon was poor in all seasons, 0.2-0.7%, (mean 0.5%) and was maximum early and post monsoon. Available Phosphorous (as P) was 0.5-3.4 mg 100 g⁻¹ soil, (mean 2.3 mg 100 g⁻¹) and was maximum during summer and minimum post monsoon.



Minimum transparency of 10 cm (monsoon) and maximum during winter and summer occurred and the highest transparency 250 cm was observed at Haskhali during winter. Minimum conductivity of 180-220 μScm^{-1} (monsoon) and maximum about 600 μScm^{-1} (winter and summer) was observed.

Hardness variation was relatively less being 80-130 mg l^{-1} during monsoon and post-monsoon and maximum of 194 mg l^{-1} at Shivnibas in summer.

Water pH was greater than 7 and highest pH 8.5 (Pairadanga) and lowest 7.5 (Shivnibas and Haskhali) occurred.

Alkalinity showed wide fluctuations. In monsoon alkalinity was 80-100 mg l^{-1} . It rapidly increased, exceeded 300 mg l^{-1} during winter and summer due to the released effluent impact.

DO was critical during summer (av. 3.2 mg l^{-1} , lowest at Shivnibas 2.0 mg l^{-1}). With release of effluents, decreases to the critically lower levels, lowest DO was 0.8 mg l^{-1} at Shivnibas. Free CO_2 was always observed except Pairadanga site during winter.

Heavy metals

Among heavy metals Zn is predominant followed by Cu, Cd and Pb.

In mg l^{-1} :

Parameters	Zn	Cu	Cd	Pb
Summer	40.8	25.1	0.44	0.41
Monsoon E	33.6	20.8	0.56	0.53
Monsoon L	56.2	26.5	1.65	1.57
Monsoon P	31.6	8.6	0.57	0.53
Winter	26.0	12.5	0.49	0.50
Mean	37.6	18.7	0.74	0.71

Sediment and water quality of Bansdah and Suguna beels showed sand was dominant (Av. 83%) in both beels and silt was 15% in Bansdah and 15.5% in Suguna Beel. The pH was alkaline (7.2-7.9, Av. 7.6) in Suguna whereas it was slightly acidic (6.0-6.8, Av. 6.5) in Bansdah. The Sp. conductivity was higher (Av. 703 μmhos) in Suguna than (643 μmhos) in Bansdah Beel and organic carbon was higher (3.3%) in Bansdah compared to Suguna (3%). Transparency was higher in Suguna Beel. Dissolved oxygen was fairly good in both the beels. Calcium carbonate in Suguna beel was nearly double (8.6%) compared to Bansdah beel. Similarly phosphate was high 5.4 mg 100 g^{-1} in Bansdah beel. The pH in Suguna ranged from (7.6-8.4) whereas in Bansdah it was 7.2-7.5.

The heavy metal content in water and fish flesh obtained in the two beels are given below :

	Bansdah (mg l^{-1})	Suguna
Zn	57.6-66.5 (61.9)	35.0-60.0 (50.0)
Cu	36.0-42.5 (39.5)	22.7-27.9 (25.7)
Cd	0.35-1.3 (0.59)	0.28-1.2 (0.58)
Pb	0.28-1.2 (0.65)	0.35-1.1 (0.61)



Heavy metals content of fishes of Churni river (in mg l^{-1})

Fish	Cu	Zn	Cd	Pb
<i>M. aor</i>				
Flesh	Tr.	1.7-6.6 (4.2)	Tr.	1.3-7.8 (4.1)
Gill	Tr.	1.5-19.0 (13.2)	Tr.	2.1-9.2 (4.3)
Liver	2.5-27.5 (10.6)	14.0-53.8 (35.0)	0.8-1.2 (1.0)	3.2-8.9 (5.5)
Kidney	2.0-10.8 (6.3)	11.6-50.8 (22.2)	Tr.-1.1 (0.4)	1.7-23.5 (7.7)
<i>L. rohita</i>				
Flesh	Tr.	3.9-4.7 (4.2)	0.20-0.25 (0.24)	0.50-1.1 (0.8)
Gill	0.1-1.5 (1.0)	20.6-30.1 (25.1)	0.40-0.60 (0.5)	1.5-1.9 (1.6)
Liver	0.9-8.5 (3.4)	24.3-47.6 (33.0)	0.40-0.80 (0.6)	1.2-3.0 (2.2)
Kidney	2.5-5.6 (4.0)	16.8-41.5 (25.3)	0.40-0.60 (0.5)	1.8-4.0 (2.9)
<i>C. mrigala</i>				
Flesh	Tr.	2.1-4.9 (3.0)	0.2	0.60-0.80 (0.7)
Gill	Tr.	15.6-26.7 (19.3)	0.6	2.0-3.5 (2.8)
Liver	3.0-6.8 (4.9)	13.0-21.8 (17.4)	0.3	1.4
Kidney	2.4-3.2 (2.8)	12.7-13.0 (12.8)	0.40-0.50 (0.5)	1.9

Pesticides

Total organochlorine pesticide residue content (ppb) in water of the river Churni and two beels of West Bengal shows higher residue content during summer

Metabolites of DDT, the 4,4'-DDD was major constituent (up to 74%) of the residue at Suguna beel.

The permissible limits for aquatic organisms of EPA, USA for 4,4'-DDT is 0.001 ppb and the limit is crossed at all the sampling sites.

The highest is 8 times of the permissible limit at Saguna beel

Total organochlorine pesticide residue content (ppb) in fish of the river Churni and two beels of West Bengal indicate highest residue (17.85 ppb) in *W. attu* (1273 g).

Establishing normal ranges

The normal range of the stress sensitive biochemical parameters of fish blood viz. Creatinine, Triglyceride and Bilirubin were determined for further field studies.



Species	Creatinine (mg dL ⁻¹)	Triglycerides (mg dL ⁻¹)	Bilirubin (mg dL ⁻¹)
<i>Rita rita</i>	0.22 to 1.2 (0.3)	41.2 to 200.6 (86.0)	1.2 to 3.0 (1.4)
<i>Labeo rohita</i>	0.4 to 2.4 (0.4)	45.1 to 152.3 (64.9)	1.2 to 3.5 (1.6)

Effluent impact on fish in River Churni

To evaluate the impact of effluent from the Darshana Mills on fish health, serum chemistry variables were investigated in *R. rita* and *L. rohita* held in cages (active monitoring) and compared with serum variables of reference *R. rita* and *L. rohita* in laboratories.

Changes in the blood parameters during active monitoring at two sites of River Churni indicated the following changes :

Physiological alterations

Hypochloremia is recorded. Elevated levels of creatinine recorded indicate renal dysfunction in fishes. Higher bilirubin levels indicate breakdown of haemoglobin. Higher triglyceride levels indicate lipid dynamics impaired. Elevated levels of BUN observed is an indicator of functional disorder in gill and kidney

Histopathological changes

Gill hyperplasia is evident along with hypertrophy and proliferation of mucus cells.

Mild congestion and marked infiltration of leucocytes after 72 hrs. occurred but showing tubular necrosis and glomerular degeneration and increased cellularity in the interstition after 15 days.

Fish community studies (IBI)

Data on the 12 metrics of Index of Biotic Integrity from the sites of River Churni and the beels Bansdah and Suguna were collected.

For the most upstream site of River Churni SN (S1) 27 species from A (S2), 13 species from H (S3) 9 species from R (S4), 19 species and from Site (S5), 13 species were recorded.

The various habitat, trophic and tolerance guild were established for all the species of fishes of each site for placement in the various metrics and for further calculation of the index.

Health status of fish in Bansdah and Suguna Beels

Comparative measurement of blood serum of *L. rohita* in the two beels exhibited the following changes in fish *L. rohita*.

Physiological alterations

Creatinine Bilirubin and Cortisol levels are elevated in fishes of Bansdah Beel.

Fish community level studies

Data on the 12 metrics of IBI from both the beels were collected. Bansdah beel recorded 16 fish species whereas Suguna beel recorded 9 species. The habitat, trophic and tolerance guild of all the species were recorded for placement in the various metrics and for further calculation of the indices.

Results and conclusions

- The results indicated that, the lab. based experiments be avoided during winter season as



Thermal stress studies

Temperature stress given are indicated below :

Time (t)	Temp. (°C)	No. of fishes used in each set	Induction Time* for stress proteins
Initial	25°C	2	1 hr.
Time (t ₀)			
Time (t ₁)	28°C	2	1 hr.
Time (t ₂)	30°C	2	1 hr.
Time (t ₃)	32°C	2	1 hr.
Final Time (t ₄)	34°C	2	1 hr.

*- time after temperature reaches to particular point.

t₀ – control/acclimatization temperature

the water temperature was below 19°C and room temperature was also very low.

- Experiment during middle of December (acclimatization at 19°C temp. instead of usual 25°C). But mortality was noticed at temperature 34°C (t₄) and slight reduction in activity was noticed below this temp. (t₃).
- Experiment during summer season was set-up for 5°C difference but mortality was noticed at 40°C (t₄).

Socio economic impact of degradation of Churni River

Unit Studies	Fishing		Catch/Day				Earning	
			2003-2004		1990			
	Days	%	Kg.	%	Kg.	%	Rs.	%
60	300-350	65.38	1-2	61.53	6-10	38.46	1300-1500	28.3
Fisherman	150-199	15.38	3-4	34.61	11-15	34.6	1000-1200	25.8
							500-700	19.2





Sub Project (b) : Studies on the clinical pathology of stress and some major disease of fish for establishing disease diagnostic standards

L. rohita subjected to cumulative stress of sub lethal phenol and low dissolved oxygen

Morphological symptoms

Fish respiring heavily with high opercular movement @ 130-170 times/min.

Fish resting at the bottom for longer period – not eating

Swelling of the gill epithelium creating difficulty for the fish to close the operculum.

Histopathological changes

Hyperplasia.

Gills swollen and clumped and gaseous exchange impeded.

Increase in the number of mucus cells occurred..

Physiological alterations

Decrease in haemoglobin – indicating inanition

Plasma cortisol levels increased and a slight decrease in leucocrit occurred – lymphocytolytic properties of corticosteroids

Glucose increased and plasma chloride decreased – common under low oxygen condition

Increase in lactic acid because of hyperactivity and hypoxic condition

Prolactin levels increased – stimulates mucus secretion and thickening of mucus coat.

Fishes C. mrigala affected by Trichodiniasis and Dactylogyrosis

Morphological symptoms

Pale colour of fish gills and one or two reddish spots on skin.

Greater opercular movement increasing from the normal 45-60 to 120-150 times/min.

Fishes cannot fully close the operculum because of swelling.

Excessive secretion of mucus.

Histopathological changes

Hypertrophy and hyperplasia occurred

Haemorrhage in gills

Increase in number of mucus cells recorded

Physiological alterations

Decrease in haemoglobin, haematocrit and protein values indicating inanition

Cholesterol levels fell indicating impaired sterol activity

Hyperglycemia

Enhanced creatinine level indicating impaired kidney function.

Enhanced prolactin level.



Isolation and identification of microbial pathogens

55 fish samples were collected from different fish farms with outbreaks of disease.

Besides samples received by this laboratory from different fish farmers, were analyzed microbiologically and the following bacterial stains/species/genus were identified.

<i>Aeromonas hydrophila</i>		
DNA group 1	:	4 nos.
<i>Aeromonas veronii b.v. sobria</i>		
DNA group 8	:	15 nos.
<i>A. encheilia</i>	:	3 nos.
<i>A. ichthosmia</i>	:	4 nos.
Other <i>Aeromonas</i>	:	9 nos.
<i>Pseudomonas</i>	:	3 nos.
<i>Vibrios</i>	:	28 nos.
<i>Burkholderia ghumei</i>	:	4 nos.

Pathogenicity and experimental induction of disease in fish

Different 10-fold dilutions of bacteria were inoculated (0.05 ml) to fish (5-8 g size).

The animals were observed for mortality at different time interval up to 10 days.

A. hydrophila AHI, *A. veronii b.v. sobria* DNA gp.8 were found to be most virulent killing all the fish within 24 hours and AH21 and AH5 killed or infected fish after 24 hours post-inoculation.

A. hydrophilla (AHI) was also tested in water treatment method by inoculating different dilutions of bacteria

in fish tanks and mortality was observed up to 10 days post-treatment.

Significantly, no mortality was recorded in any fish tanks after addition of virulent *A. hydrophila* even up to 10 days of observation period.

Antibiotic sensitivity assay of selected *Aeromonas spp.*

Antibiotic sensitivity of selected *Aeromonas* isolates was also carried out using different antibiotic discs (Himedia).

A. hydrophilla, *A. veronii b.v. sobria*, *A. ichthosmia* and *A. encheilia* were tested.

Results indicated higher sensitivity of isolates to Ciprofloxacin, Chloramphenicol, Norfloxacin but resistant to Ampicillin, Erythromycin and Oxytetracycline.

Analysis of anti-bacterial activity of different chem./formulations and estimation of minimum inhibitory conc. (MIC) for different pathogens

The important observation made was, most of the commercially available preparations like Mizophus (10% Iodine), Formalin, Avitech (Chlorine dioxide), BKC 365, Iodol-20 (2% chlorine) and Bromophor (4% bromine) were effective in inhibiting bacterial growth at 50 ppm or higher concentration where as Bromophur was not effective even at 80000 ppm. Significantly Formalin (37-41% formaldehyde solution) was quite effective even at 10 ppm concentration and economically cheaper for application.



Sub Project (c) : Development of immunological and molecular techniques for rapid diagnosis of bacterial and viral diseases of fish and shell fish

Analysis of Bacterial whole cell protein profile using SDS-PAGE and Western blotting Technique

Three different protein antigens viz. Soluble protein extract, Sonicated bacterial antigen and Sonicated protein extracts were prepared and analyzed on SDS-PAGE to observe suitability of protein preparation and variation in polypeptide pattern in *Aeromonas* spp. The polypeptide bands were visualized, scored and their molecular weight were estimated. In sonicated bacterial antigen extracts large number of protein bands (35-40) ranging in size (110 Kda – 9.5 Kda) were noted. Protein molecular weight, similarity index and dendogramic relationship were also calculated using Gel documentation system.

Bacterial Plasmid extraction and RAPD analysis on agarose gel electrophoresis

Bacterial plasmids from 20 *Aeromonas* cultures were isolated. The Plasmids were further characterized using RAPD-PCR to observe polymorphism. Different OPA, OPB and AH primers were used to note suitability in amplification. These primers were further used for characterization of plasmids.

DNA polymorphism studies of *Aeromonas* using RAPD technique

Randomly amplified polymorphic DNA (RAPD) based on PCR amplification using random primers, was employed to detect and study genomic variability in *Aeromonas* isolates collected from cases of disease in fish and shellfish.

Twenty *Aeromonas* isolates and one *A. hydrophila*

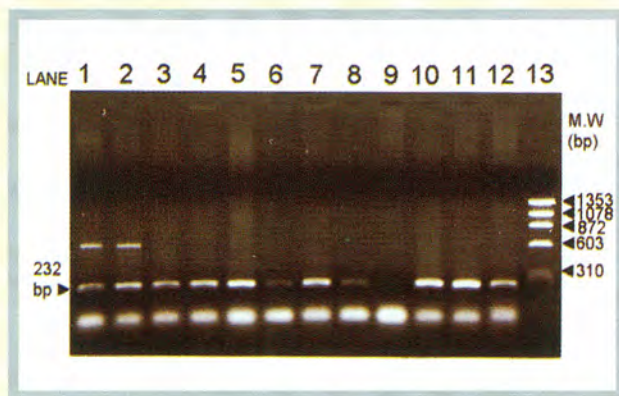
(MTCC standard strain) were used in RAPD-PCR using above 10 primers. After amplification as described above, the products were electrophoresed on 1% agarose gel. Observation under Gel documentation system revealed variable banding pattern with some isolates (Fig.1). The results indicated genomic variation of all these isolates, although these isolates gave similar cultural and biochemical reactions. Although these isolates have almost similar protein pattern, genomically these are different from each other.



Standardization and use of Molecular diagnostic techniques

(a) Detection of *Aeromonas* isolates using PCR

Development and standardization of PCR was carried out for specific detection of *A. hydrophila* DNA group-1, Aerolysin positive *A. hydrophila* and virulent (enterotoxigenic, hemolysin) *Aeromonas* spp. from samples of fish disease outbreaks and microbial samples. Primers specific for HG1 (242bp product), hemolysin gene (232 bp product) and 'aer' gene (209 bp product) were used as the target genes for PCR amplification (Fig.2).



(b) Development of *Aeromonas* DNA probe and hybridization using ECL Technique

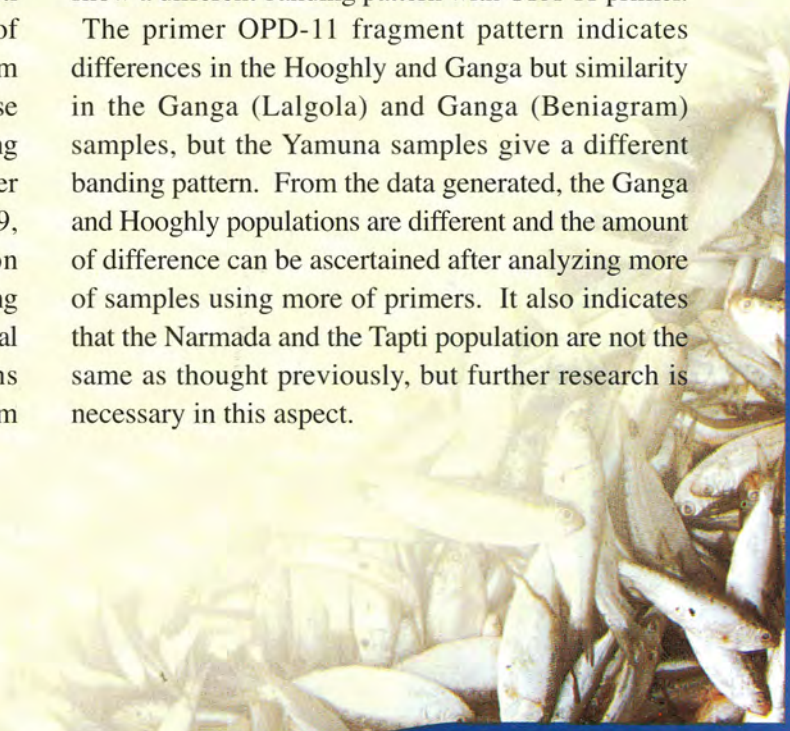
The amplified *Aeromonas* DNA product (209 bp and 232 bp products of aer gene and hemolysin gene, respectively) were used for preparation of specific DNA probe for screening of bacterial samples for detection aerolysin specific *A. hydrophila* and virulent (Enterotoxigenic, hemolysin).

Sub-Project (d) : Genetic Characterization and migration related biochemical changes of Indian shad, *Tenualosa ilisha*

During the year 2003-2004, the previously collected samples were analyzed using the molecular tool. The DNA based Random Amplified Polymorphic DNA method was used to generate the banding patterns. Samples analyzed were from rivers Hooghly (Nawabganj, Feeder canal), Ganga (Lalgola, Beniagram, Allahabad), Narmada (Bhadbhud), Tapti (Ukai), and Marine zone at Digha. The number of samples analyzed was ninety-six, twelve samples from each location as mentioned above. The Polymerase chain reaction was performed on all the samples using six different primers synthesized. The oligodecamer degenerate primers are OPA-10, OPA-11, OPA-19, OPC-01, OPD-11, and OPD-13. The reaction conditions were standardized previously and annealing temperature was 34°C. Each primer produced several bands. The differences in the banding patterns tentatively indicate that the hilsa populations from

rivers Hooghly and Ganga are different to a certain amount. The OPA-10 primer shows differences in the Narmada and the Tapti samples and minor differences in the Hooghly and Ganga samples. The OPA-11 primer indicates differences in the Hooghly and the Ganga populations. The Yamuna samples show a different banding pattern with OPA-11 primer.

The primer OPD-11 fragment pattern indicates differences in the Hooghly and Ganga but similarity in the Ganga (Lalgola) and Ganga (Beniagram) samples, but the Yamuna samples give a different banding pattern. From the data generated, the Ganga and Hooghly populations are different and the amount of difference can be ascertained after analyzing more of samples using more of primers. It also indicates that the Narmada and the Tapti population are not the same as thought previously, but further research is necessary in this aspect.





PROJECT : RA/A/2

ASSESSMENT OF FISH CATCH AND CATCH STRUCTURE FROM DIFFERENT INLAND OPEN WATER SYSTEMS IN INDIA

- Personnel** : Scientific :
S.K. Mandal, Debabrata Das, S.K. Sahu
- Technical :
Sucheta Majumder, K. Jacqueline, B.K. Biswas, B.N. Das, Ramji Tweari, J.P. Misra, Alok Sarkar, M.F. Rahman, R.C. Mandi, C. Lakra, C.K. Vava.
- Duration** : April 1999-March,2004
- Location** : Barrackpore

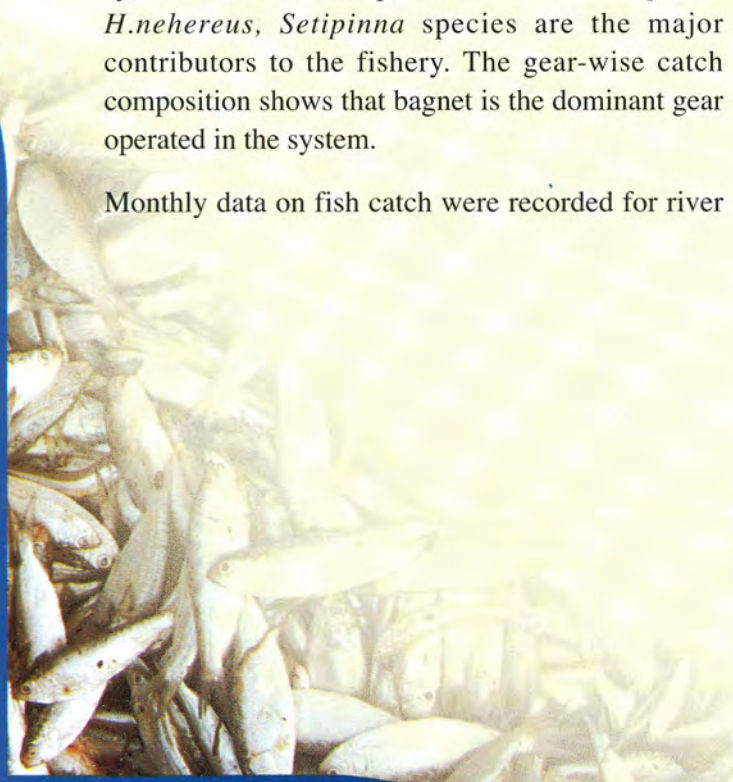
Different sampling methodologies are being adopted for data collection at various centres of the Institute depending on the fishing and landing patterns. Generally multistage sampling and systematic sampling are being adopted for catch data collection. The data on catch and effort is being utilized for the development of database under the project.

The monthly estimates for Hooghly-Matlah Estuarine system show that the species *T. ilisha*, *Pama pama*, *H.nehereus*, *Setipinna* species are the major contributors to the fishery. The gear-wise catch composition shows that bagnet is the dominant gear operated in the system.

Monthly data on fish catch were recorded for river

Brahamaputra. The species *L. dero*, *C. reba*, *L .bata* etc. are the dominant species in the catch.

The fish catch from Yamuna river and West Yamuna Canal at Karnal were recorded. The species-wise monthly estimates have been worked out and the catch estimates show that *C. carpio*, *Clarius garipineus*, *W. attu* and *C. mrigala* are the dominant species in the catch from Yamuna river. The total catch from four centres has been estimated at 56.98t. The catch from West Yamuna Canal is dominated by *C. carpio* and *B. bagarius*. The estimated catch from two landing centres has been worked out at 14.78t.





PROJECT : RA/A/4

INVENTORY OF RESOURCE AND DATABASE DEVELOPMENT IN INLAND FISHERIES THROUGH REMOTE SENSING TECHNIQUES

- Personnel** : Scientific :
R.A. Gupta, D. Nath, S.K. Mandal, Debabrata Das, S.K. Sahu
- Technical :
Sucheta Majumder, K. Jacqueline, A. Sengupta
- Duration** : April 2002- March, 2007
- Location** : Barrackpore

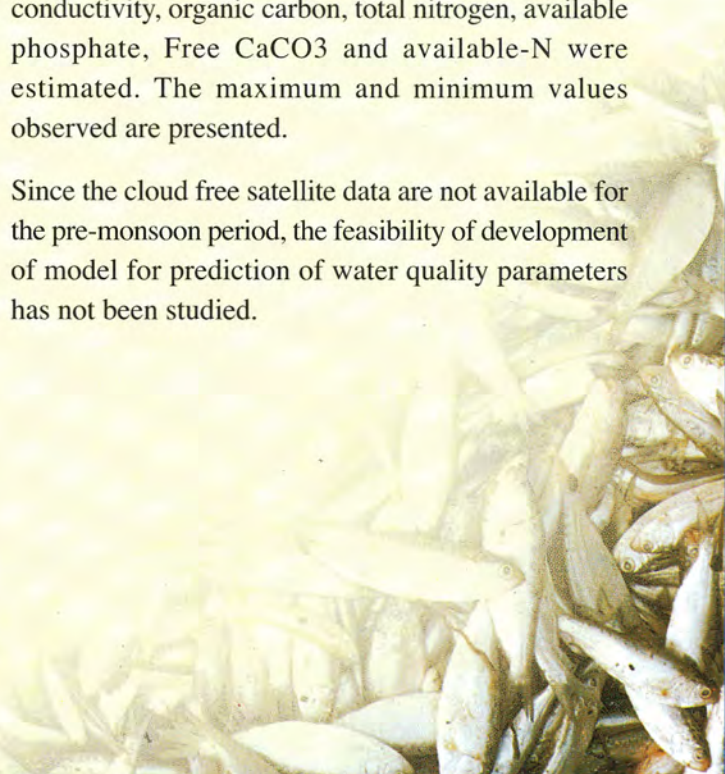
District planning maps(DPMS), land use & land cover maps and SOI sheet for the selected districts of Rajasthan state have been procured from different government agencies for the preparation of base maps. Digital base maps for selected districts of Rajasthan have been prepared.

Water and soil samples have been collected from twenty six water bodies during pre monsoon and from twenty four water bodies during post monsoon in seven districts of Rajasthan namely Jaipur, Ajmer, Kota, Cittergarh, Tonk, Udaipur and Sirohi.. Location of rail crossing, road crossing, important place, reservoirs, ponds, tanks, river bridge and land use pattern have been observed with the help of GPS. These locations are very important for geo-referencing the images, image analysis and land cover map preparation.

Observations on water quality and soil characteristics

were taken from twenty six selected water bodies during pre-monsoon in the state of Rajasthan. The parameters of study are Temperature, Transparency, Dissolved Oxygen, Sp.Conductivity, pH, Total Dissolved Solids, Total Alkalinity, Free CO₂, Chlorinity, Salinity, NO₃, Total Nitrogen, PO₄, Sulphate, Silicate, Hardness, Ca, Mg, Gross Primary Production, Net Primary Production and Respiration. Observations on soil characteristics were made and the water quality parameters such as pH, sp. conductivity, organic carbon, total nitrogen, available phosphate, Free CaCO₃ and available-N were estimated. The maximum and minimum values observed are presented.

Since the cloud free satellite data are not available for the pre-monsoon period, the feasibility of development of model for prediction of water quality parameters has not been studied.





Physico- Chemical Parameters of water in different lakes and reservoirs of Rajasthan (May, 2003)

	Depth(ft.)	Air Temp. °C	Water Temp. °C	Transparency (cm.)	D.O. (ppm)	pH	Sp Cond. (milli mhos)	TDS g/L	T.A. (ppm)	Free CO2 (ppm)	Choloronity (ppt)
Average	19.825	35.1346	30.7269	54.24	6.994	8.415	1.6062	1.044	182.92	4.085	0.4595
Max.value	2.75	24	23	8	4.8	7.9	0.17	0.111	52	0	0.0116
Min.value	70	40	35.8	135	9.6	9.7	27.8	18.07	736	14	9.9
S. E.	3.7927	0.79315	0.68777	8.16	0.224	0.106	1.0293	0.669	28.019	0.706	0.3708

Contd /

	Salinity (ppt)	NO3 (ppm)	Total N (PPM)	PO4 (ppm)	sul phate (ppm)	Silicate (ppm)	Hard- ness (ppm)	Ca (ppm)	Mg (ppm)	Gross P.P. mgC/m ³ /hr	Net P.P. mgC/m ³ /hr	Respiration mgC/m ³ /hr
Average	0.89	0.09	0.56	0.31	27.88	8.26	173.15	48.65	12.37	304.18	198.40	126.92
Mix.value	0.05	0.01	0.12	0.02	1.66	0.40	80.00	19.24	1.40	125.00	58.34	65.00
Min.value	17.87	0.34	1.80	1.77	210.0	33.60	688.00	147.49	76.62	466.68	395.85	300.00
S. E.	067	0.01	0.08	0.09	8.11	1.34	24.46	6.12	2.75	22.37	20.89	10.65

Soil Characteristics of Different lakes and reservoirs of Rajasthan (May, 2003)

	pH	Sp cond. (m mhos / cm)	Organic carbon (%)	Total Nitrogen (%) (mg/100gm)	Available -P (mg / 100g)	Free CaCO3 (%)	Available - N (mg/ 100 g)
Average	8.39	2.03	0.11	31.70	6.34	1.28	29.00
Mix.value	7.03	1.30	0.01	11.20	0.64	0.27	1.50
Min.value	9.85	10.20	0.48	60.48	35.76	3.06	68.50
S. E.	0.11	0.34	0.02	2.77	1.50	0.14	4.46



5 TECHNOLOGY ASSESSED AND TRANSFERRED

KRISHI VIGYAN KENDRA

On Farm testing

During 2003-2004, Krishi Vigyan Kendra, Kakdwip has conducted On-farm-testing on Rice-cum-fish culture to test the varieties suitability of Rice varieties with Indian Major Carp and freshwater prawn on 30 farmers field covering 10 ha area. The integration of fresh water prawn *Macrobrachium rosenbergii* and Indian major carp with high yielding rice varieties have given a paradigm shift in the production as well as income. The integration of freshwater prawn has given extra income of Rs. 27,320 to Rs. 37,020 over the control. The result has distinctly established that raising fish and prawn integrating with HYV paddy gives maximum return than single component.

Treatment	Repl- cat- ion	Area (Ha)	Production (q/ha)			Cost of Production (Rs.)	Return from OFT (Rs.)	Increase in income above control (Rs.)
			Rice	Fish	Prawn			
IET-5656 +IMC +Prawn	6	2	47.30	10.00	3.00	100000	135340	30110
Mtu-7029 +IMC +Prawn	6	2	48.50	10.50	2.90	102000	140000	36770
CR-1017 +IMC +Prawn	6	2	47.80	10.30	2.63	101500	132650	27320
NC-492 +IMC +Prawn	6	2	47.90	9.95	3.10	102000	141250	37020
MTU-7029 +IMC	6	2	48.5	10.55	-	70000	105230	Control

Feeding poultry broiler test

The result of On-farm-testing on feeding of Poultry broiler with growth promoters and anti-coccidial drugs shows that poultry broiler fed with growth promoter alone has achieved high growth rate in comparison to the birds fed with growth promoters and anti-coccidial drugs simultaneously and control.

The result of On-farm-testing on feeding of RIR poultry birds with locally available agricultural by-products shows that RIR poultry bird fed with 100% supplementation resulted 21% higher production performance over control.



Frontline Demonstration

Oil Seeds and Pulses

Under Frontline Demonstration on oilseeds and pulses, mustard variety Sanjukta Asech has given Average yield of 11.30 q/ha, 61.42% increase over the local check. Sesamum variety Improved Selection-5 has given an average yield of 8.5 q/ha, 41.66% over the local check. Green Gram variety PDM-54 has given average yield of 9.5 q/ha, 46.15% over the local check.

Crop & variety	Farmers (no.)	Area (ha)	Demonstration Yield (q/ha)			Local check (q/ha)	Potential yield	% increase in yield over local check
			Max.	Min.	Avg.			
Mustard Sanjukta Asech	75	10	12.00	10.39	11.30	7	14.0	61.42
Sesamum I.S.-5	35	05	9.35	7.20	8.50	6.0	10.0	41.66

Under FLD other than oilseeds and pulses, 7 varieties of HYV paddy Swarna (IET 5656), Dharitri (CR-1017) Ranjit, Swarna Mahsuri (MTU-7029), CSRC(S) -2-1-7, CSRC(S) – 11-0-0-5 and CSRC(S) – 5-2-2-5 have given 54.74, 53.16, 55.06, 47.51, 46.51, 43.32 and 43.41 percent higher yield over control variety Dudheswar in the Sundarban region of West Bengal.

Crop & variety	Farmers (no.)	Area (ha)	Demonstration Yield (q/ha)			Local check (q/ha)	Potential yield	% increase in yield over local check
			Max.	Min.	Avg.			
Green gram PDM-54	35	05	10.50	7.80	9.50	6.50	12.00	46.15

Chilli

Chilli variety Pusa Sadabahar has given 26q/ha maximum and 24q/ha average yield, which is 50% more than the local check variety Suryamukhi.

Production performance :

Variety	Farmers (no.)	Area (ha)	Demonstration Yield (q/ha)			Local check (q/ha)	% increase in yield over local check
			Max.	Min.	Avg.		
Pusa Sadabahar	50	10	26.00	22.00	24.00	16.00	50.00



Training and Education

Krishi Vigyan Kendra has organized 182 training programmes involving 3095 beneficiaries. 41 on campus and 141 off campus training programmes were organized for 410 and 2685 beneficiaries respectively from practicing farmers, farm women, rural youth and extension functionaries. 32 training programmes under FLD were conducted for the benefit of 518 farmers and 201 farm women.

The Kendra has also conducted field days/fish farmers days, advisory services, diagnostic services and other field extension activities for the benefit of the farming community of Sundarbans.

EXTENSION ACTIVITIES

Various activities in relevance to human resource development and transfer of technology were undertaken for the benefit of the clientele.

a) Advisory services

Necessary advice/suggestions on various aspects of Inland fisheries were rendered to:

Individuals who called on office

A total of 214 fish farmers/fishermen owning 259 ponds and 16 bheries, 23 entrepreneurs, 11 extension functionaries of State Fisheries Departments and 6 officers of State Development Departments/NGOs who called on at Institute, headquarters, Barrackpore were provided with solutions to their respective problems.

Individuals through letters

Necessary advice was rendered through letter to the clientele who approached for their problems from distant places.

Fish farmers/fishermen	:	48
Entrepreneur	:	09

College/University	:	14
Non Govt. Organization	:	03

Individuals over telephone

Necessary solution on fish mortality, management of practices were rendered to 56 clientele over phone.

Individuals through farm visit

Necessary advice were rendered to 17 clientele for their problems after visiting their farms.

Training

1. A 4-day training course on Reservoir Fisheries Development was organized for the officials of the Department of Fisheries, Government of Orissa during April 8-12, 2003 at CIFRI. Headquarters, Barrackpore. A total of 11 senior officers of the state underwent the course.
2. A 3-day training course was organized for the benefit of Fish Farmers & Fishermen of the Joka, South 24 Pargans on Inland fisheries development during May 20-22, 2003.
3. Training on Reservoir Fisheries Management for the benefit of officials from Dept. of Fisheries and Tamil Nadu Fisheries Development Corporation was organized by Coimbatore Centre of CIFRI on 26.6.2003.



Inauguration of training programme at Coimbatore

4. Organized one-day off-campus training course on prawn seed transport at Nandabhanga, Village, Block Namkhana district South 24 Parganas on 27.8.03 where 32 fishermen and fisher women



actively participated.

- Organized one-day off-campus training course on conservation of fin fish and shell fish seed at Village Moinapara, block Kakdwip district south 24 Parganas on 27.8.03 where 41 fishermen and fisher women actively participated.
- Organized one-day training programme on Pen Culture at Kanchrapara, North 24 Parganas for the extension functionaries of NGOs on 09.9.2003.



A fisherman explaining the needs towards enhancement of fish production at Kanchrapara.

- Training programme on Development and Management of Beel Fisheries of Assam was sorganized from 22-25 September, 2003 at the North Eastern Regional Centre, Guwahati.
- Organized a 8-day training programme on Participatory Rural Appraisal (PRA) during October 13-19,2003 for the benefit of the scientists of the Institute. A total of 15 senior level scientists of the Institute participated in the same.



Inaugural session of training programme on Beel fisheries at NEC.



Practical session in a training camp at NEC.

- A training programme on management of estuarine wetland (bheri) was organized at Diamond Harbour on 29.12.03. A total 36 nos. fishermen/fisherwomen participated in the programme.



PRA exercise in North 24 Parganas, West Bengal.

- Organized a training on PRA for the Extension functionaries of the North Eastern Region (Assam, Manipur, Meghalaya, Sikkim, Arunachal Pradesh Tripura) at its North Eastern Regional Centre, Guwahati during December 1-12. where 28 officials participated in the excercises.
- Organized one-day training programme on estuarine wetland with Participatory approach at Kulti Ghusighata on November 28, 2003 where 50 fishermen/ fish farmers participated.
- Organised one-day training programme on Esturine wetland with Participatory approach at



PRA exercise at Mariapatti Village, Assam.

Radhakantapur on 30.12.03 where 48 fishermen fish farmers participated.

- Organized a 9-day on-job training programme



Training is in progress towards enhancement of fish production from sewage fed wetlands

during March 24 to April 03, 2004 for the students of Industrial Fisheries, Prabhat College, Contai, Purba Midnapur .



Training session on management of Wetlands in progress at Radhakantapur.

14. Computer literacy programme for 15 members of the staff of the Institute was organized under HRD programme at Institutes headquarters during January 19-February 13, 2004.

Exhibition

CIFRI organized/participated in the Exhibitions held in various parts of the country with charts, blown-up photographs, posters, models etc to appraise Institute's work and achievements.

1. Participated in an Exhibition organized at Krishi Vigyan Kendra, Madhubani, Bihar, during 31st.October to 5 November, 2003. The exhibition was inaugurated by Hon'ble Minister for Agriculture Shri Raj Narayan Singh Ji and

Hon'ble Minister of State Shri Hukumdeo Narayan Yadav Ji. About 30,000 fish farmers, fishermen & inserted persons visited the stall. Hon'ble Minister of Fisheries, Shri Shivsankar Yadav, Govt. of Bihar also visited the stall.

2. Participated in the 7th Banga Sanskriti Utsav cum Exhibition held at Kalyani ,Nadia West Bengal during January 2-11, 2004.



Hon'ble Minister of Fisheries, Govt. of Bihar visit CIFRI pavilion at Madhubari, Bihar.

3. Participated in the Mon Mohan Mela held at Chhoto Jagulia, Barasat, North 24-Parganas, West Bengal during January 23-30,2004.
4. Participated in the Exhibition held at Gosaba, Sunderbans, South 24-Parganas West Bengal during February 4-10, 2004 to depict Institute's work and achievements.



Exhibition at Gosaba, Sunderbans.



5. Participated in an exhibition organized at Berhampur, Orissa during February 12-13, 2004 which was organized jointly by Fisheries College, Rangailunda, Orissa and CIFA, Bhubaneswar and CIFRI.
6. Participated in an exhibition held at Allahabad during March 15-16, 2004 which was organized in connection with Hindi Seminar.
7. The Institute participated in the exhibition held at Thiruvananthapuram, Kerala, during August 25-28, 2003 which was organized by University of Kerala in connection with International Conference on Disease management for sustainable fisheries.
8. Institute participated in the Exhibition organized by College of Fisheries, Mangalore during December 12-13, 2003 in connection with National Workshop on Strategies for Fisheries Development for Next Decade.

Mass awareness Campaigns

- Organized Mass awareness campaign at Moushami Island on April 19, 2003 on conservation of fishery. A total of 275 nos. of fish farmers and fisher women attended the function.
- Organized Mass awareness campaign at Tribeni on May 23, 2003. A total of 172 nos. of Prawn Seed collectors and fish farmers were present during the campaign.
- Organized 5 mass awareness campaigns on conservation of seed of fin and shell fish at Bakkhali, Frazerganj, Pathar Protima Narayanpur in Sunderbans during July 18-19, August 8, September 12, October 9, 2003. 50, 68, 58, 228 fishermen participated respectively.



Awareness campaign at Mukutmanipur against use of zero mesh size net.

- Two mass awareness Campaigns organized at Akshaynagar and Farakka to stop wanton killing of hilsa seed on 7.1.04 and 9.1.04 respectively.
- Organized one mass awareness campaign at Kolaghat, Purba Medinipur on February 1, 2004. A total 200 nos interested farmers/fishermen were present in this camp.
- Organized one mass awareness campaign on mesh size regulation at Mukutmanipur, Bankura on February 12-13, 2004 where 49 fishermen engaged in Kanshabati reservoir were present in this camp.
- Organized one mass awareness campaign at Gosaba, 24 Parganas (South) on March 15, 2004 for conservation of fin fish and shell fish seed.

Mass media coverage

- TV. Coverage on Mass Awareness Campaign towards conservation of Hilsa fish by Kolkata Doordarsan



Kendra during August 2-9, 2003 was arranged. This was telecast 10, 11 & 15 August, 2003 on the programme **Camera Cholche**.

- Two Radio programmes on fish conservation in regional languages for creating awareness among the fish farmers /fishermen of West Bengal were organised.

Farmers'/Students'/Trainees' visit

Arrangements like lectures, laboratory visit, demonstration, audio-visual show etc. were made to appraise Institute's work and achievements to 42 batches of students/trainees of various Training Institutes, Universities/Colleges, Government nominated farmers of the country during their visit to the Institute.

6 EDUCATION AND TRAINING

Man Power Development

Training (abroad)

Dr. P.K. Katiha, Senior Scientist was deputed to Colombo, Sri Lanka from 13-15 August, 2003 to attend training workshop on Development of Research Proposals Sanction.

Dr. Manoj Pandit Brahmane, Scientist was deputed at University of Hull, Hull, United Kingdom in the field of "Molecular genetics of fishes" for a period of 3 months starting from 12th January, 2004 to 12 April, 2004.

Sri N.K. Barik, Scientist participated in the Workshop on Genetic Improvement of Carp and Species in Asia" at Penang, Malaysia during March 30-April 2, 2004

Training (National)

Dr. B.P. Mohanty, Scientist (Sr. Scale) of CIFRI attended ICAR Summer School on Advanced Diagnostic Techniques and Therapeutic Approaches to Metabolic and Deficiency Diseases in Dairy Animals, organized by Indian Council of Agricultural Research in the Division of Medicine, Indian Veterinary Research Institute (IVRI), Izatnagar from July 15 to August 4, 2003.

Dr. B.P. Mohanty, Scientist (Sr. Scale) of CIFRI attended a workshop/seminar entitled LC- MS/MS-

New Technologies organized by Chromline Equipment (I) Pvt. Ltd. And Thermo Electron Corporation, USA on 2nd December, 2003 at Hotel Le-Meridian, New Delhi.

Dr. (Mrs.) Rani Palaniswamy, Sr. Scientist of CIFRI attended a training programme on Advances in Disease Diagnostics Technique for Fin and Shell Fish, during January 15 to February 4, 2004 at CIFE, Mumbai.

Deputation (abroad)

Dr. P.K. Katiha, Senior Scientist was deputed to Nairobi, Kenya for attending the baseline conference of the Challenge programme on water and food, from November 2-6, 2003.

Dr. P.K. Katiha, Senior Scientist, Dr. M.A. Hassan, Senior Scientist and Sri N.K. Barik, Scientist were deputed to Dhaka, Bangladesh for attending the workshop on "Identifying thematic priorities in Indo-Gangetic basin under the challenge programme on water and food (CPWF)", from December 21-22, 2003.

Dr. P.K. Katiha, Senior Scientist was deputed to Manila, Philippines from 17-20 March, 2004 to attend the final workshop of the project "Strategies and Options for Increasing and Sustaining Fisheries and Aquaculture Production to Benefit Poor Households in Asia".



7 AWARDS AND RECOGNITIONS

Dr. R.N. Seth, Principal Scientist, conferred Scientist of the Year Award in the field of fisheries by Bioed Research Society on the occasion of 6th Indian Agricultural Scientists of Farmer's Congress on 21st

February, 2004.

Dr. B.P. Mohanty, Scientist (Sr. Scale), nominated Member of the National Academy of Sciences, India (NASI) since 2003

8 LINKAGES AND COLLABORATION IN INDIA AND ABROAD INCLUDING EXTERNALLY FUNDED PROJECTS

Collaborative project

- ADB sponsored ICAR-ICLARM collaborative project 'Strategies and options for increasing and sustaining fisheries and aquaculture production to benefit poor households in Asia'.
- The Floodplain Wetlands Division is a collaborating Centre for the NATP Project, Germplasm inventory and gene banking of freshwater fishes run by the National Bureau of Fish Genetic Resources, Lucknow. The project comprises a systematic survey of the fisheries resources of the North-Eastern region. The scheme gives special emphasis on the topical and commercial importance of fish germplasm of the region, which needs to be carefully conserved and protected.

NATP Projects

- 1 Household food and nutritional security for tribal, backward and hilly areas
– Programme No.4.
- 2 Household food and nutritional security for tribal, backward and hilly areas
– Programme No.6.

- 3 Germplasm inventory evaluation and gene banking of freshwater fishes.
- 4 Assessment of status and possible impact of exotic fish species in major river system of India.
- 5 Fisheries management in the lentic water system : stocking of reservoir with fish feed.
- 6 Integrated National Agricultural Resources Information System.

In House Projects (AP Cess Fund Scheme)

- 1 Algal diversity of Hooghly-Matlah estuarine system with special reference to Sundarbans mangrove wetlands.
- 2 Development of inventory and fishery management models for reservoirs in India.
- 3 Techno-socio economic status of fisheries of river Ganga.
- 4 Development of clinical blood and tissue profiles and standard methods for diagnosing stress in fish and prawn.



National Fellow Scheme

- 1 Impact of mangrove ecosystem of the Sunderban, West Bengal, in estuarine fisheries development with special reference to identification and estimation of different mangroves and algae.

Linkages

Linkages have been made with National Remote Sensing Agency, Hyderabad to procure satellite maps. The help of Survey of India, Kolkata and NATMO, Salt Lake, Kolkata has been taken for using their wetland and other maps.

9 AICRP/COORDINATION UNIT/NATIONAL CENTRES

Nil.

10 LIST OF PUBLICATIONS

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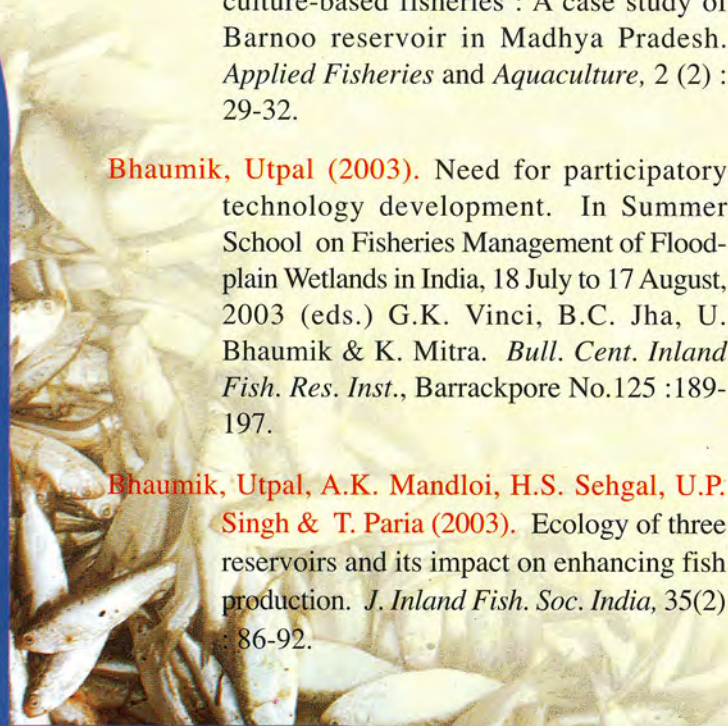
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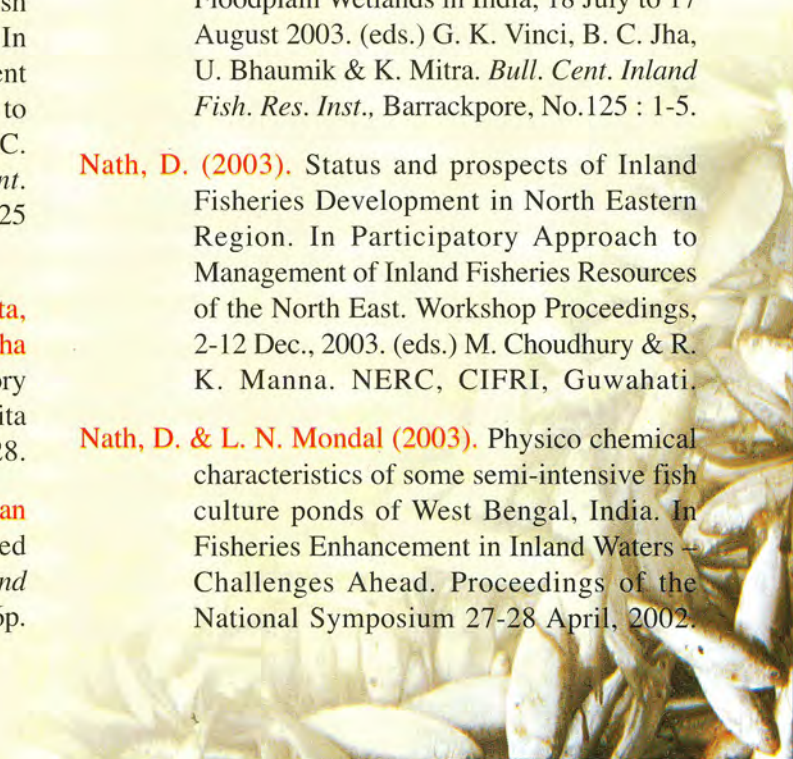
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11 LIST OF APPROVED ON-GOING PROJECTS (TITLE ONLY)

<u>Project No.</u>	<u>Name of Project</u>
RI/A/2	Breeding biology and fishery of silver carp, <i>Hypophthalmichthys molitrix</i> (val.) in Sutlej river system
RI/B/2	Assessment of ecology, biodiversity and production potential of Indus river system
RI/B/3	Evaluation of habitat degradation in the context of fisheries ecology in river Ganga
ES/B/4	Studies on the estuarine ecosystems and saline wetlands of Eastern India in relation to their production potentiality
ES/B/5	Dynamics of biotic communities of certain estuarine systems from environmental perspectives
RS/A/1	Ecology and fisheries of freshwater reservoirs
RS/A/3	Eco-status and production potential of selected reservoirs of Uttar Pradesh
RS/A/4	Ecology and fisheries of small reservoirs of Rajasthan
FW/A/7	Development of eco-friendly management norms for enhancing fish production in floodplain wetlands of India in relation to their resource characteristics
FW/A/8	Ecology and biodiversity of Kayamkulam Lake
FW/A/9	Assessment of ecological status and energy dynamics of floodplain wetlands in Central and Western Uttar Pradesh
HE/B/1	Holistic assessment of health and related biological aspects of fish and inland aquatic ecosystems
RA/A/2	Assessment of fish catch and catch structure from different inland open water systems in India
RA/A/4	Inventory of resource and database development in inland fisheries through Remote Sensing Techniques



12 CONSULTANCY, PATENTS, COMMERCIALISATION OF TECHNOLOGY

Consultancy projects

- A consultancy project entitled Assessment of fish yield potential of Chilka Lake is being pursued by the Institute from July 25, 2003.
- A consultancy project captioned "Fish conservational and hydrobiological perspectives of River Narmada with reference to Sardar Sarovar Project" is being pursued at Estuarine Fisheries Research Centre of CIFRI, Vadodara, Gujarat.
- The Commissionerate of Fisheries, Government of Gujarat, Gandhinagar has identified a sponsored project on "Feasibility Studies for Fish Production Enhancement in Selected Reservoirs of Gujarat State" and is being executed at Vadodara Centre of the Institute and two reports have already been submitted.
- A Consultancy Project "Feasibility studies for fisheries development in Kurichhu reservoir, Bhutan" was completed.

13 RAC, MANAGEMENT COMMITTEE, SRC, QRT, ETC. MEETINGS

Management Committee

30th meeting of the Institute Management Committee was held at Barrackpore on 26 August, 2003. The meeting was attended by Dr. D. Nath, Director & Chairman of the committee and other members viz. Shri Ashok Kr. Bhattacharjee, Dr. M. Y. Kamal, Dr. K. L. Sehgal, Dr. H. R. Singh, Dr. U. Bhaumik, Dr. M. K. Das, Shri D. Moitra, S.A.O., CIFRI (Member Secretary), Finance & Accounts Officer, CRIJAF, Barrackpore, and Shri V. S. Subramanian F&AO, CIFRI (as co-opted Member).

Quinquennial Review Team

The QRT of CIFRI for the period 1997-2002 constituted under the Chairmanship of Dr. M. Y. Kamal and Prof. Y. Sreekrishna, Dr. K.L. Sehgal, Prof. H.R. Singh, Prof. Brij Gopal, Dr. V.R. Chitranshi as members and Dr. M.K. Das, CIFRI as member secretary, visited Headquarters at Barrackpore, Guwahati, Alleppy, Bangalore, Vadodara and Allahabad centres of CIFRI. They had elaborate discussion with scientists on the salient findings of the various research projects and on other administrative matters and have submitted their final report to ICAR..



QRT members interacting with scientist.

Annual Staff Research Council

The Annual Staff Research Council meeting of the Institute was held on 22-23 April 2003 under the Chairmanship of Dr. V. V. Sugunan, Director, CIFRI. Progress achieved under all the research projects of the Institute was presented by respective project leaders. After elaborate deliberations future project programme for 2003-2004 was formulated.

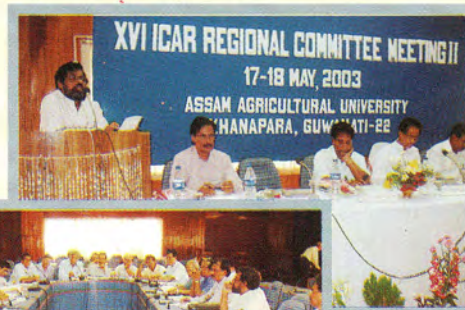
At the end all the Heads of centres, sections presented the monthly target of individual scientist and centres. There was extensive discussion and deliberation on the targets and finalization of the targets for individual scientist and the Institute was done.



Scientists interacting in the SRC meeting.

Regional Committee Meeting II

16th ICAR Regional Committee Meeting II was organized by CIFRI at Assam Agricultural University, Khanapara, Guwahati on 17th & 18th May, 2003.



Research Advisory Committee meeting in progress.



ICAR Regional Committee No. II in programme at Guwahati.

14 PARTICIPATION OF SCIENTISTS IN CONFERENCES, MEETINGS, WORKSHOPS, SYMPOSIA, ETC. IN INDIA AND ABROAD

The scientists and technicians of the Institute participated in various conferences / symposia / seminars / workshops and meetings held during April 2003 to March 2004, wherein they presented their research findings and exchanged views

with the other delegates. List of scientists who participated/presented papers in such gatherings are given below :

Conference / Symposium / Seminar / meetings Workshop, etc.	Paper presented	Authors/Participants
16th Regional Committee II meeting of ICAR, held at administrative Staff College, Guwahati, Assam, from May 17-18, 2003		R.L. Sagar
Workshop on Kharif Frontline Demonstration on Oilseeds and Pulses 2003, held at Birsa Agricultural University, Kanke, Ranchi, Jharkhand on June 20-21, 2003	i) Report of Frontline Demonstration on Oilseeds ii) Report of Frontline Demonstration on Pulses	R.L. Sagar, Ganesh Chandra
Workshop on Present Status of Feed technology and Future Strategies, held at College of Veterinary Science, ANGARU, Hyderabad on July 22-23, 2003	-	Asok Biswas



Conference / Symposium / Seminar / meetings Workshop, etc.	Paper presented	Authors/Participants
Farmers Day of Central Research Institute for Jute and allied Fibers, Barrackpore, Kolkata on August 19, 2003	-	R.L. Sagar
International Conference on Disease Management for sustainable fisheries (ICON-DMSF, 2003), from August 25-28, 2003	-	S. Bijoy Nandan
International Conference on Disease Management for Sustainable Fisheries, organized by National Academy of Agricultural Sciences (NAAS), New Delhi & University of Kerala, Department Aquatic Biology & Fisheries, Trivandrum, August 25-28, 2003	-	B.P. Mohanty
Workshop on Introspection on Cost Effective Modern Farming with reference to Second Green Revolution, held at Kolkata on August 31, 2003	Cost effective sustainable agricultural practices for Sundarban, West Bengal	Ganesh Chandra
Annual Zonal Workshop of KVks of Bihar, Jharkhand, West Bengal and A & N Islands, held at Rajendra Agricultural University, Pusa, Bihar on September 11-13, 2003	i) Annual Report(Oct., 2002 to Sept., 2003) of KVK, Kaktwip ii) Action Plan (Oct., 2003 to March, 2004) of KVK, Kaktwip	Ganesh Chandra
Workshop-cum-training programme on Participatory Rural Appraisal, held at Central Inland Fisheries Research Institute, Barrackpore, from October 13-19, 2003	-	D. N. Singh, U Moza D. Kumar, R.N. Seth, B.K. Singh, B.B Satpathy A. K. Das, S K Shau, P. Maurya, S. Samanta
Fresh water year 2003 and Farmers Day of Central Soil Salinity Research Institute, Regional Research Station, Canning Town on October, 28, 2003	-	R.L. Sagar
National workshop on Methodologies for Prioritization of Fisheries Research in India, 10-11 November, 2003 at NAARM, Hyderabad	-	H.C. Karmakar, D. Karunakaran, N.K. Barik
Workshop on Rabi Frontline Demonstration on Oilseeds and Pulses 2003 held at Rathindra KVK, Sriniketan, Viswa Bharati, West Bengal on November, 14, 2003	Action Plan of Rabi Frontline Demonstration on Oilseeds and Pulses	R.L. Sagar





Conference / Symposium / Seminar / meetings Workshop, etc.	Paper presented	Authors/Participants
National workshop on strategies for fisheries development in the next decade, held at College of Fisheries, Mangalore, from December 12-13, 2003	–	S. Bijoy Nandan
Seminar on Role of Agricultural Engineers in Water Conservation, organized by Institution of Engineers (India) at Kolkata on 12 & 13 December, 2003	–	Amitabha Ghosh, P.K. Saha, M.K. Bandopadhyaya
International seminar “Fish for All”, organized by Swaminathan Research Foundation in collaboration with World Fish Centre in Kokata during December 18-20, 2003	–	Utpal Bhaumik, M.K. Das, D. Nath, R.N. Mishra, S.S. Mishra, M.P. Brahmane, P. Maurya, P.K. Saha, B.C. Jha, A. Hajra
ICAR Regional Committee No. VIII, held from December 29-30, 2003 at University Agricultural Sciences, Bangalore	–	S. Bijoy Nandan
Rashtriya Kisan Mela at Indian Institute of Vegetable Research, Varanasi, on January 24-25, 2004	–	R.S. Panwar
National Workshop on Strategies and option for increasing and sustaining fisheries and aquaculture production to the benefit for households in India, on January, 29-30, 2004 at NACP, Pusa, New Delhi	–	R.S. Panwar
National Hindi Seminar on Samudra Krishi ki nai pragatiya, held at CMFRI, Kochi, Kerala on January 30, 2004	Sundarban ki Matisyaki S a m a s y a y e e v a m pratyashye	Ganesh Chandra R.L. Sagar
National Seminar on Prospects of ornamental fish breeding and culture in Eastern and North Eastern India, Kolkata, on 16 & 17 February, 2004	–	D. Nath, Krishna Mitra, S. Suresh, M. K. Das, M. K. Bandopadhyaya
NATP Workshop on Fisheries Management in the lentic water system : stocking of reservoir at JNKV, Jabalpur, 19-20 February, 2004	Fish disease in small reservoirs and its remedial measures –	U. Bhaumik M.K. Das P.K. Saha V. Pathak D.K. Kaushal A.K. Das P.K. Katiha



Conference / Symposium / Seminar / meetings Workshop, etc.	Paper presented	Authors/Participants
NATP Mission Mode Project meeting at Bhubaneswar, February, 2004		D. Nath
6 th Indian Agricultural Scientists and Farmers Congress, organized by Bioved Research & Communication Centre, Allahabad, on February, 21-22, 2004	–	R.S. Panwar D. Kumar, Shree Prakash, V. Pathak, K.D. Joshi, B.L. Pandey
Workshop on Biotechnology for State Level Teachers', organized by the National Academy of Sciences, India, as part of the 'Science Communication Programme' on February 27, 2004	Biotechnological applications and innovations and demonstrated modern analytical techniques in life sciences.	B.P. Mohanty
National Symposium on Antarsthalia Matsiki Anusandhan Avam Vikas – Vartman Awastha Tatha Bhawee Dishayen, organized by CIFRI at Allahabad on March 15-16, 2004	–	D. Nath R.S. Panwar B.C. Jha U. Bhaoumik A.K. Das S. Samanta
-do-	–	D. Kumar, Shree Prakash, V. Pathak, K.D. Joshi
-do-	Videshi Machhaliyon ka jalasay mataysaki par parbhav, Gobindsagar as case study	V.K. Sharma
-do-	Sundarban mein Matisyaki evam Matasya jaiv vividhta	Ganesh Chandra R.L. Sagar
-do-	–	V.K. Sharma
Annual Meeting of HFNS Jai Vigyan Project (NATP) in New Delhi, 23-24 March, 2004	–	D. Nath
AICTE Workshop on Environmental Deterioration and pollution hazards : Issues and Stake, organized by United College of Engineering and Research, United Foundation (UCER-UF), Naini, Allahabad on March 28, 2004	Delivered lecture "Aquatic Pollution & Biomarkers for Aquatic Environmental Monitoring	B.P. Mohanty



15 WORKSHOPS, SEMINARS, SUMMER INSTITUTES, FARMERS' DAY, ETC.

Summer School on 'Fisheries Management of Floodplain Wetlands in India'

A Summer School on "Fisheries Management of Floodplain Wetlands in India" was conducted from 18th July to 16th August, 2003 at CIFRI Barrackpore.

The Summer School was inaugurated by Dr. S.N. Dwivedi, with Dr. M. Sinha and Dr. P. Das as Guests of Honour. In his inaugural address Dr. Dwivedi highlighted the important role played by the floodplain wetlands in uplifting the rural economy of India especially in the North and Northeastern parts of the country. The month long Summer School was attended by 25 participants from all over the country. The Summer School covered management, production function and socio-economic aspects of wetlands fishery through lectures, laboratory classes and field trips.



Inaugural session of Summer School.

Practical session in Hooghly river basin.



Final Workshop under NATP on Fisheries Management in Lentic Water System : Stocking of Reservoir with Fish Seed

The final workshop under NATP of PSR 48 entitled "Fisheries Management in Lentic Water System :

Stocking of Reservoir with Fish Seed" was organised at Institute's Headquarters, Barrackpore during November 21 and 22, 2003. The workshop was inaugurated by Dr. M. Sinha, ex-Director, CIFRI and was presided over by Dr. P. Das, ex-Director, NBFGR. The cooperating centre, PI's presented papers on their work and achievements. All the scientists of the Headquarters actively interacted with the CCPIs.



Final Workshop on NATP in progress.

Workshop-cum-training programme on Participatory Approach to Research and Development of Inland Fisheries Resources of Northeast

The Central Inland Fisheries Research Institute (CIFRI), organized a 12-day long Workshop-cum-training programme on Participatory Approach to Research and Development of Inland Fisheries Resources of North-eastern India at its North-east Regional Centre, Guwahati during December 1-12, 2003. The programme was aimed at developing tools, techniques and methods of participatory approach in the research and development of inland fishery resources. It is part of the efforts made by the Institute



to meet the training needs of the Northeast in the field of inland fisheries. A total of 27 fisheries officers from 7 states of the Northeastern region (except Mizoram), participated in the training programme. This is for the first time that a workshop on participatory approach to research and development of inland fisheries resources was held in the region.

Mr. S.M. Sangma, Honourable Minister for Fisheries, Govt. of Meghalaya formally inaugurated the training programme on 2nd December, 2003. Dr. M. Choudhury, Officer-in-Charge of the centre welcomed the trainees and accorded words of appreciation to the trainee officers from Sikkim, who were participating in the training programme for the first time.

Mr. S.M. Sangma in his inaugural address emphasized that regular trainings by CIFRI are needed to upgrade the knowledge of the farmers in the north-eastern region on the modern technologies developed for increasing fish production.

The Minister released 3 leaflets prepared by the Centre viz., 'Pen culture in beels of Assam', NER Centre of CIFRI and 'Floodplain wetlands management' on the occasion.

Delivering the presidential lecture, Dr. D. Nath, Director, CIFRI, Barrackpore emphasized the need for human resources development in the northeastern region for better management of its fishery resources and highlighted the efforts being made by the institute in this regard.

The training schedule was drawn in such a way that most of the recent information on participatory approach to research and development in inland fisheries were made available to the trainee fisheries officers. The last part comprised carrying out the PRA field exercises in villages bordering No.46 Morakolong beel (floodplain wetland), Morigaon District and in a fishing village (Amingaon) on river Brahmaputra. The results obtained from these exercises were

synthesized in the form of a PRA report by the trainees with active collaboration by the facilitators. Various groups presented their findings.

Workshop cum Training programme on Jheel Matsika Vikas Hetu Prabandhan was organised in Hindi at Mawai Jheel Band (Uttar Pradesh) by CIFRI Allahabad



Inaugural session of Workshop-cum-Training on participatory approach.



A training session at NEC.

Centre on 24.2.2004. Over 60 fishermen, fish farmers, fish traders, village people and state fisheries extension officials participated in the workshop.

The Institute organized a National Hindi Workshop on Fisheries entitled "Antarsthalia Matsika Anusandhan Avam Vikas - Bartaman Awastha Tatha Bhabhi Dishayen" during 15-16 March 2004 at Allahabad. Renowned scientists presented papers on various aspects of Inland fisheries in Hindi. Vice-Chancellor, Purbanchal University, inaugurated the Seminar in the presence of the Deputy Director General (Fisheries) and other dignitaries.

Fish Farmers' Day

The Institute organised a Fish Farmers' Day at



Dignitaries participating in discussion in the Hindi Workshop.



Hindi Workshop in Allahabad inaugurated by Vice Chancellor, Purbanchal University.

Kujerbagi Fishermen Cooperative Society, Nataberia, 24 Parganas (North) on June 20, 2003. A total of 321 tribal fish farmers and fisher women participated in the discussion.

National Fish Farmer's Day was organized by the Institute on 10th July, 2003 at Kanchrapara Fishermen Co-operative to commemorate first success of induced breeding where about 350 fish farmers/fishermen, students and interested persons were present and took part in the interaction session.

The Institute organised a Fish Farmers' Day on 10th September, 2003 at Bijpur Fishermen Cooperative Society where about 250 fish farmers and fishermen and interested persons were present and took part in the discussion.

The Institute organised a Fish Farmers' Day at Kulti, South 24 Parganas on 27th October, 2003 where 122 fish farmers fishermen and fisherwomen were present and participated in discussion with the scientists.

The Institute organised a Fish Farmers' Day at

Charapole, North 24 Parganas, on February 27, 2004 where 200 fish farmers/fishermen participated in the programme.

A Fish Farmers' Day was organized by the Northeastern Regional Centre of Central Inland Fisheries Research Institute (CIFRI), Guwahati at Samaguri Beel, Nagaon District, Assam on 30 December, 2003. The programme was sponsored by the NATP (Jai Vigyan) sub-project on Enhancing freshwater fish production from the beels through pen culture in tribal and hilly areas of Assam. The primary purpose of the programme was to facilitate informal interaction between the researchers of the Institute and the end-users about the pros-and cons of the pen culture technology demonstrated by the Institute in selected beels of the state. Over 100 beel lessees/fishers' cooperative society members/fishers from different beels of the district participated in the day-long programme.

Two leaflets on pen culture written in local languages (Assamese and Bengalee) were released and distributed among the participants.



Fish Farmers' Day at Samaguri Beel, Assam.



Hindi Week

The Institute observed the Hindi Week during 14-20 September, 2003 by organising meetings and various competitions like essay writing, official letter writing and drafting in Hindi. The week long celebrations culminated in a meeting attended by all members of the staff. While addressing the gathering the Director appealed for progressive use of Hindi in the day to day activities of the Institute.



Scientist interacting in Hindi Week celebration.

Vigilance Awareness Week

The Vigilance Awareness Week was observed at CIFRI from October 31, to November 6, 2003. The function was inaugurated by Sri Mukul Gopal Mukhopadhyaya, Chairman of Human Rights Commission, West Bengal.

16 DISTINGUISHED VISITORS

Distinguished visitors who visited the Institute and its centres during the period were :

Sri Manmohan Samal, M.P., Rajya Sabha, New Delhi
Dr. S.A.H. Abidi, Member, A.S.R.B., New Delhi
Dr. A.K. Samanta, Member, A.S.R.B., New Delhi
Dr. Y. Srikrishna, Principal Scientist, C.M.F.R.I.,

Dr. P. Das, Ex-Director, NBFGR, Lucknow
Dr. M. Sinha, Ex-Director, CIFRI, Barrackpore
Dr. H. Saharan, Director, Department of Fisheries, Haryana
Dr. S.N. Dwivedi, Ex-Director, Deptt. of Science and Technology, Bhopal, M.P.
Dr. P.V. Dehadrai, Retd. D.D.G.(Fy), ICAR, New Delhi
Dr. S. Ayyappan, D.D.G.(Fy), I.C.A.R., New Delhi
Dr. R.K. Jena, Director, CIFA, Bhubaneshwar, Orissa
Dr. M.Y. Kamal, Retd. Vice-Chancellor, Shere Kashmir University, Srinagar, J.K.
Dr. S.N. Singh, Director, Deptt. of Fisheries, Raipur, Chhatishgarh



Sri Gautam Basu, Financial Advisor, ICAR visits laboratories.

Cochin

Dr. Brij Gopal, Prof. Zoology Department, University of Delhi

Dr. K.L. Sehgal, Retd. Director, NCWRI, Bhimtal

Prof. H.R. Singh, Pro-Vicechancellor, University of Allahabad, Allahabad



DDG(Fy) in discourse with the Scientist in Pesticide Lab.



Dr. M. V. Gupta, World Fish Centre, Penang discusses with the scientists of ICAR institutes.

Dr. V.R. Chitranshi, A.D.G.(Fy), I.C.A.R, New Delhi

Dr. K.V.K. Nair, Former Head, Water Chemistry Division, Indira Gandhi Atomic Power Station, Govt. of India, Chennai

Prof. P.K. Abdul Azis, Professor, Department of Aquatic Biology and Fisheries, University of Kerala, Trivandrum

Shri Soman, Senior Lecturer (Zoology), M.S.M. College, Kaymkulam

Prof. Santosh Kar, Deptt. of Immunology, Centre for Biotechnology, Jawaharlal Nehru University, New Delhi

Dr. B.K. Dwivedi, Director, Bioved Research Society, Allahabad

Dr. Satya Mishra, Professor, Dept. of Mathematics, University of Alabama, USA

Dr. Mark Prein, World Fin Centre, World Fish Centre, Penang

Dr. Robert Author Marg, London

Mr. Modon Dey, Sr. Scientist, World Fish Centre, Penang.

Dr. Lallan Rai, Ex-Director, Institute of Agricultural Science, BHU, Varanasi

Dr. K.C. Jain, ADG(CC), ICAR, New Delhi

Dr. S.C. Aggarwal, Joint Director, Haryana Fisheries

Mr. V.K. Goel, CEO, FFDA, Yamunanagarm Deptt. of Haryana Fisheries

Dr. K.D. Tripathi, Commissioner & Secretary, Fisheries Department, Govt. of Assam

Dr. K.G. Sunny, Associate Professor, Fisheries College, Kochi

Dr. K.V. Jayachandran, Associate Professor, Fisheries College, Kochi

Dr. T.M. Jose, Associate Professor, Fisheries College, Kochi

Dr. K.G. Padmakumar, Associate Professor, Regional Agricultural Research Station, Kumarakom

Shri K.R. Narayanan, Fisheries Consultant, Sardar Sarovar Narmada Nigam, Gandhinagar

Dr. S.S. Ghosh, Zonal Coordinator, Zone II (TOT Projects), Kolkata

Shri Ganesh Bhaval, Lead District Manager, Lead Bank (United Bank of India), District South 24 Parganas

Shri Gautam Basu, Addl. Secretary and Financial Advisor (DARE/ICAR)

Dr. William Savage, STREHM-NACA, Bangkok, Thailand

Dr. M. Sagir Ahmed, Dept. of Zoology, University of Dhaka, Bangladesh

Dr. A.K. Sikka, Director, ICAR, RCER, Patna



17 PERSONNEL (MANAGERIAL POSITION ONLY)

Director, CIFRI, Barrackpore, West Bengal

Dr. V. V. Sugunan, Director (Acting) (upto 9th June, 2003)

Dr. D. Nath, Director (Acting) (from 10th June, 2003)

Riverine Division, Allahabad, Uttar Pradesh

Dr. R.S. Panwar, Principal Scientist, Head of Division (Acting)

Reservoir Division, Bangalore, Karnataka

Dr. D.N. Singh, Principal Scientist, Head of Division (Acting)

Estuarine Division, Barrackpore, West Bengal

Dr. D. Nath, Principal Scientist, Head of Division (Acting)

Human Resource Development & Transfer of Technology Division

Dr. Utpal Bhaumik, Principal Scientist
Head of Division (Acting)

Fish Health & Environment Division, Barrackpore, West Bengal

Dr. Manas Kr. Das, Principal Scientist, Head of Division (Acting) from 18.9.2001

Floodplain Wetlands Division, Guwahati, Assam

Dr. V.V. Sugunan, Principal Scientist, Head of Division (Acting) (upto 9th June, 2003)

Resource Assessment Division, Barrackpore, West Bengal

Shri R.A. Gupta, Principal Scientist, Head of Division (Acting)

Senior Administrative Officer, CIFRI, Barrackpore

Shri D. Moitra

Finance & Accounts Officer, CIFRI,

Shri V. S. Subramanian

18 ANY OTHER RELEVANT INFORMATION SUCH AS SPECIAL INFRASTRUCTURAL DEVELOPMENT

Nil

