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Annual Report

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agr search with a human touch

Central Inland Fisheries Research Institute
Barrackpore, Kolkata - 700 120
केन्द्रीय अंतर्स्थलीय मात्स्यिकी अनुसंधान संस्थान,
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Preface

Fisheries in inland open waters play important roles in sustaining the livelihoods of millions of rural poor, providing opportunities for diverse employment, income options and food and nutritional security. Owing to good potential for production enhancements and source of original fish germplasm, inland openwaters are one of the most important fisheries resources in the country. However, overexploitation of natural fish stocks, ecosystem degradation, manmade modifications for water diversion, pollution, *etc*., are the major concerns for these waters. Further, in the event of mounting anthropogenic pressures and perceptible climatic changes, it becomes emergent to protect these waters for sustained fisheries and harness their untapped production potential.

With this backdrop, CIFRI undertook number of institute-based, sponsored and network research projects during the year. The research activities included fisheries enhancement and management in reservoirs and floodplain wetlands, assessment and conservation of fisheries in riverine and estuarine systems, impact assessment of hydrological changes on fish stocks and food-chain, assessment of fish health and environmental impact, mapping of open-water inland fishery resources through remote sensing on GIS platform, evaluation of socio-economic status of fishers and valuation of goods and services provided by these waters. Institute has initiated collaborative research on Hilsa and restoration of Chilika Lagoon with international agencies like IUCN, BOBLME and World Bank. Institute has also implemented number of Sponsored and NAIP, Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), Ministry of Agriculture, Government of India, New Delhi, consultancy and out-reach projects during the year.

CIFRI is recognised as one of the major technology provider and project monitoring agency by DAHD&F and National Fisheries Development Board (NFDB), Hyderabad, the major organisations responsible for fisheries development in India. The technologies of cage and pen culture for fish seed production and fish stock enhancement in reservoirs provided by CIFRI are the most important interventions for inland fisheries development. It has led to considerable increase in fish productivity from reservoirs and wetlands.

During the year, CIFRI strengthened research and development linkages with different research institutes, universities and other organisations like State Governments of twenty States of the country, DVC, CDA, ICZM, *etc*. CIFRI contributed immensely in preparation of Draft Report of Fisheries Working Group on "Development and management of fisheries and aquaculture" for XII Five Year Plan, submitted to the Planning Commission, New Delhi.

CIFRI also contributed significantly for skill development and sensitization of inland fisheries stakeholders through various training programmes, mass awareness campaigns, exhibitions, educational tours of students and number of stakeholders meeting. The institute shared its research achievements at different levels of clientele starting from fishers to planners and policy makers at national and international levels.

I am highly grateful to Dr. S. Ayyappan, Secretary DARE & DG, ICAR for his constant support, worthy guidance and immense encouragement to improve performance of the institute. I am highly thankful to Dr. B. Meenakumari, DDG (Fy), Dr. S. D. Singh (ADG, I. Fy.), Dr. Madan Mohan (ADG, M. Fy), Dr. (Mrs). U. Moza, Shri Anil Agarwal and Shri P. K. Bage for their guidance and continued support to implement various activities of the Institute.

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Barrackpore, Kolkata
August, 2012

A. P. Sharma
Director

Acronyms

2-D	Two dimensional
ADG	Assistant Director General
ADG (I. Fy)	Assistant Director General (Inland Fisheries)
ADG (M. Fy)	Assistant Director General (Marine Fisheries)
av.	Average
avg.	Average
BLAST	Basic Local Alignment Search Tool
BOBLME	Bay of Bengal Large Marine Ecosystem
BOD	Biochemical Oxygen Demand
C.P.	Crude Protein
C/A	Reservoir catchment area ratio
$calm^{-2}day^{-1}$	calorie per meter square per day
CART	Classification and Regression Tree
Cd	Cadmium
CD	Compact disc
CDA	Chilika Development Authority
cDNA	Complimentary deoxyribonucleic acid
CFU	Colony Forming Units
CIBA	Central Institute of Brackish Water Aquaculture
CIFA	Central Institute of Fresh Water Aquaculture
CIFRI	Central Inland Fisheries Research Institute
CISCO	Computer Information System Company
cm	Centimeter
CPUE	Catch per unit effort
cu	Copper
DAHD&F	Department of Animal Husbandry, Dairying and Fisheries
DARE	Department of Agricultural Research and Education
DDG	Deputy Director General
DDG (Fy)	Deputy Director General (Fishery)
DG	Director General
DHA	Docosahexaenoic acid
DM	Data mining
DN	Digital number
DNA	Deoxyribonucleic acid
DO	Dissolved oxygen
DSS	Decision Support System
DVC	Damodar Valley Corporation
EFC	Expenditure Finance Committee
EPA	Environmental Protection Agency
ERNET	Educational and Research Network
FAO	Food and Agriculture Organization
Fig.	Figure
FRL	Full reservoir level
FW	Freshwater
$gC/m^2/d$	Gram carbon per square meter per day
GE	Gel electrophoresis
GIS	Geographical information system
GSI	Gonadal somatic index
ha	Hectare
HDPE	High density polyethylene
HEP	Hydro-electric project
HSP	Heat shock proteins
HTML	Hyper Text Markup Language
ICAR	Indian Council of Agricultural Research
ICZM	Integrated Coastal Zone Management
IDA	International Depository Authority
IL	Interleukin
IMC	Indian major carps
IRC	Institute Research Committee
ISI	Indian Standards Institute
IUCN	International Union for Conservation of Nature
kg	Kilogram
kHz	kilohertz
Lat.	Latitude
LIC	Life Insurance Corporation of India
long.	longitude
m	meter
m/sec	meter per second
m^3sec^{-1}	Cubic meter per second
MALDI-TOF-MS	Matrix-assisted laser desorption ionization – Time of flight –Mass spectrometry
MCM	Million cubic meter
$mgCm^{-3}hr^{-1}$	Milligram carbon per cubic meter per hour
mgl^{-1}	Milligram per liter
Mn	Manganese
MoEF	Ministry of Environment and Forest
msl	Mean sea level
MTCC	Microbial type culture collection
N	Number of sample
NAIP	National Agriculture Innovation Project
NCBI	National Center for Biotechnology Information
NGO	Non Governmental Organization
NIR	Near infrared
NJCHEP	Nyamjang Chhu Hydro-electric Project
nm^{-2}	Number per meter square
NMDS	Non-metric multidimensional scaling
NO_3-	Nitrate

ORF	Open reading frame
PAN	Panchromatic
Pb	Lead
PCR	Polymerase chain reaction
PGS	Parganas
PIX	Private internet exchange
PMF	Peptide mass fingerprinting
PO_4	Phosphate
PUFA	Poly unsaturated fatty acid
QRT	Quinqennial Review Team
RAC	Research Advisory Committee
RPF	Research project format
rRNA	Ribosomal ribonucleic acid
RS	Remote sensing
SD	Stocking density
SFA	Saturated fatty acid
SHG	Self Help Group
sq.ft.	Square feet
SQL	Structured query language
SWIR	Short wave infra red
t	tonne
TL	Trophic level
TLR	Toll like receptor
TRT	Tail res tunnel
u/l	Units per liter
ucm^{-2}	Units per centimeter square
USEPA	United States Environment Protection Agency
VSAT	Very small aperture terminal
WHO	World Health Organization
yr	Year
Zn	Zinc
ZSI	Zoological Survey of India
μScm^{-1}	Micro siemens per centimeter

Executive Summary

Executive Summary

Central Inland Fisheries Research Institute (CIFRI) has grown as a premier research organization in the field of inland fisheries and aquatic ecology at national and international level. It had a modest beginning as a Research Centre on March 17, 1947 at Calcutta. Number of CIFRI scientists have been recognized at national and global level and shouldered higher responsibilities in various national and international organizations.

CIFRI has regional centers/stations at Allahabad in the north, Bangalore and Kochi in the south, Guwahati in the North-east and Vadodara in the West. Its headquarter is located in eastern region of the country at Barrackpore. The institute has sanctioned strength of 95 scientists, 86 technical, 67administrative and 153 supporting staff. At present the institute has 56 scientists, 70 technical, 52 administrative and 105 supporting staff. The institute has effectively utilized budget allocation in both plan and non-plan.

CIFRI had eight institute funded research programmes with number of projects. These were formulated as per the recommendations of Research Advisory Committee (RAC) and Quinquiennial Review Team (QRT). The projects are in line with VISION 2025 and EFC for XI Five year Plan. These were implemented through Riverine Ecology and Fisheries, Reservoir and Wetland Fisheries and Fisheries Resource and Environmental Management divisions and Agricultural Economics Section. Besides these projects, different externally funded/sponsored projects were also executed successfully. The major research findings of these projects are précised below.

Riverine fisheries

- The investigations in river Yamuna revealed establishment of resilient exotic fishes - *Cyprinus carpio* and *Oreochromis niloticus* due to highly impaired conditions of the river. The exotic fish species contributed 39% share of total catches at Allahabad. Total fish landing in the river Yamuna at Allahabad was estimated at 140.83 t during 2011.
- The assessment of biodiversity of river Ken documented 80 fish species belonging to 53 genera, 24 families and 10 orders, while river Betwa exhibited 64 species belonging to 41 genera, 20 families and 9 orders. Among them 63 species were common in both the rivers, 17 were found only in the river Ken. A total of 18 fish species were recorded for the first time from the river Ken.
- Impact of decrease in environmental flow on fish diversity was assessed in the river Sone. Drastic reduction in discharge (<5.2 %) from Indrapuri barrage into the river, significantly altered the fish diversity and composition in the downstream stretch. A total of 21 fish species reported in fifties were not available at present, while 13 new species including 4 resilient exotic fishes were reported.

Estuarine Fisheries

- Remarkable change in salinity regimes across the Hooghly estuary was observed resulting in downward shift in salinity (80 km) as compared to pre-Farakka period. Higher monsoon inflow also reduced salinity to a great extent. All major nutrients, *viz*., nitrate, phosphate and silicate showed a decreasing trend between freshwater tidal zone and the lower estuary covering marine and transition zones.
- Zooplankton diversity indicated the presence of 44 species of zooplankters, whereas molluscs were represented by 94 species across the Hooghly system.
- The dominant small indigenous freshwater fishes in Nabadwip to Balagarh stretch were *Salmophasia bacaila*, *S. phulo*, *Aspidoparia morar*, *Corica soborna*, *Puntius sophore*, *Puntius conchonius* and *Ailia coila*, while for the stretch from Tribeni to Godakhali, the gobioid fishes *Glossogobius giuris*, *Apocryptes bato* and *Odontamblyopus rubicundus* were the dominant species. From Diamond Harbour onwards, the fish assemblage structure changed to assume more of an estuarine character with dominance of mullets (*L. parsia* and *L. macrolepis*) and anchovies (*Coilia dussumieri*, *C. ramcarati*, *Stolephorus spp.*), making their significant contribution to total catch.
- Fish species, *Pinniwallago bhagirathiensis sp nov.*, and prawn *Macrobrachium hooghliense sp nov.* were the new species recorded from Hooghly estuary during this study and these have been registered with the ZSI.
  The data on seed availability and gonadosomatic index of hilsa in course and period of migration in the estuary indicated its breeding zone 250 – 300 km from sea face in river Hooghly. Accordingly three breeding grounds for hilsa have been identified.
- The livelihood diversification among fisher women revealed highest diversification for nursing (29%) followed by fish grading (27%) and livestock rearing (15%) in two stretches of upper Hooghly estuary around Nawabganj and Tribeni.

Fish Health & Environment

- Investigations were conducted in river Brahmani from Vedvyas to Alapua (850 km stretch) to assess the ecological integrity, applying different bioindicators standardised under the project. River Bramhani is free from metal pollution (studied metals: Cd, Cu, Pb, Mn, Zn). Water and sediment quality of the Vedvyas to Jenapur stretch was optimum except at Darjing and Bijigol which were moderately polluted. The stretch recorded 61 species belonging to 19 families and 42 genus. Cyprinids were the dominant group (36.53%) followed by Bagrid (9.61%) and Schilbid catfish (9.61%). 63.46% were important food fishes.

- Proteome map of lens and muscle proteins of Indian

major carps *Labeo rohita, Catla catla* and the catfish *Rita rita* were generated, for the first time.

- About 32 crystallin spots; 11 α-A-, 4 α-B- and 17 γ-crystallins, out of total of 75 crystallin spots were identified in *Rita rita*.
- SWIR and green band significantly correlated with chlorophyll a and these bands were capable of predicting chlorophyll pigment concentration.
- The phenol degrading bacteria were identified by 16S-rDNA sequencing as: *Pseudomonas aeruginosa, Achromobacter xylooxydans, Pseudomonas putida, Bacillus megaterium, Microbacterium sp., Staphylococcus epidermidis and Klebsiella* sp.
- Four strains of bacteria have been tested in animal models and one strain was highly effective in reducing arsenic absorption and toxicity in the body and also effective in improving clinic-pathological conditions in arsenic-exposed animals. Thus the bacterium has potential in mitigating arsenic problem in arsenic exposed animals and man.
- For the first time, reference muscle proteome of commercially important inland fish *Catla catla* was generated and 70 proteins were identified using proteomic tools. Reference muscle proteome map for large riverine catfishes *Sperata seenghala* and *Sperata aor* were also generated. Using this information, a web-based database, named "*CifriFishProt*" has been developed.

Fisheries Resource Assessment

- Major rivers of northern and southern India, namely, Ganga, Yamuna, Chambal, Betwa, East Banas, Sone, Ken, Rupnarayan, Ajay, Subarnarekha, Kangsabati, Tapti, Narmada, Godavari, Krishna, Cauvery, Tawa, Tungbhadra, Hemawati, Mahanadi and Pennar were delineated using TNT Mips software for preparing species distribution map on rivers. Database were populated using fish species data for river Ganga, Narmada stretch-wise and for other rivers, like Brahamputra, Cauvery, Krishna and Godavari river-wise. Database was populated from published literature and published bulletins of CIFRI. This Web GIS will show the information of fish species on different stretches of rivers
- Significant positive ($p<0.01$) correlations between arsenic content in fish flesh and that of pond water ($r= 0.388$, $n= 294$) and sediment ($r= 0.462$, $n= 294$) have been established.

Reservoir Fisheries

- The limnological investigations of Mallaghatta, a small shallow reservoir in Karnataka indicated productive characteristics. Following CIFRI guidelines, the reservoir was stocked with 13.82 lakh seed (average length: around 4.0 cm) during 2008-11. An estimated catch of 22.47 t was recorded during February 2011 to January 2012. The average CPUE was 15.9 kg/day/fisher with the estimated yield at 59 kg/ha/yr.
- Hydroacoustic surveys were conducted in Kelavarappalli reservoir of Kerala. Fish distribution studies showed 2 to 682 fish detections at different zones.
- The experimental fishing with monofilament gill nets in surveyed areas revealed that 14 to 20 % fishes could be caught in Kelavarappalli Reservoir. Food web model on this reservoir revealed that African catfishes are detrimental for the fisheries and accordingly orders have been issued to ban the culture and marketing of African catfish in the state.
- The mass balance model and food web interactions in Karapuzha Reservoir, Kerala revealed that the Gangetic carps do not negatively impact the endemic species in reservoir ecosystem. Based on CIFRI's recommendation the Kerala Government has decided to stock reservoirs with Gangetic carps for enhancing fish production.
- A modified Verhulst-Schaffer model has been developed for sustainable fishery exploitation levels in stocked reservoirs, while a bio-economic model was used to estimate maximum sustainable yield and maximum economic yield.

Wetland Fisheries

- A fish yield model has been developed for predicting yield from wide range of ecosystems. The model predicted fish yield between 435 - 4190 kg/ha/yr with varying degree of stocking density depending upon their ecological condition.
- The scientific management of fish production in seasonally flooded area through community participation resulted in a fish productivity of 4948 kg/ha with 87% contribution of stocked fishes in paddy cum fish culture system and 4130 kg/ha in fish based system. The overall benefit cost ratio was estimated at 1.99 for former and 2.99 for the latter.
- Cage culture experiment at Charan beel, Morigaon, Assam was undertaken with a view to standardize stocking density of *Cirrhinus mrigala* fry at 300 fry/ m^2.
- The impact assessment of stocking in Charan beel revealed increase in fish yield from 228 kg/ ha/yr during 2000-01 to 740 kg/ ha/ yr during 2010-11. The share of major carps also increased to 62.8% during this year.
- Comparative studies on effect of open and closed nature of beels on wetland production process and biodiversity revealed more water table decrease, higher water productivity, sediment enzyme and microbial nutrient regeneration potential and benthic productivity in closed beels.
- Surveys of selected estuaries, rivers, reservoirs and wetlands revealed the presence of 13 species of exotic fishes, of this 10 have food value *(Hypophthalmichthys molitrix, H.nobilis, Ctenopharyngodon idella, Cyprinus carpio, Barbonymus gonionotus, Oreochromis niloticus niloticus, O. mossambicus, Clarias gariepinus, Piaractus brachypomus, Osphronemus* sp.) and three were of non food value (*Pterygoplichthys*

disjunctivus, P. pardalis, *Gambusia affinis)*. The abundance index of the exotic fishes in the studied water bodies varied from 8 to 54%.

Valuation of Inland Open Waters

- Partial valuation exercise of a 22 km stretch of river Brahmaputra around Guwahati in Assam estimated the annual value of its goods and services at Rs 107 crores.
- The annual total economic value of goods and services provided by Gosaba Island of South 24 Parganas in Sundarbans was estimated to be at Rs. 85.89 crores. The highest contributor was eco tourism (39%) followed by dike maintenance function of mangrove (22%) and fisheries (15%).

Outreach Projects

Carp culture in cages and pens using feed

Beneficial role of feed additives (probiotic and herbal attractant) was successfully demonstrated for carp rearing in cages installed in reservoir. Feeding time, frequency and ration levels were established for better feed consumption and utilization for raising carps in cages during summer and winter.

Outreach activity on fish genetic stocks

Accession numbers were obtained for 29 sequences submitted to NCBI gene bank.

Nutrient profiling and evaluation of fish as a dietary component

- Nutrient profile of the giant river-catfish *Sperata seenghala,* showed that it is a good source of lean meat and trace elements *viz*. zinc and iron.
- Fatty acid profiling of Indian shad hilsa, T*enualosa ilisha*, showed that medium-sized fish contained the highest amount of unsaturated fatty acids as well as ω-3 PUFAs, EPA plus DHA and the lowest amount of saturated fatty acids (SFAs). On basis of fatty acid profiles, medium-sized hilsa is the best followed by the small-sized fish for human health and nutrition.

ICAR Network Projects

Impact, adaptation and vulnerability of Indian agriculture to climate change- Impact assessment of climate change on inland fisheries

Vulnerability assessment of inland fisheries in West Bengal showed that Nadia and Murshidabad districts were in the very high vulnerable group among all districts of the state. It also revealed that fisheries in about 66% districts (6 out of 9) are vulnerable to climate change.

Microbial phosphorus transformation in inland open waters

The study observed that floodplain wetland sediments were very rich in phosphorus, mostly as organic matter, which got partly released in summer through microbial decomposition. Number of bacteria releasing P from inorganic and organic forms in culture media and in sediment in microcosm were isolated and identified.

National Initiative on Climate Resilient Agriculture

Assessment of spawning behaviour of major fish species in inland environment with a view to harness the beneficial effects of temperature

Survey of fish hatcheries was conducted in the states of Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, West Bengal, Assam and Tripura. The information gathered revealed advancement of the breeding period and a longer breeding duration of the Indian Major Carps (IMC). An e-Atlas of the hatchery survey data of Assam comprising various aspects of the breeding and spawning of the fishes was prepared.

National Fund for Basic Strategic and Frontier Application Research in Agriculture

The nature of impact of abiotic stresses on three diverse freshwater species of fishes

Proteomic analysis of liver proteins of heat stressed fishes revealed that the intensity of several proteins significantly increased in 36°C temperature-exposed fish liver indicating generalized up regulation of the expression level of heat-stress responsive proteins. The unique proteins identified by peptide mass fingerprinting include glyceraldehyde-3-phosphate dehydrogenase, ferritin, glutathione S-transferase, superoxide dismutase, HSP-60, -actin and, phosphoglycerate kinase.These findings have been compared with liver proteome of fishes colleted from the naturally heat stressed sites, like hot springs and thermal discharge sites.

National Agriculture Innovation Project (NAIP)

Arsenic in food chain: Cause, effect and mitigation

In vivo testing of a promising bacterial strain for its arsenic mitigation properties in animals indicated that it was deposited into MTCC/IDA. The accession number of the same was obtained.

Muscle proteome profile of Indian major carp *Labeo rohita* collected from arsenic contaminated versus reference ponds were compared using 2-D image analysis software. Analysis showed unique changes in proteome profile.

Bio-prospecting of genes and allele mining for abiotic stress tolerance

During the year 252 salt stress tolerant bacteria were isolated and 90 bacterial isolates were genotyped using 16S rRNA gene sequence analysis. 21 salt stress tolerant genes were characterized.

Toll-like receptors in phylogenetically divergent fish species–their contribution in modulating the innate immunity

Successful amplification of partial cDNA sequences of TLR21, MyD88, IL8, and IL-1β of catfish, *H. fossilis* and *C. batrachus* from head kidney showed sequence homology with LRR region and TIR domain to the tune of 84-99% in different cases. Induction by *A. hydrophila* on semi-quantitative expression of TLR signaling molecule, MyD88 revealed peaking at 3 hpi and 6 hpi in kidney and spleen respectively while dose specific induction with *E. tarda* in head kidney showed peak expression at 10^9 CFU.

Sustainable livelihood improvement through need based integrated farming system models in disadvantaged districts of Bihar

Culture of exotic catfish, *Pangasius sutchi* was conducted in rearing pond in Bihar with bottom covered with low cost polythene (HDPE) sheet to prevent leaching loss. A fish productivity of 4.59 ton/ha was obtained in 6 month.

Central Sector Scheme

Strengthening of database and geographical information system of the fisheries sector

Information gathered from six districts of Haryana showed total pond area (below 10 ha) at 14227 ha out of which only 12212 ha were used for aquaculture. The estimated productivity was 5267 kg/ha/year. Water bodies of Bihar, Tripura, Maharashtra, Mizoram and Manipur were delineated using PAN imageries. One CD of electronic Atlas on water bodies of Madhya Pradesh was released.

Department of Animal Husbandry Dairying and Fisheries (Government of India)

An assessment of literacy, income and health status of fishers in India

The data collected from over 1000 inland fisher households of 12 states of India revealed average family size at 4.68, literacy at 71%, birth weight of infant at 2.58 kg, average annual income per household Rs 30720/- with contribution of fisheries at 52% and average annual expenses at Rs 26200/with 51% share of food.

Consultancy Projects

- Assessment of environmental flows for Shivasamudram seasonal power scheme on river Cauvery, Karnataka
- Minimum environmental flow for the sustenance of ecology and biodiversity in Nyamjang Chhu river for Nyamjang Chhu HEP, Tawang
- Study of aquatic biodiversity in the river Ken
- Study of minimum environmental flows requirement for aquatic life in river Dri and Tagon for Etalin Hydroelectric Power Project
- Study of minimum environmental flows requirement for aquatic life in river Dri and Tagon for Attunli Hydroelectric Power Project
- Investigation and suggestive measures on fish migration in river Kameng for Londa (Talong), Hydroelectric Project, Arunachal Pradesh
- Post restoration assessment of the ecology and fisheries diversity of Chilika Lake

Human Resource Development

CIFRI was actively involved in capacity building, advisory and fisheries development activities. These activities included 27 training programmes, 14 Mass awareness campaigns, 22 exhibitions, 5 educational tours of students and 5 special day celebrations.

Introduction

Introduction

Brief History

The sub-committee of Central Government on Agriculture, Forestry and Fisheries led to establishment of the Central Inland Fisheries Research Station in Calcutta under the Ministry of Food and Agriculture, Government of India on 17 March 1947. Based on performance of the Station, it was elevated to Central Inland Fisheries Research Institute (CIFRI) in 1959 and shifted to Barrackpore (West Bengal) in its own building. The Institute came under the umbrella of Indian Council of Agricultural Research (ICAR), New Delhi in 1967. During last four and half decades, the institute has gone from strength to strength to establish itself as a premier research organisation on inland fisheries and aquatic ecology.

In the beginning, the objective of Institute was to appraise inland fishery resources and to evolve suitable methods for their optimum fish production. The research efforts of institute were devoted to understand and document the ecology and production functions of various inland water bodies in the country.

The plan priorities of Government of India during late sixties and seventies were on aquaculture research and development. In consonance with the priorities, the institute made significant progress and the Planning Commission approved five All-India Coordinated Research Projects namely Composite Fish Culture, Riverine Fish Seed Prospecting, Air-breathing Fish Culture, Ecology and Fisheries Management of Reservoirs and Brackish water Fish Farming during 1971-1973. The combined success of projects Composite Fish Culture & Fish Seed Production initiated in 1974 brought blue revolution in the country creating history in fish culture and laying down solid foundation for development of freshwater aquaculture in the country. The splendid success in the field of fresh and brackish water aquaculture led to establishment of the Freshwater Aquaculture Research & Training Centre at Dhauli (Orissa) in 1977, which was elevated to Central Institute of Freshwater Aquaculture, (CIFA) and Central Institute of Brackish-water Aquaculture (CIBA) in 1987. Similarly the achievements of CIFRI in coldwater fisheries gave birth to Directorate of Coldwater Fisheries (erstwhile National Research Centre on Coldwater Fisheries). Further, National Bureau of Fish Genetic Resources is also an outcome of CIFRI researches. Thus, CIFRI gave birth to four major fisheries research institutions in the country.

After formation of specialised institutes, mandate of CIFRI was modified to conduct research on fisheries in inland open waters, namely, rivers, reservoirs, floodplain and manmade lakes, estuaries, lagoons and backwaters. Since 1987, the institute is working on fisheries management and enhancement of fish production from these large water bodies. Accordingly, the mandate, vision and mission of the institute were modified time to time. During XI-Five Year Plan these were as follows:

Mandate

- To undertake basic, strategic and applied research in inland open-water fisheries viz. rivers, reservoirs, lakes, estuaries and associated waters
- To develop ecosystem-based technology and strategies for productivity enhancement in mandated waters
- To monitor environmental changes, their impacts on fisheries and developing mitigation action plans in collaboration with other organizations
- To create awareness, provide training and consultancy in inland open-water fishery management.

Vision

Eco-friendly enhanced fish production and productivity from inland open waters for livelihoods and societal benefits.

Mission

Knowledge based management for enhanced fishery, conservation of biodiversity, integrity of ecological services, and to derive social benefits from inland open waters.

Organizational structure

The institute research activities are pursued through three divisions and one section. The Heads of Division (HoDs) are the co-ordinators of research programmes undertaken in their division. One research programme is implemented by a section, with in-charge of the section as co-ordinator.

The regional Heads of the centres of CIFRI at Allahabad and Guwahati are the administrative heads and look after the implementation of the projects of all the divisions at respective regional centres. The Institute's research activities under various research projects are executed from the headquarters at Barrackpore, Regional Centres at Allahabad and Guwahati and research stations/ centres at Bangalore, Vadodara, Kolkata and Kochi. The aim and functions of divisions, sections and research support services are summarised below.

- **Riverine Ecology and Fisheries Division** with its headquarter at Barrackpore strives to monitor and develop effective management action plan for riverine and estuarine ecology and fisheries and resources of the country with adequate emphasis on the conservation of fish stocks. The research activities are executed from Barrackpore, Kolkata, Vadodara and regional centres at Allahabad and Guwahati.
- **Fishery Resources and Environmental Management Division** is based at Barrackpore and is working on fish health and environmental issues related to open-water fishery resources *viz.*, rivers, wetlands, reservoirs and estuaries. Monitoring of the ecosystem health and development of mitigation action plan through biochemical, microbiological, and biotechnological approaches for ecosystem restoration is also the responsibility of this Division. The division is also addressing the climate change issues related to fisheries and aquaculture. Creating resource management database on fish stocks and fishery resources in easily accessible formats is the other area of research of the division. The aim of this database management is to develop models or tools for sustainable exploitation of inland fish stocks.
- **Reservoir and Wetland Fisheries Division** aims at developing management norms for enhancing fish production from large, medium and small reservoirs of the country. The Division also carries out research on the wetland ecosystem production processes for optimising fish yield with special attention to biodiversity conservation and development of environment-friendly technologies. The research activities of this Division are implemented from Barrackpore and Bangalore, Kochi and regional centres at Guwahati and Allahabad.
- **Agricultural Economic Section** is conducting research on socio- economic, institutional and other relevant issues across different inland resources. The section is conducting research on valuation of inland resources and socio-economic aspects of fishers operating in reservoirs, rivers, wetlands and estuaries. The section located at Barrackpore executes projects in different parts of the country.

Research Support Services

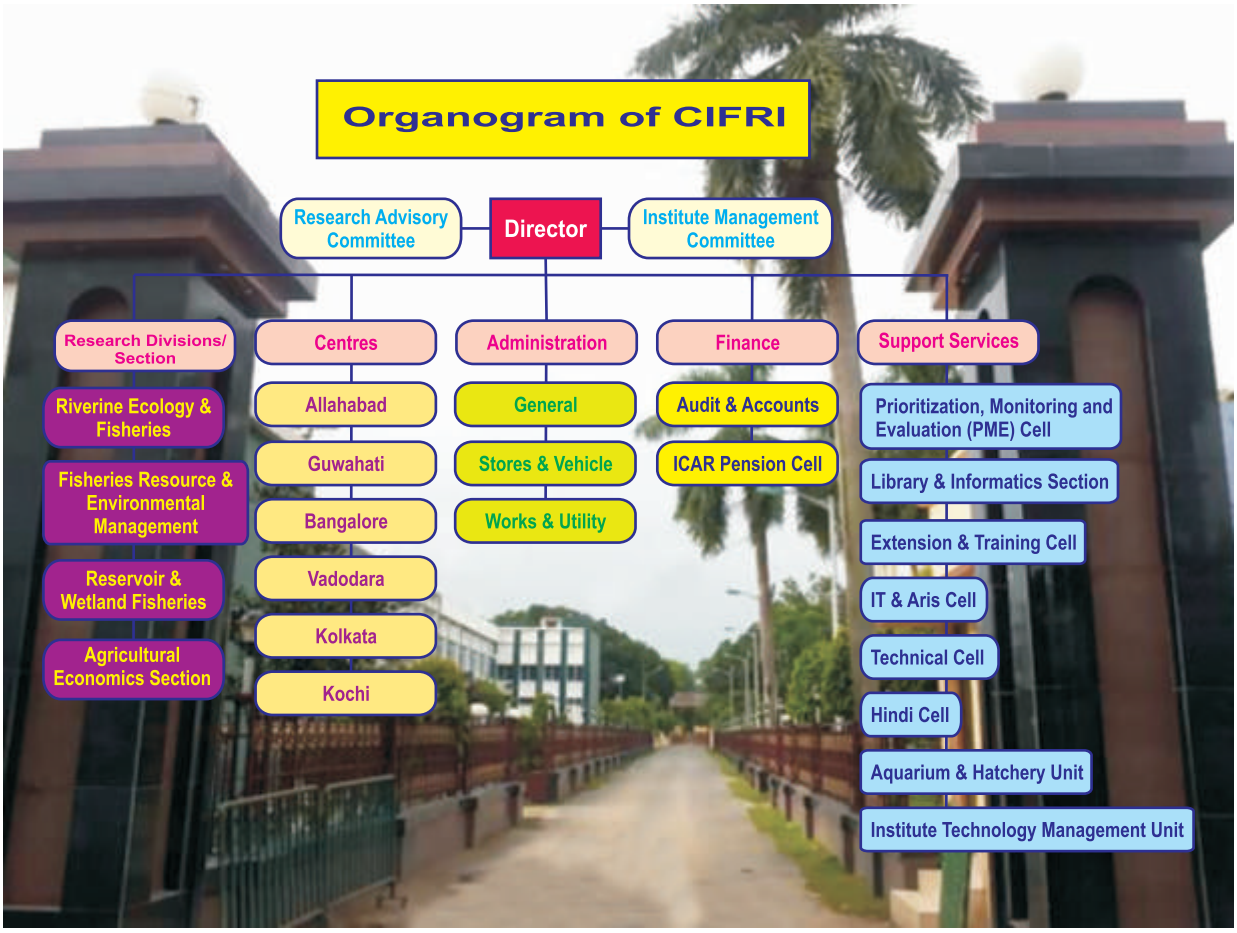
To execute various research activities, the institute has a support system in form of following cells, sections and units.

- **Prioritisation, Monitoring and Evaluation (PME) cell** is responsible for prioritisation, monitoring and evaluation of the research and other activities of the Institute. It is to co-ordinate, synthesize and monitor recommendations of QRT, RAC and IRC. It is responsible for preparation of institute publications including bulletins, annual report, newsletters, brochures, pamphlets, leaflets, etc., to disseminate institute achievements among various stakeholders. It maintains RPF files and scientific publications of Institute. It responds to queries raised by parliament, audit, ICAR and any other agencies. Finally, it is to support the Director and management in planning and implementation of different activities of the institute. Different research, administration and account sections assist the cell for these activities.
- **Extension & Training Cell** undertakes/organizes on regular basis various trainings, demonstrations, exhibitions, Fish Farmers' Day, and other extension activities for dissemination of various technologies of inland fisheries to the fish farmers, fishers, entrepreneurs, extension functionaries, *etc*. It also maintains liaison with other agencies. The institute has aimed at manpower development through this cell.
- **Technical Cell** provides technical support in preparation of monitoring reports to ICAR and Subject matter Division. Different research, administration and accounts sections assist the cell for these activities.
- **IT & ARIS Cell** promotes the use of information technology and provides computer, 24 hours LAN and internet facility to staff members. The cell provides technical expertise for computer application and related items procurement and maintenance, e-governance, e-procurement, Institute web hosting and server/computer security. The cell is equipped with infrastructure like Linux server, D-Link managed and unmanaged switches, CISCO Router, PIX Firewall, Workstations, printers, scanners and various licensed software. ERNET/VSAT facility has also been provided to all research stations.
- **Library and Informatics Section** facilitates various research activities through procurement, maintenance and issuing of books, journals, project reports, institute publications, etc. This year, library added 140 books and subscribed to 12 foreign journals and 70 Indian journals. The current total holdings are 12,869 books including over 1800 Hindi books and number of miscellaneous publications. Digitization of books and other materials is completed during the year.

- **Institute Technology Management Unit** executes the IPR related activities of the Institute.
- **Aquarium and Hatchery Unit** maintains the Institute aquarium and hatchery under National Seed Project.
- **Hindi Cell** publishes technical documents, reports, magazines in Hindi, translates various technical details in News Letter, Annual Report and other research publications. The Cell also carries out various social activities to popularize the Hindi language.
- **Administration section** is responsible for overall administration in the institute. The section is divided in number of sub-sections to support the Director and other research and technical staff for smooth implementation of research, extension and other activities.
- **Finance and Accounts section** looks after the financial management of the institute and maintains the financial records to provide support to the Director and institute staff to implement different activities as per financial regulations.

The Director is the only Research Management Position in the institute. He heads the Institute and is responsible for its overall management with support from Institute Management Committee. The Institute Research Committee and the Research Advisory Committee make specific recommendations pertaining to research and extension activities of the Institute.

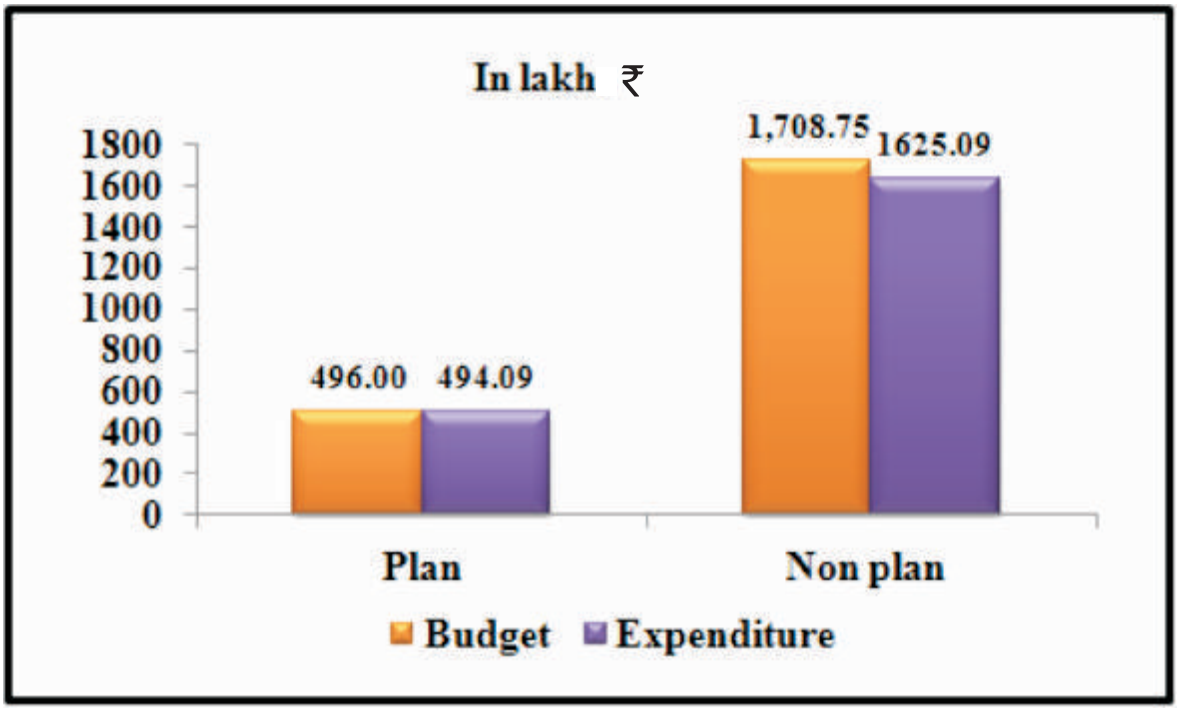
The structural outline of the Institute is depicted in the Organogram.



Budget Details

Budget Statement for the Year 2011-2012 **(Lakh ₹)**

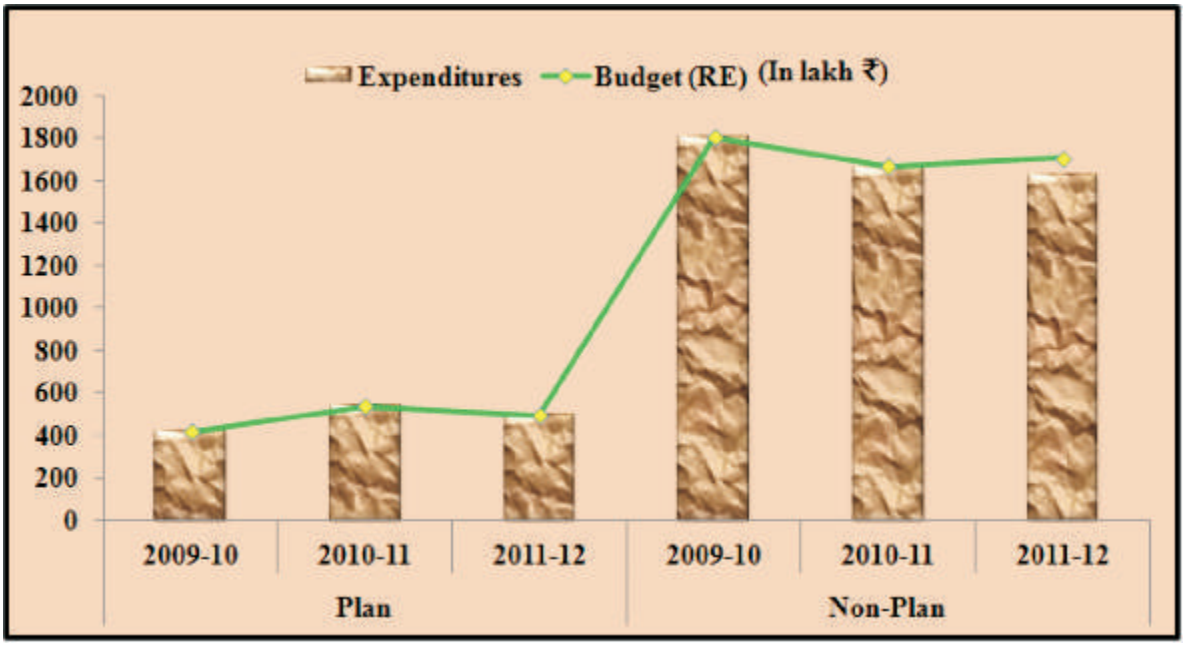
Head of Account	Budget (R.E.)		Expenditure	
	Plan	Non-Plan	Plan	Non-Plan
Pay & Allowance Including OTA	0.00	1576.00	0.00	1516.80
T.A.	41.00	6.00	40.85	5.79
Other Charges including Equipment, Library Books, IT and HRD	310.00	126.75	308.93	103.01
Works	145.00	0.00	144.31	0.00
Grand Total	**496.00**	**1708.75**	**494.09**	**1625.60**



Budget Details

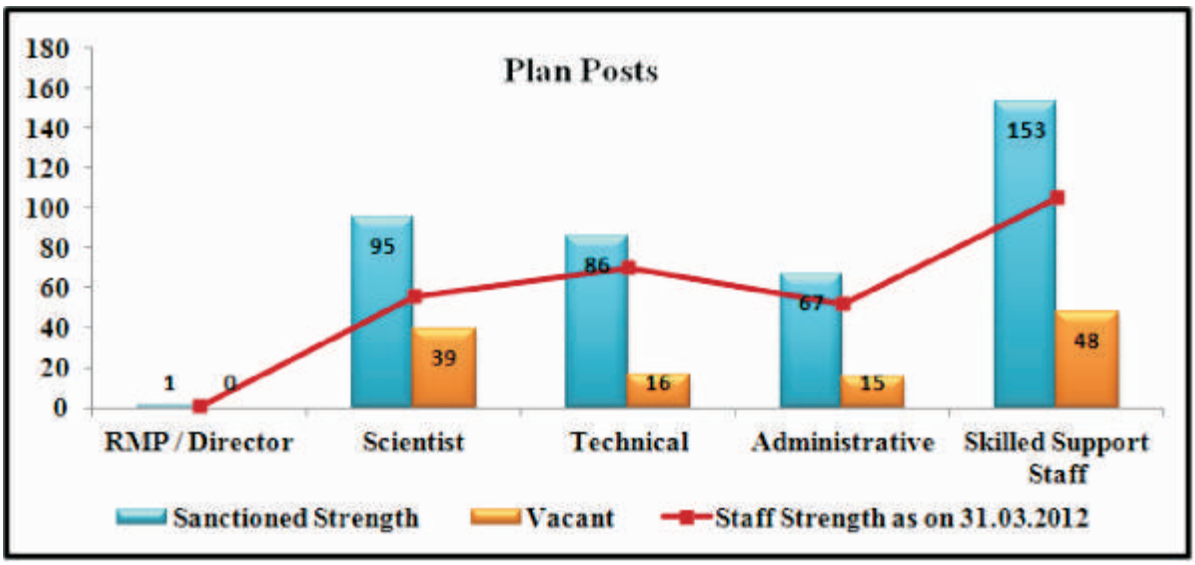
Comparative Budget Statement for Last Three Years (Lakh ₹)

Particular/ Year	Plan			Non-Plan		
	2009-10	2010-11	2011-12	2009-10	2010-11	2011-12
Budget (RE)	420	540	496	1807.67	1669.95	1708.75
Expenditures	419.67	539.65	494.09	1807.67	1661.5	1625.60



Staff Position as on 31 March, 2012

Category	Plan Posts		
	Sanctioned Strength	Staff Strength as on 31.03.2012	Vacant
RMP / Director	1	1	-
Scientist	95	56	39
Technical	86	70	16
Administrative	67	52	15
Skilled Support staff	153	105	48
Total	**402**	**284**	**118**



Research Achievements

Programme: Developing fish stock and management protocols of rivers and associated ecosystems

Programme Co-ordinator: U. Bhaumik, Riverine Ecology and Fisheries Division

Project: RFM/NR/07/01/001

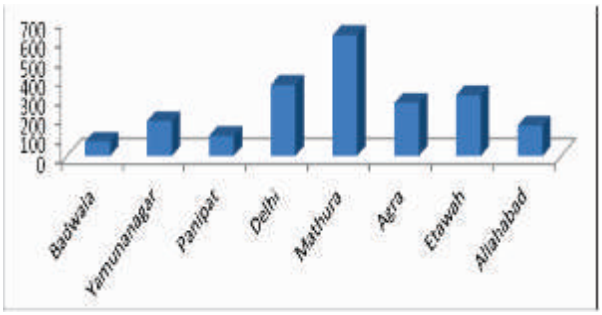
Generating benchmark information on ecology and fisheries for the Yamuna river for formulation of management action plans

Principal Investigator: K. D. Joshi
Co-PIs: S. S. Mishra and A. Alam
Technical support: S. K. Srivastava, K. Srivastava and V. Kumar

The river Yamuna from upstream hilly stretch at Badwala (Dehradun) to its confluence with the river Ganga at Arail (Allahabad) were studied for its abiotic and biotic parameters and fishery of the system.

Sediment quality

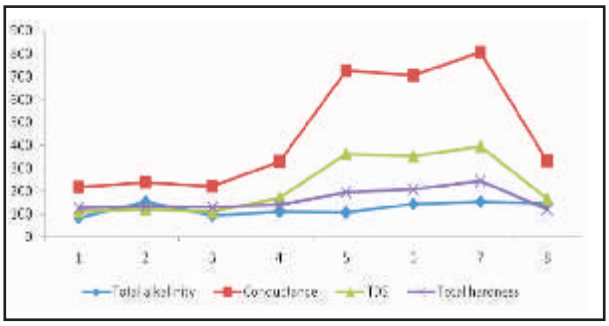
The sediment characteristics of the river Yamuna at 8 sampling centres between Badwala (Dehradun) to Arail (Allahabad) was observed to be alkaline in reaction (*pH*: 6.9-7.7). Sand content was high between Badwala-Agra stretches (94-99.0%) with decreased values (79.0-83 %) at Etawah-Allahabad. Free $CaCO_3$ ranged between 1.00 and 1.88%. The values for specific conductance showed abrupt changes being maximum at Mathura (630 µmhos) and minimum at Badwala (76.0 µmhos) due to accumulation of pollutants. Organic carbon (0.015-0.41%) was poor in all the stretches while available phosphorus was quite rich (1.6 -3.4 mgP/100 g).



Specific conductance of the Yamuna sediments during 2011-12

Water quality

Due to almost complete diversion of the Yamuna water coupled with discharge of huge quantity of sewage and industrial effluents considerable deterioration was observed in respect of water quality between Mathura-Etawah stretch with considerable decline in dissolved oxygen (4.7-5.28 mgl^{-1}) and accumulation of carbon dioxide (3.0-12.0 mgl^{-1}).



Variations in key water quality parameters at different sampling centres of the river Yamuna (1-Badwala, 2-Yamunanagar, 3-Panipat, 4-Delhi, 5-Matura, 6-Agra, 7-Etawah, 8-Allahabad)

Abrupt changes and high values of the vital chemical parameters like alkalinity, conductance, dissolved solids and hardness (106.0-156.0 mgl^{-1}, 330.0-806.0 µmhos, 170.0-398.0 mgl^{-1} and 142.0-244.0 mgl^{-1}, respectively) in the river between Delhi to Etawah stretch indicate highly impaired condition. Chloride was also very high between Delhi-Etawah stretches (71.0-142.0.0 mgl^{-1}). Dissolved organic matter, which is an apparent indicator of organic loading in the system, was also very high in these stretches (3.47-3.9 mgl^{-1}). The situation however showed considerable improvement at Allahabad stretch with all the chemical parameters including chloride and organic matter depicting considerable reduction.

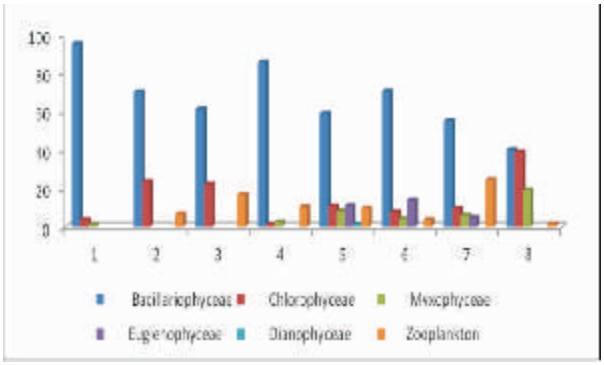
Biotic communities

The biotic components including fishes have also evidenced influence of pollution and organic load in the

river Yamuna particularly between Yamunanagar-Etawah stretch, as the biota was dominated by pollution indicator forms.

Plankton

Annual average abundance of plankton in the river Yamuna varied from 125 to 860 ul^{-1} being minimum at Panipat and maximum at Mathura. Phytoplankton composed 75.6 to 100 % of the group and the rest were zooplankton. Bacillariphyceae (40.1-95.1%) remained dominant component in almost all the stretches followed by Chlorophyceae (1.33-39.0 %) and Myxophyceae (0.0-19.2 %) with scarce and site specific population of Euglenophyceae and Dinophyceae. A total of 51 taxa were observed during the period in which 20 forms were from Bacillariphyceae, 15 Chlorophyceae, 5 Myxophyceae, 3 Euglenophyceae, 1 Dinophyceae, 3 rotifers, 2 crustacean and 2 protozoan. The maximum diversity was recorded at Agra stretch (19 forms) followed by Mathura, Etawah etc. The upland stretch of the river at Badwala registered 6 forms including *Diatoma vulgare* and *Tabellaria* sp. The important forms recorded from mid and down-stream stretches were *Nitzschia* sp., *Navicula* sp; *Cyclotella sp, Nitzschia palea*, *Melosira granulata* among Bacillariphyceae, *Ankistrodesmus falcatus, Scenedesmus, Pediastrum* sp among Chlorophyceae; *Merismopedia and Phormidium* among Myxophyceae; *Euglena* and *Phacus* among Euglenophyceae, *Peridinium* sp. among Dinophyceae. *Moina* sp., *Diaptomus* (Crustacean) and *Epistylis* sp. (Protozoan) were the major zooplanktonic forms encountered in the river.



Group wise composition (%) of plankton in the river Yamuna at 8 sampling stations (1-Badwala, 2-Yamunanagar, 3-Panipat, 4-Delhi, 5-Mathura, 6-Agra, 7-Etawah, 8-Allahabad)

Periphyton

The periphytic abundance in different sites of the river varied from 350 μcm^{-2} (Panipat) to 2253 μcm^{-2} (Mathura). The assemblage was constituted by phytoplankton only. Periphytic maxima were observed during winters. Bacillariphyceae (42.3-98.1%) being dominant component in almost all the stretches except Allahabad where Chlorophyceae (53.4 %) formed main group. Euglenophyceae was also present at highly impaired Mathura, Agra and Etawah stretches of the river. A total of 34 forms were encountered from the river, in which maximum diversity was recorded at Etawah stretch (17 forms) followed by Mathura, Agra, Delhi; minimum (6 forms). Dominant periphytic forms were *Cyclotella, Nitzschia, Navicula, Meridion, Melosira* among Bacillariophyceae; *Ankistrodesmus, Scenedesmus and Closterium* among Chlorophyceae; *Phormidium and Oscilltoria* among Myxophyceae; *Euglena* among Euglenophyceae.

Bottom biota

The numerical abundance of macrobenthic organisms at different sampling sites in the river Yamuna varied from 20 to 210 n m^{-2} being maximum at Agra and minimum at Badwala. The upstream stretch mainly consists of insect larvae. Dominance of *Tubifex* among annelids and Chironomus among insects in the middle stretch (Delhi-Etawah) indicate presence of organic load in the system. The Allahabad stretch of the river is rich in diversity and populations dominated by molluscs -*Bellamya bengalensis*, *Campeloma* sp., *Corbicula striatella* sp. and *Lymnaea* sp. reflect reduction in pollution load and improvement in water quality.

Fish and fishery

The river Yamuna holds rich piscine diversity owing to vast and varied catchments, influence of tributaries and diverse habitats. A total of 99 fish species classified under 68 genera, 26 families and 9 orders have been recorded from the river during the period. Out of these, maximum 88 species were from Allahabad stretch of the river followed by Agra and Panipat (70); Mathura and Delhi (66) and Yamunanagar (64). Family Cyprinidae dominated with 39 species followed by Siluridae (10 species) and others. The upstream cold-water stretch of the river at Badwala registered minimum 12 species. The drastically altered river habitats in the mid and downstream stretches are highly invaded by exotic fish species. Among the above 93 fish species were native and 6 species namely *Oreochromis niloticus, Cyprinus carpio, Hypophthalmichthys molitrix, Hypophthalmichths nobilis, Ctenopharyngodon idella* and *Clarias gariepinus,* were exotic. The exotic *Cyprinus carpio* and *Oreochromis niloticus* are fully established in the middle and downstream stretch of the river. The maximum invasion of exotics was observed from highly impaired Delhi-Etawah stretch of the river.

Fish landing in the river Yamuna at Allahabad during 2011 was estimated at 140.83 t in which contribution of major carps, catfishes, other fishes and exotics was 26.53 t (18.85 %), 20.999 t (14.91 %), 38.54 t (27.37 %) and 54.76 t (38.88 %), respectively. While total fish landing at Allahabad was estimated at 180.439 t during 2011, in which contribution of major carps, catfishes, other fishes and exotics was 30.369 t (16.83 %), 26.791 t (14.85 %), 59.018 t (32.71 %) and 64.261 t (35.61 %), respectively. Due to prolonged monsoon floods and resultant lesser fishing exposure, 19.71 % decrease in fish landing was registered at Allahabad in comparison to the preceding year. Hilsa fishery completely disappeared from the entire Yamuna river, as not a single specimen was observed during the period.

Project: RFM/NR/07/01/002

Understanding the impact of specific river link on the ecology and production functions

Principal Investigator: K. D. Joshi
Co-PIs: V. Pathak (up to 31.10.2011), R. S. Srivastava, D. N. Jha and Absar Alam
Technical support: S. K. Srivastava, K. Srivastava and Vijay Kumar

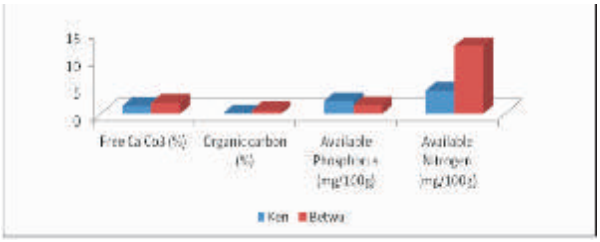
The ambitious Ken-Betwa link project envisages diversion of surplus waters (1020 m cum/annum) of Ken basin to dewater deficit Betwa basin. At present the water flow in the river Betwa is depleting rapidly. It was proposed that the surplus water of the river Ken will be drained through a 231.45 km link canal to the Betwa river after constructing a dam in the river Ken at Daudhan. The present studies were conducted in the Ken and Betwa rivers to assess the pre-linking scenario of abiotic, biotic and fishery parameters and assess the likely impact of linking.

Sediment quality

Sediment was dominated by sand in the river Ken (93.7 %) in comparison to the river Betwa (73.2 %).

River Betwa

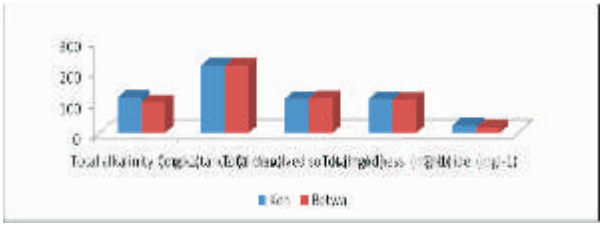
Accordingly higher values of silt (24.3 %) were observed in Betwa. The sediments were alkaline in reaction (pH: 7.5 and 7.6) in both the rivers. The values of conductance and free calcium carbonate were comparatively higher in Betwa (191.2 µS/cm and 2.03 %) than the river Ken (99.25 µS/cm and 1.50 %). Contrary to this the nutrient status in respect of available phosphorus was higher in the Ken (2.4 mg/100 g) than the Betwa (1.6 mg/100g). Organic carbon was higher in the Betwa (0.71 %) than the Ken (0.16 %). As both the river traverse through almost similar catchments, so the parameters are almost in similar ranges, the variations reported in conductance, free calcium carbonate etc. could be attributed to the river modifications.



Vital sediment parameters in the Ken-Betwa rivers

Water quality

The common feature of both Ken and Betwa rivers were rich oxygen (8.3-8.5 mgl^{-1}), alkaline pH (7.6) and poor nutrients (phosphate: 0.02 and 0.04 mgl^{-1}) although organic carbon was high (0.85 and 1.08 mgl^{-1}). The important chemical parameters - alkalinity, conductance, dissolved solids, hardness and chloride were comparatively higher in Ken (115.67 mgl^{-1}, 220.0 µS, 111.0 mgl^{-1}, 110.0 mgl^{-1}, 24.85 mgl^{-1}, respectively) than Betwa (99.67 mgl^{-1}, 219.0 µS/cm, 111.0 mgl^{-1}, 108.0 mgl^{-1}, 17.73 mgl^{-1}, respectively). Rich oxygen and moderate values of chemical parameters showed that the rivers were free from pollution load.



Comparison of vital water quality parameters in the Ken-Betwa rivers

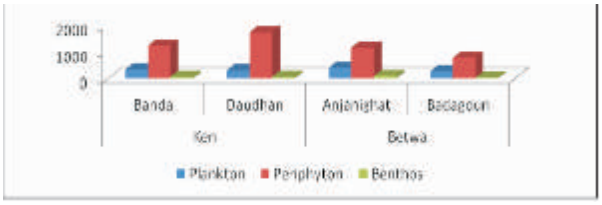
Rate of energy transformation

Studies on net energy transformation by producers were studied in both the rivers. The rate of energy transformation was comparatively higher in the Ken (av. 3290 cal m^{-2} day^{-1}) than the Betwa (av. 2897 cal m^{-2} day^{-1}).

Biotic communities

Plankton

Plankton population in the river Ken varied from 40 to 510 ul^{-1} (average 323 ul^{-1}) in different seasons. Maximum abundance was observed during winter followed by summer and minimum during monsoon. Generally phytoplankton formed the major constituent and only 10.5 % was contributed by zooplankton at Banda during post-monsoon. Among various planktonic groups, Bacillariphyceae (54.2-100.0 %) dominated during all the seasons and centres followed by Chlorophyceae (0.0 to 23.1 %), Myxophyceae (0.0 to 18.7 %) and the others. A total of 61 forms were recorded from the river in which 55 were phytoplankton and the rest zooplankton. Considerable inter stretch variation were observed in abundance and composition of various groups. Common genera encountered in the river Ken were *Navicula* sp., *Synedra* sp, *Fragillaria* sp. *and Meridion sp.* among Bacillariophyceae; *Ankistrodesmus* sp. *and Coelastrum* sp. among Chlorophyceae; *Phormadium* sp., *Lyngbya* sp. among Myxophyceae. Among the zooplanktonic forms *Diaptomus* sp. and *Bosmina* sp. were amongst crustaceans.



Average abundance of plankton, periphyton and benthos in the Ken-Betwa rivers

The plankton population in the river Betwa was observed in the range of 30 to 670 ul^{-1}. Maximum abundance was found during summer followed by winter and minimum during monsoon. Phytoplankton contributed 66.7 to 100 % of the plankton and the rest were zooplankton. A total of 41 genera were recorded from the river in which 33 were phytoplankton and the rest zooplankton. The common planktonic genera encountered in the river Betwa were *Synedra, Navicula,* and *Tabellaria* among Bacillariophyceae, *Ankistrodesmus,* and *Microspora* among Chlorophyceae; *Anabaena, Phormidium*, and *Lyngbya* among Myxophyceae and *Diaptomus* among crustaceans for zooplanktonic forms.

Periphyton

Periphytic population was in the range of 40 to 3440 cm^{-2} in the river Ken. Bacillariphyceae (60.3-88.7%) dominates among the various periphytic groups followed by Myxophyceae (6.2-36.7%) and Chlorophyceae (1.7-4.5%). In the river Betwa periphytic assemblage varied from 140-2680 ucm^{-2}. The dominant group was Bacillariophyceae (54.8-66.8%) followed by Myxophyceae (37.6-24.8%) and Chlorophyceae (7.5-8.3%). Common genera encountered were *Synedra*, *Fragillaria, Navicula,* and *Meridion* among Bacillariophyceae; *Ankistrodesmus* and *Cosmarium* among Chlorophyceae and *Phormadium* among Myxophyceae.

Benthos

Benthic population ranged between 47 and 187 nm^{-2} in the river Ken and 30 to 95 nm^{-2} in the Betwa. Insects (*Gomphus* and Chironomus larvae) were dominant in the Ken during summer and molluscs (*Bellamya bengalensis, Thiara tuberculata, Thiara lineata Gyraulus labiatus, Lamellidens marginalis and Parreysia flavidens)* during post-monsoon months while in the Betwa the annelids (*Nais* and *Tubifex)* were dominant group followed by molluscs (*Bellamya bengalensis, Gyraulus labiatus, Lamellidens corrianus*) . A total of 14 taxa were observed in the entire stretch, in which 12 belong to Molluscs and 1 each to Dipterans and Annelids.

Fish and fisheries

Owing to vast variations in habitats, both the river hold rich fish diversity. During the period under study a total of 81 fish species belonging to 54 genera, 24 families and 10 orders have been recorded from the river Ken. Out of these, 77 species are native and four are exotic (*Cyprinus carpio, Oreochromis niloticus, Hypophthalmichthys molitrix* and *Ctenopharyngodon idella)* fishes.

Chitala chitala from river Ken

A rare fish-*Anguilla bengalensis* from river Ken

molitrix and *Ctenopharyngodon idella)* fishes.

A total of 64 fish species belonging to 41 genera, 20 families and nine orders were recorded from the river Betwa. Out of these, 62 species are native and two exotic (*Cyprinus carpio* and *Oreochromis niloticus*). The major fishery recorded from different sampling sites in the river comprised of carps (*Labeo calbasu*), catfishes (*Sperata aor, Sperata seenghala*), murrels, eels and other miscellaneous species.

Out of the fish species observed in both the rivers 63 were common, 17 were only found in the river Ken; one species restricted to the river Betwa. A total of 18 fish species were recorded for the first time from the river Ken. Ken and Betwa rivers harbor certain threatened fish species along with some other fishes. A few stray specimens of very rare catadromous fish, *Anguilla bengalensis bengalensis* was also observed from both the rivers, while the fish was reportedly vanished from the main Yamuna river.

Likely impacts of inter-linking of rivers

Conspicuous variations in geographical, altitudinal, morphometric and substratum characteristics of the rivers support sizeable population of diverse fish species and number of breeding and feeding sites in the river course. The likely impacts of the envisaged surplus water transfer from the Ken to Betwa basin would be as follows:

- Water transfer is proposed from midstream segment of the river Ken at Daudhan, hence the fish diversity, composition, breeding and feeding grounds, migratory route in the downstream segment of the river would be affected negatively.
- The river Ken still holds some sizeable populations of *Chitala chitala, Notopterus notopterus, Sperata seenghala, Sperata aor, Labeo rohita, Wallago attu* and *Channa marulius*, depletion in water volume and velocity would affect the populations negatively.
- One of the rare fish species *Anguilla bengalensis bengalensis*, which is not sighted in the main trunk of the river Yamuna is still available in both the rivers. Further diversion of the Ken water and related developmental activities would definitely lead to extermination of this valuable fish species from the rivers.
- The river Ken also harbours some rare, endangered and threatened fish species; the proposed obstruction and water diversion would result in further depletion of the above populations.
- Both the rivers harbour sparse mahseer (*Tor tor*) population; the proposed dam in the river Ken would block free movement of the fishes to their breeding and feeding grounds, hence lead to further depletion of the species from the system.
- The proposed reservoir to be commissioned at Daudhan (approximate area 9,000 ha) would provide a valuable resource for reservoir fish production.
- Diverted additional water from Daudhan to the canal command area would help in revival and development of tank/lake/pond fishery in the drought prone command area.
- The proposed water augmentation would definitely mitigate the depleting fishery and piscine diversity in the water deficient river Betwa.

Project: RFM/ NR/ 07/ 01/003

To estimate environmental flow requirements of various categories of rivers in India

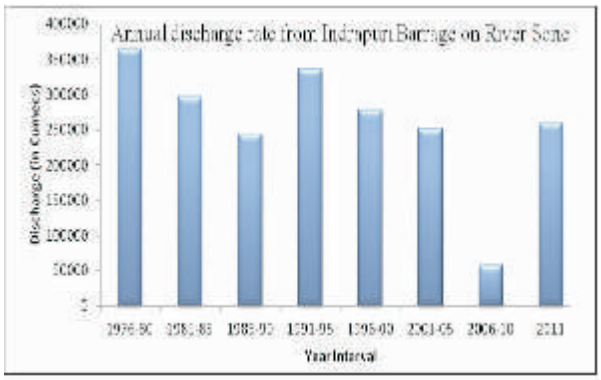
Principal Investigator: V. Pathak (up to 31.10.2011), K. D. Joshi (since 01.11.2011)
Co-PIs: A. K. Sahoo, D. N. Jha and A. Alam
Technical support: S. K. Srivastava and V. Kumar

The river Sone is an important right bank tributary of the Ganga river system. The river originates at an elevation of 600 msl near Amarkantak plateau in Madhya Pradesh and debouches in the river Ganga about 16 km upstream of Dinapur in the Patna district of Bihar. The river Sone was well known for changing course but this tendency has been checked by the formation of anicut at Dehri in the year 1873-74 and construction of Indrapuri Barrage in 1968. Construction of Indrapuri barrage and diversion of water had drastically changed the downstream flow, ecology and fishery. Studies were made at four selected sampling sites in the river to assess the impact of environmental flow on abiotic parameters, benthic and fishery components.

Water discharge from the Indrapuri barrage

River bed below Indrapuri barrage

During the period under report, heavy monsoon rains in the upper catchment area augmented the river flow substantially in comparison to the preceding year, hence released 21.78 times more water from Indrapuri barrage. Total discharge from Indrapuri barrage during the year 2011 was 2,60,245 m^3sec^{-1} (Av. monthly 21,687 m^3sec^{-1}) in comparison to mere 11,951 m^3sec^{-1} (Av. 996 m^3sec^{-1}) in the year 2010. Total discharge during flood period (July-October) and lean period (remaining months) was 2,28,376 m^3sec^{-1} (87.8 %) and 31,869 m^3sec^{-1} (12.2 %) respectively. The maximum discharge was 1,58,331 m^3sec^{-1} in the month of September 2011, while almost nil discharge during January – March 2011. The water discharge of the river during 2011 was considerably higher than the recommended value of 18.9 % of Mean Annual Runoff or 1,14,884 mcm as calculated by using the software - Global Environmental Flow Calculator. The heavy monsoon rains and flood has slightly improved the riverine characteristics and increased its wetted perimeter during lean period from 2-5 % to 12-15 %. The annual water discharge from barrage during 1980-2005 was of moderate to high quantity, but in recent past the discharge showed a drastic reduction and remained only 56363 m^3sec^{-1} (average 4680 m^3sec^{-1}) of which 81 % during flood and 19 % during lean season in the time period of 2006-10.



Variations in water discharge in the river Sone from the Indrapuri barrage during 1976 to 2011.

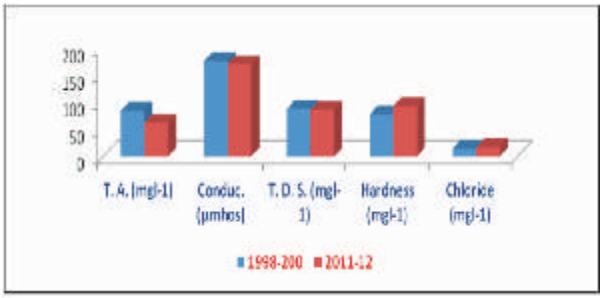
Sediment quality

Seasonal studies were conducted at four sampling centres including - three downstream to Indrapuri barrage and one upstream (Tilauthu). Sediment was dominated with sand in the entire stretch (79.5-99.0 %) but slightly lower values at Dehri - on Sone. Sediment was alkaline in reaction with pH ranging from 7.4 to 7.9 throughout the river. The organic carbon (0.24 %) available phosphorus (2.1 mgl^{-1}) and available nitrogen (3.57 mgl^{-1}) were comparatively in similar ranges with a few exceptions.

Indrapuri barrage on the river Sone

Water quality

The common water quality parameters in the river both above and below the barrage were rich oxygen (6.9-7.4 mgl^{-1}), alkaline pH (6.5 to 8.4), poor nutrients (PO_4: 0.02-0.04 mgl^{-1} and NO_3^-: 0.04 to 0.06 mgl^{-1}) and moderate dissolved organic matter (0.79 to 1.32 mgl^{-1}).



Comparison of important water quality parameters in the river Sone (1998-2000 & 2011-12)

The other chemical parameters like alkalinity, conductance, dissolved solids and hardness generally showed an increasing trend from Tilauthu (60.0 mgl^{-1}, 166.0 µS/cm, 86.0 mgl^{-1} and 84.0 mgl^{-1} respectively) to Koilwar (69.0 mgl^{-1} , 178.0 µS/cm, 89.0 mgl^{-1} and 87.0 mgl^{-1}, respectively). Chemical parameters showed healthy condition of the river. The current sediment and water quality parameters were almost similar to the study made during 1998-2000.

Potential energy resource of the river

The average rate of energy transformation by producers was comparatively lower above the barrage (2682 cal m^{-2} day^{-1}) and showed an increasing trend reaching maximum (3468 cal m^{-2} day^{-1}) at Koilwar. It was observed during the study that the flow rate has not affected the water quality and potential energy resource of the river over the years except slightly increasing trend in the down stretch.

Bivalve dominated bed at the Koilwar

Macro-benthic invertebrates

A total of 20 benthic forms were recorded belonging to molluscs (9 bivalves, 9 gastropods), insects (1) and oligochaete (1). Macrobenthic abundance at various centers ranged between 43-144 nm^{-2} being maximum at the upstream stretch -Tilauthu and minimum at the Koilwar and Andhari. The biota was dominated by molluscs (66-84%) followed by dipterans (9-34%) and oligochaetes. The maxima were observed during winter (175 nm^{-2}) and minima during monsoon (30 nm^{-2}) in the entire stretch. Gastropods remained the dominant component in all the seasons. The major forms encountered during the period were *Bellamya bengalensis, Thiara scabra, Brotia costula* and *Corbicula striatella* among Gastropods; *Lamellidens corrianus* and *Parreysia cylindrica* among Bivalves and Chironomus among dipterans.

Fish diversity and fishery

Due to sharp variations in the habitat characteristics, the river harbor diverse fish species. Hence a total of 87 fish species belonging to 58 genera, 24 families and 9 orders were observed from the river Sone. The drastic reduction in the water discharge from the Indrapuri barrage since last few decades has significantly altered the fish diversity and composition in the downstream stretch.

The upstream stretch of the barrage at the Tilauthu is in comparatively better condition and reflects good fish diversity and catches. Annual fish landing at the Tilauthu is estimated about 22t, mainly comprising miscellaneous fishes (75 %) followed by catfishes (15 %) and Indian major carps (10 %). The estimated fish landing at downstream to the barrage at Dehri-on-Sone and the Koilwar stretches varied from 11-15 t and mainly comprise miscellaneous fishes (50-95 %), catfishes (5-10 %) and scarce major carp populations. Sizeable invasion of exotic fishes has been observed from downstream stretches and maximum at the Koilwar where exotics constitute 20-35 % of the total fish landings. Meager Indian major carp population was observed at the Tilauthu stretch of the river and only a few fingerlings in the downstream segments during post-monsoon season.

Calculation of 35 years discharge data of the river Sone reveals that the mean annual runoff of the river reduced to 5.2 % during the last decade. Hence, severe impact of the construction of the Indrapuri barrage on the river Sone and resultant low water discharge are well discernible on river habitats, hydrological regime, fish diversity and fishery of the downstream segments. As a cumulative effect of the above activities 21 fish reported from the river in the fifties are not observed now days.

Further as a result of the drastic reduction in water flow pattern and alterations in morphometric characteristics of the river, 13 fish species (including 4 exotics - *Clarias gariepinus*, *Hypophthalmichthys molitrix*, *Cyprinus carpio* and *Oreochromis niloticus*) not evidently reported from the system earlier, have now appeared in catches from the downstream stretch during the period.

Experimental fishing in the river Sone above the Indrapuri barrage

Programme Title: Development of sustainable fisheries management protocols for estuaries and associated water bodies

Programme Co-ordinator: U. Bhaumik, Riverine Ecology and Fisheries Division

Project: ESF/WR/07/02/004
Developing and testing software based model as a forecasting mechanism for west-coast estuarine ecosystems

Principal Investigator: S. N. Singh
Co-PIs: K. Chandra and A. K. Prusty
Technical support: R. C. Mandi, R. K. Sah, J. K. Solanki, K. Jacquline, B. N. Das, K. P. Singh and A. Roychoudhury

Water quality

The observations under the study indicates that the water temperature varied from 24.2 to 33.6 ^{0}C for the Sabarmati estuarine system as a whole. There has been vast variation in water transparency which fluctuated from 4.0 to 86.0 cm. The stretch from the Rasikpura to Vataman recorded lowest transparency levels (4.0 to 16.0 cm.) due to receipt of brown/black colour effluents. Based on the prevailing transparency regime, a horizontal demarcation was evident, with high transparency at upper estuarine extent and low at lower estuarine expanse and this is attributed to effective tidal oscillation. The water reaction was alkaline and pH fluctuated from 7.0 to 8.52 confirming the system as a single entity. The dissolved oxygen regime (nil to 6.92 mg l^{-1}) indicated the Sabarmati estuarine system being a stressed environment, particularly the expanse from the Rasikpura to Vataman where DO was nil. High free CO_2 up to 52.0 mgl^{-1} corroborated the above inference. By and large, stressed conditions prevailed at all the representative sites with varying degree of intensity. Expanse from the Rasikpura to Anandpura recorded high total alkalinity (av. 231.5 to 360.50 mg l^{-1}) as compared to upper extent represented by the Paldi to Indira bridge (98.15 to 171.60 mg l^{-1}). Specific conductance portrayed parallel trend and a zonal demarcation was evident since stretch denoted by the Rasikpura to Anandpura experienced comparatively higher specific conductance (av. 2249.75 to 2638.25 µS cm^{-1}) than the upper estuarine extent represented by the Paldi to Indira bridge (av. 248.0 to 500.50 µS cm^{-1}). Major nutrients *viz.* phosphate, nitrate and silicate were considered for evaluating the trophic status of the Sabarmati estuarine system. Based on the average phosphate content (0.0195 to 0.2598 mg l^{-1}), the system may be classified under fairly rich side. Based on the average nitrate levels (0.629 to 2.810 mg l^{-1}), the Sabarmati estuarine system may be denoted as fairly fertile entity. Silicate content (av.13.43 to 23.74 mg l^{-1}) was significantly high.

Sediment's quality

Sediment reaction by and large was alkaline and the pH varied from 6.81 to 8.72 for the Sabarmati estuarine system as a whole. Organic carbon content (0.21 to 2.10 %) denoted fairly rich status of the system which was corroborated by available phosphorus (1.16 to 5.60 mg 100 g^{-1}) levels. Available nitrogen content of the system as a whole fluctuated between 5.60 and 12.88 mg/100 g, which also reflected fairly rich status of the system.

Specific conductance (av. 835.3 to 1174.5 µS/cm) was high at the stretch represented by the Rasikpura to Anandpura as compared to upper stretch (av. 508.5 to 581.0 µS/cm). Free $CaCO_3$ content was high (av. 10.06 to 13.0 %) at upper extent than lower estuarine expanse (av. 5.75 to 7.56 %) represented by the Rasikpura to Anandpura. Soil texture was predominantly sandy (av. 84.30 to 88.30.0 %).

Spatio-temporal variations of the plankton

Spatio-temporal dynamics of planktonic population prevailing at different representative sites was explored qualitatively and quantitatively and the salient features relevant to selected sites are as follows: Anandpura representing the lower estuarine extent recorded quite high plankton abundance of 4522 nos.l^{-1}. Phytoplankton (98.30 %), mainly contributed by Blue-greens (96.04 %) was the mainstay of this planktonic population. The blue-greens were represented by *Oscillatoria salina, Arthrospira* sp., *Spirulina* sp., *Microcystis aeruginosa* and *Agmenellum* sp. The zooplankton contributed meagerly (1.68%) and was shared by Protozoa (1.17 %) and Rotifera (0.31 %). The protozoans were prominently represented by foraminiferans *viz. Textularia* sp., and *Globigerina* sp. and rotifers mainly by *Brachionus calcyflorus, Keratella cochlearis* and *Asplanchna priodonta.*

The Vataman site experienced average plankton abundance of 3462 nos.l^{-1}. Phytoplankton (97.66 %) excelled as the major component of this abundance which was most conspicuously represented by Myxophyceae (90.58 %) like the preceding site. *Oscillatoria salina., Spirulina* sp, *Microcystis aeruginosa* and *Agmenellum* sp. represented the blue-greens assemblage. The diatoms (6.93 %) had fair contribution and *Synedra ulna. Aulacoseira granulata, Nitzschia umbonata* and *Navicula subtilissima* were important diatom taxa. Zooplankton (2.19 %) was mainly comprised of Protozoa (0.95 %) and Rotifera (0.66 %). Foraminiferans *viz. Textularia* sp. and Mastigophoran represented by *Euglena acus* and *Phacus suecica* contributed the protozoan population while *Brachionus*

bidentata and *Asplanchna priodonta* were important taxa representing the rotiferan population. This site recorded incidence of bacterium, *Zoogloea ramigera* (0.12 %), a bio-indicator of water contaminated with sewage and industrial wastes.

Ingoli, representing the lower expanse recorded slightly higher plankton population of 3791 nos. l^{-1} as compared to the preceding site. Regarding the qualitative texture of this abundance, phytoplankton (97.73 %) emerged as the most conspicuous component. Like the previous sites, Myxophyceae (92.74 %), shared the bulk of this abundance and was followed by Bacillariophyceae (4.59 %). Zooplankton (1.85 %) had meager contribution and was mainly represented by Protozoa (1.27 %) and Rotifera(0.40%). This site encountered high bacterial population represented by *Z. ramigera* (0.29 %) which is indicative of a stressed environment. Further, the upper stretch represented by the Rasikpura site recorded an average plankton population of 681 nos. l^{-1}. Pertaining to the qualitative spectrum of this planktonic population, phytoplankton (60.05 %) excelled as the major component, the bulk of which was contributed by Myxophyceae (47.28 %) and Bacillariophyceae (11.01 %) was of secondary importance. Significantly high population of zooplankton (32.45 %) was mostly comprised of Protozoa (30.10 %) and Rotifera (1.62 %). *E. acus, P. suecica* and *Vorticella* sp. were important taxa representing protozoan community. This site experienced higher incidence of bacterial population represented by Z. *ramigera* (1.04 %). The higher incidence of *Z. ramigera* population further confirmed that the expanse from the Vataman to Rasikpura is environmentally degraded. The further upstream stretch represented by the Paladi experienced highest average plankton abundance of 16996 nos. l^{-1} and like the preceding site, phytoplankton (87.90 %) proved the most reputed component while zooplankton (12.10 %) had also considerably high contribution. Pertaining to the qualitative spectrum, Myxophyceae (84.63 %) excelled as prominent floral component. The rotifers (8.58 %) and cladocerans (2.16 %) shared the bulk of the zooplankton assemblage of this site. *Filinia longiseta, Monostyla clastocerca, Conochilus unicornis, Keratella cochlearis, Hexarthe* sp. were prominent rotiferan taxa while *Bosmina* sp. *and Diaphnosoma* sp. denoted the cladoceran assemblage. The Indira Bridge representing the freshwater site recorded least plankton abundance of 105 nos.l^{-1}. Pphytoplankton (84.76 %) emerged as the most eminent floral fraction. With Bacillariophyceae (54.29 %), Myxophyceae (17.14 %) and Chlorophyceae (13.33 %), sharing the phytoplankton assemblage while the zooplankton had also considerably high population (14.29 %) which was comprised of Rotifera (4.77 %) and Copepoda (3.81%).

Summing up of the foregoing account revealed that the plankton abundance of the Sabarmati estuarine system as a whole varied from 105 (Indira Bridge) to 16996 nos. l^{-1} (Paldi). Phytoplankton was the mainstay of this abundance, which varied from 60.05 to 98.30 %. Pertaining to the qualitative texture, Blue-greens (47.28 to 96.04 %) excelled as the most eminent floral component except at the Indira bridge site where Bacillariophyceae (54.29 %) emerged as major group. Chlorophyceae proved the floral element of secondary importance. The zooplankton assemblage (1.68 to 32.45 %) was mainly comprised of protozoans and rotifers.

Spatio-temporal variations of the macro-benthos

Macro-benthic community analysis the Sabarmati estuarine system revealed that Anandpura, the lower estuarine site harbored low average macro-benthic population of 52 nos. m^{-2}. Diptera (82.69 %) followed by Annelida (13.46 %) excelled as the major component. *Tendipes tentans and Palpomyia tibialis* were important dipteran taxa. Vataman site recorded comparatively the higher average macro-benthic abundance of 231 nos.m^{-2} which was mainly contributed by Diptera (96.53 %) Prominentdipteran taxa were *Tendipes tentans* and *Chaoborus albipes.* Ingoli site contained poor average macro-benthic population of 36 nos.m^{-2}. Pertaining to the qualitative spectrum of this abundance, Diptera (55.56 %) and Mollusca (44.44 %) shared this abundance. The dipteran population was mainly comprised of chironomid larval forms and *Palpomyia tibialis*, while molluscan population was represented by *Digoniostoma pulchella, Gyraulus convexiusculus, Bellamaya dissimalis* and *Thiara tuberculata.* Rasikpura was observed to be the highly stressed site since this harboured very feeble average macro-benthic population of 9 nos.m^{-2} solely represented by Mollusca. *Bellamaya dissimalis*, *Lymnaea acuminata* and broken shell of *Corbicula annandalei* were important molluscans taxa. Paldi, the further upper site recorded highest average macro-benthic population of 1109 nos.m^{-2}. Diptera (96.75 %) contributed most of the macro-benthic abundance at this site. The dipteran population was represented mainly by *Tendipes tentans* Incidence of rat-tailed maggot, *Tubifera (Eristalis) tenax* inferred the organic enrichment of this site which is also conspicuous by highest benthic population at this site. Indira Bridge site representing the fresh water extent experienced an average macro-benthic abundance of 580 nos.m^{-2}. Mollusca (40.69 %) and Diptera (30.17 %) and Annelida (27.59 %) shared the bulk of macro-benthic population. *Bellamaya bengalensis, Digoniostoma pulchella, Thiara tuberculata, Gabbia orcula, Lymnaea acuminata and Corbicula peninsularis* were important molluscans taxa while dipteran population was represented by *Tendipes tentans, Pentanura monilis, Palpomyia tibialis.* Prominent annelid taxa were *Tubifex tubifex* and *Nais nais.*

Summarizing the above, the average macro-benthic abundance of the Sabarmati estuarine system as a single entity varied from 9 (Rasikpura) to 1109 nos. m^{-2}(Paldi). The benthic population was by and large comprised of dipteran and molluscans taxa .

Primary production studies

The Sabarmati estuarine system experienced average gross primary production rate varying from nil to 204.95 $mgCm^{-3}hr^{-1}$. Stretch extending from the Rasikpura to Vataman was observed to be severely stressed since this could not be recorded in this stretch. Average net production rate corroborated the above inference which fluctuated from nil to 87.12 mg $m^{-3}hr^{-1}$. Respiration rate was significantly high indicating higher organic loading. The P/R ratio reflected prevalence of heterotrophic conditions (zero to 0.72) which further confirmed that the Sabarmati estuarine system is highly stressed environment, particularly the Rasikpura to the Vataman stretch .

Testing of Bayesian Belief Networks model for its comprehensive applications

Fresh evidences generated this year were utilized to develop Bayesian Belief Networks based model and this has once again proved its efficacy as a potential tool as DSS for eco-health management.

Project: ESF/ER/10/02/005

Hydro-ecological conditions and their impact on fish distribution, population structure and sustenance under present flow regime in Hooghly estuarine system

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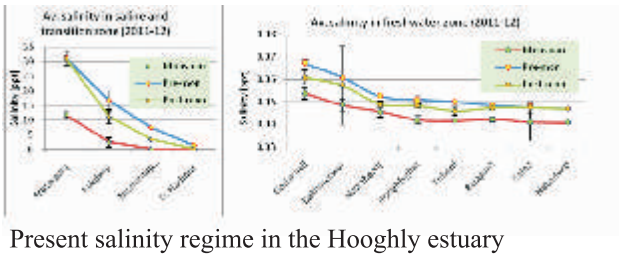
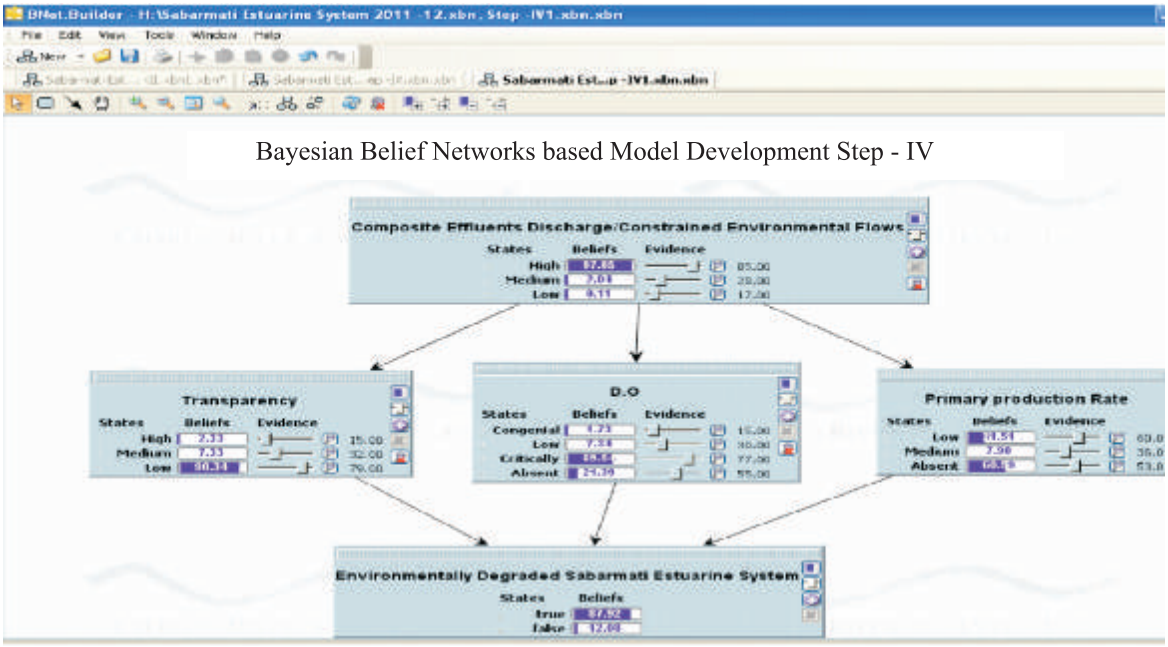
Present salinity regime of the Hooghly estuary

The salinity based zonation of 295 km long Hooghly estuary, which existed during pre-Farakka period has become modified as indicated from the observed values during 2011-12 .



Present salinity regime in the Hooghly estuary

The lower 50 km may now be assigned as saline zone, the upper 170 km (from Godakhali to Nabadwip) as



Bayesian Belief Networks based Model Development Step - IV

freshwater zone and the middle 75 km as transition or mixing zone. As of now, about 80 km downward shift in salinity has occurred in comparison to pre-Farakka period. Higher monsoon inflow affects a downward shift of the demarcation lines between the zones.

Other limnological parameters of the Hooghly estuary

Secchi depth transparency was found to be generally low (6-75 cm) in the Hooghly estuary with higher values at Fraserganj during post-monsoon. Water temperature varied in the range of 18.6 to 36.6°C. Specific conductivity varied in the range of 205 µS/cm at Nabadwip during monsoon and 43300 µS/cm at Fraserganj during pre-monsoon. Water was alkaline in nature and varied in the range of 7.0-8.8. Dissolved oxygen ranged between 4.6 and 8.3 mg/l with lower values during monsoon and significantly higher values during post-monsoon. All the nutrients viz. nitrate, phosphate and silicate observed a decreasing trend from freshwater to saline zone. BOD (Biochemical Oxygen Demand) seldom exceeded WHO / ISI recommended limit of 3 mg/l, except at Dakhineswar centre with higher BOD (4.4 mg/l) during pre-monsoon indicating local pollution.

Sediment parameters of the Hooghly estuary

Sediment pH was alkaline in nature and varied in the range of 7.6 to 8.7. Soil organic carbon generally remained low and varied in the range of 0.09 to 1.47 % (av. 0.58%). Accordingly soil total nitrogen was also low and ranged between 0.017% and 0.087% (av. 0.04%). Impact of local pollution is observed at Dakhineswar with higher values of organic carbon (av. 0.72%) and total nitrogen (av. 0.07%).

Plankton and benthos

Inventory on zooplankton diversity indicated the presence of 44 species of zooplankters across the Hooghly system. The most frequently encountered species were *Acartia spinicauda*, *Pseudodiaptomus serricaudata* and *Brachionus calyciflorus*. Among the phytoplankton, common species include *Nitzschia obtusa*, *Amphora lineolata*, *etc*. Benthic fauna consisted of 94 species of molluscs (Gastropods – 51 species, Bivalves – 39 species and Cephalopods – 4 species) from the Hooghly estuarine system. Abundance and distribution patterns of all molluscan species have been assessed along the salinity gradient.

Fish diversity and distribution

A total of 301 fish species belonging to 19 orders and 73

Bag net in all the zones

Veti/Vessel jal in FW zone

families were recorded during the entire project duration from the Hooghly estuary. The average number of species per family was highest among freshwater species (3.39), followed by marine (2.6) and estuarine species (1.7). The orders with highest family diversity were Perciformes (31 families; 102 species) followed by Siluriformes (9 families; 39 species) and Cypriniformes (4 families; 38 species). In terms of species richness Cyprinidae (32), Sciaenidae (18), Gobiidae (18), Engarulidae (15) and Clupeidae (14) were most dominant.

In the tidal freshwater stretch, the dominant fish species were *Corica soborna*, *Setipinna phasa*, *Odontamblopus rubicundus*, *Amblypharyngodon mola*, *Ailia coila, Tenualosa ilisha*, *Salmophasia bacaila*, *S. phulo*, *Aspidoparia morar*, *Puntius sophore*, *P. conchonius*, *Glossogobius giuris*, and *Apocryptes bato*. The estuarine zone was dominated by species like *O. rubicundus*, *Otolithoides pama*, *Escualosa thoracata*, *T. ilisha, Polynemus paradiseus*, *Liza parsia, L. macrolepis* and anchovies (*Coilia dussumieri*, *C. ramcarati*, *Stolephorus spp.*). In the lower high saline zone, the dominant fish species were *Harpadon nehereus*, *O. rubicundus*, *C. dussumieri*, *P. paradiseus* and *T. ilisha.* The change of fish community structure during monsoon was more prominent in tidal freshwater stretch with *A. coila*, *Labeo calbasu*, *Labeo rohita*, *Cirrhinus reba*, *A. mola* and *Channa punctata* dominating the fish community.

Discovery of new species of fish and prawn

One fish species, *Pinniwallago bhagirathiensis sp nov.*, and one prawn *Macrobrachium hooghliense sp nov.* were described and reported as new to science. The holotypes have been deposited in the National Zoological Collections of the Zoological Survey of India, Kolkata with holotype IDs ZSI FF4488 and ZSI C5914/2 respectively.

Macrobrachium hooghliense, newly discovered prawn from Hooghly

First record of sea horse species

From Kakdwip area, the sea horse species, *Hippocampus kuda*, an endangered fish species which has been listed in the Schedule – I of the Indian Wildlife (Protection) Act, 1972 was collected. This is the first record of sea horse from the riverine section of the Hooghly estuary.

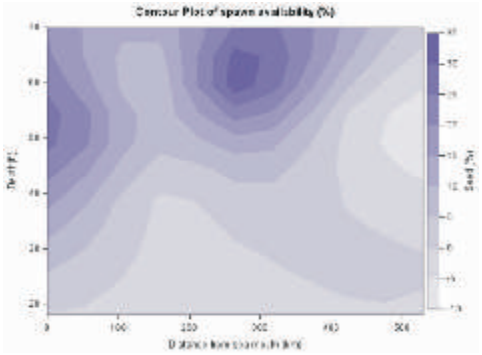
Sea horse recorded from riverine area of the Hooghly estuary

Winter migratory bag net fishery

A total of 107 species of fishes, 14 species of prawns, 7 species of crabs and 3 species of cephalopods have been recorded in the winter migratory bag net catches of the Hooghly estuary. The winter bag net catch of current year (2011-12) was estimated to be 34962 tonnes.

Model based prediction of hilsa breeding ground

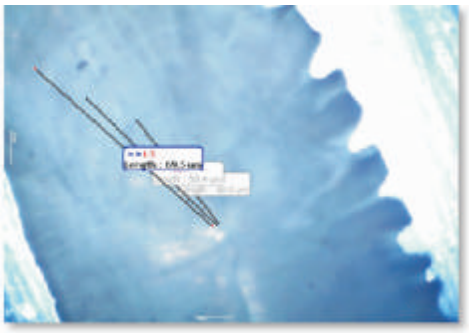
Based on seed availability and gonadosomatic index of migratory hilsa species, an attempt was made to identify the hilsa breeding ground in the Hooghly estuary. Model predicted that the most probable breeding zone of hilsa was 250 – 300 km from sea face .



Most probable breeding zone of hilsa in Hooghly estuary

Age and growth study of Hilsa by Otolith signature

A complete annular ring was observed at 215 mm hilsa indicating the age of one year, while fish at 410 mm showed three complete annular rings indicating fish to be three years old. Maximum length of hilsa in the sampling was observed to be 448 mm; indicating at present fishable life span of hilsa is 3+ year in Hooghly estuary. Earlier report of Pillay (1958) indicated maximum length



Otolith showing three annular rings

of 436 mm for 3.5 year hilsa, while Ruben *et al.* (1992) have observed maximum length at 508 mm for 4 year hilsa in the Hooghly estuary.

New records in Hilsa

Largest recorded hilsa

The length of hilsa either from sea or rivers is known to be maximum of around 510 mm in Indian waters. Recently, a female hilsa of 614 mm in length and 4250 g in weight was collected from the commercial catch of the Tapti estuary at Surat in Gujarat, which is stated to be of highest size recorded so far in India.

Smallest mature hilsa

Field observations from Hooghly estuary indicated that size at maturity of hilsa has gone down where even a small size of hilsa (215 mm, 105 g) had attained gonadal maturation with GSI value of 12.38 .

Largest recorded hilsa

Smallest mature hilsa

Project: ESF/ER/10/02/006

Ecological impact of mangroves on the fisheries with special emphasis on recruitment

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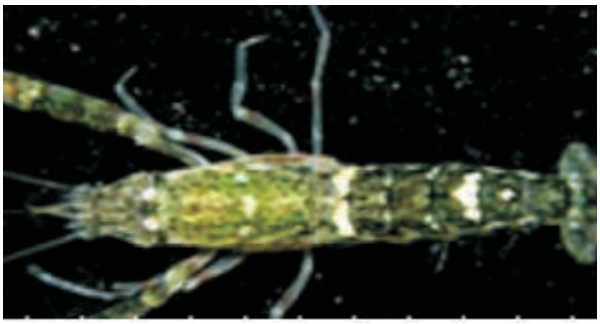
During 2011-12, a survey was conducted in three distinctly different areas of Sunderbans, *viz*., Gosaba, Dhamakhali/Sandeshkhali and Namkhana. Fisheries related parameters of water, soil, plankton, periphyton, benthos were assessed and correlated with the fish species available in these study sites.

Water and soil parameters of the Sunderbans

In general, water transparency was much higher in rivers of Sunderbans area, *e.g*., 78 cm Secchi depth was observed in the Bidya river (Gosaba). Similar transparency was recorded in the Muriganga river at Kankramari Char. Water was more turbid (Secchi depth 4-11 cm) in the Ichhamati-Raimangal river system around the Dhamakhali – Sandeshkhali area.

Water was saline in nature in most of the rivers of Sunderbans due to lack of freshwater discharge. However, impact of some freshwater discharge in



Alpheus rapax

Ichhamati-Raimangal river system around Dhamakhali – Sandeshkhali area made river water less saline (0.09-2.20 ppt). Higher salinity (14.8 – 28.2 ppt) in rivers around Gosaba area impacted fish community structure with an overwhelming dominance of *Harpadon nehereus* in bagnet catches. Parameters like sp. conductivity (1261 – 35600 µS/cm), total hardness (300-4300 mg/l), Sulphate (16.7-101.3 mg/l) etc were influenced by the salinity pattern and followed similar trend of salinity. Total alkalinity, on the other hand, was not influenced by saline water and varied in the range of 92-144 mg/l. Water *pH* was alkaline in nature and ranged between 7.5 and 8.5. Higher water *pH* was recorded from rivers around Dhamakhali – Sandeshkhali area. Dissolved oxygen was conducive to aquatic life and varied in the range of 5.5-7.2 mg/l. Among nutrients, nitrate level was higher (0.2-0.6 mg/l) in the Ichhamati-Raimangal river system as compared to Gosaba or Namkhana area. Similar trend of higher phosphate and silicate was also observed in the Ichhamati-Raimangal river system.

Organic carbon content of soil was at a medium level (0.6-0.9%), while the soil reaction was in alkaline range (*pH* 8.4-8.9). Total nitrogen was in normal range (0.03-0.57%). Soil specific conductivity followed the trend similar to salinity. Soil samples were also analyzed for two enzyme activities, *e.g.,* dehydrogenase and alkaline mono phosphatase for soil/sediment quality. A wide variation in enzyme activity was observed revealing the differences in soil microbiological activities depending on location.

Fish and fisheries of the Sunderbans

Survey was conducted during July 2011 in rivers around the Gosaba area of Sunderbans. A total of 37 fish species were recorded from the Gosaba area. *Harpadon nehereus* was found to be dominant in the catch (87.88 % in numbers) followed by *Coilia ramcarati* (5.67 %), *Setipinna taty, Pellona ditchela, Otolithoides pama* and *Coilia reynaldi*.

Panulirus ornatus

Sandeskhali area of the Sunderbans was surveyed during September 2011. All the fishing gears operating during the study period were covered to estimate the species composition. A total of 87 species of fishes belonging to 32 families were encountered from Sandeskhali-Dhamakhali area. Maximum diversity was observed in Gobiidae (12 species), followed by Mugilidae (6 species) and Sciaenidae (5 species). Two species of gobiids, *viz., Taenioides gracilis* and *Mahidolia mystacina* were recorded for the first time in the Sunderbans. The bag net catch was dominated by *Odontamblyopus* rubicundus (38.9 %), *Escualosa thoracata* (33.6 %) and *Mystus gulio* (3.88 %). The juveniles of hilsa (*Tenualosa ilisha*) were abundant in the bag net catches in the area (about 8.33 % in numbers). In the *Charpata jal*, the dominant species were *Mystus gulio* (62.4 %), *Liza parsia* (12.3 %), *L. macrolepis* (9.7 %) and *L. tade* (6.37 %).

During December 2011, Namkhana-Bhagabatpur area was surveyed. Samples were collected from 16 sampling stations covering the various rivers, canals and creeks, *viz.,* Hooghly, Saptamukhi, Raimangal, Ichhamati, and Thakuran. A total of 68 fish species were recorded from the Namkhana-Bhagabatpur area. The goby, *Acentrogobius cyanomos* and the puffer fish, *Arothron stellatus* were recorded from this region, which merit as the first record from Sunderban region. Lack of freshwater discharge in rivers inside Sunderbans is evidently the sole reason for extremely low availability of migratory hilsa, as compared to the Muriganga river which has high freshwater discharge from the Hooghly-Bhagirathi river system.

which has high freshwater discharge from the Hooghly-Bhagirathi river system.

Other biotic communities of the Sunderbans

Assessment of the other biotic communities has been made during this period. A total of 24 species of prawns, 33 species of crabs, 3 species of stomatopods, 2 species of sea-anemones, 2 species of star fishes, 74 species of molluscs, 36 species of zooplankters and 5 species of fish parasitic isopods were recorded during the study.

Fish recruitment study in the Sunderbans

The larval and juvenile samples were collected from catches in locally employed gears such as *meen jal* (a fine meshed net for capturing larvae and juveniles of fishes and shell fishes), bag nets and shooting nets. Experimental tow net operation was also carried out to maximize the sampling effort. The studies were conducted on both mangrove forest zone and the mangrove reclaimed zones. The larval/juvenile samples represented 27 species of finfishes, 6 species of prawns (*Fenneropenaeus indicus, Metapenaeus monoceros, Metapenaeus brevicornis, Parapenaeopsis sculptilis, Penaeus monodon* and *Acetes* spp.) and 4 species of crabs (*Charybdis rostata*, *Scylla serrata*, *Matuta planipes* and *Portunus sanguinolentus*). It was observed that the mean density (numbers/m^2) was higher in the mangrove zone in comparison to the zones where the mangrove vegetation has been cleared.

Project: ESF/ER/10/02/007

Gender impact assessment in inland open water fisheries

Principal Investigator: A. Roy
Co-PI: G. Chandra
Technical support: S. Saha and S. Majumdar

Two stretches of the upper Hooghly estuary, namely, Nawabganj and Tribeni were slected to assess the impact of gender role in open water fisheries. The basic information as well as the gender involvement was gathered using participatory rural appraisal tools in two villages located near the stretches.

Extent of gender participation in fisheries activities

Participation of fisher women in fishery activities in comparison to fishermen is absolutely minimal in the Tribeni stretch. In the Nawabganj stretch, fisherwomen performed grading of fish almost every day. It provides extra income of Rs. 60 per day to the family as mixed fish catch sold at low price in comparison to graded fish. Fisherwomen are also involved in other income generating activities like stitching clothes, wage earning, livestock, nursing and cooking. Catching of fish from the river and selling them is the responsibility of fishermen in this area.

Gender livelihood diversification

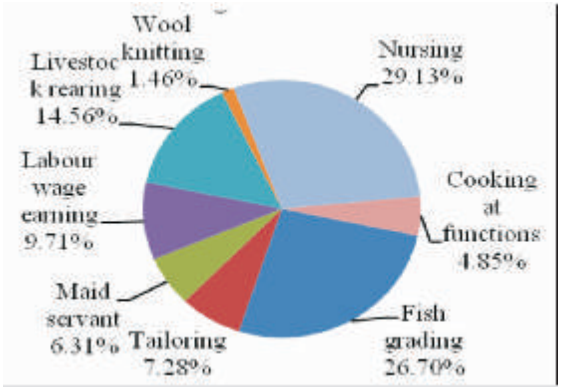
Livelihood diversification of fisher women was observed with declining fish catch and increase in numbers of fishers in last decade or so. Highest diversification (29.13%) was observed for Nursing followed by Fish grading (26.7%) and Livestock rearing (14.56%).

Socio-economic status

More than 80 % of the households in those two stretches come under below poverty line. Only 10 % of the population is educated beyond high school level. Five percent families are in the upper middle class, where one or two members are in government or private service. Fishing in the Nawabganj is more frequent and continuous in every month. The socio-economic status of fishers in Nawabganj is far better than Tribeni because of the proximity to educational institution, markets, and city.

Drudgery analysis

Intensive hard labour in routine work of fisher women is involved in fish grading, tailoring, labour wage earning etc. Cooking, livestock rearing etc comprise the category involving medium labour, whereas net weaving, washing, marketing of household goods and looking after children *etc*. are relatively easier in terms of labour involved.



Livelihood diversification for additional income

Programme: Environment and Fish Health Management in Inland Open Waters

Programme Co-ordinator: M. K. Das, Fishery Resource and Environmental Management Division

Project: FHE/ER/07/06/001

Developing fish-based indicator tools for environment monitoring

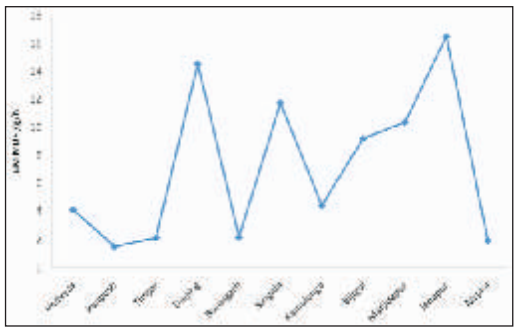
Principal Investigator: M. K. Das
Co-PIs: S. Samanta, M. Naskar, M. K. Bandyopadhyay, S. K. Manna, S. K. Sahu, D. Karunakaran, A. M. Sajinaand D. Sudheesan
Technical support: S. Bhowmick, L. R. Mahavar, K. Saha, H. C. Banik, S. K. Pal, S. Bandyopadhyay and A. Ghosh

River Brahmani and Narmada

Investigation under the project was conducted in 850 km stetch of river Brahmani from Vedvyas to Alapua in Orissa to assess the ecological integrity of the river. The entire stretch containing eleven sites for sampling was divided into two zones *viz*. upper stretch (Vedvyas – Bonaigarh), middle and lower stretch (Sirigida – Alapua). Investigation was also conducted in river Narmada.

Habitat characteristics

The river stretch investigated had the following characteristics: Elevation: 196 m-34 m; Width: 700 m-400 m; Depth: 5' -21'; Water velocity (m/sec): 1.4-0.2; Substrate type: Boulder, cobbles to sand clay; pH: alkaline ranging from 7.0 – 7.66 except at Darjing (6.8); Higher values of COD (7.2 – 10.0 mg l^{-1}) recorded in Vedvyas and Bonaigarh and less (6.6 – 7.1 mg l^{-1}) in lower and middle stretches. Dissolved oxygen ranged from 6.6 – 9.35 mg l^{-1} and mean specific conductivity ranged from 73.0-126.5 µS/cm.



Sediment dehydrogenase activity of river Brahmani

Assessment of water & sediment microbial enzyme activities

The river sediment respiration was within normal limit indicating healthy river condition.

Fish community studies

Fish diversity

In river the Brahmani species of the family Cyprinidae were dominant in all the 11 sites of the river. A total of 61 species were recorded belonging to 19 families. Food fishes constituted 63%, followed by 27% ornamental fish species. Jenapur, at downstream, recorded the highest number (51) of species dominated by hervbivores (44) and highest number of intolerant species (7).

Seasonal survey was carried out in the upper and lower stretches of river Narmada in the month of July 2011 and February 2012. Based on the important fishing centres, confluence zone, near proximity to effluent discharge points the stretches of the lower and upper segment of the river were divided in 10 sampling points covering about 580 km of river stretch. A total no of 77 fish species, belonging to 35 families were recorded from all the sites and adjoining fish landing centres. The fishes were categorized into trophic, habitat and tolerant guilds.

Environmental factors and relation with species diversity and distribution

Analysis of spatial relation of fish species abundance and environmental variables in the river Brahmani showed significant relation of lower depth with greater species diversity and abundance. In general, fish species distribution patterns in the river Brahmani were similar in both the pre- and post-monsoon season. The permutation test indicated that depth was statistically significant ($p<0.05$) for the species gradient. The species distribution gradient was relatively more towards lower depth. Other water and soil parameters analysed showed species distribution pattern was indifferent to these characteristics.

Project: FHE/ER/07/06/002

Monitoring and bioaccumulation of metal and pesticide contamination in the food chain of inland open waters

Principal Investigator: S. Samanta,
Co-PI: S. K. Nag
Technical support: K. Saha, L. R. Mahavar, S. Bandyopadhya and A. Ghosh

The water and sediment samples of the river Brahmani indicated that the studied metals (Cd, Cu, Pb, Mn, Zn)

were much below their level of pollution. The fish flesh samples also exhibited absence of any appreciable amount of the studied metals indicating that these are safe for human consumption.

The metal content in water samples of Sisodra to Ambetha stretch of the river Narmada showed safe levels of the studied metals (Cd, Cu, Pb, Mn, Zn). Sediment samples indicated moderate level of pollution in the Jhanore to Bhadbut area with Cu (90 – 170 ppm; > 50 ppm polluted USEPA criteria) and Zn (136 – 153 ppm; moderate pollution limit 90-200 ppm as per USEPA criteria) due to the discharges received in the stretch from Gujarat Industrial Development Corporation.

The data of metal content in sediments of the river Damodar, collected earlier under the project were also analysed. Although an increasing trend of Cu, Mn, Pb and Zn was noticed, it was statistically insignificant. Copper and zinc content in sediment was found at moderately polluted level with respect to the USEPA permissible limits.

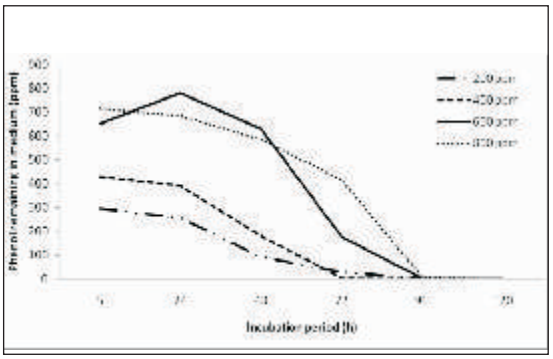
Project: FHE/ER/07/06/003

Microbial diversity assessment and their role in environmental mitigation in inland waters

Principal Investigator: S. K. Manna
Co-PIs: S. Samanta, B. K. Behera and P. Maurye
Technical support: H. C. Banik

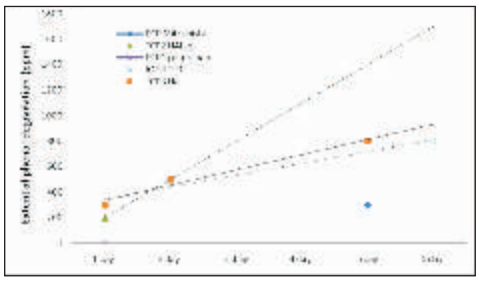
Laboratory based phenolic compound degradation trial by selected isolates

The 4-amino antipyrene method was modified to microvolumes for estimation of microbial phenol degradation in sewage water. The method was used to quantify phenol biodegradation in culture media. Thirty two bacterial strains were examined for phenol degradation. Twenty one strains grew well in phenol containing mineral medium and completely degraded 800-1000 ppm phenol in 6 days period in culture media.



Phenol degradation by strain phenol shawallace

To examine survival of the isolates in the polluted water and to examine efficacy of the isolates in phenol degradation in such environments, bacteria were added to sewage water supplemented with phenol. It was observed that most of the test strains were able to survive in sewage and efficiently degraded phenol. The phenol degradation ability was comparable to or even better in sewage than in mineral medium, indicating probable efficiency of the isolates in pollutant degradation under field condition.



Bacterial phenol degradation in sewage water

Identification of phenol degrading microbes : The phenol degrading bacteria were identified by 16S-rDNA sequencing method as: *Pseudomonas aeruginosa, Achromobacter xylooxydans, Pseudomonas putida, Bacillus megaterium, Microbacterium* sp., *Staphylococcus epidermidis* and *Klebsiella* sp.

Project: FHE/ER/07/06/005

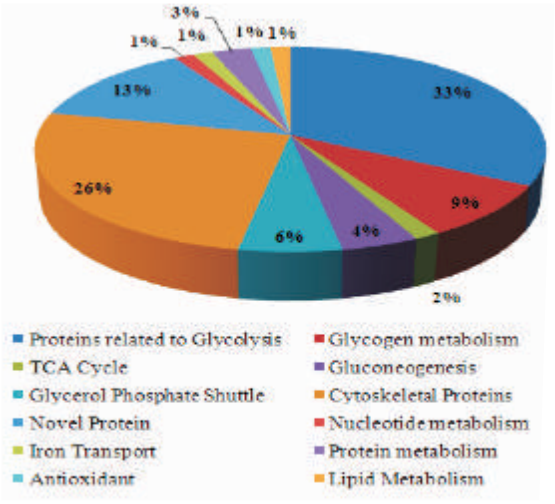
Developing health management protocols for inland aquatic ecosystems through proteomics

Principal Investigator: B. P. Mohanty
Co-PIs: M. K. Bandyopadhyay, D. Karunakaran and P. Maurye
Technical support: S. Bhowmick and Sk. Rabiul

The project aims at identification of biomarkers, under proteomics platform, which would be suitable for the pollution monitoring of the inland aquatic ecosystem.

Proteomic information on muscle proteome of *Catla catla*

To search for proteomic biomarkers for riverine pollution monitoring in muscle proteins of Indian major carp *Catla catla* generating the reference proteome map is a prerequisite. Reference muscle proteome of *Catla catla* have been generated and 70 proteins have been identified using proteomic tools like 2-D gel electrophoresis (2-GE), 2-D immunoblotting and MALDI-TOF-MS. The proteins identified include triosephosphate isomerase, pyruvate kinase, aldolase A, enolase 1 (α), phosphoglycerate kinase, glyceraldehyde- 3-phosphate dehydrogenase, L-lactate dehydrogenase, glycogen phosphorylase (Muscle), phospho-glucomutase-1, aspartate amino transferase, fructose-1,6-bisphosphatase, glycerol-3-phosphate



Classification of proteins identified by PMF via MALDI-TOF MS on the basis of pathways involved

dehydrogenase 1, muscle-type creatine kinase (M1, M2, M3), actin (α and β), adenylate kinase, transferrin variant F, protesome subunit alpha type 6, alpha-1-antitrypsin homolog, peroxiredoxin, apolipoprotein A-I etc. This is first such study on any commercially important fish species in India. The proteomic information generated will serve as baseline information in identification of biomarkers.

Muscle proteome of riverine catfishes *Sperata seenghala* and *Sperata aor*

Reference muscle proteome map for large riverine catfishes *Sperata seenghala* and *Sperata aor* have been generated. Proteins in the muscle proteome are being studied for pollution biomarker identification.

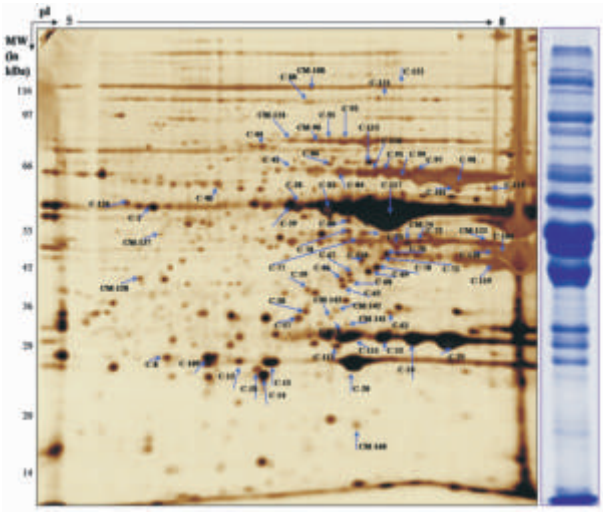
In continuation to our earlier findings on differential HSP70 expression in white muscle of freshwater catfish *Rita rita* under 2-D immunoblot platform, which might act as a riverine pollution biomarker, analyses of HSP70 expression patterns were carried out on *Rita rita* collected from different zones and stretches of rivers.

Development of a web-based database on fish proteomics

Using the proteomic information generated under this project, a web-based database, named CifriFishProt has been developed. The database contains information on muscle proteome of *Catla catla*, *Sperata seenghala* and *Sperata aor*, lens proteome of *Labeo rohita* and *Rita rita* and liver proteome of *Channa striatus.*

Antimicrobial peptides from skin mucus of fish

The skin mucus of fishes *L. rohita* and *R. rita* were tested by disc diffusion assay on agar plates. The proteins containing antimicrobial peptides were purified and



Muscle proteome of Indian major carp *Catla catla.* The proteins identified by PMF via MALDI-TOF-MS are shown by arrow marks

checked for inhibition with ten number of bacteria. Six species of *Pseudomonas* were highly and moderately sensitive to mucus antimicrobial proteins from *L. rohita* as compared to *R. rita*. The spectrum of antibacterial activity of mucus peptides from these two fishes was maximum for *E. tarda* (6 mm). The inhibitory activity of the antimicrobial peptides was moderately high for *Aeromonas* spp. (3.2-2.8 mm).

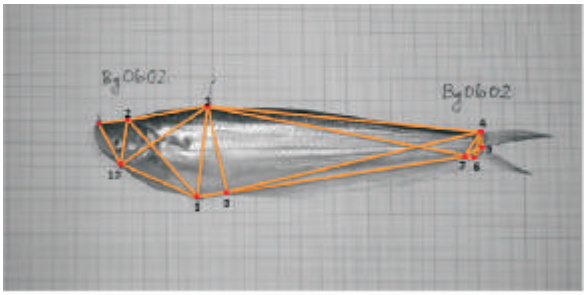
Project: FHE/ER/07/06/006

Population status of *Ompok* spp. in selected Indian rivers : Strategies for their conservation

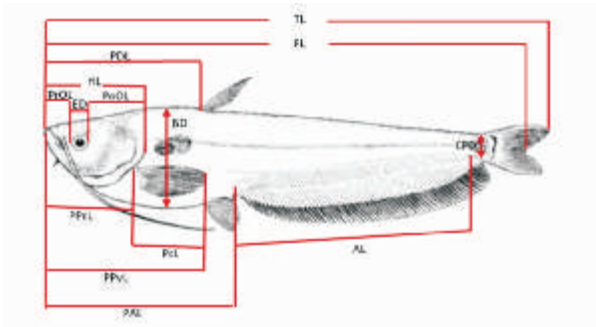
Principal Investigator: A. M. Sajina
Co-PIs: B. K. Behera, M. F. Khan, D. Sudheesan,. S. Das and D. N. Jha
Technical support: S. Bhowmick and K. Sucheta Majumdar, L. R. Mahavar and S. K. Pal

Population structure studies

Investigation on stock structure of *Ompok* spp. populations based on multidisciplinary analyses have been initiated, using conventional and truss morphometry, meristics and mtDNA markers as stock identification tools. Sampling was carried out at the river Bhagirathi stretches at Agradwip (23°34´N and 88°13´E).



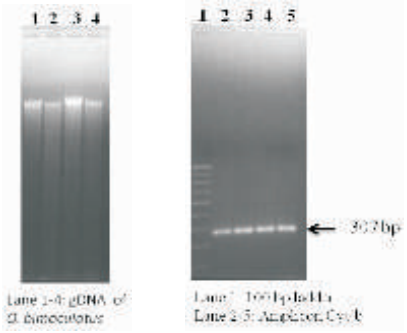
Truss Network of *Ompok* spp.



Conventional morphometric traits studied for *Ompok* spp.

Meristic traits of *Ompok* spp studied

S.No.	Meristic Traits
1	Dorsal fin rays
2	Pectoral fin rays
3	Pelvic fin rays
4	Anal fin rays
5	Caudal fin rays
6	Gill rakers
7	Branchiostegal rays



Genomic DNA has been isolated following standard Phenol-Chloroform method from fresh caudal fin tissues from 66 specimens. PCR was performed for Cytochrome-b gene at an annealing temperature of 56°C for 43 DNA samples.

Cytochrome–b gene sequence of *Ompok bimaculatus*

TTTAATAAAGCTTTCCCTCCAACATCTCAGCATG
ATGAAACTGGKKGGCTTCCTTACTATTATTATGC
CTCATCATACAAATCCTAACAGGACTATTCCTAG
CCATACACTACACCTCAGACATTTCAACAGCCT
TTTCATCCGTAGCTCACATCTGCCGAGACGTAA
ACTACGGCTGATTTATTCGTAATATCCACGCCAA
TGGAGCCTCATTCTTCTTCATCTGTATTTACCTT
CACATTGGACGAGGTCTCTACTACGGCTCATAC
CTATACAAAGAAACCTGAAACATCGGAGTAGTA
CTATTACTACTCGTAATAATAACTGCATTCGTCG
GATACGTCCTTGCCMWGAGGACAAATATCATTC
TGAGGGCCTGCAGTTTAA

Studies on feeding and reproductive biology of the species were also conducted.

Programme: Assessment of Resources and Database Development in GIS Platform for Inland Fisheries Using Remote Sensing Techniques

Programme Co-ordinator: M. K. Das, Fishery Resource and Environmental Management Division

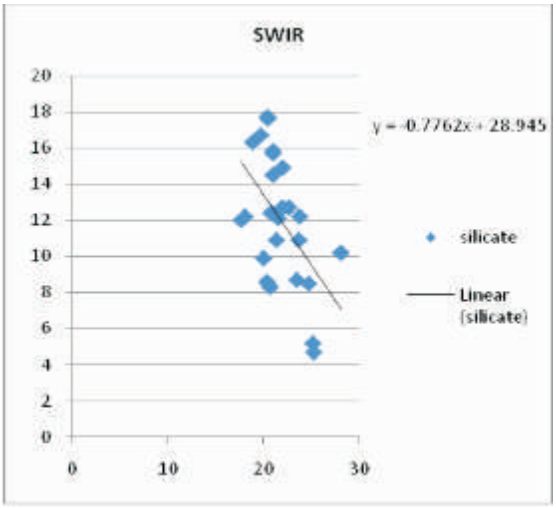
Project: FRA/ER/07/07/001

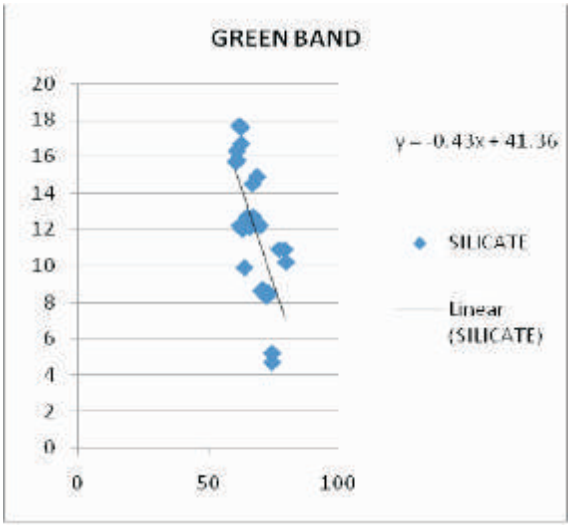
Assessment of inland resources using remote sensing techniques

Principal Investigator: D. Karunakaran
Co-PIs: D. Das and S. K. Sahu
Technical support: S. Majumder, Sunita Prasad, S. Bandopadhyay, S. Mandal and B. Bose

Study was conducted in 19 water bodies in Kaveri basin in the district of Mandya and Hassan of Karnataka to develop linear and multiple linear regression models that could be able to estimate water quality and chlorophyll. Post-monsoon IRS P6 imageries acquired on different dates were applied with linear uniform stretch to expose temporal variation in image brightness and applied the darkest pixel atmospheric correction to correlate with Remote Sensing imagery. The spectral reflectance signatures (DN values) of all four bands of the imagery were calculated through TNT Microimages image processing software and regressed against the water samples to produce a model to accurately predict chlorophyll *a* concentrations across the Kaveri basin.

From the study, it was observed that silicate is correlated significant in 0.01 levels in Green, SWIR band and 0.05 degree of correlation in Red band. Sulphate is significant in 0.01 levels in NIR water pH is significantly correlating in Red band. SWIR and green band significantly correlated with chlorophyll a and these bands were capable of predicting Chlorophyll pigment concentration.





Correlation coefficients for different physio-chemical parameters significantly correlated with various bands.

Pearson Correlation Coefficients, N = 25 Prob > |r| under H0: Rho=0										
	No3	Trans.	depth	Turbidity	sp_cond	Salinity	Chlori-nity	pH	Silicate	sulphate
NIR	0.32960 0.1076	0.16954 0.4178	-0.40899 0.0424	0.21974 0.2912	0.39762 0.0490	0.16077 0.4427	0.19398 0.3528	0.12278 0.5588	-0.16903 0.4192	0.59378 0.0018
RED	0.10367 0.6219	0.00093 0.9965	-0.55029 0.0044	0.18071 0.3874	0.25766 0.2137	0.10080 0.6316	0.12183 0.5618	0.01565 0.9408	-0.41455 0.0394	0.24862 0.2308
GREEN	- 0.15684 0.4540	-0.29425 0.1534	-0.47198 0.0172	-0.46157 0.0202	0.08254 0.6949	0.49769 0.0114	0.49773 0.0113	0.57737 0.0025	-0.70401 <.0001	-0.02512 0.9051
SWIR	0.40453 0.0449	-- 0.40455 0.0449	1.00000	0.03106 0.8828	-0.42166 0.0358	0.49756 0.0114	0.49785 0.0113	-0.18701 0.3707	-0.52796 0.0067	

Green : Correlation is significant at the 0.01 level; Red : Correlation is significant at the 0.05 level

Pearson Correlation Coefficients, N = 25 Prob > |r| under H0: Rho=0				
	chlo_a	chlo_b	chlo_c	total_chlo
GREEN BAND	0.54355 0.0050	0.48241 0.0146	0.30896 0.1329	0.53372 0.0060
SWIR NIR	0.59362 0.0018	0.55436 0.0040	0.35015 0.0862	0.60534 0.0013

Project: FRA/ER/07/07/002

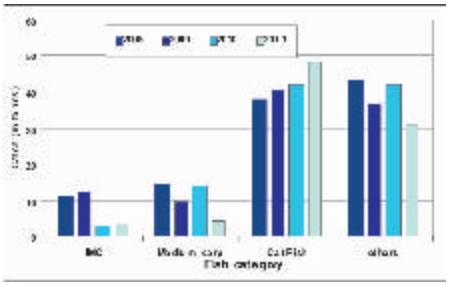
Development and standardization of database on Web GIS platform for capture fisheries inventory of resources and database

Principal Investigator: S. K. Sahu
Co-PIs: D. Karunakaran and D. N. Jha and A. K. Yadav
Technical support: S. Majumdar, S. Prasad and B. Bose

Systematic sampling on ten days in a month is being adopted for data collection at Allahabad and Guwahati centers of the institute depending on the fishing and landing patterns. The data on catch are being utilized for the development of database under the project. The data collected at different centers from various water bodies have been compiled and stored in the database for future use.

Brahmputra river (Uzan Bazar)

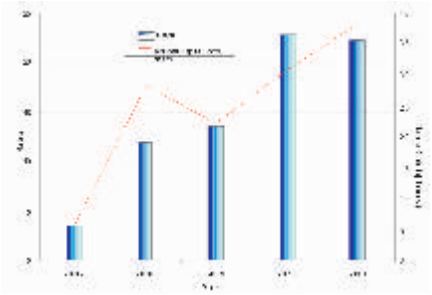
Monthly data on fish catch were recorded from the Brahamaputra River at Guwahati. It indicated that the species *A. morar, A. coila, L. bata, T. ilisha* and *L. dero*, were the dominant species in the catch. This year the estimated catch of *L. dero* was the lowest in many years. The estimated total catch worked out to be 87.35 t at the centre for 2011. In the previous year (2010) the catch was 101.07 t from the same landing centre. Catch composition of the last four years shows that in the last four years the production of IMC is decreasing, only excepting catfish production showed a positive trend in landing. Overall fish catch for this year shows a downwards trend.



Four years catch data of Guwahati

Ganga River (Allahabad)

The catch data were recorded from the Ganga river system at Allahabad centre. Tilapia was the major contributor to the fishery during 2011. The total catch from Sadiapur has been worked out at 140.8 t and from Daragunj it has been worked out at 39.6 t. Overall landing pattern shows an increasing trend but this year landing is 20 % less in comparison to previous year. Total estimated landing at Allahabad from the Ganga is 180.44 t.



Tilapia catch trend in last five years at Allahabad

Monthly catch shows that the month of June has maximum production followed by March. It is also observed that the catch for the first six months is higher in comparison to the last six months. It is also observed that in the last five years Tilapia catch increased by seven folds. In the year 2011 the tilapa contribution was more than 23% of the total catch.

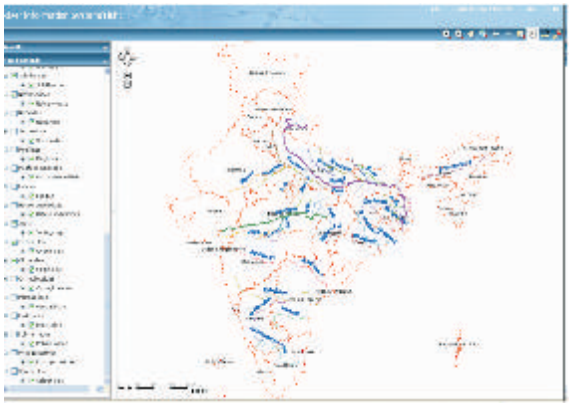
Fish species distribution map of river

Major rivers of North and South India namely Ganga, Yamuna, Chambal, Betwa, East Banas, Sone, Ken, Rupnarayan, Ajay, Subarnarekha, Kangsabati, Tapti, Narmada, Godavari, Krishana, Kaveri, Tawa, Tungbhadra, Hemawati, Mahanadi and Pennar were delineated using TNT Mips software for preparing species distribution map on rivers.

Fish species database, for 60 families in 14 orders namely Aulopiformes, Anguilliformes, Beloniformes, Clupeiformes, Cypriniformes, Cyprinodontiformes, Elopiformes, Perciformes, Pleuronectiformes, Scorpaeniformes, Siluriformes, Synbranchiformes, Tetraodontiformes, and Osteoglossiformes has been

developed in MS-Access. In the database most of the species belong to fresh water species except a few. The species belonged to the families Ambassidae, Amblycipitidae, Anabantidae, Anguillidae, Aplocheilidae, Ariidae, Badidae, Bagridae, Balitoridae, Belonidae, Carangidae, Channidae, Cichlidae, Clariidae, Clupeidae, Cobitidae, Cynoglossidae, Cyprinidae, Drepaneidae, Eleotridae, Engraulidae, Gerreidae, Gobiidae, Haemulidae, Heteropneustidae, Kurtidae, Latidae, Leiognathidae, Lobotidae, Lutjanidae, Mastacembelidae, Megalopidae, Mugilidae, Nandidae, Notopteridae, Osphronemidae, Pangasiidae, Platycephalidae, Plotoside, Polynemidae, Pristigasteridae, Scatophagidae, Schilbeidae, Sciaenidae, Scombridae, Serranidae, Siganidae, Sillaginidae, Siluridae, Sisoridae, Soleidae, Sphyraenidae, Stromateidae, Synbranchidae, Synodontidae, Terapontidae, Tetraodontidae and Trichiuridae.

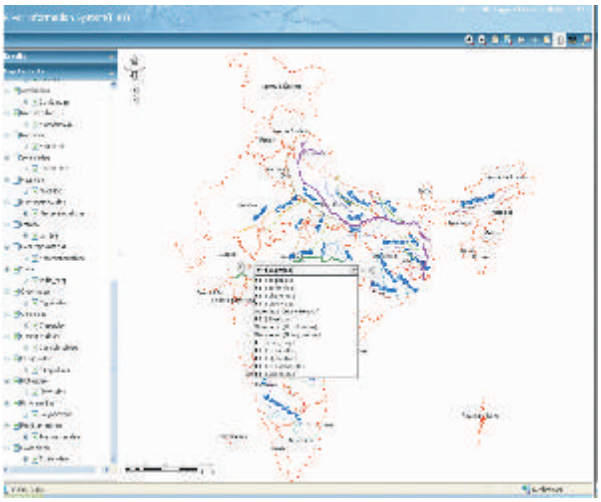
Database were populated using fish species data for rivers Ganga and Narmada in a stretch-wise manner and for others like Brahmaputra, Kaveri, Krishna and Godavari river wise. Database was populated from published literature and published bulletins of CIFRI. Species name were taken from verified FAO fish base. Subernrekha estuary has also been added in this distribution map.



River distribution map

The Web GIS shows information of fish species from different river stretches . The web screen snapshot of fish species distribution maps is depicted below.

For making on-line database for water and soil quality parameter, a data structure was created in MYSQL server database. The Form was designed using HTML, scripting was developed using PHP to integrate user's input and My SQL database by way of connecting querying and updating data to the database. For validating data java script was used at client side. The screen shots of landing and soil parameter data is shown below.



Fish species distribution map

Screen shot of data entry module

Project: FRA/ER/10/07/003

Bio-applications using data mining

Principal Investigator: D. Das
Co-PI: M. K. Bandyopadhyay
Technical support: S. Majumdar

Data-mining technique/ association rule mining technique is the combination of statistical, computational and heuristic applications. This DM technique is used to help in identifying ideal or desirable species association in inland fisheries. From field surveys, some potential inter species associations (46) have been identified. The best species association is identified between A. *mola and Puntius* sp. because of prevailing high frequency of data. Negative association between two species has been identified between *Mystus aor and Tilapia nilotica.* The species composition analysis has indicated a harmonic association of Indian major carps (*Catla catla, Labeo rohita* and *Cirrhinus mrigala*) with *Puntius conchonius, Puntius ticto*, *Puntius gelius*, *Gudusia chapra*, *Amblypharyngodon mola*, *Channa punctatus*, *Channa striatus* and *Mystus vittatus*.

Programme: Developing fishery management norms for sustainable fisheries in floodplain wetlands

Programme co-ordinator: B. C. Jha, Reservoir and Wetland Fisheries Division

Project: WLF/ER/07/04/001

Testing and refinement of fish yield enhancement strategies in floodplain wetlands/ small reservoirs

Principal Investigator: M. A. Hassan
Co-PIs: B. C. Jha, A. K. Das, D. Das and D. Panda and D. K. Meena
Technical support: B. K. Biswas, D. K. Biswas, S. Ghosh, S. Saha, S. Das, B. Naskar and Y. Ali

A fish yield enhancement model has been developed for calculating predictive yield in different category of wetlands. The predicted yield envisaged against varying degree of stocking density and ecological conditions.

Refinement of yield predictive model

The main objective of the project was to refine the yield enhancement strategies in floodplain wetlands. Besides ecological attributes seed stocking is considered as the major intervention to improve fish yield from wetlands. Data on ecological attributes, stocking and actual fish yield were collected from 30 wetlands of Bihar and West Bengal under the lower Ganges basin as the basic inputs for the said model.

The selected wetlands were from the same river basin, but indicated significant geo-spatial differences from ecological view point. The wetlands were clustered based on their ecological similarity for developing this model. Six clusters were formed at a similarity level of 30%, combining minimum of 2 to maximum of 12 wetlands. Two attributes, such as depth and conductivity played the dominant role in forming a cluster with maximum number of 12 wetlands while in another cluster consisting of 10 wetlands, 4 parameters such as area, transparency, macrophyte cover and detritus indicated similarity. Attributes like plankton and benthos density also helped to form two clusters. The three dimensional Non-metric Multidimensional Scaling (NMDS) method was used to ordinate the ecological attributes as per their similarity and dissimilarity. Classification and regression tree (CART) was also constructed using NMDS axis value as the ecological variables and potential predictor variables.

The analysis indicated that the first axis of NMDS isolated the significant positive coefficients of ecological attributes (area, depth, macrophyte, transparency and detritus) from the negative coefficients of lesser importance (conductivity, plankton and benthos density). While the second axis of NMDS isolated only conductivity having strong influence and the third axis indicated two parameters (plankton and benthos density) located in opposite poles having positive and negative coefficients that influence the yield. The three equations thus obtained are:

PRIN1=0.363Area+0.372depth+0.493Transp-0.08Cond-0.18pdensity-0.220Bdensity+0.441Detritus+0.448Macrophyte
PRIN2=0.430Area+0.218depth-0.01Transp+0.768Cond+0.342Pdensity+0.162Bdensity-0.172Detritus+0.01Macrophyte
PRIN3=-0.120Area-0.253depth+0.062Transp+0.177Cond-0.547 Pdensity+0.721Bdensity+0.033Detritus+0.28Macrophyte

The model indicated that various options like if the value of first axis (PRIN 1) is more than 1.4 then stocking density should be kept below 9208 no/ha to obtain yield of 640 kg/ha/yr. Further, if the PRIN 1 value is more than 0.14 then stocking density should be kept less than 1982 no/ha to obtain 435 kg fish/ha/yr while if the value is less than 0.14 then yield of 1000 kg/ha/yr is predicted with a stocking density between 1982 and 9208 no/ha.

The models predict that if the cumulative value of the parameters of third axis is less than 2.05, then stocking density should be kept between 3780-9208 no/ha to obtain a yield of 1028 kg/ha/yr. However, in order to narrow down the stocking density between 1982 and 2200 no/ha, the predicted yield would be 800 kg /ha/yr, provided the cumulative value of the parameters of third axis is more than 2.05.

Project: WLF/ER/07/04/003

Developing site specific fish based farming systems in seasonally flooded area through community participation

Principal Investigator: P. K. Katiha
Co-PIs: U. Bhaumik, A. Pandit, R. K. Manna, G. Chandra and A. Roy
Technical support: S. Saha, D. K. Biswas, K. K. Sarma and S. Mondal

Under the project two *beels*, namely, Janki Chak (JC) and Dakshin Anukha (DA) *beels* in Moyna Block of Purba Midnapur district of West Bengal were targeted. The acreage under seasonally flooded areas was 33 and 13 ha. Physico-chemical properties of water and soil of the water body were monitored intermittently during the culture period, which suggested highly eutrophic nature of these water bodies. Institutional and governance

View of Janki Chak (JC) *Beel* at Moyna

arrangements indicated that *Gram Samiti* leased out these water bodies, through open auction to a society for period of one year and six months for fish culture. The lease amount was Rs 12 lakh for JC and 6 lakh for DA. The scientific practices of fish production resulted in a total production of 136.28 t with maximum share of *L. rohita* (42.92 t) followed by *C. catla* (34.96 t) and *C. mrigala* (28.17 t) at Janki Chak. The average fish productivity was estimated at 4130 kg/ha, which was reasonably high for such water bodies. In case of Dakshin Anukha, the fish productivity was 4948 kg/ha, contributed mainly by IMC (84.2%) with a total production of 64.32 t. The viability of scientific production practices in terms of economics at Janki Chak revealed that the total cost of fish production at Rs 43.58 lakh with a total income of Rs 130.23 lakh and net profit of Rs 86.65 lakh. The overall Benefit cost ratio was estimated at 2.99. The total cost of fish production at Dakshin Anukha was Rs 31.41 lakh. The total income was at Rs 62.65 lakh with net profit of Rs 31.24 lakh. The B:C Ratio was 1.99, confirming the viability culture-based fisheries, developed by CIFRI, in such water bodies. The survey for assessment of adoption gap between the recommended practices of fish production and existing practices revealed low gap. Only 16% fishers were having high level (50-75.1%) of adoption gap, whereas 67% had low level (0-25%) of adoption gap. For rice production scientific recommendations were mostly adopted. High yielding varieties, seed treatment, seed rate, recommended fertilizers were used by most of the farmers (82%). Majority of farmers were also found using overdose of plant protection chemicals. Non-availability of spawn in the area, siltation, poor water quality, institutional credit and poor remuneration of their product were identified as the major constraints.

Harvesting at Janki Chak (JC) Beel at Moyna

Project: WLF/NE/07/04/005

Standardizing fish stock enhancement protocols

Principal Investigator: B. K. Bhattacharjya
Co-PIs: V. Kolekar, S. Yengkokpam, D. Debnath and A. K. Yadav
Technical support: K. K. Sarma P. Gogoi and A. Kakoti

Impact of stocking on fish yield

A case study was conducted in Charan beel (seasonnally open beel, 60 ha), Morigaon district, Assam for assessing the impact of stocking on fish yield. The fish productivity of the beel was estimated at 228 kg/ ha/ yr during 2000-01, mainly from natural population of major and minor carps (*L.gonius, L. rohita, C. catla, L. dero, C. mrigala, C. reba, L. calbasu, L. bata*) contributing 31.32%, large carnivores (*Wallago attu*, *Channa striatus*, *Chitala chitala*) contributing 15.78% and small economic fishes

(e.g., *Puntius* spp., *Colisa* spp., *Channa* spp., *Mystus* spp., glass fishes, *Rasbora* spp., *Badis* spp., *A. mola* etc.). The contribution of major carp was estimated at of 52.9%. Introduction of culture-based fisheries during 2010-11 could increase the productivity to the tune of 324% (740 kg/ ha/ yr).

Impact of stocking on catch composition

Impact assessment of stocking was conducted in Damal (closed) and Udari (seasonally open) beels, Morigaon district, Assam, on fish catch composition. Damal (16 ha) was stocked intermittently for the past 8-10 years, contrary to Udari beel where stock enhancement was never practiced, considering the possibility of stock escapement through the connecting channel during the flood season. Fish yield rate in Damal beel was estimated at 437.81 kg/ ha/ yr, contributed mainly by minor and exotic carps (55%). The indigenous fish species *like G. chapra, Puntius spp., A. mola*, catfishes, glass fish and *Macrobrachium* spp. The productivity of Udari beel was estimated at 373.8 kg/ ha/ yr, contributed mainly by minor and exotic carps (33%) while the commercially important indigenous fish species had the major share (67%). The occurrence of exotic fish species in Udari beel is due to its connectivity with an adjusant wetland (Pokoria beel) which is under stock enhancement regime. Lower contribution of commercially important indigenous fish species in Damal beel could be attributed to the cumulative effect of stocking of the Indian major carps over a longer period of time (8-10 years).

Optimization of stocking density in cage culture

Cage culture experiment was conducted at Charan beel, Morigaon, Assam for standardizing the stocking density

A battery of cages installed in Charan beel, Morigaon district, Assam

Fish seed stocking in cages installed in Charan beel, Morigaon district, Assam

of *Cirrhinus mrigala* fry. A battery of twelve cages (individual cage dimensions 2 x 2 x 2 m) were stocked with *C. mrigala fry* (av. length 4.18 ± 0.07 cm, av. weight 0.71 ± 0.03 g) at six different stocking densities, *viz*. 50 (Sd1), 100 (SD2), 150 (SD3), 200 (SD4), 250 (SD5) and 300 (SD6) fry/ m^3 with two replicates each. Fishes were fed twice daily with a formulated mashed feed (34.61% CP) for three months. Different stocking densities significantly ($p<0.05$) affected growth parameters of reared fish. The stocking density of 100 and 150 fry/ m^3 showed better growth performance compared to other groups in terms of final weight, weight gain percent (WG) and specific growth rate (SGR). Higher stocking density of 250 and 300 fry/ m^3 had statistically similar growth performance as of the lowest stocking density of 50 fry/ m^3. Similarly feed efficiency ratio (FER) and protein efficiency ratio (PER) indicated the same trend as that of growth. Stocking density had profound effect on the survival of the reared fish as the highest survival was observed in the lowest stocking density (SD1), decreased in SD2, SD3 and SD4 and lowest in SD5. Since the survival percentage was statistically insignificant with the groups having higher growth rates (SD2 and SD3), a stocking density of 300 fry/ m^3 could be optimal for raising *C. mrigala* seeds in beels. In view of the present findings, stocking densities higher than 300 fry/ m^3 may also be tried for raising of *C. mrigala* fry.

Adoption of pen culture technology developed by CIFRI in Sonitpur district of Assam

A field survey was conducted in four sites of Sonitpur district of Assam where pen culture was being practiced to assess the adoption level of CIFRI pen culture technology. Nayanjyoti Self help group (SHG) of Parmaighuli, Balipara Block, Sonitpur, Assam undertook pen culture in Rangapani Jan beel in April 2010 with the partial financial assistance from District

Fishery Development Office (DFDO). The area covered under pen culture was 1 ha with an average water depth of 5.5 ft. Stocking was done with *Labeo rohita, Catla catla, Cirrhinus mrigala, Cyprinus carpio* and *Labeo gonius* following a species ratio of 40 Catla: 30 *Labeo* spp.: 30 C. *mrigala* & *C. carpio* at a stocking density of 5000 fingerlings/ ha. The total cost including construction, seed and feed was ₹ 1.06 Lakhs of which 85% was borne by the DFDO. Another pen culture activity was undertaken by a Non-governmental Organization (NGO) known as Maandal in Kachu beel, Morabhalari, Chiloni, Sonitpur Dist. covering an area of 1.35 ha during 2009-2010. The total cost involved in this case was ₹ 3,73,950. Two more pen culture operations by Amarjyoti SHG in Rangapani beel and Kachu beel Agragami Samiti in Kachu beel have met with partial success because of flash floods damaging the pens in the former and because of uncontrolled predators such as tortoise, crabs, otters, snakes, etc. in the latter.

Demonstration of Pen culture

A net pen measuring 100 x 100 sq. ft. has been installed in Takmu Lake in Bishnupur district, Manipur in collaboration with the Directorate of Fisheries, Govt. of Manipur during March, 2012 for giving demonstration of table fish production of IMC and a locally important minor carp (*Osteobrama belangeri*).

Project: WLF/NE/07/04/07

Socio–economic evaluation and delivery mechanism in floodplain wetlands

Principal Investigator: G. Chandra
Technical support: K. K. Sarma

Socio-economic evaluation of fishers

Statistically significant correlation was found among lease amount, number of gear, number of *katal,* production, *beel* area, IMC catch, exotic, catfish, indigenous fish catch (significance at 0.01 level). The correlation between seasonal opening of *beel* with catch

of IMC (<2 kg), cat fish, indigenous fish catch (significance at 0.01 level) was significant. Correlation among number of *katal,* number of dragnet, exotic carp, catfish, area was significance at 0.01 level.

Benefit sharing arrangement in fisheries management

Benefit sharing between fishers and the lessee depends on lease arrangement and fishing practices. In community based management *beels*, the governance is transferred to the *beel* development committee every three years. Therefore, benefit sharing is governed by the decision of *beel* development committee. In terms of fishing practices, *viz*. *katal* fishing in both co-operative as well as individual managed *beels*, the benefit sharing arrangement was favoured of fishers.

Challenges, concerns and choices for sustainable fisheries management in floodplain wetlands of Assam

Management faces some fundamental choices, and questions. Moving from a sectoral to an integrated approach implies balancing alternatives. All the challenges faced by wetland fisheries in turn raise the concerns of ecosystem health, social justice, livelihoods and employment, and food security and safety.

Typology of benefit sharing arrangement

On the basis of Management regime					
Beel Management	Approach	Governance	Fishing	Sharing Arrangement Fishers Lessee	
Community based fisheries Management	Community based	Designed to provide the means to local communities	Community	Fixed by the beel development committee (membership to every household of the nearby area)	
Cooperative Based Management	Access and benefit sharing	Designed to address to equitable access	Cooperative members	50	50
Individual management	Access and benefit sharing	Designed to address to equitable access	With stocking	30-40	60-70
			Without stocking	40-50	50-60

Challenges and choices for floodplain wetland fisheries in Assam

Situation and trends	Challenges	Choices
Overexploitation of fisheries resources-catch per unit effort decreasing	How to restore this exploited ecosystem?	Short term versus long term use of fisheries
Increasing number of people employed in fishing	How to protect the interest of fishers and consumers?	Small scale versus large scale operation
Other use of wetlands (other than fisheries)	How to maintain balance in profit and cost to society?	Fisheries versus eco-tourism
Involvement of a large number of middle man	How to maintain sustainable fisheries?	Community based versus individual based fisheries
Decreasing area of wetlands	How to reduce siltation and conversion of marginal area for other uses?	Protecting fishers interest.

Fishing in beel

Fisheries information flow index of *beel* fisheries of Assam

Information flow of Assam was made on the basis of media source used by the fishers to get information related with scientific *beel* fisheries management. The data collected from 91 beels of 21 districts was used for this purpose. All three sources, viz. interpersonal, group and mass communication source use by the fishers was taken into consideration. On the basis of this index district wise disaggregated communication use map of Assam was developed on GIS plateform. Two districts namely Karbi Anglong and North Kachar hills were not covered under the data collection for this study.

Information flow map of Assam

Project: WLF/ER/10/04/008

Evaluation of impact of river connectivity on wetland health, biodiversity and productivity in relation to fishery

Principal Investigator: M. Aftabuddin
Co-PIs: M. A. Hassan and A. K. Das
Technical support: B. K. Biswas, S. Ghosh, S. Saha, S. Das and Y. Ali

Two wetlands in Nadia district of West Bengal viz. Chhari Ganga (CG) having round the year connectivity to parent river, the Ganges and Bhomra having seasonal/no connectivity to river Yamuna were selected for evaluating the impact of extent of river connectivity on physico-chemical parameters of water, sediment enzyme and biochemical indicators and biotic community structure. Sampling during summer 2011 showed more water depth (avg. 287.0 cm) for CG compared to Bhomra (avg. 48.0cm). Transparency showed full column productivity in Bhomra than partial in CG.

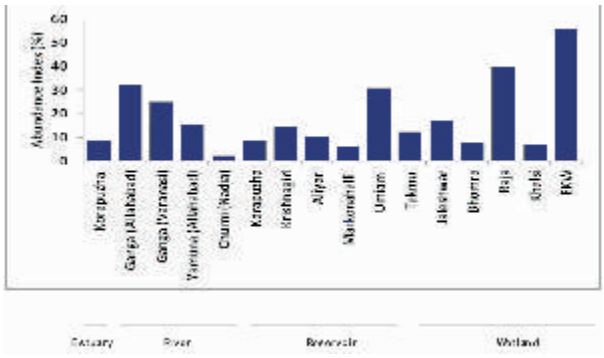
During summer, higher water temperature, pH, conductivity, alkalinity, hardness and calcium were observed in Bhomra wetland than CG. Phosphate – P, nitrate-N and silicate – Si were higher in Bhomra than CG. Sediment phosphorous and carbon cycling enzymes, conductivity, moisture and organic matter, oxidation reduction potential and DNA were shown to be higher in closed than open wetlands. Higher column and benthic detritus production were observed in Bhomra than CG. Microbial functional group analysis of sediment collected from CG and Bhomra during monsoon, winter and summer revealed higher aerobic heterotrophic, phosphorous solubilizing, phophatase producing and nitrifying bacterial population in closed than open wetland. Distribution and abundance of plankton and benthic population during summer varied distinctly in both the wetlands with higher abundance of plankton and benthos in Bhomra than CG.

Project: WLF/ER/10/04/009

Fish assemblage, habitat preference and assessment of exotic fishes in inland open waters

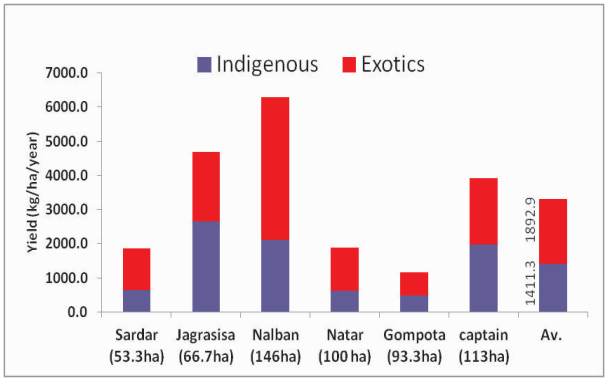
Principal Investigator: V. R. Suresh
Co-PIs: B. C. Jha, K. D. Joshi, M. F. Khan, P. Panikkar, S. K. Sahu, S. Yengkokpam, A.Ekka, D. Panda and C. M. Roshith
Technical support: B. K. Biswas, D. K. Biswas, K. P. Singh, S. Saha, S. Ghosh, Y. Ali, J. Valmiki, M. E. Vijayakumar, K. K. Sarma, A. Kakati and S. Das

Surveys conducted in selected estuaries, rivers, reservoirs and wetlands revealed the presence of 13 species of exotic fishes, of this 10 have food value (*Hypophthalmichthys molitrix, Hypophthalmichthys nobilis, Ctenopharyngodon idella, Cyprinus carpio, Barbonymus gonionotus, Oreochromis niloticus niloticus, O. mossambicus, Clarias gariepinus, Piaractus brachypomus, Osphronemus* sp.) and three were of non food value (*Pterygoplechthys disgunctivus, P. pardalis, Gambusia affinis*). The abundance index of the exotic fishes in the water bodies studied varied from 8 to 54%. Assessment of the abundance index of the exotic fish species in some of the open waters showed substantial presence in some stretches of rivers, reservoirs as well as wetlands.



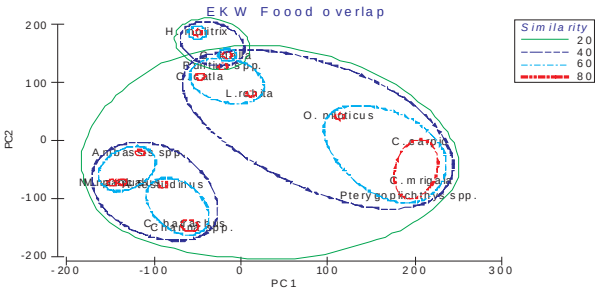
Abundance index of exotic fishes in various open water systems.

The studies carried out in East Kolkata Wetlands, undergoing extensive mode of culture and culture based fisheries, revealed sizeable presence of exotics. About 43% of the total catch constituted Indigenous species and the rest (57%) contributed by exotic fish species, indicating substantial contribution from exotics.



Contribution of exotic fishes in selected east Kolkata wetlands

Assessment of the food spectrum of the exotic fish species and that of the other commonly occurring species in the wetland revealed general food item overlapping with most of the indigenous species. At 20% similarity, except that of *H. molitrix*, all the species studies had food overlap. At 60% similarity, the feeding habits falls under three major groups. The food items of the indigenous species, *Cirrhinus mrigala* was severely overlapped with that of *O. niloticus, C. carpio* and *Pterygoplichthys* spp., indicating potential competetion for food .



Food overlap of fishes in East Kolkata Wetlands

Fish landing data of the river Yamuna was collected from mid and downstream stretches from Etawah, Agra, Mathura, and Delhi. The river is infested with two exotic species (*C. Carpio* and *O. niloticus niloticus*). *O. niloticus* dominates the catches at Etawah, Agra and Mathura, followed by *C. Carpio*. The fish landing data recorded from Allahabad stretch of the river showed an estimated landing of 58.2 tonnes, in which exotic fishes (*C. Carpio* and *O. niloticus niloticus*) dominated, followed by major carps, catfishes and others. *C. Carpio* and *O. niloticus niloticus* contributed 43.03 % of the fish catch at Allahabad.

Project: WLF/NR/07/04/010

Exploratory survey and fisheries enhancement in wetlands of Bundelkhand region

Principal Investigator: B. K. Singh
Co-PIs: K. D. Joshi, R. S. Srivastava, D. N. Jha and A. Alam
Technical support: S. K. Srivastava, K. Srivastava and V. Kumar

After conducting exploratory survey in Bundelkhand region, two wetlands- Jagat sagar and Dhubela were selected for fish production enhancement studies during the year. Jagat sagar (102 ha) and Dhubela (35 ha) are situated in Chhatarpur district of Madhya Pradesh. Both the wetlands are closed and not connected with any river.

Sediment

Sediments of both the wetlands were alkaline in reaction (7.5-7.7) and dominated by sand (97.8-98 %). Organic carbon was comparatively higher in Jagat sagar (0.9%) than Dhubela (0.19%). The nutrient status of both the wetlands in respect of available phosphorus was high (4.8-5.7 mg/100g) but available nitrogen was comparatively low (10.5-18.3 mg/100g).

Water

Common features of both the wetlands were alkaline pH (7.7), rich oxygen (7.44-7.77 mgl^{-1}) and rich dissolved organic matter (3.98-5.58 mgl^{-1}). The average values of the other water quality parameters-alkalinity, specific conductance, dissolved solids and chlorides in Dhubela (116.33 mgl^{-1}, 247.3µmhos, 125.3 mgl^{-1} and 19.4 mgl^{-1}) were almost similar as in Jagat sagar (108.7 mgl^{-1}, 237.7 umhos, 120.3 mgl^{-1} and 15.2 mgl^{-1}), respectively. Rich oxygen, alkaline pH, rich dissolved organic matter, moderate alkalinity, conductance, dissolved solids, hardness etc. reflect the productive nature of the wetlands.

Microbiological quality assessment of water & sediment samples

The water and sediment samples are now being further processed to estimate the bacterial load in terms of total aerobic-heterotrophic bacteria count (TPC), total *Vibrio* count (TVC) and total *Aeromonas* count (TAC). The bacterial culture plates are still being processed and after obtaining total bacterial colony data, the results will be presented.

Biotic communities

Plankton

Average population of plankton was 643 u/l in Jagat Sagar, and 1153 u/l in Dhubela jheel. Phytoplankton productivity was higher and contributed 100% (Jagat sagar) and 95% (Dhubela) with predominance of blue green algae (36-47%) followed by green algae (30-38 %) and diatoms (14-18%). Zooplankton was represented by rotifers only in Dhubela jheel. The abundance of myxophyceae increased from monsoon to post monsoon and then reduced in winter season as dominance of chlorophycae was observed in the wetlands. Seasonally maximum planktonic density was noticed during post monsoon season. Dominant taxa were *Synedra ulna, Gomphonema parvulum, Cymbella* among Bacillariophyceae; *Pediastrum simpex, Ankistrodesmus falcatus Tribonema sp.* among chlorophyceae; *Merismopedia elegans, Lyngbya limenetica, Microcystis aeruginosa, Anabaena sp.* among myxophyceae; *Euglena gracilis* among euglenophyceae and *Brachionus caudatus* among rotifers.

Periphyton

Periphytic density was 1223 u cm^{-2} in Jagat sagar and 847 ucm^{-2} in Dubela jheel. The predominant group was bacillariophyceae (38-40%) followed by chlorophyceae (25-38%), myxophyceae (20-27%) and euglenophyceae (4-5%). Maximum abundance was recorded in post monsoon season in both the wetlands. Abundant algal genera were - *Synedra ulna* and *Cymbella* among bacillariophyceae; *Spirogyra sp., Ankistrodesmus falcatus* and *Kirchinella.* among Chlorophyceae; *Phormidium, Lyngbya limenetica, Anabaena sp. Aphanezomenon sp.* among Myxophyceae and *Euglena gracilis* among euglenophyceae .

Macrobenthic invertebrates

Macrobenthic population of Jagat sagar was 310 nm^{-2} and Dhubela 250 nm^{-2}.The biota was dominated by Insecta (72-74 %) whereas Molluscan population was 26-28% and represented by gastropods. The encountered forms were *Bellamya bengalensis and Gyraulus rotula* amongst gastropods *and Chironomus* among insects.

Macrophytes

Both the wetlands have similar type of macro vegetation comprising *Vallisneria, Nymphaea, Hydrilla, Ceratophyllum, Potamogeton* but the growth is more in Jagat Sagar.

Stocking of fish seed

Jagat sagar wetland was stocked by society members during August 2011 with 4.9 lakh fry/ fingerlings of IMC and exotic fishes in the ratio of catla 15 %, rohu 25 %, mrigal 32 %, grass carp 20 % and common carp 8%. While the Dhubela sagar was stocked with 4.4 lakh seed of IMC (57 %), big head (23 %), grass carp (9 %) and common carp (11 %). Auto-stocking of Labeo *rohita* and *Cirrhinus mrigala* was also reported in Dhubela jheel.

Fish yield

A total of 20.5 t and 9.0 t of fishes were harvested from Jagat sagar and Dhubela wetlands, respectively. The fish yield from Jagat sagar was estimated as 201.0 kg/ha/yr and 257.0 kg/ha/yr from Dhubela. As fish production potential of the wetlands was estimated as 840 kg ha^{-1} yr^{-1} and 918 kg ha^{-1} yr^{-1} respectively. Only 23-24% of potential is harvested from the wetlands and there is gap between potential and actual yield. This gap can be bridged by applying management norms for enhancing the harvest upto 50 % of the potential. Harvesting operations were

Fishing in wetland

Sampling

conducted mainly through drag nets, gill nets, cast nets. Fishing was done with the help of society fishermen and it was generally conducted twice a year- during October-December and February-April. Boats are generally used for fishing operations. A total of 13 boats are used in Jagatsagar and 7 in Dhubela sagar.

Socio-economics and fishery management

Socio-economic survey of fisher's community of Mau-Sahania village situated in vicinity of Jagat sagar and Dhubela wetlands was conducted. The village has approximate population of about 10000. About 350 fishers are associated in fishing and their population is about 2000. The main source of livelihood was fishing from these two wetlands and the average annual earning was ₹ 25000 from all sources. Some fisherwomen were involved in fish marketing and labour job for getting livelihood.

Programme: Improving the Fish Productivity of Indian reservoirs

Programme Co-ordinator: B. C. Jha, Reservoir and Wetland Fisheries Division

Project: RES/SR/07/03/001

Multi-location trials on improving fish yields in small reservoirs located in different agro-climatic zones (Karnataka and Kerala)

Principal Investigators: D. S. K. Rao (Karnataka) and R. Palaniswami (Kerala)
Co- PIs: M. Karthikeyan and P. K. Katiha
Technical support: S. Manoharan, U. Unnithan and M.E. Vijay Kumar

Mallaghatta Reservoir (Karnataka)

Morphometric features

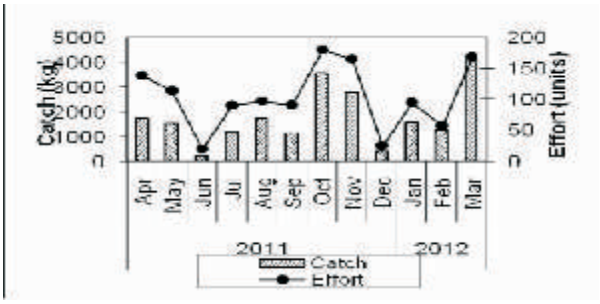
Mallaghatta, a small shallow reservoir, constructed across a seasonal stream (Sub-basin: Shimsha river; Main Basin: Kaveri river) in Tumkur District of Karnataka State was investigated. The reservoir, also, receives inflow from Hemavathy reservoir. The principal morphometric features are- Area at FRL: 630.4 ha, Mean depth: 2.9 m, and C/A ratio: 9.13.

Physico-chemical features of water: Water was well buffered; *pH* was mildly alkaline and fluctuated between 7.3 and 7.5. Ionic concentration was 430 to 550 µS/cm; mean: 433.3 41.6 µS/cm. Reservoir is polymictic due its shallowness and unsheltered location. Strong vertical heterogeneity is not recorded in physico-chemical parameters.

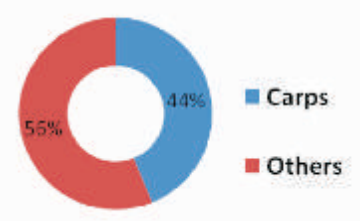
Plankton: The phytoplankton community was dominated by myxophyceae (95.6%) followed by chlorophyceae (1.7%), dinophyceae (2.6%) and the rest by bacillariophyceae (average 4177.5 u/l). The zooplankton community was dominated by copepods (56 %), rotifers (35 %), cladocerans (4%) and the rest by protozoans (average density: 326.7 ind./l).

Primary production: The mean gross primary production was high at 2.8 $gC/m^2/d$, while mean net primary production was 1.0 $gC/m^2/d$, suggesting good productivity status for the reservoir. The mean community respiration of 1.7 $gC/m^2/d$ suggests low heterotrophic activity. A*max* (Maximum photosynthetic efficiency) ranged from 56.3 – 234.4 mg $C/m^3/h$ (Mean: 111.5±54.7). The Carlson Trophic Index for Secchi depth is 60.0 and for Chlorophyll '*a*' is 68.1 suggesting that the reservoir is eutrophic.

Fishery: The Department of Fisheries, Government of Karnataka has leased the reservoir to a society. The Society has stocked 13.82 lakh seed (average length: around 4.0 cm) during 2008-11 with catla 27.9%, rohu 39.9%, common carp 26.8% and grass carp 5.4%. An estimated catch of 21.2 t was recorded during April 2011 to March 2012 with highest landings of 4.1 t recorded in March 2012 and lowest of 0.19 t in June 2011. The average CPUE was 17.1 kg and the estimated yield was 56 kg/ha/yr. The potential fish yield is 200 kg/ha/yr. Indian major carps (IMC), the stocked species, contributed 44.6% to the total catch with the rest mainly by autochthonous tilapia. The stocking recommended as per Welcomme (1976) is 425 no/ha/year (catla:rohu:mrigal:4:3:3).



Estimated fish catch (kg) & fish Percentage composition during 2011-12



Catch composition at Mallaghatta Reservoir

Recommendations

- Stocking of *C. mrigala* in addition to catla is recommended.
- Grass carp may be stocked regularly to control the vegetation and also to get extra fish.
- Harvesting less than 1.0 kg fish to be avoided.
- Pen culture for raising advanced fingerlings may be practiced.
- To promote species native to Kaveri river basin, stocking *of L. fimbriatus, L. kontius, G. dubius* and *P. carnaticus* are recommended.
- Exploitation of minor cyprinids in summer to be done.

Vazhani reservoir (Kerala)

Morphometric features of the reservoir

The reservoir was created by constructing an earthern dam of 792 m long during the year 1959 across Keecheri

river in Thrissur district of Kerala. It has a water spread area of 255 ha at FRL. It is located at 10° 38' N and 76° 19' E. It has a storage capacity of 18.121 mm^3 and irrigates an area of 4313 ha. The maximum water level is 62.98 m and the minimum is 39.62 m. This reservoir receives an average rainfall of 235 cm per year.

Physico-chemical characteristics of water

The physico-chemical characteristics of reservoir water were investigated at four stations at different depths depending upon the water level of the reservoir. There was no thermal stratification though the temperature gradually decreased from surface to bottom. The surface water temperature varied from 28 to 31° C, whereas it ranged from 26 to 30°C. The transparency of the water ranged from 50 to 154 cm. The *pH* 5.6 to 6.9. The dissolved oxygen content showed wide fluctuations. DO was very low (1.0 mg l^{-1}) during the post-monsoon sampling and gradually increased during winter (2.2 to 4.1 mg l^{-1}) and summer (4.3 to 6.2 mg l^{-1}) samplings. Free carbondioxide was present in all the sampling and ranged from 0.4 to 4.4 mg l^{-1}. The specific conductivity values (43.3 to 49 mhos cm^{-1}) indicate that the reservoir is moderately productive. The total alkalinity varied from 20.8 to 38.0 mg l^{-1}. The hardness, Ca and Mg content of the water were relatively low in this reservoir. The nutrient status of the reservoir indicates that the reservoir is medium in production. The gross and net primary production of the reservoir was 183.58 and 85.93 mg C/m^3/day.

Plankton

In general the plankton population of the reservoir was low. The phytoplankton (94 %) was dominant among the plankton. The dominance of the phytoplankton was attributed by a single bloom of *Lyngbya* sp. during the month of January at 1m depth. Species of *Microcystis*, *Chlorella, Dictyosphaerium*, *Closterium, Stauratrum* were also present in phytoplankton. Zooplankton was contributed by *Filinia longiseta*, *F. terminata*, *Ceriodaphnia, Moina brachiata, Diaptomus* and *Canthocamptus*.

Benthos

Benthic fauna was manily contributed by oligochaetes (79%) followed by chaoborus (17%) and chironomus (4%). The dominance of oligochaetes may be due to the clayey nature attributed by larger amount of detritus flow in to the reservoir. *Tubifex* sp, *Chironomus plumosus*, *Chironomus* sp. and *Belostoma* sp were the forms identified.

Fisheries

The total fish yield during the period 2011-2012 was 541.5 kg. Among this the contribution of *C. catla* was 43.0% followed by *O. mossambicus* (31.1%) and *L. rohita* (20.7%). The other fishes observed in the landings were, *C. mrigala*, *Etroplus surentensis*, *Barbus* sp., *Cyprinus* sp., and *Macrobrachium rosenbergii*.

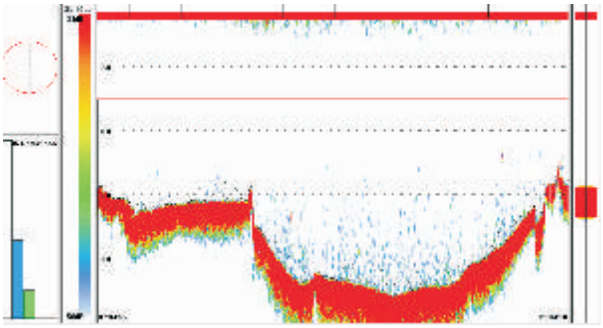
Project: RES/SR/07/03/002

Characterization of fishery and population trends using acoustics and experimental fishing

Principal Investigator: M. F. Khan
Co- PIs: P. Panikkar and B. C. Jha
Technical Support: M. E. Vijay Kumar

Kelavarappalli Reservoir in Tamil Nadu

Acoustic survey: Hydroacoustic surveys were conducted at Kelavarappalli Reservoir. The Portable Simrad EY60, split beam echo sounder with frequency 120 kHz and elliptical transducer (opening angles at -3dB were 4 and 10 degrees) were used. The acoustic surveys and depth profiling was done in lotic, intermediate and lentic zones. Different transects are selected in each zone and acoustic runs were made in the early morning and evenings. Fish distribution studies showed 2 to 682 fish detections at different zones of the reservoir. The coordinates of transects surveyed were recorded using GPS. The boat speed and area surveyed are also digitally recorded. The water parameters, dissolved oxygen, temperature, conductivity was measured at surface using portable instrument and from conductivity salinity is estimated and incorporated in SIMRAD ER60 software. The received histograms were de-convoluted to account for random aspect of fish distribution and then used for scaling the integrator values.



Acoustic survey with 35 fish detections with a target strength ranging between -33 dB to -50 dB at Kelavarappalli Reservoir

The fish concentration was found to be more in the intermediate zone followed by lotic zone and lentic zone. There was a marked variation during the acoustic survey recording more number of fishes during the night surveys than day in all experiments. By conducting experimental fishing with monofilament gill nets at the habitats from where acoustic data were recorded, 14 to 20 percent fishes could be fished out during different experiments in Kelavarappalli Reservoir.

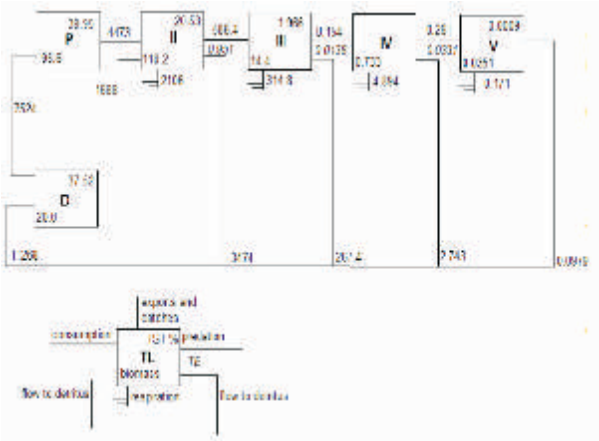
Mass balance model of Karapuzha reservoir using Ecopath with Ecosim

Karapuzha reservoir, (Lat. 11°37' N Long.76°10'30" E) located at Wayanad district of Kerala is an important reservoir well suited for culture based fisheries. An earthen dam was constructed across Karapuzha of Kabini basin in Wayanad district. This reservoir was impounded in 1979. The total water spread area of this reservoir is 855 ha at FRL. Fishing activity is confined to the intermediate and lentic zones of this reservoir. The priced freshwater prawn *Macrobrachium rosenbergii* is an important species. Diverse species including indigenous Kaveri carps, Indian Major Carps, Cichlids, Murrells, Catfishes and miscellaneous fishes are being caught here. The major gear operated is monofilament gill nets.

A mass-balance model of Karapuzha reservoir was constructed using ECOPATH with 15 ecological groups to describe the food web and trophic flows. Trophic level I in the reservoir included the primary producers(phytoplankton, macrophytes) and detritus. Trophic levels (TL), estimated from the weighted averages of prey trophic levels, varied from 1.0 for phytoplankton, macrophytes, and detritus to 3.36 for the top predator, aquatic birds. The trophic levels of zooplankton and planktivorous fishes ranged from 2.00 to 2.58.

Quantitative representation of trophic interactions within the food web of the Karapuzha reservoir. The area of each box is proportional to the biomass of the corresponding compartment.

Lindeman spine analysis revealed trophic pathways with up to five levels in the Karapuzha reservoir model. The trophic aggregation routine showed that most of the biomass and flows are concentrated on trophic levels II and III. Biomass associated with the highest trophic levels (TL IV and V) were very small, 0.733 and 0.351 respectively. The energy flows are concentrated in the lower part of the food web. The mixed trophic impact matrix indicates that very small fraction of changes in biomass of *Clarias gariepinus* would have negative effects upon eels and snake heads. Similarly small changes in *O. mossambicus* biomass would have negative impact upon the planktivorous fishes. Eels have negative impact on most of the fish groups and even the aquatic birds. The network summary statistics computed for the model suggest an overall picture of the Karapuzha reservoir as a system of a low degree of maturity.



Simplified trophic flow model of Karapuzha reservoir showing discrete trophic levels. Detritus (part of TL I) has been separated to show its significance as energy source in each ecosystem. The flow of energy expressed in t $km^{-2}yr^{-1}$.

Experimental fishing at Karapuzha reservoir

The gear for the experimental gillnet fishing was made of Poly amide monofilaments with knot-to-knot mesh sizes of 70, 80, 90, 100 and 110 mm with an average hanging depth of 4.5 m. *O. mossambicus* dominated the catch in experimental gill net fishing in all the experiments followed by *Labeo rohita*. This is a marked change as the CIFRI's recommendation to stock this reservoir has yielded Indian major carps in experimental fishing and the CPUE ranged from 0.2 to 2.3 kg/hr. Other species which were observed regularly in monofilament gill nets include *Labeo fimbriatus Puntius wynaadensis*, *Clarius gariepinus, Garra gotylla, Barilius bakeri* , *P. ticto* , *Mastacembelus armatus*, *Catla catla*, *Paratelphusa* spp. and *Macrobrachium rosenbergii* .

Mastacembelus armatus caught in gill net in Karapuzha reservoir, wayanad, Kerala

Major findings

- The portable acoustic device generated data on the fish distribution in Kelavarapalli reservoir and helped to identify the potential fishery zones in the reservoir.
- Food web models of Karapuzha Reservoir in Kerala constructed to understand the ecosystem properties and functioning of this reservoir ecosystem.

Utility of the results obtained

- The studies conducted in Kelavarappalli reservoir, Hosur Tamil Nadu indicated over-exploitation of fish stocks and recommended reduction in fishing effort and closed fishing in September and February; the recommendation has been accepted and implemented by the Tamil Nadu Government. CIFRI's food web model on this reservoir ecosystem revealed that African catfishes are detrimental for the fisheries and Coimbatore District Collector issued orders banning culture and marketing of African catfish.
- The Kerala Government faced opposition from various quarters not to stock the Gangetic carps in Kerala reservoirs as it may affect the reservoir food web. The mass balance model and food web interactions in Karapuzha Reservoir, Kerala revealed that the Gangetic carps do not negatively impact the endemic species in reservoir ecosystem. CIFRI's study was highlighted and brought to the notice of Chief Minister, Kerala and based on CIFRI's recommendation the Kerala Government decided to stock its reservoirs with Gangetic carps for enhancing fish production.

Project: RES/SR/07/03/003

Development of models for fish yield estimation in reservoirs

Principal Investigator: M. Karthikeyan
Co- PI: . D. S. K. Rao
Technical support: M. E Vijay Kumar

The relationships / models estimated earlier were fine tuned as under

- Estimated relationship of fish yield with area, mean depth and primary production using the reservoir data from the states of Karnataka, Rajasthan, Maharashtra, Tamil Nadu, Uttar Pradesh, Haryana, Kerala, Himachal Pradesh, Andhra Pradesh, Orissa, Madhya Pradesh and Punjab.
- Relationship of fish yield with area and mean depth for the reservoirs of Tamil Nadu and Rajasthan.
- Models developed for fish yield estimation based on the size and productivity of the reservoirs using data collected from Karnataka, Tamil Nadu, Rajasthan, Andhra Pradesh and Madhya Pradesh.

Verhulst-Schaffer model

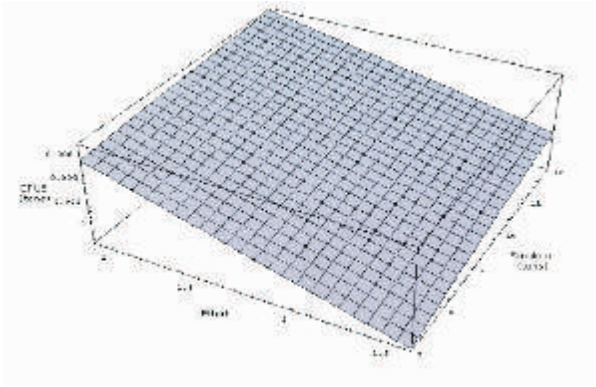
A modified Verhulst-Schaffer model mentioned below takes into account the impact of fingerlings stocking in reservoirs on fish population growth. It was attempted in stocked reservoirs in India.

$$\frac{dX}{dt} = (r_0 + aS)X\left[1 - \frac{X}{K}\right] - H$$

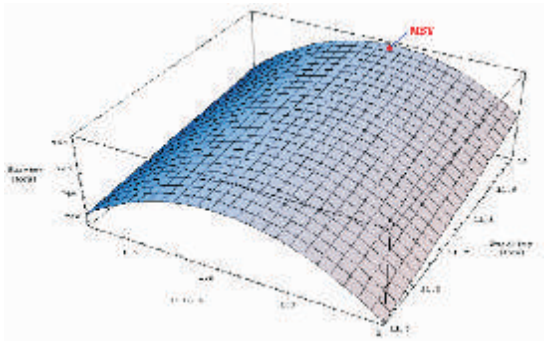
where **F(X)** – Natural population growth **H = qEX**
X – Stock biomass **q** – Catchability coefficient
r – Intrinsic growth rate **E** – Fishing effort
K – Carrying capacity
(ro + a S) - Intrinsic growth rate affected by stocking **S**

When sustainable equilibrium occurs, CPUE is an index of stock abundance. That is,

$$CPUE_{(E,S)} = qK\left(1 - \frac{qE}{r_0 + aS}\right) \quad \text{.....Eq (1)}$$



Relationship of CPUE with Effort and Stocking



Relationship of Harvest regimes with Effort & Stocking levels

Eq (1) is a non-linear function in effort (E) and stocking (S). Parameters were estimated from the secondary data on catch/effort and stocking collected from Bargi reservoir in Madhya Pradesh (using the software *Mathematica ver 5.2*) and model validation was done. The estimated CPUE function is given below:

$$CPUE_{(E,S)} = 0.0685126\left(0.0130721 - \frac{0.00950413638\,E}{0.61429 + 0.137866\,S}\right) \quad R^2 = 0.99$$

Relationship of CPUE with Effort and Stocking

Relationship of harvest regimes with effort & stocking levels was also estimated as follows:

$$H_{(E,S)} = 0.00950413638\,E - \frac{0.00651153094\,E^2}{(0.61429 + 0.137866\,S)}$$

From the analysis, maximum sustainable yield (MSY) was estimated at 787 tonnes for S_{MSY} = 12 and E_{MSY} = 1.66.

Further, a bio-economic model was developed using the data on socio-economics of fishers collected from this reservoir and maximum economic yield (MEY) was estimated at 781 tonnes for S_{MEY} = 12 and E_{MEY} = 1.52. Validation of this model with data from other reservoirs is being done. Such a study would help in recommending several plausible management measures for sustainable fisheries development in reservoirs

Programme: Economic Valuation of Inland Fisheries Resources in India

Programme co-ordinator: P. K. Katiha, Agricultural Economics Section

Project: FSE/ER/07/08/001

Economic valuation of inland fisheries resources in India

Principal Investigator: P. K. Katiha
Co-PIs: A. Sinha, B. K. Bhattachajya, R. S. Srivastava, A. Pandit, A. Ekka and A. K. Yadav
Technical support: S. Saha, D. K. Biswas, S. Ghosh, and D. Saha

Inland water bodies provide multiple functions that have economic value. The present study quantified the economic value of goods and services of two inland waters, namely, 22 km Brahmaputra river stretch from Palasbari to Chandrapur located in Kamrup district in Assam and Gosaba Island in Sundarbans, West Bengal.

The number of stakeholders of the Brahmaputra river stretch were Government, private agencies and NGOs, who are associated both directly and indirectly with the river. Among the State Government Departments, Directorate of Fisheries, Directorate of Agriculture, Water Resources Department, Directorate of Inland Water Transport, Directorate of Irrigation, *etc*. are the stakeholders. For fisheries, the fishing rights were leased out to private parties. There were five lessees in the selected stretch for fishing of Bramhaputra. The lessees allowed fishers to catch the fish; in return they give 40% of the value of catch. The goods and services valued were fisheries, navigation, drinking water which use only surface water. The other uses are surface irrigation,

Local fish market for Brahmaputra fish catch

Water abstraction from river Brahmaputra

Sand mining in the study stretch

tourism, sand mining and brick klins. The total annual value was estimated at Rs.107 crore. Highest percentage share was for brick kilns (44.04) followed by tourism (26.46), drinking water (20.96) and sand mining (7.57). Fisheries of the river contributed Rs. 26.4 lakh annually to the total value of river stretch estimated.

Gosaba Island in South 24 parganas in Sundarbans is bound by Matla and Zilla rivers/ creeks. The total area of the Gosaba block is 29672.52 ha. Located at about 110 km from Kolkata, the Gosaba Island is connected only by water ways with rest of the world. The tangible goods valued under this project were fisheries, non timber forest products (NTFP's) like honey and bee wax, agriculture produce, *etc.* The services included eco-tourism, dike protection as function of mangroves; etc. The total value was estimated to be 85.89 crores annually. Out of which 39% was contributed by eco-tourism. Dike maintenance function of mangrove contributed 22% followed by fisheries, agriculture and NTFP's and least contribution was made by option value (1 %) of mangroves.

Brick klin at the bank of river Brahmaputra

Fishing boats in a tributary of Brahmaputra

For Policy makers, having a better understanding of an area's capacity to supply goods and services is very important and the value of that capacity allows them for better comparison towards development alternatives. By better understanding of the risk and cost associated with inland ecosystem, decision makers can make better choices and achieve sustainable economic development at both local and regional level.

Outreach Activity

Project : OR/ER/08/09/001

Carp culture in cages and pens using feed

Principal Investigator: M. A. Hassan
Co-PIs: M. Aftabuddin and D. K. Meena

Feed additive for better feed utilization

In order to attenuate the problem, use of additives like feed attractant for facilitating initial feed location and final consumption, and probiotic for better feed utilization were attempted singly and in combination for *L. rohita* in an indoor feed trial facility.

Three iso-nitrogenous (C.P. 26%) experimental diets were prepared to test the role of probiotic (2%), attractant (2%) and combined inclusion of probiotic (2%) and attractant (2%) in feed consumption pattern of Indian major carp, *L. rohita.*

The ranges of water quality parameters monitored during the trial were temperature, 23- 27 ^{0}C; pH 7.6-7.9 and conductivity 409-419 µS/cm.

At the end of the 63 days of indoor feeding trial, it was observed that feed consumption was comparable between diets containing only attractant (85.68%) and combination of both probiotic and attractant (86.17%), while significantly low feed consumption (78.42 %) was recorded with diet containing probiotic only.

Live weight gain in response to various additives indicated that combined use of attractant and probiotic in diet resulted into almost doubling the growth rate (93.61% live weight gain over the initial weight) compared to their individual inclusion (59.66 % and 52.72% for attractant and probiotic, respectively) in the diet. Comparison of feed conversion rate (FCR) indicated that combined inclusion of attractant and probiotic led to better FCR than the other two diets containing other additives individually.

Cages in Palna reservoir in Jharkhand

Carcass analysis also indicated the beneficial effect of combined use of both attractant and probiotic in the diet as there was highest accretions of both protein and lipid in the fish body fed the said diet.

Three daily feeding schedules such as once, twice and thrice were tried with duplicate set of cages. The feed was offered per day in a hanging tray at a particular place at a given time intervals following fixed time schedule. Feeding trial of 45 days duration at average water temperature of 28.5°C indicated feed consumption rate of 4-7% of body weight, depending upon the feeding frequencies. During this period, the beneficial impact of feeding more than once was recorded with the highest daily average biomass growth of 108 g with feeding 3 times/day which was almost comparable with (101.7 g) group fed twice daily. The lowest daily average biomass growth of 76.3 g was noted with fish fed once daily. At a reduced water temperature of 24°C, feed consumption rate reduced to 2-4% of body weight. This has affected the pattern of daily average biomass growth. During winter with low water temperature and reduced feed consumption the increase in feeding frequency did not reflect any beneficial impact in growth increment.

Project : OR/ER/08/09/002

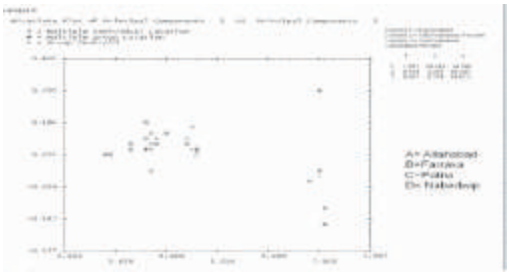
Outreach activity on fish genetic stocks

Principal Investigator: V. R. Suresh
Co-PIs: B. K. Bhattacharjya, B. K. Behera, S. N. Singh, D. Debnath, D. Panda and D. K. Meena
Technica Support: D. K. Biswas, K. P. Singh, Md Y. Ali, Pranab Gogoi, Jayesh K. Solanki, Rajesh K. Shah and A. K. Jana

Samples of target species, *Catla catla*, *Labeo rohita, Cirrhinus mrigala, Labeo fimbriatus* and *Macrobrachium rosenbergii,* were collected from four stations along the Ganga, Brahmaputra and Narmada rivers. The fecundity range of specimens collected from Ganga were 2.4 to 13.4 lakh for *L. rohita* of 5.5 to 12 kg weight; 1.6 to 7.7 lakh for *C. catla* of 9 to 11 kg weight and 5.8 lakh for *C. mrigala* of 2.3 kg weight. The fecundity ranges of samples collected from river Narmada were 5.76 to 13.72 lakh for *Labeo rohita* of 2.2 to 4.5kg weight; 1.11 to 1.75 lakh for *C. mrigala* of 1.35 to 1.75 kg weight; 1.5 to 4.02 lakh for *L.fimbriatus* of 1.15 to 2.55 kg weight and 1.05 to 2.67 lakh for *M. rosenbergii of* 25.5 to 40.0 g weight. The specimens of *C. catla* were all males. The comparative fecundity and relative fecundity (Rl) of the specimens are shown in the following table.

Fecundity of the fishes

Species	Ganga		Brahmaputra		Narmada	
	Fecundity (lakh)	RL. fecundity (Lakh/kg)	Fecundity (lakh)	RL. fecundity (Lakh/kg)	Fecundity (lakh)	RL. fecundity (Lakh/kg)
C. catla	1.6-7.7	0.18-0.45	1.17	0.45-1.2		
L. rohita	2.4-13.4	0.46-1.12	2.7-12.4	1.4-2.8	5.76-13.72	2.62-3.05
C. mrigala	5.8-6	2.5-4.8	3.7	0.49	1.11-1.75	0.82-1
L. fimbriatus					1.5-1.02	1.3-1.6
M. rosenbergii	1-1.8	0.04-0.07 (lakh/g)			1.05-2.67	0.04-0.07 (lakh/g)



Genetic studies on these specimens could generate 29 sequences, which were submitted to NCBI gene bank for which accession numbers were obtained. (Jq912082, JQ912083, JQ912084, JQ912085, Jq912086, Jq912087, JQ912088, JQ912089, JQ912090, Jq912091, JQ912092, Jq912093, JQ912094, JQ912095, JQ912096, JQ912097, JQ912098, JQ912099, JQ912100, JQ912101,JQ912102, JQ912103, JQ912104,JQ912105, JQ912106, JQ912107, JQ912108, JQ912109, JQ912110)

Project : OR/ER/08/09/3

Nutrient profiling and evaluation of fish as a dietary component

Principal Investigator: B. P. Mohanty
Co-PIs: B. K. Singh, B. K. Behera, M. Aftabuddin and D. Debnath
Technica Support: S. Bhowmick, S. Banerjee, Sk. Rabiul and A. K. Jana

Nutrient profile of the giant river-catfish (*Sperata seenghala)*

The giant river-catfish (*Sperata seenghala)* contributes significantly to the inland fisheries production in the tropical rivers and also enjoys high consumer preference. Information on the complete nutrient profile of this commercially important species has been generated. Proximate composition analysis showed that moisture, crude protein, crude fat and ash contents are 79.40 ± 0.09%, 20.06 ± 1.13%, 1.40 ± 0.79% and 0.90 ± 0.08%, respectively. Amino acid analysis showed that the fish flesh is rich in the essential amino acids like histidine, threonine and leucine and the ratio of essential to non-essential amino acid is 0.89 indicating its superior protein quality. Fatty acid profiling showed that it is low in fat. The mineral profiling showed that this species is rich in zinc, iron and calcium. The present study showed that *Sperata seenghala* is a good source of lean meat and trace elements viz. zinc and iron.

Fatty acid profile of Indian shad *Tenualosa ilisha*

Consumption of polyunsaturated fatty acids is known to be associated with a number of health benefits.Fish oils are rich in PUFAs. *Tenualosa ilisha*, a highly preferred food fish in South-Asian countries, is rich in oils; however, information on fatty acid profiles of different size-groups of hilsa is scanty. In the present investigation, information on fatty acid profiles of different size groups of hilsa has been generated. Analysis showed that medium-sized fish contained the highest amount of unsaturated fatty acids as well as ω-3 PUFAs, EPA plus DHA and the lowest amount of saturated fatty acids (SFAs). PUFA content was highest in small-sized hilsa; however, ω -3 PUFA content was lower and SFAs content was higher than medium-sized fish. In large-sized fish, although ω-3/ω-6 ratio was highest, quantitatively they contained the lowest amount of PUFAs and highest amount of SFAs. Thus, on the basis of fatty acid profiles, medium-sized hilsa is the best.

National Agricultural Innovation Projects

Arsenic in food-chain: Cause, effect and mitigation

Principal Investigator: S. Samanta
Co-PIs: M. K. Das, B. P. Mohanty and S. K. Manna

Four bacterial strains have been found to reduce significant amount of Arsenic in sediment microcosm developed by us indicating their probable role in arsenic reduction and mobilization in nature. Some of these strains have been identified as *Chryseobacterium* and *Acinetobacter* spp.

Four bacteria have been tested *in vivo* for their arsenic mitigation properties and two strains were found effective in enhancing excretion and reducing body burden of Arsenic. One such strain has been deposited in to MTCC/IDA and accession number obtained.

With the objective of Arsenic mitigation in man and animals, 28 bacteria have been isolated from natural and experimental systems and preserved in laboratory. Rapid identification of 8 of them has indicated presence of well known bio-remediating organisms like *Achromobacter xylosoxidans*, *Stenotrophomonas maltophila* and *Ochrobactrum anthropi*.

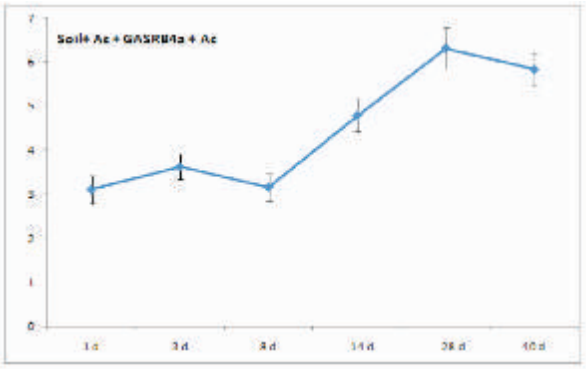
Significant positive ($p<0.01$) correlations between Arsenic content in fish flesh and that of pond water ($r= 0.388$, $n= 294$) and sediment ($r= 0.462$, $n= 294$) hve been recorded.

Muscle proteome profile of Indian major carp *L. rohita*, collected from arsenic contaminated versus reference ponds were compared using 2-D image analysis software. Analysis showed unique changes in proteome profile.

Experimental exposure was carried out using *L. rohita*. Changes in protein expression have been observed and specific changes have been noticed. Plasma proteome maps have been generated for plasma biomarkers for As-exposure.

Microcosm experiment was conducted and examined the Arsenic reduction activity of the isolates in sediment microcosm. It was observed that at least few of the isolates significantly reduced sediment arsenate to arsenite, proving their role in Arsenic reduction and mobilization in natural sediment.

Besides establishing microbial role in arsenic pollution, use of bacteria in arsenic mitigation was also attempted. Four strains have been tested in animal models and one strain was highly effective in reducing arsenic absorption and toxicity in the body and also effective in improving clinic-pathological conditions in Arsenic-exposed animals. Thus the bacterium has potential in mitigating Arsenic problem in arsenic exposed animals and man.

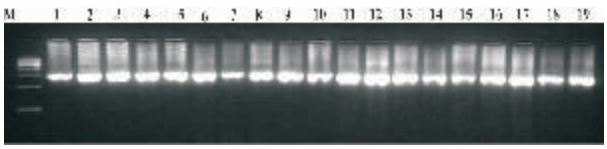


Bacterial arsenate reduction in sediment microcosm

Bioprospecting of genes and allele mining for abiotic stress tolerance

Principal Investigator: B. K. Behera
Co-PI: D. K. Meena

The soil, water and sediment samples, with regard to extreme conditions of salinity, from Bakkhali, Fresergunj, Kakdwip, Namkhana, Alampur and Deuli Bunglow of West Bengal, Chandipur, Puri, Chandrabhaga and Chilika of Orissa, Vizag, Yanam , Kakinada and Rajahmundry of Andhra Pradesh were collected. A total of 253 salt stress tolerant bacteria were isolated and out of that molecular identification of 81 isolates were completed using 16S rRNA gene sequence analysis. Seventy six bacterial 16S rRNA gene sequences have been submitted to NCBI Gene Bank and the Accession Numbers were received.



M-500bp DNA Ladder; Lane: 1-19, 16S rDNA amplicon of 1500bp

16S rRNA amplicon (1500bp) of 19 bacterial isolates

Physiological study was conducted by culturing the bacterial isolates in different elevated salt concentrations. For salt stress, cultures were grown at 37° C to a density of about 5 x 10^7 cells/ml. At this point, the cells were treated with 1.5%, 5%, 10%, 15%, 20%, 25% and 30% salt stress. Growth was monitored by determination of OD_{500}. It was observed that, one microbial isolate was resistant to 30%, 8 microbial isolates were resistant to 25%, 24 microbial isolates were resistant to 20%, 48 microbial isolates were resistant to 15%, 233 microbial isolates were resistant to 10% and 239 microbial isolates were resistant to 5% NaCl concentrations. A total of 253 microbial isolates were grown in 1.5% NaCl concentration.

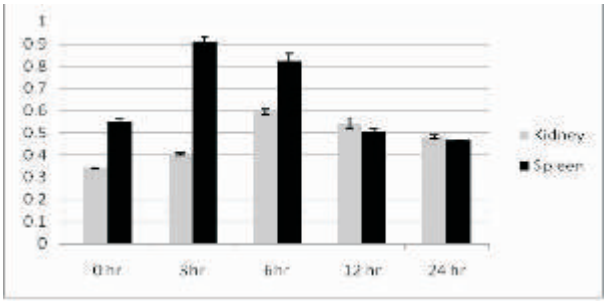
The whole genome transcriptome sequencing of *Enterobacter aerogenes* KCTC2190 grown in 15% salt stress condition was carried out. Total RNA was isolated and reverse transcription of the RNA was performed to generate cDNA. The cDNA was sequenced and 71,538,156 reads were generated. All the 71,538,156 reads were filtered to remove low quality and duplicate reads. The filtration resulted in 44,569,066 high quality read, which were used for analysis. Transcriptome assembly and annotation resulted in 7472 transcripts. NCBI ORF finder tool was used to find the ORFs for all 7472 assembled transcripts. Out of that, 6263 transcripts resulted into 1532 complete ORFs with both start and stop codons and 5013 partial ORFs missing either start/stop or both codons. The tool was not able to find any ORFs for 1209 transcripts out of 7472 assembled contigs. Further these complete and partial ORFs were annotated using NCBI BLASTP program against bacterial UniProtKB database. BLAST results were parsed with custom BioPerl scripts and based on the top BLAST hits; transcriptome sequences were associated with protein names and UniProtKB ID. 21 salt stress tolerant genes have been identified from this transcriptomic analysis and these ESTs have been submitted to NCBI Gene Bank and accession numbers received.

Toll like receptors in phylogenetically divergent fish species-their contribution in modulating innate immunity (catfish)

Principal Investigator: M. Aftabuddin
Co-PI: P. Maurye

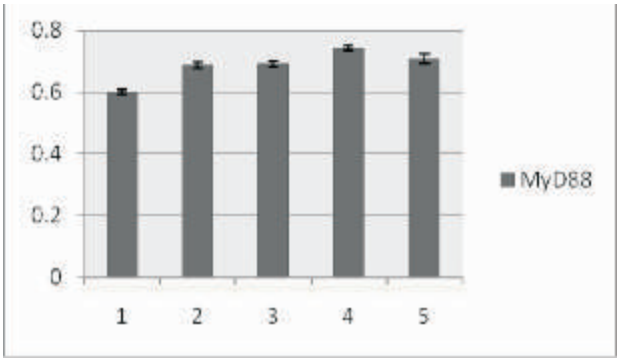
PCR amplification, sequencing and analysis of highly expressed TLR genes and signaling molecule of Toll-like receptor pathway of catfish: The PCR protocol was standardized for successful amplification of partial c DNA sequence of MyD88 (300bp) and IL8 (280 bp) from head kidney of catfish H. fossilis and TLR21 (296 bp) and IL-1β (300 bp) from head kidney of *C. batrachus* by using primer used for *I. punctatus.* Sequence alignment of partially amplified region of *H. fossilis* MyD88 revealed 90% sequence homology with *I. punctatus* spanning the region from 593 bp to 862 bp *and that p*edicted amino acid sequence found homology to death domain. Partial sequence of 296bp of TLR 21 showed 89% sequence homology with *I. punctatus and 99% with H. fossilis and* spans from 1477 bp to 1803 bp and aligned to LRR region of *I. Punctatus* TLR21. Sequence alignment of partially amplified region of *C. batrachus* IL-1β revealed 84% sequence homology with *I. punctatus* and that predicted amino acid sequence found homology to Protein kinase C phosphorylation, Casein Kinase II phosphorylation and N-glycosylation site. Sequence of MyD88 (300 bp) of catfish *H. Fossilis* and TLR 21(296 bp) and IL-1 β (300 bp) of *C. batrachus* were submitted to NCBI and accession no. are awaited.

Analysis of time and dose specific expression of signaling molecule of Toll-like receptor pathway of catfish in response to pathogen:



Time specific expression of MyD88

Semi quantitative expression of signaling adapter molecule, MyD88 was studied at 0, 3, 6, 12 and 24 hpi in tissues like head kidney and spleen were studied in both control and *Aeromonas hydrophila* treated fish. Induction study of MyD88 was done by normalizing the respective tissues with that of β actin. MyD88 peaked at 3 hpi and 6 hpi respectively in kidney and spleen.



MyD88 expression in response to different doses of *E.tarda*

Induction of catfish *H. fossilis* was done with different doses of *E. tarda* viz. 10^6,10^7,10^8,10^9, 10^{10} CFU for ten days and the expression of MyD88 was studied for the different doses in head kidney. The peak expression was shown by 10^9 CFU of *E. Tarda.*

Sustainable livelihood improvement through need based integrated farming system models in disadvantaged districts of Bihar

Principal Investigator: M. A. Hassan
Co-PIs: M. K. Bandyopadhyay

As a measure of contingent plan for drought period, culture of exotic catfish, *Pangasius sutchi,* was attempted

in the rearing pond of the carp hatchery complex of NAIP project site at Sakri Chaur, Jandaha. The pond was stocked with exotic catfish, *P. sutchi*, which can sustain low water depth, high temperature and high stocking density. A rearing pond of 0.014 ha was used for this purpose. The pond bottom was dressed evenly and covered with low cost polythene (HDPE) sheet to prevent leaching loss. Then plastic sheet was covered with a layer of 5-6" soil. The pond walls were also lined with HDPE sheet up to 2 m height.

HDPE lined pond preparation

Water filling in pond

The average initial length and weight at stocking was 7.2 cm and 7.58 gm. They were fed with a commercial floating pellet @ 5% of live weight. Water was replenished at regular interval during hot summer months to maintain water depth. The innovation proved successful and showed encouraging results. The fish grew to 37.5 cm and 510 gram after 6 months of rearing. A total of 120 fishes (60 % survival) could be retrieved from the pond, corresponding to production of 61 kg fish.

After pre-stocking treatment, such as, application of lime and organic manure the pond was filled with ground water and fingerlings of *P. sutchi* were released in the pond after 15 days at the rate of 15,000 fingerlings/ha.

Seed release in pond

Harvesting

Thus, the result indicated that fish production to the tune of 4.59 tons/ha/6 month could be obtained with this culture practice.

National Fund for Basic Strategic and Frontier Applications Research in Agriculture

The nature of impact of abiotic stresses on three diverse freshwater species of fishes

Principal Investigator: B. P. Mohanty

Exploration of the underlying mechanism of thermoregulation is a major concern to understand the patho-physiology of heat stress related illnesses. Temperature stress is a common abiotic stress that disturbs cellular homeostasis and leads to severe retardation in growth, production and development in fish. Conducting investigations on fish exposed to heat stress under laboratory-based experimental thermal exposure and natural thermal exposure at hot springs and thermal discharge sites of Thermal Power Plants can help in identifying biomarkers for acquired thermotolerance. Survey was conducted to locate such sites. Following sites were surveyed: (a) Atri in Odisha - a natural hot spring, (b) Bakreswar in West Bengal- a cluster of natural

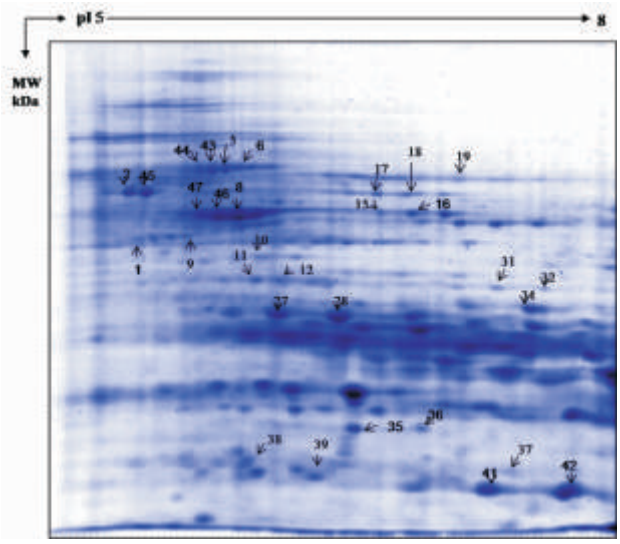
hot springs, (c) NTPC, Farakka, (West Bengal- a Thermal Power discharge site and (d) NTPC, Talcher, Odisha- a Thermal discharge site. Out of these Atri hot spring and Farakka (NTPC thermal discharge site) were found to be ideal sites for the study.

NTPC, Farakka, West Bengal- Thermal discharge site

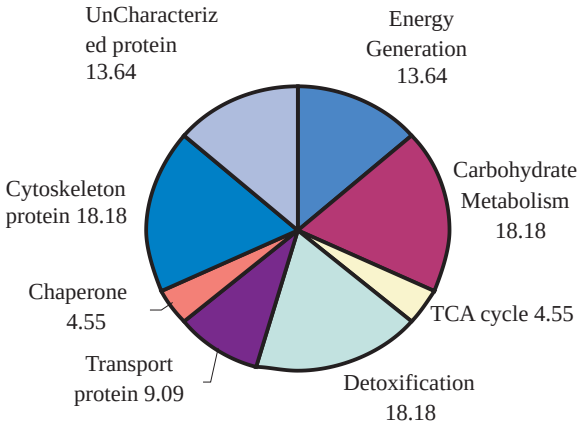
Atri, a hot spring in Odisha

Proteomic analysis of liver proteins of *Channa striatus* exposed to thermal stress

Proteomic analysis of liver proteins of heat-stressed (32 °C, 36 °C for 96 hrs) *Channa striatus* revealed that the intensity of several proteins including glyceraldehydes-3-phosphate dehydrogenase, ferritin, glutathione S-transferase, superoxide dismutase, HSP-60, -actin and, phosphoglycerate kinase significantly increased in 36°C temperature-exposed fish liver indicating generalized up regulation of the expression level of heat-stress responsive proteins.



Liver proteome of *Channa striatus* exposed to heat stress. The protein spots of interest which are altered upon exposure, were identified by peptide mass fingerprinting (shown by arrow heads)



Cellular functions of the Channa striatus liver proteome. All 27 proteins were grouped according to the cellular processes in which they are involved.

Sponsored Projects

Impact, adaptation and vulnerability of Indian agriculture to climate change- Impact assessment of climate change on Inland Fisheries

Principal Investigator: M. K. Das
Co-PI: S. K. Sahu

Vulnerability assessment indicated that Nadia and Murshidabad districts in West Bengal are in the very high vulnerable group among all districts of the state, where as East Mednipur, Hooghly are in Highly vulnerable group and Burdwan, West Mednipur are in the vulnerable group. It also shows that fisheries in about 66% (6 out of 9) districts are vulnerable to climate change. The Districts 24 PGS (S) and 24 PGS (N) show moderate and lower level of vulnerability of combined VI scores but have very high level of VI on adaptive capacities indicating high vulnerability in the event of cyclones or storms.

In Orissa the overall vulnerability score for Balasore was more (0.57) among the three districts of Orissa of importance for inland fisheries and ranked first with very high vulnerability. Where Khurda district ranked third with smallest score of 0.36 and having very less vulnerability.

Impact of drought during 2009 in West Bengal recorded a rainfall deficit of 29 % in the district of North 24 Parganas and 27 % in Bankura during the months of March, April & June showing deficiency by -25% , -96% & 71% respectively as compared to previous years in the last decade. Spawn death was maximum (45%) at district North 24 Parganas while in district Bankura the maximum loss was due to low demand of fish seed which was 80% among the other three attributes.

Microbial phosphorus transformations in inland open waters

Principal Investigator: S. K. Manna
Co-PI: S. Samanta

Phosphate solubilizing bacterial (PSB) load was estimated in two wetlands and ranged widely between 99-960 x 10^3 CFU/g sediment and 30-3800 CFU/ml water.

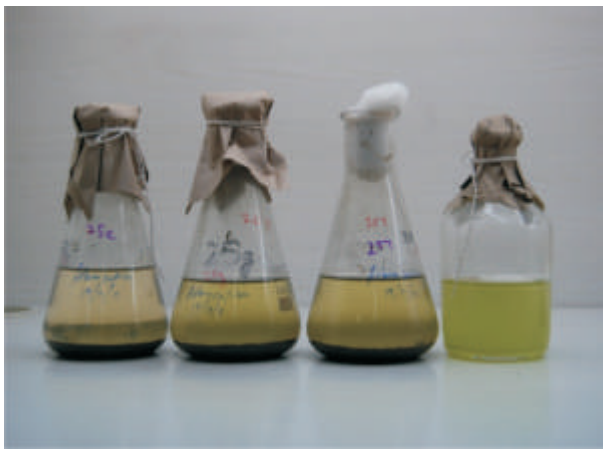
Nearly a hundred bacteria have been examined for their phosphate solubilizing and phytate mineralizing activities. The average P solubilization activity was high for isolates from Bhomra wetland and low for those from water samples. Also the isolates from Bhomra wetland and those from river Churnii had significantly higher activity than those from Akaipur wetland and from aquaculture ponds.

Phytate mineralizing ability of the strains also varied among different source of isolation. The mean P solubilization activity was highest for isolates from wetland and lowest for those from water samples. The strains from fish intestine had high phytase activity and are potential candidates for fish feed phytate degradation.

To examine the usefulness of bacterial isolates in releasing P from sediment-bound forms, a sediment microcosm protocol was developed and strains having prominent phosphate solubilizing and phytase/ phosphatase activities were examined for P release in sediment microcosm. A total of 26 strains have so far been examined. It was observed that only a few strains were able to release P from sediment indicating their potentiality for use. The P release was also studied using primary producer, viz. cyanobacteria, as an indicator. A few of our strains promoted cyanobacterial growth through release of sediment bound P, as happens in ponds and wetlands during summer, indicating potentiality of the strains in biofertilization of ponds and wetlands/ reservoirs for production enhancement.

Sources	No. of PSB isolates	Inorganic P solubilization (mgP/l)	
		Range	Mean
Bhomra sediments	24	18.81- 68.87	37.8
Akaipur sediments	15	8.98- 44.58	26.77
Churni sediments	13	8.55- 68.63	36.45
Pond sediments	3	24.76-28.49	27.08
Fish intestine	5	19.64-25.23	22.75
Bhomra water	2	6.30- 48.77	27.54
Akaipur water	10	8.34- 68.63	41.61

Comparative phosphate solubilzation by PSB isolates from various resources



Growth of photosynthetic *Aphanocapsa* sp. in flasks containing P releasing bacteria.

National Initiative on Climate Resilient Agriculture Project

Assessment of spawning behaviour of major fish species in inland environment with a view to harness the beneficial effects of temperature

Principal Investigator: M. K. Das
Co-PIs: U. Bhaumik, K. D. Joshi, M. Naskar, M. Aftabuddin, S. K. Sahu, B. K. Bhattacharjya, D. Debnath, D. Sudheesan and S. Das

Gonadal maturity stages of Indian major carps *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala* of six states namely West Bengal, Assam, Tripura, Andhra Pradesh, Madhya Pradesh and Uttarakhand, three coldwater fishes *Schizothorax richardsonii*, *Onchorhynchus mykiss* and *Tor putitora* and two estuarine fishes *T. ilisha* and *Liza parsia* were studied conforming to the objectives of the technical programme during April 2011-March 2012. Based on the occurrences of gamete (oocyte) maturity stages, GSI and allied parameters, efforts have been made to correlate the studied reproductive physiology of fishes with climate data of respective states/districts.

Survey was conducted in the fish hatcheries based on the structured questionnaire developed under the project in the states of Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, West Bengal, Assam and Tripura. The information gathered reveals indications of an advancement of the breeding period and longer breeding duration of the IMC. Fish spawning characteristics have been further investigated in relation to prevailing climate parameters at respective locations. The hatchery survey data comprising various aspects of the breeding and spawning of the fishes has been compiled and presented in the form of e-Atlas. e-Atlas for West Bengal and Assam has been completed.

Monthly fish sample analysis on the gonadal maturity, GSI and related climatic parameters revealed that the reproductive maturity of IMC has advanced by nearly one month (from April to March) and the duration of spawning has extended by one month (from July to August). Monthly variation in the occurrences of gamete (oocyte) maturity stages and mean monthly GSI values in relation to temperature and rainfall pattern have been analysed for IMC sampled from Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, West Bengal, Assam and Tripura.

On the different high altitude zones of Uttar Pradesh and Uttarakhand, beneficial impact of climate change (decrease in duration of low temperature regime) has been observed on breeding of rainbow trout, presently a 1.0-1.5ºC increase in water temperature in comparison to that during 2000-'03 has facilitated the advancement of gonadal maturity and 'ready-to-breed' condition as early as January. The IMC *Labeo rohita* presently is surviving and growing in the pond waters of Uttarakhand hills. Rohu is expected to become a candidate species in coldwater aquaculture in near future. The increase in temperature is one of the prime reason for the growth and survival of the fish.

Breeding periodicity of estuarine fishes *T. ilisha* and *Liza parsia* have been determined on the basis of month-wise variation in occurrences of oocyte maturity stages, GSI values. Furthermore the influences of climatic factors (salinity, water temperature and rainfall) upon their breeding behaviour have been investigated. Statistical analysis to identify patterns of different stages of maturity of *H. ilisha* in relation to water temperature in Hooghly estuary indicated that the VIIth stage of maturity was attained in the water temperature range between 30°C and 31°C. It ensured that temperature range of 29°C - 32°C would be conducive for spawning. It is a deviation from earlier observations.

Impact of change in temperature on certain reproductive physiological processes of IMC, viz., endocrine

functioning, gamete and gonad maturation, vitellogenesis, ovulation, fertilization efficiency have been investigated. Cholesterol and protein level in fish tissues, biomolecular changes in fish serum, liver, ovary and muscle have been analysed and further correlated with stages of reproductive growth.

Strengthening of database and geographical information system of the fisheries sector

Principal Investigator: A. P. Sharma
Co-PIs: K. D. Joshi, M. Kartikeyan, S. K. Sahu, B. K. Bhattacharjya, D. Karunakaran, D. N. Jha and A. K. Yadav

Under first component Haryana and Karnataka State were selected for fish catch estimation. Six district of Harayana State were selected and monthly catch data and resource data were collected. The estimate shows that total pond area (below 10 ha) is 14227 ha out of which only 12212 ha were used for fisheries. Total estimated catch for the year 2011-12 is 57113 tones. Productivity of ponds were estimated and found 5267 kg/ha/year. Water bodies of Bihar, Tripura, Maharastra, Mizoram and Manipur were delineated using PAN imageries. One electronic Atlas on water bodies of MP state was released by honourable Chief Minister of MP Shri Shivaraj Singh Chauhann along with four cabinet Minsters in fish festival at Bhopal on 4th Feb 2012. Trainning on methodologies and software were organized for two states at Allahabad center.

Release of e atlas of Madhya Pradesh by Honourable Chief Minister of MP Sri Shivaraj Singh Chauhan on 4th Feb 2012 at M.P. Fish festival.

An assessment of literacy, income and health status of fishers in India

Principal Investigator: P. K. Katiha

The specific objectives of the study were to assess the status of literacy, health and income of inland fishers in India. The information was collected from 981

households operating in rivers, reservoirs, floodplain wetlands, estuaries and lakes of twelve states, namely, Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal.

Fisher folk in the age group of 36-55 constituted about 47 per cent of the respondents. For family composition males outnumbered females in most states except Jharkhand and Kerala, The overall male – female ratio indicated that for every 1000 females there were 1130 males. The average size of family was 4.68. Most of (48 per cent) respondents belonged to family size category between 2-4 members. The average adult- child ratio was 1.51.

The general literacy rate was 71 per cent with 30 per cent upto primary, 36 per cent upto secondary and only 5 per cent reached college level. The overall dropout percentage was 61.23. It was found that the tendency to drop out was more with secondary education followed by primary and least with collegiate education. The improved facilitates and measures for increasing level of awareness about education resulted in better literacy. The average distance to a primary school was 1.32 km, high school was 4.23 km college was 11.73 km and

Primary Health Centre in rural area of West Bengal

A school in rural area of West Bengal

professional institution was 19.83 km from fishing villages. Vaccination Pox, BCG, MMR and Polio were regularly taken. The average birth weight of males was 2.6 kg and female was 2.57 kg. The incidences of mortality among mother were 0.70 per cent and that of infant were 4.3 per cent during birth. The most frequent disease among adults was fever/flu. Its occurrence was 2.81 months for males and 3.45 months among females. The important common diseases among children were fever, diarrhoea, body ache, and skin disorder. On an average the primary health centre was at a distance of 2.31 km and the hospital at 11.1 km. The major problem in health management was cleanliness/ sanitation, drinking water, etc.

The major income sources comprised of fishery, business, agriculture, labour services, and other service sectors. Out of total average income of Rs 2558/month the highest share was of fisheries (52.15 %) followed by labour (22.55 %), business (14.77 %) and agricultural (11.63 %). The average monthly expenditure per household was Rs 2084.20 with 50.68 % on food and 9.37 % on education. Information on savings indicated that 35.44 % of the respondents had no savings and 52.45 % had saving < Rs 50000. The average amount of indebtedness per person was Rs 21133.40. On an average 46.27 per cent of the loan was repaid. Private money lenders constituted the major source of loans followed by Banks and other sources like LIC, SHG, *etc*. The major purpose of loans was purchase of craft/ gear and other fishing related equipments, *etc*. The important suggestions for enhancing the income and employment included arranging the institutional financial support like micro credit for fisher folk; SHG, *etc*, regulation of fish marketing through institutional interventions; vocational training for fisherwomen to undertake house hold income activities during dry/ off season; and provision of rural infrastructure for general societal/human development.

Assessment of environmental flows for Shivasamudram Seasonal Power Scheme on river Kaveri, Karnataka

Principal Investigator: A. P. Sharma,
Co-PIs: U. Bhaumik, M. K. Das, A. K. Sahoo,. S. K. Rao, M. F. Khan, P. Panikkar and V. Kumar

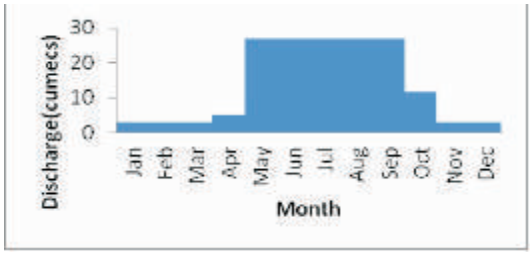
Shivasamudram is a Run-Off-River Power Project across Kaveri river near Shivasamudram, Karnataka State. For quantification of minimum river flow, investigation was undertaken by seasonal sampling at three stations viz. Weir point, Bharachukki (below weir) and Doddamakali (above weir). Data on both abiotic and biotic factors including fish diversity was generated. Weir station was found to be much suitable for breeding and spawning of many indigenous fish species including *Garra gotyla* and *Puntius karnaticus*. While Bharachuki habitat was found more suitable for residence of *Tor khudree*. Minimum river flow has been calculated considering 20% of the average flow of lean season in 90% dependable year maintaining a minimum depth of 0.5 m and velocity of 0.5 m/s in order to protect the breeding and spawning ground of these indigenous fish species.

Experimental fishing at weir site

Minimum environmental flow for the sustenance of ecology and biodiversity in Nyamjang Chhu river for Nyamjang Chhu HEP, Tawang

Principal Investigator: A. P. Sharma,
Co-PIs: U. Bhaumik, M. K. Das, A. K. Sahoo, S. Bandyopadhyay, B. K. Bhattacharjya, D. Debnath and P. Gogoi

Nyamjang Chhu Hydroelectric project (NJCHEP) is a run-of-the-river and is located along Nyamjang Chhu in Arunachal Pradesh. A total of 35 Km stretch of Nyamjang Chhu river flowing downstream from the barrage site to the Tail res tunnel (TRT) was surveyed and four sites



Seasonal flow requirement for sustenance of fish in Nyamjang Chhu River

Nyamjang Chhu River

were selected for the sample collection. The flow estimation has been carried out for 90% dependable year. Building block method analysis showed that in order to maintain the aquatic ecology in the river and sustenance of fishes for the season I (May – September), minimum discharge of 25.6 cumecs from the barrage, while during lean period i.e November to March a minimum water release of 3.5 cumecs from the barrage will maintain conducive depth and flow velocity of 0.55 m and 0.36 m s-1 respectively. This flow release form the barrage would facilitate sustenance of the fish during the lean season. While the high flow release during the monsoon would support river channel maintenance and would act as flood pulses.

Study of aquatic biodiversity in the river Ken

Principal Investigator: A. P. Sharma,
Co-PIs: U. Bhaumik, K. D. Joshi, B. K. Singh, A. Alam, S. K. Srivastava, K. Srivastava and V. Kumar

The river Ken was surveyed for selection of suitable sampling sites and data source. Four sampling centres namely Tighra, Daudhan, Banda and Chilla representing the different river characteristics and situated at accessible sites were selected for collection of ecological and fishery data.

- Completed field campaigns and the final report will be submitted soon.

Study of minimum environmental flow requirement for aquatic life in river Dri and Tagon for Etalin Hydroelectric Power Project

Principal Investigator: A. P. Sharma
Co-PIs: U. Bhaumik, K. D. Joshi, B. K. Bhattacharjya, A. K. Sahoo, D. Debnath, K. K. Sharma and P. Gogoi

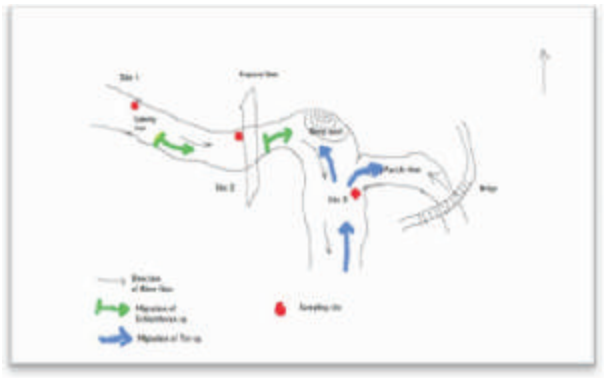
The Etalin Hydroelectric Power Project is a run-of-the-river and is located in Dibang basin with its catchment entirely within the Indian Territory bordering Tibet. A preliminary study was undertaken to estimate the minimum flow requirement for maintenance of fish diversity. Based on one season study and general guidelines (MoEF) the minimum flow requirement for the sustenance of ecology and biodiversity in Dri and Tangon rivers can be taken as 20% of the average flow of lean season in 90% dependable year maintaining a minimum depth and velocity suitable for breeding and spawning of *Schizothorax* sp. .

Fish seed of *S. richardsonii* at dam site

Investigation and suggestive measures on fish migration in river Kameng for Londa (Talong), Hydroelectric Project, Arunachal Pradesh

Principal Investigator: A. P. Sharma,
Co-PIs: U. Bhaumik, M. K. Das, B. K. Bhattacharjya, A. K. Sahoo, D. Debnath, P. Gogoi and A. Kapapi

The Talong Londa Hydro Electric project is a run of the river project proposed on Kameng river at Seppa, East Kameng district of Arunachal Pradesh, which is a right bank tributary of river Brahmaputra. As the project aims at the fish species migration study, our investigation infers that the dam axis and its upstream are very much conducive for juvenile rearing of *Schizothorax* sp. Deep pools below the dam axis, which may form the shelter



Schematic diagram of the sampling site and path showing the fish migrations

ground of these species. After spawning they migrate towards upstream as evident from our experimental fishing. Therefore, construction of dam will have an adverse impact on the *Schzothorax* sp. population in terms of its migration vis-a-vis breeding and spawning.

Post restoration assessment of the ecology and fisheries diversity of Chilika lake

Principal Investigator: A. P. Sharma,
Co-PIs: B. C. Jha, V. R. Suresh, R. K. Manna, D. Panda and C. M. Roshith

The project has been formally launched on 10 February 2012.

Technologies assessed and transferred

Technology assessed / transferred	Site	Beneficiary	By the centre
Fisheries enhancements in beels	Charan beel, Assam Udari beel, Assam Damal beel, Assam	Fisher, Fisher co-operative, Assam Fisheries Development Corporation, Department of Fisheries	CIFRI Regional Centre, Guwahati
Fisheries enhancements in reservoirs	Kelavarappalli, reservoir, Tamil Nadu Karapuzha reservoir, Kerala Mallaghatta reservoir, Karnataka	Fisher, Fisher co-operative, Department of Fisheries	CIFRI Regional Centre, Bangalore
Fish based integrated farming	Janki Chak seasonally flooded beels, West Bengal Dakshin Anukha, seasonally flooded beels, West Bengal	Fisher, Farmers, Fisher co-operative, Department of Fisheries, Department of Agriculture	CIFRI, Barrackpore
Fish seed raising in pens in beel	Rangapani Jan *Beel*, Assam Kachu *Beel*, Assam	Fisher, Fisher co-operative, Assam Fisheries Development Corporation, Department of Fisheries	CIFRI Regional Centre, Guwahati
Fish seed raising in cages in beel	Charan beel, Assam		
Fish seed raising in cages in reservoirs	Palna reservoir, Jharkhand	Fisher, Farmers, Fisher co-operative, Department of Fisheries Damodar Valley Corporation	CIFRI, Barrackpore

Pen culture in Rangapani Jan *beel* in Sonitpur, Assam

Cage in Palna reservoir in Jharkhand

Catch of a haul in Janki Chak seasonally flooded *beel*

A battery of cages installed in Charan beel, Morigaon district, Assam

Training, Mass Awareness Campaigns and Exhibition

Trainings

S. No.	Title	Date	Venue	No. of participants
1	Oxbow lake stockable size major carp's seed production in floating cages	19 May, 2011	Mathura Beel, Kanchrapara, West Bengal	44 fishers of West Bengal
2	Fish culture in pen enclosures	20-21 May, 2011	Meen Bhawan, Directorate of Fisheries, Guwahati	62 BDC members of Assam
3	Fish culture in pen enclosures	07-08 June, 2011	Meen Bhawan, Directorate of Fisheries, Guwahati	62 BDC members of Assam
4	Inland fisheries development	08-13 June, 2011	CIFRI, Barrackpore	36 DFO, Fisheries Dept., Govt. of Bihar
5	Inland fisheries production and resource management.	21-30 June, 2011	CIFRI, Barrackpore	29 Fish farmers, Bihar
6	Recent advances in management of fisheries and aquaculture in Northeast Region	05-07 July, 2011	ICAR Research Complex, Barapani	19 Programme Co-ordinator in North-eastern states
7	Inland fisheries production & resource management	22-31 July, 2011	CIFRI, Barrackpore	28 Fish farmers, Bihar
8	Fish seed rearing in cages and pens for stocking oxbow lakes	29 July, 2011	Kujerbaghi, Nadia, West Bengal	40 tribal fisher West Bengal
9	Fish culture in pen enclosures	2-3 August, 2011	Meen Bhawan, Directorate of Fisheries, Guwahati	62 BDC members of Assam
10	Inland fisheries production & resource management	24 August-02 September, 2011	CIFRI, Barrackpore	29 Fish farmers, Bihar
11	Fishery development in small reservoirs	30 August, 2011	Manbazar-I, Purulia, West Bengal	25 tribal fishers, West Bengal
12	Inland fisheries production & resource management.	13-22 September, 2011	CIFRI, Barrackpore	28 Fish farmers, Bihar
13	Fishery development in *Chaur* (Wetlands) of Bihar	26-30 September, 2011	Pirapur Village, Vaishali, Bihar	13 fishers of Jandaha *Chaur* in Bihar
14	Sustainable fishery development in low depth perennial wetlands	10 October, 2011	Barpara, Naihati, 24-Pgs (North), West Bengal	35 fishers of West Bengal
15	Strengthening of database and geographical information system for fisheries sector	12-15 October, 2011	CIFRI, Allahabad	Fisheries officials of Madhya Pradesh and Uttarakhand
16	Productivity management of Indian reservoir fisheries (NFDB sponsored)	13-19 October, 2011	CIFRI, Bangalore Centre	19 Fishery Officials from 9 States of India
17	Inland fisheries production & resource management.	11-19 November, 2011	CIFRI, Barrackpore	20 Fish farmers, Bihar

Trainings

S. No.	Title	Date	Venue	No. of participants
18	Sustainable fishery management in freshwater wetlands (NFDB sponsored)	15-21 November, 2011	CIFRI, Guwahati	20 fishery officials from the states of UP, Bihar, WB, Assam, Arunachal Pradesh and Meghalaya
19	Enclosed fishery enhancement techniques for inland open water resources (NFDB sponsored)	13-19 December, 2011	CIFRI, Barrackpore	18 Fishery Officials from 8 States of India
20	Major carps seed production in floating cages for stocking large inland water bodies	17 December, 2011	Maithon reservoir, Jharkhand,	40 fishers of Jharkhand
21	Aquatic inland resources and environment through RS and GIS application	10-30 January, 2012.	CIFRI, Barrackpore	25 officials of ICAR KVKs and State Departments
22	Fishery management of floodplain wetlands	17-23 January, 2012	CIFRI, Guwahati	Students of Cachar College, Silchar, Assam
23	Inland fisheries production & resource management.	12-17 March, 2012	CIFRI, Barrackpore	15 ATMA fishers, Samastipur, Bihar
24	Propagation of inland freshwater ornamental fishes	16 March, 2012	Rajchandrapur, 24-Pgs (North), West Bengal	60 fishermen and 20 fisherwomen, West Bengal
25	Entrepreneurship opportunities in fisheries sector	17-23 March, 2012	CIFRI, Allahabad	Progressive fish farmers of Haryana
26	Inland fisheries development	20-26 March, 2012	CIFRI, Barrackpore	21 Fisheries students of Begusarai, Bihar
27	Dissemination of appropriate techniques of diversification and fish production enhancement from the wetlands	28 March, 2012	Jagat Sagar and Dhubela wetlands in Chhatarpur district of Madhya Pradesh	40 fishers of Bundelkhand in Uttar Pradesh and Madhya Pradesh

Photographs of Mass Awarness & Training

Mass Awareness Programme

S. No.	Title	Date	Venue	No. of participants
1	Effect of unwanted destruction of fish seeds during prawn PL collection in Hooghly estuary	27 May, 2011	Kalisthan, 24-Pgs (South), West Bengal	59 fisherwomen
2	Effect of unwanted destruction of fish seeds during prawn PL collection in Hooghly estuary.	16 June, 2011	Godakhali, 24-Pgs (South), West Bengal	50 fishermen
3	Awareness campaign on conservation of hilsa	16 June, 2011	Godakhali, 24-Pgs (South), West Bengal	65 fishermen of river Hooghly from Godakhali area
4	Community based fishery development in low depth flood plain wetlands	23 August, 2011	Janakichak, Moyna, Midnapur (E), West Bengal	32 fish farmers
5	Fish & prawn seeds Conservation	20-22 September, 2011	Suryanagar, Kakdwip, West Bengal	60 participants and 10 dignitaries
6	Conservation of small indigenous fishes in oxbow lakes.	27 September, 2011	Mathura Beel, Kanchrapara, West Bengal	50 fishers
7	Awareness campaign on conservation of hilsa	16 October, 2011	Digha, West Bengal	100 fishers , traders, members of cooperative society
8	Scope of inland fisheries development and conservation	02 November, 2011	Sultanpur, U.P.	150 fish farmers
9	*Ganga Nadi main Matsya Sanrakshyan evam Samvardhan kee Awasyakta*	21 November, 2011	CIFRI, Allahabad	110 fishers
10	Credit-linked developmental schemes for fisher women	20-21 December, 2011	CIFRI, Barrackpore	30 participants
11	Save Hilsa fingerlings and juveniles from unwanted fishing in Hooghly river	28 December, 2011	Nababganj, 24-Pgs (North), West Bengal	50 fishers
12	Conservation need of indigenous wetland fishes	07 January, 2012	Thakurnagar, 24-Pgs (North), West Bengal	60 fishers
13	Save Hilsa seeds in Hooghly river	12 January, 2012	Bawali, 24-Pgs (South), West Bengal	50 fishers and 60 general public
14	Conservation of economically important freshwater fish species	22 February, 2012	CRRI, Cuttack, Odisha.	100 fish farmers

Exhibition

S. No.	Name of Exhibitions	Date	Venue
1	Agribusiness Exhibition	11 August, 2011	NIRJAFT, Kolkata
2	15th National Exhibition	07-11 September, 2011	Belghoria, Kolkata
3	Jharkhand Matsya Maha Sammelan	16-17 September, 2011	Ranchi, Jharkhand
4	Fish Farmers *Gosthi*	02 November, 2011	NFDB, Sultanpur
5	3rd Agro Protech-2011	03-05 November, 2011	Milan Mela Ground, Kolkata
6	Rastriya Krishi *Mela*	16-20 November, 2011	UAS, Bangalore
7	9th Indian Fisheries Forum Trade Fair	19-23 December, 2011	Chennai, Tamil Nadu
8	Exhibition , Fisheries Dept., Govt. of Assam	29 December, 2011	Guwahati, Assam
9	All India Congress of Zoology Exhibition	29-31 December, 2011	Lucknow, U.P.
10	*Puspa,Krishi-O-Silpa Mela*	07-16 January, 2012	Thakurnagar, 24-Pgs (N)
11	*Monmohan Mela–O-Lokosanskriti Utsav*	08-15 January, 2012	Chotojagulia, 24-Pgs (N)
12	*Sanchita Sishu, Kishore Utsav-O-Mela*	12 January, 2012	Bawali,Budge Budge, 24-Pgs (S)
13	SAFE Agri *Mela* 2012	14-17 January, 2012	Satjelia, Sunderban,, 24-Pgs(S)
14	Subhas *Mela* 2012	23-29 January, 2012	Taldi,24-Pargs (S)
15	Raipur Fish Festival	27-29 January, 2012	Raipur, C.G.
16	Bhopal Fish Festival	04-06 February, 2012	Bhopal, M.P.
17	Agricultural Scientists & Farmers Congress Exhibition	18-19 February, 2012	Allahabad,U.P.
18	Eastern Zone Regional Agricultural Fair	21-23 February 2012	CRRI, Cuttack
19	Pusa *Krishi Vigyan Mela*	29 February -04 March, 2012	IARI, New Delihi
20	*Krishi Vigyan Mela* 2012	1-3 March, 2012	IARI, New Delhi
21	Challenges and Opportunities in Aquaculture Exhibition	16-17 March, 2012	CIFA, Bhubaneswar
22	National Farmers Fair and Vegetable Show	17 March, 2012	IIVR, Varanasi

Awards/Recognitions

Name(s) of personnel	Name of the Award/Recognition	Place & date
Prof. A. P. Sharma	President elect	Animal, Veterinary and Fisheries Section, 100 th Indian Science Congress 2013, Kolkata
Prof. A. P. Sharma	Chairman	Planning commission Subgroup on 'Inland Fisheries and Freshwater and Coldwater Aquaculture' for XII Five Year Plan
Dr. S. S. Mishra	Fellowship	Society of Biological Sciences & Rural Development at Allahabad, November, 2011
Dr. A. K. Sahoo	Best Young Scientist Award	9th Indian Fisheries Forum at Chennai, 23 December, 2011
Dr. M. K. Das	Bioved Fellowship for outstanding contribution in the field of Fish & Aquatic Environment Health	14th Indian Agricultural Scientists & Farmers Congress at Allahabad during 18-19 February, 2012
Dr. Utpal Bhaumik	Bioved Fellowship award	14th Indian Agricultural Scientists & Farmers Congress at Allahabad during 18-19 February, 2012
Dr. K. D. Joshi	Bioved Fellowship award	14th Indian Agricultural Scientists & Farmers Congress at Allahabad during 18-19 February, 2012
Dr. B. P. Mohanty, *et al*.	2nd prize in Poster Presentation Eminent Indian Zoologist Medal	International Workshop on "Arsenic in the food chain : cause, effect and mitigation" at Kolkata 20 February, 2012 XXII Meeting Zoological Society of India Lucknow, 28-29 November, 2011

Linkage

The institute maintains close linkages with several organizations involved in fisheries research and development. The institute collaborated with them in research, development, extension, outreach activities, seminars, workshops, publications. The key partners of the institute are:

International

- International Water Management Institute, Colombo
- International Food Policy Research Institute, Washington
- International Union for Conservation of Nature, New Delhi
- Bay of Bengal Large Marine Ecosystem, Chennai
- World Bank, New Delhi
- Wetland International, New Delhi

National

State

- All the Department of Fisheries of Indian states with inland fisheries resources
- State Institute of Rural Development (SIRD), Govt. of Assam
- Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia
- Rajendra Agricultural University, Pusa, Samastipur
- West Bengal University of Animal and Fisheries Sciences, Kolkata
- Assam Agricultural University, Jorhat

Central

- Planning Commission, New Delhi
- National Fisheries Development Board, Hyderabad
- Department of Animal Husbandry, Dairying and Fisheries, New Delhi
- Central University of Bihar, Patna
- College of Fisheries, Central Agricultural University, Lembucherra, Agartala

ICAR

- Indian Agricultural Research Institute, New Delhi
- Indian Veterinary Research Institute, Izatnagar
- National Dairy Research Institute, Karnal
- Central Research Institute for Dryland Agriculture, Hyderabad
- ICAR Research Complex for NEH, Hill, Umiyam, Meghalaya
- National Research Centre on Yak Dirang
- Zonal Project Directorate (ZPD), ICAR Zone III, Umiam, Meghalaya
- National Bureau of Agriculturally Important Microorganisms (NBAIM) Mau
- Central Rice Research Institute, Cuttack
- National Research Centre for Groundnut, Junagarh
- Central Potato Research Station, Patna
- National Centre for Agricultural Economics & Policy Research, New Delhi
- Central Marine Fisheries Research Institute, Kochi
- Central Institute of Fisheries Technology, Kochi
- Central Institute of Freshwater Aquaculture, Bhubaneswar
- Central Institute of Brackishwater Aquaculture, Chennai
- Central Institute of Fisheries Education, Mumbai
- Directorate of Coldwater Fisheries, Bhimtal
- National Bureau of Fish Genetic Resources, Lucknow

Others

- Indian Institute of Technology, Kharagpur
- Department of Biotechnology, Indian Institute of Technology, Guwahati
- Bioved Research Institute of Agriculture & Technology, Allahabad
- Bharatiya Agro Industries Foundation (Bihar Programme), Patna
- Chilika Development Authority, Bhubaneswar

Publications


Tenualosa ilisha -
A Rich Source of
omega-3 Fatty Acids
Inland Fisheries Management
Training
Manual
Therapeutic Value of Fish

Publications

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Genomic Resources Submitted to NCBI GenBank (5)

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JF784024, JF784025, JF784026, JF784027, JF784028, JF784029, JF784030, JF784031, JF784032, JF784033, JF784034, JF784035, JF784036, JF784037, JF784038, JF784039, JF784040, JF784041, JF784042, JF784043, JF784044, JF784045, JF784046, JF784047, JF267324, JF267325, JF267326, JF267327, JF799876, JF799877, JF799878, JF799879, JF799880, JF799881, JF799882, JF799883, JF799884, JF799885, JF799886, JF799887, JF799888, JF799889, JF799890, JF799891, JF799892, JF799893, JF799894, JF799895, JF799896, JF799897, JF799898, JF799899, JF799900, JF799901, JF799902, JF799903, JF799904, JF799905, JF799906, JF799907, JF799908, JF799909, Jf799910.

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Leaflet (5)

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2. हसन, एम ए, पंकज पटियाल और सुधीर कुमार. 2011। बिहार के चौर क्षेत्रों की उत्पादकता बढ़ाने के लिये पेन मे मत्स्य बीज पालन। केन्द्रीय अंतर्स्थलीय मात्स्यिकी अनुसंधान संस्थान, बैरकपुर।

3. Roy, A., Manna, R. K., Bhaumik, U. and Bandyopadhyay, M. K. 2011. Leaflet on hilsa conservation (Bengali). CIFRI, Barrackpore.

4. Sharma, A. P., Roy, A., Manna, R. K., Bhaumik, U. and Bandyopadhyay, M. K. 2011. Conserve Hilsa, Secure your future. CIFRI, Barrackpore.

5. CIFRI, Allahabad, 2011. गंगा नदी तंत्र की मात्स्यिकी।

Consultancies

Project	Name of funding agency
Assessment of environmental Flows for Shivasamudram Seasonal Power Scheme on river Cauvery, Karnataka	Karnataka Power Corporation Limited (KPCL), Karnataka
Minimum environmental flow for the sustenance of ecology and biodiversity in Nyamjang Chhu river for Nyamjang Chhu HEP, Tawang	Bhilwara Energy Limited, Bhilwara
Study of aquatic biodiversity in the river Ken	National Water Development Agency Gwalior, Madhya Pradesh
Study of minimum environmental flow requirement for Aquatic life in river Dri and Tagon for Etalin Hydroelectric Power Project	Etalin Hydro Electric Company Limited, Gurgaon, Haryana
Study of Minimum Environmental Flow Requirement for Aquatic Life in river Dri and Tagon for Attunli Hydroelectric Power Project	Attunli Hydro Electric Company Limited, Gurgaon, Haryana
Investigation and suggestive measures on fish migration in river Kameng for Londa (Talong), Hydroelectric Project, Arunachal Pradesh	GMR Londa Hydropower Private Limited
Post restoration assessment of the ecology and fisheries diversity of Chilika Lake	Chilika Development Authority (CDA) Bhubaneswar

Meetings

Research Advisory Committee Meeting

The Research Advisory Committee meeting of the Central Inland Fisheries Institute for the year 2011 was convened during the 9-10th April 2011 at CIFRI Barrackpore. Under the Chairmanship of Dr. R. K. Sinha, the following RAC members attended the meeting. The Chairman highlighted the challenges for open water fisheries and emphasised upon the issues of poor adoption of inland fisheries technologies and stressed the need for developing appropriate technologies by practitioners and package of practices to meet the greater expectations of the public and policy makers and strong dissemination mechanisms. He reiterated the need for change in orientation of CIFRI programs in NRM footsteps during the XII plan. Dr. S. D. Singh, ADG (I. Fy), ICAR stressed on the need for synergizing opinion to resolve the conflict between conservation and increasing fish production and called for efforts towards sustainability. Director, Prof. A. P. Sharma in his concluding remarks assured that the recommendations will be implemented.

Planning Commission Meeting of Subgroup on "Inland Fisheries, Freshwater Aquaculture and Coldwater Aquaculture

The first meeting of Planning Commission subgroup on 'Inland Fisheries and Coldwater Aquaculture' for XII Five Year Plan was held at CIFRI, Barrackpore on May 10, 2011. The meeting was attended by the Chairman of Working Group, Dr. Dilip Kumar, members of sub group, special invitees and CIFRI scientists. The Chairman stressed to promote inclusive growth through judicious utilization of fisheries and aquaculture resources and to mobilize the inland fisheries and aquaculture potential for ensuring rural livelihood support The suggestions given for the development of the sector were: productivity enhancement for inland fisheries, aquaculture and cold water fisheries; seed production, seed certification, quarantine and disease surveillance facilities, strengthening of database, infrastructure development, value addition and post harvest technologies and government policies and human resource development.

II meeting of Planning Commission Subgroup on "Inland Fisheries, Freshwater Aquaculture and Coldwater Aquaculture"

The second meeting of Planning Commission subgroup on 'Inland Fisheries and Freshwater and Aquaculture' for XII Five Year Plan was held at CIFRI, Barrackpore on May 31, 2011. Most of the working sub group members and the chairman attended the meeting. The meeting was primarily to formulate fisheries development schemes for XII Plan based on the suggestions received from different stakeholders. Besides ongoing schemes number of new schemes was suggested on: integrated schemes like fish-cum-dairy, fish-cum-duckery, fish-cum-pig in selected states, encourage entrepreneurship for new fishery graduates and weed clearance in floodplain wetlands.

Institute Research Committee Meeting

The Annual meeting of Institute Research Committee was held during June 26-29, 2011 at Barrackpore. Prof. A. P. Sharma, Director, and Chairman, IRC presided over the meeting. Prof. R. K. Sinha, Chairman RAC, CIFRI attended the meeting on June 26, 2011. All the Heads of Division (HoDs) and scientists of all cadres participated in this important meeting. Prof. Sharma informed the house about institute, externally funded and consultancy projects executed by the Institute In view of the reorientation of Institute research programme towards an NRM approach, he asked the scientists to shift emphasis on holistic research management

considering multiple use of the aquatic ecosystems considering other uses also, besides fisheries. He encouraged the scientists to bid for competitive grant projects of different national and international agencies, *e.g.* DST, DBT, NFDB, CGIAR, *etc*. Prof. R. K. Sinha pinpointed the changing research environment with improvement of technology and distribution of time of scientists. He advised to have more research on water availability, environmental flow and application of models to solve these problems. Prof. Sharma made a presentation on "Prioritizing research on inland fisheries and aquatic ecosystem management". He raised number of prioritized research issues for inland fisheries, which need to be addressed during XII Plan.

II meeting of Planning Commission Working Group

The second meeting of Planning Commission Working Group on 'Development and Management of Fisheries and Aquaculture' for XII Five Year Plan was held at CIFRI, Barrackpore on July 22, 2011. The meeting was chaired by Dr, Dilip Kumar, Chairman of the Group in presence of Shri Tarun Sridhar, Joint Secretary (Fy), DAHD&F Government of India, New Delhi; Dr. V. V. Sadamate, Advisor (Agriculture), Planning Commission, Govt. of India, New Delhi, and number of very senior officials from Central government, State Line Departments, Universities, NGOs, ICAR Institutes and other development agencies. All the three sub-groups presented the status, plan of action and strategies for development and management of fisheries and aquaculture during XII plan for the country. Number of suggestions was made on the occasion.

NMPS Meeting

The Meeting of National Mission for Protein Supplements (NMPS) was organized by CIFRI at Barrackpore on 21 July, 2011. The meeting was attended by the personnel from State Department of Fisheries, National Fisheries Development Board, CIFRI, private cage manufacturing firms, *etc*. The main purpose, components and activities of the national

mission were described. The financial aspects, cage farming in reservoirs, design and problems in cage farming were also discussed. Different agencies opined about the mission and suggested for better implementation of the program.

BOBLME meeting

Meeting of National Working Group on Sundarbans was convened at the Central Inland Fisheries Research Institute (CFRI), Barrackpore on 23 July 2011. Many well-known mangrove experts of India, Officials of Fisheries Department & Sundarbans Department of West Bengal, Professor from University of Calcutta & Jadavpur, representatives from WWF, Zoological survey of India, Sundarbans Development Board, NGOs, Integrated Coastal Zone Management Project (ICZM), National Organizations working on mangroves, Indian Navy and Scientists of CIFRI attended the meeting. The future plan of action for conservation of biodiversity in Sundarbans was discussed. Number of relevant recommendations was made.

Midterm review of XX RCM meeting

The review of XX Regional Committee meeting was held at the institute on September 24, 2011. The nodal officer

of the region, Dr. B. Meenakumari, Deputy Director General (Fy) ICAR, New Delhi took an account of the progress made during the year and the gaps to be addressed. The document on "Centre State Co-ordination in Agriculture Extension and Education" was released in the meeting. Representatives from number of institutions in the region attended the meeting and presented progress of their work and future thrusts.

Institute Management Committee meeting

The Fortieth Institute Management Committee (IMC) meeting was organised at CIFRI, Barrackpore on 12 January, 2012. The meeting was attended by all the members of committee including Dr. S. D. Singh, ADG (I. Fy), ICAR, New Delhi. The action taken report of last IMC was presented and the committee expressed satisfaction on the progress. The committee members visited different laboratories and interacted with the scientific and administrative staff of the institute.

The National Consultation on Prioritization of Research Programmes

CIFRI organised a National Consultation on Prioritization of Research Programmes of CIFRI for XII Five Year Plan on

January 18, 2012 at CIFRI, Barrackpore. Dr. R. K. Sinha, Chairman, RAC, CIFRI, Barrackpore, Dr. A. G. Ponnaih, Director, CIBA, Chennai, Dr. P. C. Mohanta, Director, DFR, Bhimtal, Dr. P. Das, Former Director, NBFGR, scientists, fisheries experts, NGO Representatives and Progressive Fish Farmers attended the meeting. The major suggestions included: i) monitoring of the natural ecosystem with ecosystem approach, ii) generation of water recharge data for rivers and wetlands and iii) water requirement for fisheries in important river systems like Ganga and Yamuna. He further mentioned to carry out more research work on environmental flow, restoration of rivers, wetland river connectivity, fish taxonomy, hydro-geo-morphological studies, hydrodynamics in collaboration with ISI Kolkata, sustainable fisheries enhancement in inland open water ecosystem, fish behaviour, socio- economics, networking of CIFRI with universities with focus on field based investigations, *etc*.

Chilika Consultancy project meeting

The institute organised the Launching workshop of CIFRI/CDA-ICZM Consultancy Project on "Post-restoration assessment of ecology and fisheries diversity of Chilika lake" on 10 February, 2012 at Barrackpore. The workshop was attended by representatives from

Chilika Development Authority and CIFRI scientists. Dr. A. K. Pattnaik, Chief Executive of the authority made a presentation on "An overview of Chilika Environment and Fishery" to flag the issues. Dr. V. R. Suresh presented the project work plan. The modalities and proposed research work was discussed at the meeting. Prof. A. P. Sharma and Dr. B. C. gave their expert comments on the project and its implementation.

RFD Nodal officer meeting

The RFD nodal officers of all the institute of Fisheries Division participated in a meeting organised at the institute on February 22-23, 2012. Dr. B. Meenakumari, DDG (Fy) presided over the meeting. Dr. Madam Mohan (ADG (M. Fy) and Shri Anil Agarwal, Principal Scientist, Fisheries Division, ICAR, New Delhi also participated in the meeting. The meeting was primarily for finalisation of RFD document of Fisheries Division for XII Plan.

Participation of Scientists in Conference, Meeting, Workshops, Symposia

Participation of Scientist in Meetings/workshop abroad

Name(s)	Name of the meeting/workshop/conference/training programme	Place & Date/duration
Sharma, A. P.	Consultation meet ing on Ecosystems for Life: A Bangladesh-India Initiative E4L) project organized by IUCN	Kathmandu, Nepal 03-04 August, 2011
	Visit Uganda and Kenya as a part of exposure programme Ecosystems for Life: A Bangladesh - India Initiative (E4L) project	Uganda & Kenya , 11-18 September, 2011
	Meeting of BOBLME on Hilsa fisheries assessment working group	Dhaka, Bangladesh 9-12 October, 2011
Bhaumik, U.	Consultation meeting of the Ecosystem for life: A Bangladesh India initiative (E4L) project organized by IU CN to develop methodology for investigation on Hilsa	Kathmandu, August 03-04, 2011
	Joint Research Team meeting under Ecosystems for Life: A Bangladesh -India initiative (E4L) project organized by IUCN	Dhaka, November 23 -25, 2011
Manna, S. K.	NAIP funded Foreign Deputation program on Microbial Molecular Taxonomy under Prof. William B. Whitman, Department of Microbiology, University of Georgia	Georgia, 15 August 2011 – 14 November, 2011
Panda, D.	Meeting of BOBLME on Hilsa fisheries assessment working group	Dhaka, Bangladesh 09-12 October, 2011
Samanta, S.	NAIP funded Foreign Deputation program on Improved Techniques in Arsenic Analysis Including Speciation Studies under Prof. Ravi Naidu, University of South Australia	Australia, 16 January 2012-14 February, 2012

Participation of scientists in conference, meetings, workshops, symposia, *etc*. in India

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
1	Sharma, A. P.	First Meeting of the Working Group on Development and Management of Fisheries and Aquaculture for the XII Five Year Plan	Hyderabad, 14-17 April, 2011
		Workshop on Mid Term Evaluation on Stocking of Fingerlings on Its Impact in Increase of Fish Production under Reservo ir Fisheries Development Programmes of NFDB	Mysore, 20-22 April, 2011
		I Meeting of Planning Commission of Sub -Group II on "Inland Fisheries and Freshwater & Coldwater Aquaculture" for the XII Five Year Plan	Barrackpore, 10 May, 2011
		Meeting for discussion on Inland Fisheries & Fresh Water Aquaculture with the Scientists of CIFE for the preparation of XII Five Year Plan document	Mumbai & New Delhi, 23-24 May, 2011
		II Meeting of Planning Commission of Sub - Group II on "Inland Fisheries and Fresh water & Coldwater Aquaculture" for the XII Five Year Plan	Barrackpore, 31 May, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		8th Meeting of the Technical Monitoring Committee for the Central Sector Scheme on Strengthening of Database & Geographical Information System for the Fisheries Sector	Shillong, 03 June, 2011
		Advisory committee meeting on Preparation of draft Plan of Inland Fisheries and Aquaculture under the Chairmanship of Secretary, Ani mal and Fish Resources, Government of Bihar	Patna,16 June, 2011
		Meeting for review of physical and financial progress of the scheme Development and demonstration of cage culture technology in reservoirs for raising table fish at NFDB	Hyderabad, 18 June, 2011
		Meeting on organic farming and Fisheries Development in Bihar organized by the Govt. of Bihar	Patna, June 21 -22 June, 2011
		Workshop on Development of Inland Fisheries & Aquaculture in the State of Meghalaya organized by the Govt. of Meghalaya	Shilling, 30 June, 2011
		Consultation on Reservoir Fisheries Development in Uttar Pradesh	Bareilly, 07 -08 July, 2011
		Sub-committee meeting for preparation of the Road Map for Fisheries Development at Bihar	Patna, 14 July, 2011
		Meeting of Planning Commission's Sub group on Fisheries for DARE	New Delhi,15 July, 2011
		ICAR Director's Conference and Foundation Day	New Delhi, 16 July, 2011
		Planning Commission meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore 22 July, 2011
		Bay of Bengal Large Marine Ecosystem (BOBLME) First National Level Workshop on Sundarbans, India	Barrackpore, 23 July, 2011
		3rd meeting of the Working Group on the Development and Management of Fisheries & Aquaculture for the XII Five Year Plan at CIBA	Chennai, 18 August, 2011
		Expert Committee Meeting for Tilapia Culture at CIBA	Chennai,19 August, 2011
		Brain Storming Session on Eco-leveling at ICAR	New Delhi, 27 August, 2011
		Meeting on Reservoir Fisheries Development in the Kerala State organized by Government of Kerala	Trivandrum, 31 August, 2011
		Visit to Himachal Pradesh to evaluate the feasibility of cage culture of fish and rearing of fish seed and to discuss othe r issues related to Inland Fisheries in the State	Chandigarh,08 September, 2011
		Brainstorming meeting on Water at NBFGR	Lucknow, 18 -19 October, 2011
		Consultation on Chilka Consultancy Project with Project Director, Coastal Zone Management	Bhubaneswar, 20 -21 October, 2011
		Discussions on Reservoir Fisheries Development project with Hindustan Agro & Senior Officials of Maharashtra Government	Pune, 26 -27 October, 2011
		Interaction Meeting with Minister -in-Charge, Fisheries, Food Processing Industr ies and Horticulture, West Bengal	Kolkata, 17 November, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Valedictory function of NFDB training at CIFRI, Guwahati Centre	Guwahati, 21 November, 2011
		Meeting of Administrative Officers & Finance & Accounts Officers of ICAR Institutes	New Delhi, 22 November, 2011
		Review meeting on the progress of 'Reservoir Stocking Program' for the year 2011 -12	Hyderabad, 28 November, 2011
		Workshop on preparation of status of Fisheries Development in Madhya Pradesh	Bhopal, 30 November, 2011
		Meeting on 'Development of sewage fed fisheries in the East Kolkata Wetlands' convened by the State fisheries Department, West Bengal	Kolkata, 01 December, 2011
		Foundation Day programme of NBFGR and Stake Holders Meeting	Lucknow,11 -13 December, 2011
		9th Indian Fisheries Forum on Renaissance in Fisheries; Outlook and strategies organized by CMFRI, Cochin	Chennai, 19 -22 December, 2011
		22nd All India Congress of Zoology & National Seminar on Recent advances in Biological Sciences: Biodi versity and Human Welfare in Department of Zoology, University of Lucknow	Lucknow, 29 -31 December, 2011
		Fish Festival organized by Department of Fisheries, Madhya Pradesh	Bhopal, 04 -05 January, 2012
		Lecture in All India Science Congress and Inception meeting of Chilika Project	Bhubaneswar, 06 -08 January, 2012
		Interface meeting on Cage Culture Programme at DVC	Maithan, 24 -25 January, 2012
		Fish Festival of Department of Fisheries, Government of Chhattisgarh	Raipur, 27 -28 January, 2012
		Launching workshop on Post - restoration assessment of ecology and fisheries diversity of Chilika lake	Barrackpore, 10 February, 2012
		ICAR RFD Nodal Officers meeting	Barrackpore, 22 February, 2012
		First meeting and video conference on Nor way-India-Bangladesh Consortium for Hilsa Aquaculture in South Asia between NOFIMA, CIFRI, Private partner, BFRI and Worldfish Centre	Barrackpore, 05 March, 2012
		NFDB Project Review Meeting	New Delhi,12 March, 2012
		Meeting to finalise agenda for Convention to strengthen ICAR Institute -SAU-State Department Interface	Kalyani, 13 March, 2012
		Lecture on Research and development in Fisheries Science at North Bengal University	Siliguri,19 March, 2012
		Workshop on "Su stainable utilization of mountain fishery resources of North East Region	Guwahati, 24 -25 March, 2012
2	Aftabuddin, M.	International Brainstorming Meet on Recent Advances in Fish Reproductive Physiology organized by CIFA	Bhubaneswar,16 August 2011
		CAC Meeting of NAIP project Toll -like receptors in phylogenetically divergent fish species, their contribution in modulating innate immunity	Bhubaneswar, 01 September, 2011
		National Workshop and Stakeholders meet on Fish Feed organized by CIFA	Bhubaneswar, 01 -02 November,2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		9th Indian Fisheries Forum on Renaissance in Fisheries; Outlook and strategies organized by CMFRI, Cochin	Chennai, December 19 - 23, 2011
		National Consultation on Prioritization of Research programmes of CIFRI for XII five ye ar plan	Barrackpore, January 18, 2012
3	Alam, A.	14th Indian Agricultural Scientists & Farmers Congress	Allahabad ,17-18 February, 2012
4	Bandyopadhyay, M. K.	Bay of Bengal Large Marine Ecosystem (BOBLME) First National Level Workshop on Sundarbans, India	Barrackpore, 23 July, 2011
		3rd Agri Protech 2011 Organised by Indian Chamber of Commerce	Kolkata, 03 -05 November 2011
		National Seminar "Advances in use of non - conventional energy sources in agriculture, fisheries and rural development" org anised by Institute of Engineers, Kolkata	Kolkata, 19-20 January, 2012
		ICAR RFD Nodal Officers meeting	Barrackpore, 22 February, 2012
5	Behera, B. K.	CAC meeting of the NAIP project on 'Bioprospecting of genes and allele mining for abiotic stress tolerance'	New Delhi 02 -04 May, 2011
		Workshop on, "Development of Inland Fisheries and Aquaculture in the State of Meghalaya"	Shillong, 29-30 July, 2011
		Meeting on "Inland stock certification and Ecolabelling"	New Delhi, 27 August, 2011
		Expert group meeting of management and control of aquatic animal diseases	New Delhi, 14 October, 2011
		Pre-CAC and CAC meeting of NAIP Project on "Bioprospecting of genes and allele mining for abiotic stress tolerance"	New Delhi, 01-03 November, 2011
		99th Indian Science Congress organized at KIIT University	Bhubaneswar, 03 - 07 January, 2012
		Attended Partners Meet on "Fish Bioinformatics: Challenges and opportunities"	Lucknow, 20 March, 2012
6	Bhattacharjya, B. K.	International Seminar on "Bioresourc es and Human Sustenance" organized by Department of Zoology, Cotton College, Guwahati and Zoological Society of Assam	Guwahati,20-22 October, 2011
		Diversified aquaculture organized by Kolong - Kapili (NGO), Bagibari, Kamrup district, NABARD Regional Offi ce, Guwahati and Dept. of Fisheries, Govt. of Assam	Guwahati, 28 December, 2011
		Protection and Preservation of Chandubi lake	Chandubi, 3, January, 2012
		Recent Trends in Statistics and its Applications	Guwahati, 03-04 February, 2012
		NE Food Tech Summit organized by Ministry of Food Processing Industries, GOI and Indian chamber of commerce	Guwahati, March, 2012
		Sustainable utilization of Mountain fishery resources of NE region organized by DCFR, Bhimtal	Guwahati, 24-25 March, 2012
7	Bhaumik. U.	International Seminar on "Bioresources and Human Sustenance" organized by Department of Zoology, Cotton College, Guwahati and Zoological Society of Assam	Guwahati,20-22 October, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Diversified aquaculture organized by Kolong - Kapili (NGO), Bagibari, Kamrup district, NABARD Regional Office, Guwahati and Dept. of Fisheries, Govt. of Assam	Guwahati, 28 December, 2011
		Protection and Preservation of Chandubi lake	Chandubi, Assam 3, January, 2012
		Recent Trends in Statistics and its Applications	Guwahati, 3-4 February, 2012
		NE Food Tech Summit organized by Ministry of Food Processing Industries, GOI and Indian chamber of commerce	Guwahati, March, 2012
		Sustainable utilization of Mountain fishery resources of NE region organized by DCFR, Bhimtal	Guwahati, 24-25 March, 2012
		International Seminar on "Bioresources and Human Sustenance" organized by Department of Zoology, Cotton College, Guwahati and Zoological Society of Assam	Guwahati,20-22 October, 2011
8	Chandra, G.	Second Meeting of the subg roup on 'HRD, Training and Accreditation' of the Planning Commission Working Group on Agricultural extension in Agricultural and Allied Sector for the XII Plan	Kalyani, 10 June, 2011
		14th Sundarban Day organized by an NGO in collaboration with CIFRI	Jadavpur, 13 June, 2011
		National Workshop on Best Practices in Sustainable Agriculture" organised by Natural Resource Management Centre, NABARD	Kolkata 04 -05 August, 2011
		7th Brackishwater Aqua Farmers Meet organized by Kakdwip Research Centre of CIBA	Kakdwip, 21 October, 2011
		3rd Agri Protech 2011 Organised by Indian Chamber of Commerce	Kolkata, 03 -05 November 2011
		9th Indian Fisheries Forum on Renaissance in Fisheries; Outlook and strategies organized by CMFRI, Cochin	Chennai, 19 -22 December, 2011
		International Symposium on Ecosystem approach to fisheries in the Bay of Bengal Large Marine Ecosystem organised by BOBP and BOBLME	Chennai, 21 December 2011
		Madhya Pradesh State Fish Festival organised by Dept. of Fisheries, Govt. of Madhya Pradesh	Bhopal 04-06 February, 2012
		Global Conference on Women in Agriculture	New Delhi, 13 -15 March 2012
9	Chandra, K.	14th Sundarban Day organized by an NGO in collaboration with CIFRI	Jadavpur, 13 June, 2011
		Bay of Bengal Large Mari ne Ecosystem (BOBLME) First National Level Workshop on Sundarbans, India	Barrackpore, 23 July, 2011
10	Das, A. K.	ICAR sponsored Training Programme on Inland Fisheries Management for District Fishery Officers of Bihar	Barrackpore, 08 -13 June, 2011
		Awareness campaign for National Mission for Protein Supplements (NMPS) on Cage culture in reservoirs	Ranchi, 11 -20 August, 2011.
		Awareness campaign for National Mission for Protein Supplements (NMPS) on Cage culture in reservoirs	Ranchi, 17 -20 September, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		NFDB sponsored Training Program on "Productivity management of Indian reservoir fisheries" for State Fisheries Officers organised by Regional Centre of CIFRI, Bangalore.	Bangalore, 13 -19 October, 2011
		NFDB sponsored Training Program on En closed Fishery Enhancement Techniques for Inland Open Water Resources	Barrackpore, 13 -19 December, 2011
		Inception Meet of NFDB -DVC-CIFRI Interface on Development & demonstration of cage culture in reservoirs for raising table fish	Maithon, 24 January, 2012
		Winter School on Aquatic Inland Resources and their Environment Assessment Through RS & GIS Applications	Barrackpore, 10 -30 January, 2012
		Matsya Utsab - 2012 organised by Deptt. of Fisheries, Govt. of Madhya Pradesh	Bhopal, 02 -07 February, 2012
		Training on "Reservoir fisheries management" under Social Integrated Program, of DVC	Burdwan, 14 September, 2011
		Training on "Reservoir fisheries management" under Social Integrated Program, of DVC	Maithon, 07 -08 January, 2012
		Training on "R eservoir fisheries management" under Social Integrated Program, of DVC	Panchet, 17 January, 2012
11	Das, M. K.	Sustainable agriculture and climate change organized by SAFE, India	Kolkata, 08 -10 April, 2011
		Interaction meet with Hon'ble Union Minister for Agriculture	New Delhi, 17 November, 2011
		Network project on Impact Vulnerability & Adaptation of Inland Fisheries to climate change	New Delhi, 22-23 March, 2012
		International Workshop on Arsenic in Food Chain: Cause, Effect and Mitigation or ganized by DNGMRF and BCKVV	Kolkata, 20 February, 2012
12	Das, S. K.	Use of Vermicomposted Fly Ash in Agriculture organized by Institute of Agriculture, Viswa Bharati, Santiniketan	Bolpur, 26 May, 2011
		14th Sundarban Day organized by an NGO in collaboration with CIFRI	Jadavpur, 03 June, 2011
		Bay of Bengal Large Marine Ecosystem (BOBLME) First National Level Workshop – on Sundarbans, India	Barrackpore, 23 July, 2011
		Awareness campaign on fish and prawn seed conservation	Kakdwip, 20 -22 September, 2011
		NAIP sponsored training entitled Assessment of quality resilience of soils	Bhopal, 09 -13 January 2012
		Brainstorming Session on Emerging scientific issues in inland open water fisheries and development	Barrackpore, 17 March, 2012
13	Das, S.	I Meeting of Planning Commission of Sub -Group II on "Inland Fisheries and Freshwater & Coldwater Aquaculture" for the XII Five Year Plan	Barrackpore, 10 May, 2011
		II Meeting of Planning Commission of Sub - Group II on "Inland Fisheries and Fresh water & Coldwater Aquaculture" for the XII Five Year Plan	Barrackpore, 31 May, 2011
14	Debnath, D.	Protection and Preservation of Chandubi lake	Chandubi, 03 January, 2012

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		NE Food Tech Summit organized by Ministry of Food Processing Industries, GOI and Indian chamber of commerce	Guwahati, 13 March, 2012
		Food safety issues in high moisture food commodities organized by NRC on Pig, Guwahati and CIFT, Cochin	Guwahati, 22 March, 2012
		Sustainable utilization of Mountain fishery resources of NE region organized by DCFR, Bhimtal	Guwahati, 24-25 March, 2012
15	Ekka, A.	National Consultation on *"Gender Perspective in Agriculture"* organized by DRWA, Bhubaneswar	New Delhi, 8-9 August, 2011
		Planning Commission meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore 22 July, 2011
		Seminar on "*Bio-Informatics*" organized by CIFRI Barrackpore	Barrackpore, 16 December, 2011
		National Consultation on Prioritization of Research Programmes of CIFRI for XII Five Year Plan	Barrackpore, 18 January, 2012.
		"*Fish Festival*" organized by Department of Fisheries, Govt. of Chhattisgarh from.	Raipur, 27-29 January, 2012
16	Hassan, M. A.	National Workshop and Stakeholders meet on Fish Feed organized by CIFA	Bhubaneswar, 01-02 November, 2011
		"Brainstorming session on Researchable Issues in Aquaculture Nutrition"	Chennai, 14 November, 2011
		Annual Workshop of the NAIP Component III	Patna, 2-3 March, 2012
17	Jha, D. N.	Bio-informatics in Fishery Domain	Lucknow, 12-22 October, 2011
		NAIP sponsored programme on Data Analysis using SAS	Mohanpur, 17 February, 2012
18	Jha, B. C.	Meeting on Cage fish farming in Madhya Pradesh reservoirs under NMPS	Bhopal, 7-9 April, 2011
		Meeting on Cage fish farming in Maharashtra reservoirs under NMPS	Mumbai, 12-16 April, 2011
		Meeting on Cage fish farming in Jharkhand reservoirs under NMPS	Ranchi, 27-28 April, 2011
		meeting of NMPS on with cage fish farming in reservoirs of Chhattisgarh in connection	Raipur, 12-15 May, 2011
		Seminar on Fisheries Development in Madhya Pradesh organized by the Department of Fisheries Madhya Pradesh	Bhopal, 22-24, May, 2011
		Meeting for appraisal of projects at Guwahati Centre of CIFRI	Guwahati 28-29 May, 2011
		Meeting for the selection of reservoirs in Maharashtra under NMPS	Mumbai, 7-10, June, 2011
		Institutes Management Committee Meeting	Cochin, 15-17 June, 2011
		Workshop to provide technical guidance on reservoir fisheries development in the state of Mizoram under NFDB scheme	Aizawl, 20-22 June, 2011
		Project evaluation of CIFRI Centre Bangalore for and NFDB, Hyderabad to attend a meeting on reservoirs	Bangalore, 11-13, July, 2011
		Evaluation of reservoir Projects of NFDB	Hyderabad, 11-14, July, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Workshop on policy formulation for the sustainable management of Chilika Lake organized by CDA	Bhubaneswar, 19-21 July, 2011
		Monitoring of reservoir fisheries development under NFDB scheme in Odhisa	Bhubaneswar, 27-29 July, 2011
		Meeting on wetland fisheries development in Bihar	Patna, 13-14 August, 2011
		Seminar on Sustainable development of wetlands" convened by Magadh University	Bodh Gaya, 22-23 August, 2011
		Seminar entitled "Fisheries development of NE states" organized by CIFA, Bhubaneswar	Guwahati 10-13 September, 2011
		Meeting on Fisheries development of NE states organized by NABARD	Guwahati, 23-24 September, 2011
		Seminar on "Scope and prospect of fisheries development in Tamil Nadu" organized by CIBA	Chennai, 30 September to 1 October, 2011
		Selection of reservoirs under NMPS in Madhya Pradesh	Bhopal, 15-18 October, 2011
		Discussions on Reservoir Fisheries Development project with Hindustan Agro & Senior Officials of Maharashtra Government	Pune, 26 -27 October, 2011
		Selection of reservoirs under NMPS in Uttar Pradesh	Lucknow, 9-12 November, 2011
		Meeting on Fisheries development in Bihar	Patna, 20-23, November, 2011
		XXII Meeting Zoological Society of India	Lucknow, 28-29 November, 2011
		Institute Management Committee Meeting of CIFT, Cochin	Cochin, 5-7, December, 2011
		Impact Assessment of Dams across river Siang on fisheries and biodiversity Arunachal Pradesh	Itanagar, 15-18 December, 2011
		Developing the policy guidelines for wetland fisheries development in Bihar	Patna, 4-6 January, 2012
		Monitoring of cage fish farming in DVC Reservoir under NFDB scheme	Maithan, 12-14 January, 2012
		CDA project formulation meeting for the XII plan	Bhubaneswar 12-13 February, 2012
		Meeting on project formulation and execution organized by Wetland International, New Delhi,	Bhubaneswar, 15-16 March, 2012
19	Joshi, K. D.	49th Expert Appraisal Committee meetings of the Ministry of Environments, GOI on Hydro-Electric Projects	New Delhi, 29-30 April, 2011
		Thematic meeting on Fisheries at CMFRI	Kochi, 06 May, 2011
		50thExpert Appraisal Committee meetings of the Ministry of Environments, GOI on Hydro-Electric Projects	Roorkee, 2-3 June, 2011
		Meeting-cum-Workshop of the Heads of the Divisions and Regional Stations/Centres	CIAE, Bhopal 14 -15 June, 2011
		51st, Expert Appraisal Committee meetings of the Ministry of Environments, GOI on Hydro-Electric Projects	New Delhi 15-16 July, 2011
		Workshop on River Basin Ecological Management organized by IIT, Kanpur	Kanpur 6 August, 2011
		52ndExpert Appraisal Committee meetings of the Ministry of Environments, GOI on Hydro-Electric Projects	New Delhi 16-17 September, 2011
		53rd Expert Appraisal Committee meetings of the Ministry of Environments, GOI on Hydro-Electric Projects	New Delhi 11-12 November, 2011
		Workshop entitled "Ganga Nadi main Matsya Sanrakshyan evam Samvardhan kee Awasyakta"	Allahabad, 21 November, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Foundation Day programme & Stakeholders meeting at NBFGR	Lucknow, 12 December, 2011
		National Conference on Orchids in India, jointly organized by the NASI, Allahabad and National Academy of Sciences, Allahabad	Allahabad, 21 December, 2011
		NFDB sponsored training programme	Lucknow, 08 February, 2012
		55th Expert Appraisal Committee meetings of the Ministry of Environments, GOI on Hydro-Electric Projects	New Delhi, 10-11 February, 2012
		14th Indian Agricultural Scientists & Farmers Congress	Allahabad ,17-18 February, 2012
		UGC sponsored National Workshop on Allelopathy & Bio-management of exotic weeds at University of Allahabad	Allahabad, 27 February, 2012
		Centenary Programme of Vigyan Parishad, Prayag, Allahabad	Allahabad, 13 March, 2012
		Challenges in Biodiversity Conservation and Sustainability at Allahabad University	Allahabad, 17 March 2012
		National Workshop on Frugal Innovations for Sustainable Solutions in Fisheries and Aquaculture Sectors	Lucknow, 24 March, 2012
		56th Expert Appraisal Committee meetings of the Ministry of Environments, GOI on Hydro-Electric Projects	New Delhi, 30-31 March, 2012
20	Kartikeyan, M.	Training programme on Productivity Management of Indian Reservoir Fisheries (sponsored by NFDB, Hyderabad),	Bangalore, 13-19 October, 2011
21	Karunakaran, D.	Winter School on "Aquatic Inland Resource and Environment Assessment Through remote Sensing and GIS"	Barrackpore, January, 10-31, 2012
22	Katiha, P. K.	Workshop on "Mid-term Evaluation on stocking of fingerlings on its impact in increase of fish production"	Mysore, April 19-23, 2011
		Planning Commission meeting of Sub Group-II: Inland Fisheries and Freshwater & Coldwater Aquaculture under Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore, 10 May, 2011
		Planning Commission meeting of Sub Group-II: Inland Fisheries and Freshwater & Coldwater Aquaculture under Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore, 31 May, 2011
		Attended Golden Jubilee Function of CIFE, Mumbai	Mumbai, June 06, 2011
		Workshop on "Prioritization of fisheries research and development in the country"	Mumbai, June 07, 2011
		Meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Hyderabad, 16 June, 2011
		Planning Commission meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore 22 July, 22, 2011
		Bay of Bengal Large Marine Ecosystem (BOBLME) First National Level Workshop – on Sundarbans, India	Barrackpore, 23 July, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Planning Commission Draft committee meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore, 09-11 August, 2011
		Jharkhand Matsya Mahasamlan 2011	Ranchi, September 16-17, 2011
		Planning Commission Draft committee meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore, 24-27 September, 2011
		Meeting of DAHD&F project on "An Assessment of Literacy, Income and Health status of Fishers in India".	Cochin, 17-18 November, 2011
		9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
		"National Consultation on Prioritization of research programmes for XII FYP of CIFRI"	Barrackpore, 18 January, 2012
		Sensitizing cum Training workshops for the PME Cells In Charge on Half Yearly Progress Monitoring	Bhubaneswar, 07 February, 2012
		Ph. D. Committee meeting at Vidyasagar University	Midnapur, 10 February, 2012
		Meeting to finalise agenda for Convention to strengthen ICAR Institute-SAU-State Department Interface	Kalyani, 13 March, 2012
		IMC meeting of DCFR, Bhimtal	Bhimtal, 17 March, 2012
		Sustainable utilization of Mountain fishery resources of NE region organized by DCFR, Bhimtal	Guwahati, 24-25 March, 2012
23	Shri M. F. Khan	Attended Second Expert committee meeting on Tilapia culture in India organized by CIFA	Vijayawada, 07-08 September, 2011
		Training programme on Productivity management of Indian reservoirs organized by CIFRI Centre, sponsored by National Fisheries Development Board	Bangalore, 13-19 October, 2011
		9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
24	Manna, R. K.	Bay of Bengal Large Marine Ecosystem (BOBLME) First National Level Workshop – on Sundarbans, India	Barrackpore, 23 July, 2011
		Agribusiness campaign organized by ZTM - BPD	Kolkata, 11 August, 2011
		Consultative Workshop for Conservation Strategies of Gangetic Dolphins (*Platanista gangetica*) in South Bengal	Kolkata, 28 September, 2011
		Awareness campaign on fish and prawn seed conservation	Kakdwip, 21 September, 2011
		BOBLME meeting on the development of Sunderbans	Fraserganj, 28 November, 2011
		9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
		Praveen Patrachar Pathyakram ke byaktigat sampark karyakram	Kolkata, 25 January, 2012

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Launching workshop on Post- restoration assessment of ecology and fisheries diversity of Chilika lake	Barrackpore, 10 February, 2012
		19th West Bengal State Science & Technology Congress	Kolkata, 01-02 March, 2012.
25	Manna, S. K.	2nd Meeting of the Expert Group to suggest short-term and long-term measures for creating an appropriate and effective legal and institutional framework for management and control of aquatic animal diseases	New Delhi, 04 April, 2011
		10th CIC meeting of the NAIP on Arsenic in food chain: cause, effect and mitigation	Kalyani, 02 May, 2011
		Annual Review Meeting of the AMAAS project	Mau, 14-15 May, 2011
		Review meeting of the NAIP on Arsenic in food chain: cause, effect and mitigation	Kalyani, 26 May, 2011
		NAIP-organized Interaction meet with scientists trained abroad in frontier areas of agricultural sciences	New Delhi, 28-30 November, 2011
		Brainstorming meeting of the network project on Fish health in XII Plan	Chennai 12 December, 2011
		International Workshop on Arsenic in Food Chain: Cause, Effect and Mitigation organized by DNGMRF and BCKV	Kolkata, February 20 2012
26	Meena, D. K.	Workshop on communication media by Prashar Bharti	Cochin, 15-16 April, 2011
		Workshop on IPR In agriculture	Cochin 26-27 April, 2011
		Group discussion on price rise on integrated agricultural product	Kolkata, 17 September, 2011
		NAIP training on "Allele Mining in Natural Genetic Resources for Targeted Trait improvement"	Lucknow, 25 February to March 09, 2012
27	Mishra, S. S.	14th Indian Agricultural Scientists & Farmers Congress	Allahabad, 17-18 February, 2012
28	Mohanty, B. P.	3rd Annual Review Meeting of Outreach Activities	New Delhi, 05-06 April, 2011
		Workshop on Proteomics - Principles, Methods and Applications organized by Proteomics Society, India, Aravind Medical Research Foundation, Madurai	Madurai, 15-16 April, 2011
		19th IERG (Indian Eye Research Group) Meeting jointly organized by LV Prasad E ye Institute & CCMB, Hyderabad LV Prasad Eye Institute and CCMB, India	Hyderabad, 30-31 July, 2011
		Wet-lab Training on 'Mineral analysis using ICP - MS' at M/s Thermo Fisher Scientific India Pvt. Ltd., Powai Center, Mumbai	Mumbai, 26 August, 2011.
		Workshop on 'Nutrient Profiling Data Analysis and Presentation' organized at Directorate of Coldwater Fisheries Research	Bhimtal, 18-19 October, 2011
		2nd Consortium Advisory Committee (CAC) Meeting, National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA) Project	New Delhi, 16 November, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		XI Annual Conference of Indian Society of Veterinary Pharmacology & Toxicology (ISVPT - 2011) and National Symposium on 'Bioinformatics in Drug Designing and Challenges and Opportunities in Veterinary Drug Development'	Izatnagar, 17-19 November, 2011
		Indo-Swiss Science Workshop on 'Ecology and Conservation of Chilika Lake' organized by Chilika Development Authority (CDA) in collaboration with Embassy of Switzerland in India and KIIT University, Bhubaneswar at Wetland Research & Training Center, Barkul, Odisha	Barkul, 25-26 November, 2011
		GC and GC-MS Repair and Maintenance Workshop conducted by M/s Thermo Fisher Scientific India Pvt. Ltd. at State Forensic Science Laboratory, Guwahati	Guwahati, 7-9 December, 2011
		9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
		22nd All India Congress of Zoology organized by the Zoological Society of India (ZSI) at University of Lucknow	Lucknow, 29-30 December, 2011
		99th Session of Indian Science Congress organized by the Indian Science Congress Association and KIIT University, Bhubaneswar	Bhubaneswar, 03-07 January, 2012
		Meeting of Review Team for e-Course on Biochemistry for B. F. Sc. Degree Program (under NAIP Project) by Fisheries College and Research Institute, TANUVAS, Tuticorin.	Tuticorin, 14-15 March, 2012
29	Nag, S. K.	Workshop on Thermo Scientific Analytical Technologies & Solutions organized by M/s Thermo Fisher Scientific India Pvt. Ltd.	Kolkata 28 May, 2011
		Seminar on 'Wet Chemistry Automation and TOC/TN analysis' organized by M/s Skalar Analytical India Pvt. Ltd.	Kolkata, August 23, 2011
		Seminar on 'Welcome to the World of Laboratory Glassware' organized by M/s Borosil Glass Works Ltd.	Kolkata 06 September, 2011
		NAIP research project on Strengthening Statistical Computing for NARS sponsored Training Program on 'SAS: Multivariate Data Reduction and Analysis'	Mumbai 12-17, October 2011
		Seminar on 'Food Safety' organized by M/s Waters India Pvt. Ltd.	Kolkata 08 November, 2011
		Training on GC/GCMS Maintenance and Application organized by M/s Thermo Fisher Scientific India Pvt. Ltd.	Guwahati, 07-09 December, 2011
		IUPAC sponsored International Conference on 'Agrochemicals Protecting Crops, Health and Natural Environment: Role of Chemistry for Sustainable Agriculture' jointly organized b y the Society for the Promotion of Sustainable Agriculture, IARI and ICAR	New Delhi 15-18 February, 2012.

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
30	Naskar, M.	Training programme on "Aquatic Inland Resource and Environment Assessment Through remote Sensing and GIS"	Barrackpore, 10-30 January, 2012
31	Palanisamy, R	9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
32	Panda, D.	Winter School training on "Aquatic Inland Resources and Environment Assessment through RS and GIS Application"	Barrackpore 10-30 January, 2012
		Review meeting of e-course for B. F. Sc. Programme for the course "Inland fisheries" at Fisheries College and Research Institute, Tuticorin, Tamil Nadu	Tuticorin, 27-28 February, 2012
		DVC-CIFRI interface meeting organized for demonstration of cage culture technology	Maithon, 24 January, 2012
		Launching workshop on "Post- restoration assessment of ecology and fisheries diversity of Chilika Lake"	Barrackpore,10 February, 2012
33	Pandit, A.	Planning Commission meeting of Sub Group-II: Inland Fisheries and Freshwater & Coldwater Aquaculture under Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore, 10 May, 2011
		Planning Commission meeting of Sub Group-II: Inland Fisheries and Freshwater & Coldwater Aquaculture under Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore, 31 May, 2011
		Planning Commission meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore 22 July, 22, 2011
		9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
		Meeting to finalise agenda for Convention to strengthen ICAR Institute-SAU-State Department Interface	Kalyani, 13 March, 2012
34	Panikkar, P.	Meeting with the Chief Minister of Kerala on "The impact of stocking of reservoirs in Kerala"	Thiruvananthapuram, 31 August, 2011
		Training programme on Productivity management of Indian reservoirs organized by CIFRI Centre, Bangalore sponsored by National Fisheries Development Board	Bangalore, 13-19 October, 2011
		Krishi Mela 2011 at GKVK Campus, Hebbal, Bangalore	Bangalore, 16-20 November, 2011
35	Rao, D. S. K.	National workshop "Scaling up of shrimp BMP program at the national level"	Chennai, 16-18 May, 2011
		Meeting cum Work shop on Heads of Divisions and Regional Stations of ICAR Institutes	Bhopal, 14 -15 June 2011
		Meeting on Macro level Environmental Impact Assessment of Bellary District	Bangalore, 24 August, 2011
		Expert Member (Aquatic) in the team to conduct Macro-level EIA studies on the effect of mining activities, as per Supreme Court order, in Bellary District	Bellary, 13-16 September, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Meeting of the Sub Group on Fisheries for Department od Agricultural Research and Education at CIFE, Mumbai	Mumbai, 24 September, 2011
		Training programme on Productivity Management of Indian Reservoir Fisheries (sponsored by NFDB, Hyderabad) organized by CIFRI Centre, Bangalore	Bangalore 13-19 October 2011,
		Rastriya Krishi Mela at GKVK Campus, Bangalore	Bangalore, 16-20 November, 2011
		9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
		Annual technical meeting of Animal Sciences and Fisheries Sciences at UAS, Bangalore	Bangalore, January 2011
		National Consultation on prioritization of research programmes of CIFRI for XII Five year plan	Barrackpore, 18-19 January 2012
		National Conference on New Vistas in Indian Aquaculture in commemoration of Silver Jubilee celebration of CIBA, Chennai	Chennai, 23-24 February 2012
		Awareness Programme on "Reservoir Fisheries Management" and "Cage Culture for Fish Seed Rearing" at Reservoir	Mallaghatta, 20 March, 2012
36	Roshith, C. M	BOBLME TDA Consultancy Workshop – India on Puri	Puri, 18 May, 2011
		Bay of Bengal Large Marine Ecosystem (BOBLME) First National Level Workshop – on Sundarbans, India	Barrackpore, 23 July, 2011
		BOBLME meeting on Development of Sunderbans	Fraserganj, 28 November, 2011
		9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
		Launching workshop on Post- restoration assessment of ecology and fisheries diversity of Chilika lake	Barrackpore, 10 February, 2012
		Seminar on Marine fishery of West Bengal: Problems and Prospects at Jadavpur University	Kolkata, 14 March, 2012
37	Sahoo, A. K.	Bay of Bengal Large Marine Ecosystem (BOBLME) National Level Workshop – on Sundarbans, India	CIFRI, Barrackpore, 23 July, 2011
		Expert Appraisal Committee meeting on River Valley Projects by Ministry of Environment and Forest, GOI	New Delhi, 16-17 September, 2011
		Brain storming meeting on Genomic Platform	Lucknow, 26 September 2011
		Eighth International Symposium on Diseases in Asian Aquaculture	Mangalore, 21-25 November, 2011
		9th Indian Fisheries Forum organized by Central Marine Fisheries Research Institute, Kochi and Asian Fisheries Society, Indian Branch	Chennai, 19-23 December, 2011
		National Consultation on Prioritization of Research Programmes of CIFRI for XII Five Year Plan	Barrackpore, 12 January, 2012

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		First meeting and video conference on Norway-India-Bangladesh Consortium for Hilsa Aquaculture in South Asia between NOFIMA, CIFRI, Private partner, BFRI and Worldfish Centre	Barrackpore, 05 March, 2012
		National conference on Aquaculture: Fish for Billion	Bhubaneswar, 16-17 March, 2012.
38	Sahu, S. K.	Fifth meeting of Technical committee on GIS under CSS on Strengthening of Database and Geographical Information System for the fisheries Sector	Barrackpore 06 May, 2011
		NNRMS-SCA Meeting on Stretching of Database and GIS for Fisheries Sector in National Natural Resource Management System	New Delhi, 25 May, 2011
		8th Technical Monitoring Committee meeting of Central Sector Scheme	Shillong, 02 June, 2011
		High Level NICRA Review Meeting	New Delhi, 12 December, 2011
		National symposium on Research in Animal Science: Development and Evolution	Siliguri , 19 -20 March, 2012
		ICAR Workshop of Network project on Impact, Adoption and Vulnerability of Indian Agriculture to Climate Change	New Delhi, 21-22 March, 2012
39	Sajina, A. M	Planning Commission meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore 22 July, 22, 2011
		Planning Commission Draft committee meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore, 09-11 August, 2011
		Planning Commission Draft committee meeting of Working Group on Development and Management of Fisheries and Aquaculture for the XII Five-Year Plan	Barrackpore, 24-27 September, 2011
40	Samanta, S.	Annual Review Meeting of the AMAAS project	Mau, 14-15 May, 2011
		"Stakeholders' meeting for preparation of XII plan for coastal areas" organized by Regional Research Station, Canning of Central Soil Salinity Research Institute	Canning, 11 November, 2011
		"Stakeholders' workshop for up-scaling technologies under NAIP for enhancing the productivity of degraded coastal land" organized by Regional Research Station, Canning of Central Soil Salinity Research Institute	Canning, 11 November, 2011
		International Workshop on Arsenic in Food Chain: Cause, Effect and Mitigation organized by DNGMRF and BCKVV	Kolkata, 20 February, 2012
41	Satpathy, B. B.	Bay of Bengal Large Marine Ecosystem (BOBLME) First National Level Workshop – on Sundarbans, India	Barrackpore, 23 July, 2011
		Review meeting of Mega seed project	New Delhi, 19-20 September, 2011
		Training programme on Credit linked Development Schemes for fisher women, organised by CIFRI Centre Kolkata	Kolkata, 20 December, 2011

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Meeting of ICAR Seed project	Udaipur, 16-17 January, 2012
42	Sinha, A.	National Consultation on Prioritization of Research Programmes of CIFRI for XII Five Year Plan	Barrackpore, 12 January, 2012
		Stakeholder Meeting organized by CIFRI, Barrackpore	Barrackpore, 18 January, 2012
		Brainstorming Session on Emerging scientific issues in inland open water fisheries and development organized by CIFRI, Barrackpore	Barrackpore 17 March, 2012
43	Singh, B. K.	National Conference on Orchids in India, jointly organized by the NASI Allahabad and National Academy of Sciences, Allahabad	Allahabad, 21 December, 2011
		14th Indian Agricultural Scientists & Farmers Congress	Allahabad ,17-18 February, 2012
44	Singh, S. N.	Meeting cum Workshop " Towards more effective role of Head's of Division and Regional stations in ICAR institutes	Bhopal, 14 -15 June, 2011
		National Consultation on " Prioritization of Research Programmes of CIFRI for XII Five Year Plan"	Barrackpore, 18 January, 2012
		58th meeting of Nagar Rajbhasha Karyanvayan Committee, Vadodara convened by Commissioner of Central Excise and Customs,	Vadodara, 01 February, 2012
		'Hindi Vishva Divas" organized by HWP, Department of Atomic Energy, Govt. of India, Vadodara	Vadodara, 11 January, 2012
45	Suresh, V. R.	Tran-boundary Diagnostic Analysis consultation workshop organized by the Fishery Survey of India under the project Bay of Bengal Large Marine Ecosystem	Kolkata, 09 June, 2011
		National level meeting on Sundarbans, organized, jointly by the Bay of Bengal Large Marine Ecosystem Project, Fisheries Survey of India and CIFRI	Barrackpore, 23 July, 2011
		Meeting of the RFD Nodal Officers of fisheries research Institutes of ICAR, organized by SMD (Fisheries), ICAR	New Delhi, 01 September, 2011
		Interaction meeting with Cabinet Minister for Agriculture	New Delhi, 08 November, 2011
		Interaction Meeting with Minister-in-Charge, Fisheries, Food Processing Industries and Horticulture, West Bengal	Kolkata, 17 November, 2011
		Meeting on 'Development of sewage fed fisheries in the East Kolkata Wetlands' convened by the State fisheries Department, West Bengal	Kolkata, 01 December, 2011
		DVC-CIFRI interface meeting organized for demonstration of cage culture technology	Maithon, 24 January, 2012
		ICAR RFD Nodal Officers meeting	Barrackpore, 22 February, 2012
46	Yadav, A. K.	Recent Trends in Statistics and its Applications	Guwahati, 3-4 February, 2012
		NE Food Tech Summit organized by Ministry of Food Processing Industries, GOI and Indian Chamber of Commerce	Guwahati, 13March, 2012

S. No.	Name	Name of the meeting/workshop/conference/ training programme	Place & date/duration
		Food safety issues in high moisture food commodities organized by NRC on Pig, Guwahati and CIFT, Cochin	Guwahati, 22 March, 2012
		Sustainable utilization of Mountain fishery resources of NE region organized by DCFR, Bhimtal	Guwahati, 24-25 March, 2012
47	Yengkokpam, S.	NE Food Tech Summit organized by Ministry of Food Processing Industries, GOI and Indian chamber of commerce	Guwahati, 13 March, 2012
		Sustainable utilization of Mountain fishery resources of NE region organized by DCFR, Bhimtal	Guwahati, 24-25 March, 2012

Events

Gurudev Rabindra Nath Tagore's 150th Birth Anniversary Day

The institute has celebrated 150th Birth Anniversary of Gurudev Rabindra Nath Tagore with great enthusiasm on June 02, 2011 at Barrackpore. The events organsied on the occasion included drama, dances and songs based the poems of Gurudev. Many speakers including Prof. Sharma, Dr. B. C. Jha and Dr. U. Bhaumik expressed their views on the occasion.

Fish Farmer's day

CIFRI celebrated National Fish Farmers day on 10 July, 2011. Hon'ble Janab Abu Hena, Minister in Charge of Fisheries. Government of West Bengal was the Chief Guest and Dr. P. Das, Former Director, NBFGR, Lucknow and Dr. B. K. Mahapatra, Director, CRIJAF, Barrackpore were the Guests of Honour. Shri Hena visited all the laboratories and interacted with the institute scientists. Seven successful Fisher/fish farmers were honoured with Best fisher/Farmer award. About 200 fishermen participated in this occasion.

ICAR Foundation day

The ICAR Foundation Day was organised on 16 July, 2011. Dr. P. Das, Former Director, NBFGR, Lucknow was the Chief Guest, Dr. Apurba Ghosh, Former Acting Director, CIFRI, Barrackpore and Dr. R. M. Bhoumick, Former Principal Scientist of CIFRI were the guests of honour. Number of former scientists and staff of CIFRI attended the function. While welcoming the dignitaries, Dr. Bhaumik described the role of ICAR in national development, especially in fisheries. Dr. Das, Dr. Ghosh and Dr. Bhoumick also expressed their view on the research gaps and raised the issues for future research and development in inland fisheries. One interactive session was also organized to highlight the importance of

fisheries research in development and future course of action and strategies for research in inland fisheries.

Dr. B. Meenakumari, Deputy Director General (Fy) visited the institute

Dr. B. Meenakumari, Deputy Director General (Fy) has visited the institute. She has visited all the laboratories and held discussions with the staff members. She has also taken account of the progress of institute EFC. And given suggestion for its improvements

Independence Day

CIFRI celebrated the Independence Day with great zeal and enthusiasm on 15 August, 2011. Prof. Sharma hoisted the National Flag and remembered the contributions of great freedom fighters. He also told to improve the values of life following their footsteps. Dr. Sharma also mentioned about the achievements of CIFRI during the year and suggested to plan the work meritoriously and give 100% to contribute towards development of fisheries sector. All the CIFRI staff and members of their family members were present at the occasion. A cultural programme was also organized in the auditorium of the institute.

Hindi Pakhwada

The Institute observed 'Hindi Pakhwada' during the period from 14-28 September, 2011. During this fortnight a number of Hindi competitions like *nibandh lekhan, tippany lekhan, Shabdawali, Viyakhyan, Hindi Patra lekhan, Quiz, etc*. were conducted. A large number of staff members and their family members participated in these competitions and won many prizes. During the fortnight suggestions were made to promote use of Hindi in office.

Vigilance Awareness Week

CIFRI organized Vigilance Awareness Week from 31 October to 5 November, 2011. Vigilance Awareness Week started with the pledge on 31st October 2011. Prof. Sharma and other staff members of the institute expressed their views on the occasion.

World Fishery Day

CIFRI has organized World Fisheries Day at its Allahabad Regional Centre on 21 November, 2011. Seminar was organized in Hindi on "Ganga Nadi Mein Matsya Sanrakshan Evam Samvardhan Ki Awashayakta". Large number of riverine stakeholders including representatives from State Departments, former CIFRI scientists, fishers, fish traders, NGOs, *etc*., expressed their views on the occasion. One pamphlet "Ganga Nadi Tantra Ki Matsyaki" was also released.

Blood Donation and medical checkup Camp

CIFRI Recreation Club organized a free medical and blood donation camp in collaboration with Chitranjan Medical College, Kolkata and BMRC Nursing home, Barrackpore on 6 January, 2012. The number of blood donors was 27 Including CIFRI staff and their family members. Medical and general check up included blood sugar (60), general checkup (75) and ECG (36).

Union Minister of State visited the institute

Dr. Charan Das Mahant, Hon'ble Minister of State for Agriculture and Food Processing Industries, Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India, New Delhi visited the institute on January 20, 2012. He showed keen interest in institute research and other activities on reservoir fisheries management, cage and pen culture, mapping of inland water resources, aquatic bio-diversity, fish conservation in natural waters, biotechnology, *etc*. He interacted with the institute scientists and praised in the institute research work and leadership with high words.

Republic day

CIFRI celebrated the Republic Day on 26 January, 2012 at all the centres. The function at Barrackpore was

organized by the committee headed by Dr. B. P. Mohanty. Prof. Sharma unfurled the National Flag in front of all the staff and their family members. Over 250 persons attended the function. A cultural programme has organized in the Auditorium.

CIFRI Foundation day

CIFRI is organized its 66th Foundation Day of on 17 March, 2012 at Barrackpore. Number of events took place on the occasion. Dr. Brij Gopal, Coordinator Centre for Inland Waters in South Asia and former Professor Jawaharlal Nehru University, New Delhi was the Chief Guest and key speaker. Dr. Dilip Kumar, Former Vice Chancellor, CIFE, Mumbai, Dr. P. Das Former Director, NBFGR, Lucknow, Dr. S. P. Ayyar and Dr. M. Sinha, Former Directors of CIFRI Barrackpore were the Guests of honour. The lecture by Dr. Brij Gopal was highly appreciated. The other dignitaries also gave their opinion on R&D in fisheries sector of India. A Brainstorming session was also organized of sustainable inland fisheries.

Distinguished visitors

- Dr. P. Das, Former Director, NBFGR, Lucknow
- Dr. Dilip Kumar, Former Director, CIFE, Mumbai
- Dr. S. D. Singh, ADG (Inland Fy), ICAR, New Delhi
- Prof. Samir Banerjee, RAC member, Calcutta University, Kolkata
- Prof. Prakash Nautiyal, Department of Zoology and Biotechnology, Hemwati Nandan Bahuguna Garhwal University, Srinagar, Uttarakhand.
- Prof. N. C. Dutta, Retd. Prof., Calcutta University, Kolkata
- Dr. Md. Shaha Ali, Sr. Scientific Officer, Bangladesh Fisheries Research Institute, Dhaka
- Dr. Md. Khalilur Rahman, Sr. Scientific Officer & Sub-station Chief, Bangladesh Fisheries Research Institute, Dhaka
- Gopal Chandra Datta, Hub Manager, CSISA, World Fish Centre, Dhaka, Bangladesh
- Dr. B. Meenakumari, DDG (Fy), ICAR, New Delhi
- Dr. K. M. L. Pathak, DDG (AS), ICAR, New Delhi
- Dr. Bangali Baboo, National Director, NAIP, ICAR, New Delhi
- Dr. S. N. Dwivedi, Former Director, CIFE, Mumbai
- Dr. M. Mohan, ADG (MF), ICAR, New Delhi,
- Dr. J. K. Jena, Director, NBFGR, Lucknow
- Dr. A. K. Ghosh, Former Director, CIFRI, Barrackpore
- Dr. B. K. Dwivedi, Director, Bioved Research Institute of Agriculture and Technology, Allahabad
- Prof. Anita Gopesh, Deptt. of Zoology, Allahabad University, Allahabad
- Dr. D. N. Barthakur, Former Vice Chancellor, Assam Agricultural University, Jorhat
- Dr. A. Chakraborty, Director of Research (Vety), Assam Agricultural University, Khanapara Campus, Guwahati
- Dr. A. K. Gogoi, Zonal Project Director, ICAR Zone III, Umiam, Shillong
- Dr. R. N. Goswami, Dean, College of Veterinary Science, Khanapara, Guwahati
- Dr. M. Das, Associate Director of Extension Education (Vety), Assam Agricultural University, Khanapara Campus, Guwahati
- Dr. S. Saikia, Chief Scientist, Horticultural Research Station, Assam Agricultural University, Kahikuchi.
- Dr. S. K. Dhyani, Director, NRC for Agroforestry, Jhansi.
- Dr. H. C. Bhattacharyya, Director of Extension Education, Assam Agricultural University, Jorhat
- Dr. P. C. Mahanta, Director, Directorate of Cold water Fisheries Research (ICAR), Bhimtal, Uttarakhand
- Dr. D. N. Kalita, Programme Coordinator, KVK, Kamrup (M), Guwahati.
- Dr. P. Nath, Director of Fisheries, Government of Arunachal Pradesh, Itanagar
- Dr. M. M. Goswami, Professor, Department of Zoology, Gauhati University, Guwahati
- Dr. Rupankar Bhagabati, Joint Director, ICAR Research Compex for NEH Region, Arunachal Pradesh Centre, Basar
- Dr. T. R. Gibinkumar, Assistant Director, MPEDA, Regional Office, Guwahati.

- Shri Sugata Ghose, Director, Coconut Development Board, Guwahati.
- Dr. M. Sinha, Advisor (Fishery), Government of Tripura.
- Dr. Usha Moza, Principal Scientist, Inland Fisheries, ICAR, New Delhi
- Prof. R. S. Chauhan, HOD, Aquaculture, College of Fisheries, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand
- Dr. C. Vasudevappa, NFDB, Hyderabad
- Dr. M. Mukherjee, Director, Dept. of Fisheries, Govt. of West Bengal
- Dr. N. Sarangi, Ex- Director, CIFA, Bhubaneswar, Orissa
- Mr. Nishat Ahmed, Director, Dir. of Fisheries, Government of Bihar, Patna
- Shri K. S. Sidhu, Chairman, Punjab Fish Farmers and Fisheries Association
- Shri Gopalkrishnan Nair, MD, KAVIL, Kochi, Kerala
- Dr. Dipayan Dey, Chair, South Asian Forum for Environment (SAFE), Kolkata
- Dr. B. N. Pandey, Former Dean & Professor, Magadh University, Gaya
- Dr. P. N. Pandey, Former Professor, Ranchi University, Ranchi,
- Dr. S. N. Biswas, Deputy Director, Dept. of Fisheries, Govt. of West Bengal
- Shri Sudhir Kumar Pandey, Expert, Chaur based fisheries, Dholi, Bihar
- Dr. A. K. Roy, Secretary, Fisheries Department, Assam
- Shri. Rajiv Kumar, Director of Fisheries, Jharkhand
- Shri C. Haridas, Consultant Planning Commission, Govt. of India, New Delhi
- Shri Gour Halder, Manager, Bhomra Beel, West Bengal
- Dr. S. Purkayastha, DDF and Nodal Officer, AACP & Directorate of Fisheries, Govt. of Assam
- Shri S. Chakraborty, Former Additional Director of Fisheries, Govt. of West Bengal
- Dr. Prabhat P. Ghosh, Director, Asian Development Research Institute, Patna
- Sh. Tarun Sridhar, Jt Secretary of Deptt of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India
- Shri V.V. Sadamate, Planning Commission, Govt. of India
- Dr. G. Syda Rao, Director, CMFRI, Kochi
- Dr. A. G. Pooniah, Director, CIBA, Chennai
- Dr. P. Paul Pandian, Dy. Commissioner (Fy), Ministry of Agriculture, Government of India
- Sh. Debasish Sen, Secretary, Dept. of Fisheries, Govt. of West Bengal
- Shri B. Vishnu Bhat, Fishery Development Commissioner, DAHD&F
- B. K. Mishra, Director, FISHCOPFED
- Dr. Madhu Soodana Kurup, VC, KUFOS, Kochi, Kerala
- Dr. H. Shivananda Murthy, Former Director of Extn., KVAFSU
- Shri Ajit Sinha Patil, President, Maharashtra Fish Farmer Association, Mumbai
- Dr. Chandrika Sharma, Secretary, I.C.S.F, Chennai

- Dr. Manmohan Singh, Commissioner, Fisheries, Govt. of Andhra Pradesh
- Dr. V. V. Sugunan, Former ADG, Fy, ICAR, New Delhi
- Dr. K. Vijayakumaran, Director General, Fishery Survey of India
- Prof. Sugata Hazra, Director, School of Oceanographic Studies, Jadavpur University
- Dr. Anurag Danda, Sr. Programme Coordinator, WWF-India, SundarBans Programme
- Dr. Ch. Satyanarayana, Assistant Zoologist, ZSI, Kokata
- Prof. Amalesh Choudhury, Founder, Dept. of Marine Science, University of Calcutta and S. D. Marine Biological Research Institute, Sagar Island
- Shri Bulganin Mitra, Scientist, ZSI, Kolkata
- Dr. K. R. Naskar, Former Pr. Scientist, CIFRI, Barrackpore
- Dr.Somenath Bhattacharyya Deputy Director (Technical) ICZM Project, West Bengal

Personnel on important positions as on 31 March, 2012

CIFRI, Barrackpore, West Bengal
Dr. A.P. Sharma, Director

Riverine Ecology and Fisheries Division, CIFRI, Barrackpore, Wet Bengal
Dr. Utpal Bhaumik, Principal Scientist, Head

Fishery Resource & Environmental Management Division, CIFRI, Barrackpore
Dr. Manas Kumar Das, Principal Scientist, Head

Reservoir & Wetland Fisheries Division, CIFRI, Barrackpore, Barrackpore
Dr. B.C. Jha, Principal Scientist, Head

CIFRI Regional Centre, Allahabad, Uttar Pradesh
Dr. K.D. Joshi, Principal Scientist, Head

CIFRI Regional Centre, Guwahati, Assam
Dr. B.K. Bhattacharjya, Senior Scientist, Head

Officer-in-Charge, CIFRI Regional Centre, Vadodara, Gujarat
Dr. S.N. Singh, Principal Scientist

Officer-in-Charge, CIFRI Regional Centre, Bangalore, Karnataka
Dr. D.S. Krishna Rao, Principal Scientist

Officer-in-Charge, CIFRI Research Centre, Salt Lake, Kolkata
Dr. Archana Sinha, Principal Scientist

In-Charge, Prioritization, Monitoring and Evaluation Cell and Agricultural Economics Section, CIFRI, Barrackpore
Dr. P.K. Katiha, Principal Scientist

In-Charge, Institute Technology Management Unit & Technical Cell, CIFRI, Barrackpore
Dr. V.R. Suresh, Principal Scientist

In-Charge, Extension & Training Cell, CIFRI, Barrackpore
Dr. M.K. Bandopadhyay, Senior Scientist

Officer-in-Charge, CIFRI Research Centre, Kochi, Kerala
Dr. R. Palaniswami, Senior Scientist

In-Charge, Aquarium & Hatchery Unit, CIFRI, Barrackpore
Dr. B.B. Satpathy, Senior Scientist

In-Charge, Library & Informatics Section, CIFRI, Barrackpore
Dr. R.K. Manna, Senior Scientist

In-Charge, IT & ARIS Cell, CIFRI, Barrackpore
Shri D. Karunakaran, Scientist (SS)

Senior Finance & Accounts Officer, CIFRI, Barrackpore
Shri Rajesh Sahay

Drawing & Disbursing Officer, CIFRI, Barrackpore
Mr. A.K. De, Assistant Administrative Officer

In-Charge, Stores Section, CIFRI, Barrackpore,
Ms. Sikha Majumder, Assistant Administrative Officer

In-Charge, Administration I & Administration .II Section, CIFRI, Barrackpore
Ms. Anita Majumdar, Assistant Administrative Officer

Promotion

Name	Designation	Promoted to	With effect from
Shri Swapan Kr. Ghosh	T-4	T-5	01.07.2007
Shri N. C. Biswas	T-4	T-5	01.01.2008
Shri U. K. Chatterjee	T-4	T-5	01.01.2008
Shri D. Chatterjee	T-4	T-5	03.02. 2010
Shri B. N. Das	T-4	T-5	03.02. 2010
Shri K. P. Singh	T-4	T-5	03.02. 2010
Shri R. K. Sah	T-3	T-4	03.02. 2010
Shri S. K. Dev	T-3	T-4	03.02. 2010
Shri A. Roy Chowdhury	T-3	T-4	27.08. 2010
Shri Ram Sajiwan	T-3 (Driver)	T-4 (Driver)	29.06.2011
Ms. Dhanmaya	SSS (MACP2)	SSS (MACP3)	15.07.2011
Ms. Bulbul Mallick	Assistant	Assistant Administrative Officer	03.12.2011
Ms. Amita Chakraborty	Senior Clerk	Assistant	05.12.2011

Transfer

Name	Designation	Place of posting	Transferred to
Shri Rajiv Lal	Chief Administrative Officer	Barrackpore	NIRJAFT, Kolkata
Dr. R. K. Paul	Scientist	Barrackpore	IASRI, New Delhi
Dr. A. K. Prusty	Scientist	Vadodara	PDFSR, Meerut
Shri K. P. Nath	Finance and Accounts Officer	Barrackpore	CRIJAF, Barrackpore
Ms. K. Jacquline	T-6	Barrackpore	CIBA, Chennai
Shri P. R. Rao	Assistant Director (OL)	Barrackpore	ICAR HQ, New Delhi
Shri R. K. Ghosh	Assistant Finance and Accounts Officer	Barrackpore	NIRJAFT, Kolkata
Shri Dileep Kumar	Assistant	Barrackpore	NRC for Litchi, Bihar
Shri P.Murleedharan	Assistant	Barrackpore	IISR, Appangala
Ms. R. K. Sarder	Skilled Support Staff	Barrackpore	Kolkata
Shri B. K. Sahani	Skilled Support Staff	Barrackpore	CIFRI, Kolkata
Dr. Archana Sinha	Principal Scientist	CIFE, Mumbai	Barrackpore
Dr. Arun Pandit	Senior Scientist	CRRI, Cuttack	Barrackpore
Dr. S. K. Das	Senior Scientist	IGFRI, Jhansi	Barrackpore
Dr. S. K. Nag	Senior Scientist	IGFRI, Jhansi	Barrackpore
Shri D. K. Meena	Scientist	CIFT, Cochin	Barrackpore

Superannuations

Name	Designation	Date of retirement
Shri J. Ray	Assistant Administrative Officer	30.04.2011
Shri N. C. Biswas	T-5 (Driver)	30.04.2011
Shri N. R. Kundu	Assistant	30.04.2011
Dr. K. Chandra	Principal Scientist	31.08.2011
Shri Ranjit Singh	T-5 (Driver)	31.08.2011
Shri A. Murugeshan	Skilled Support Staff	31.08.2011
Dr. V. Pathak	Principal Scientist	31.10.2011
Ms. Godhuly Mondal	Skilled Support Staff	31.10.2011
Shri S.P. Mondal	Assistant	30.11.2011
Shri B.C. Das	Skilled Support Staff	31.12.2011
Dr. A. K. Chattopadhyay	Technical Officer (T-7-8)	31.01.2012
Shri P.P. Ghosh	Lower Division Clerk	31.01.2012
Shri I.R. Balmiki	Skilled Support Staff	31.01.2012
Shri M. Mahadeva	Skilled Support Staff	31.01.2012
Shri G. Pathak	Technical Officer (T-9)	29.02.2012
Shri H.C. Banik	Technical Officer (T-5)	29.02.2012
Ms. Anjali Neogi	Assistant	29.02.2012
Shri Ananda Biswas	Skilled Support Staff	29.02.2012
Shri Rajendra Ram	Skilled Support Staff	29.02.2012
Shri B. Hazarika	Skilled Support Staff	29.02.2012
Shri L. K. Halder	Skilled Support Staff	31.03.2012
Shri M. Anjanappa	Skilled Support Staff	31.03.2012

New Appointments

Name	Designation	Place of posting	Date of appointment
Shri Rabindra Kumar Sardar	Skilled Support Staff	Kolkata	27.08.2011
Shri Shyamal Chandra Sukla Das	Scientist	Barrackpore	22.12.2011
Shri Pronob Das	Scientist	Barrackpore	23.12.2011
Ms. Sukham Monalisa Devi	Scientist	Barrackpore	23.12.2011

हिन्दी सारांश

केन्द्रीय अंतर्स्थलीय मात्स्यिकी अनुसंधान संस्थान
बैरकपुर, कोलकाता – 700120

प्रस्तावना

अंतर्स्थलीय विवृत जलक्षेत्र मात्स्यिकी करोड़ों लोगों की आजीविका एवं आय उपार्जन के साथ–साथ उनकी खाद्य व पोषण सुरक्षा में एक महत्वपूर्ण एवं अभिन्न भूमिका निभाता है। इसका संभावित मत्स्य उत्पादन बहुत अधिक होने के कारण इसे एक अन्यतम मात्स्यिकी संसाधन क्षेत्र के रूप में देखा जाता है पर प्राकृतिक रूप से उपलब्ध मत्स्य संचयन के अत्यधिक दोहन के कारण हाल के वर्षों में कई समस्याओं को सामना करना पड़ रहा है, जैसे पारिस्थितिकी तंत्र का अपकर्ष, मानवजनित कार्यकलापों के कारण जल धारा में परिवर्तन और प्रदूषण, आदि। अतः मानवजनित दबाव और जलवायू परिवर्तन के कारण दीर्घकालिक मत्स्य उत्पादन प्राप्ति के लिये संभावित मत्स्य उत्पादन क्षेत्रों की पहचान एवं उनका उपयोग आवश्यक है।

इन सभी को ध्यान में रख कर के. अं. मा. अनु. संस्थान ने कई सांस्थानिक, प्रायोजित और नेटवर्क परियोजनाओं को प्रारंभ किया है। अनुसंधान कार्यकलापों में जलाशयों और आर्द्रक्षेत्र झीलों की मात्स्यिकी संवर्धन एवं प्रबंधन, नदीय और ज्वारनदमुख मात्स्यिकी का आंकलन एवं संरक्षण, मत्स्य संचयन एवं खाद्य श्रृंखला में होने वाले जलीय परिवर्तन, मत्स्य स्वास्थ्य एवं पर्यावरणीय प्रभाव का आंकलन, जी आई एस प्लेटफार्म आधारित सुदूर संवेदन द्वारा अंतर्स्थलीय विवृत जल क्षेत्र मात्स्यिकी का मैपिंग एवं इन जलक्षेत्रों पर निर्भरशील मछुआरों के आर्थिक–सामाजिक स्तर एवं संसाधनों का मूल्यांकन करना है। संस्थान द्वारा हिल्सा मछली के अनुसंधान और चिलिका झील के पुनरूत्थान हेतु अंतर्राष्ट्रीय संगठनों जैसे, IUCN, BOBLME और विश्व बैंक के सहयोग से परियोजनायें क्रियान्वित की गई हैं। साथ ही कई प्रायोजित, एन ए आई पी, DAHD&F, परामर्शी और आउटरीच परियोजनाओं को भी आरंभ किया गया है।

देश में मात्स्यिकी विकास की दिशा में कार्यरत कई संस्थानों जैसे पशुपालन, दुग्धपालन व मात्स्यिकी, कृषि मंत्रालय, भारत सरकार, नई दिल्ली और राष्ट्रीय मात्स्यिकी विकास बोर्ड (NFDB), हैदराबाद के अनुसार के. अं. मा. अनु. संस्थान का प्रौद्योगिकीय सेवा और परियोजना प्रबंधन में एक विशिष्ट स्थान है। संस्थान द्वारा विकसित तकनीक जैसे जलाशयों में मत्स्य बीज उत्पादन एवं मत्स्य संचयन संवर्धन हेतु पिंजरा व पेन पालन अंतर्स्थलीय मात्स्यिकी विकास के क्षेत्र मे एक महत्वपूर्ण उपलब्धि है। इस तकनीक से जलाशयो और आर्द्रक्षेत्रों में मत्स्य उत्पादन में वृद्धि हुई है।

रिपोर्ट अवधि के दौरान, संस्थान ने अनुसंधान एवं विकास को अन्य अनुसंधान संस्थानों, विश्वविद्यालयों, 20 राज्य सरकारों, DVC, CDA और ICZM आदि के साथ मिलकर एक नई दिशा प्रदान की है। साथ ही संस्थान ने 12वीं पंचवर्षीय योजना हेतु ''मात्स्यिकी और जलकृषि के विकास एवं प्रबंधन का विकास' पर फिशरीज वर्किंग ग्रुप पर ड्राफ्ट रिपोर्ट तैयार करने में महत्वपूर्ण योगदान दिया है। इस ड्राफ्ट रिपोर्ट को योजना आयोग को प्रस्तुत कर दिया गया है।

इस दौरान संस्थान द्वारा अंतर्स्थलीय मात्स्यिकी से जुड़े कार्यकर्ताओं के लिये प्रशिक्षण, जनजागरूकता कार्यक्रम, प्रदर्शनी, छात्रों के लिये शैक्षणिक कार्यक्रम और बैठक आदि का आयोजन किया गया। राष्ट्रीय एवं अंतर्राष्ट्रीय स्तर पर मत्स्य पालको से लेकर योजनाकारों और नीति निर्माण से जुड़े संगठनों में अनुसंधान उपलब्धियों का प्रचार–प्रसार किया गया।

मैं डा. एस. अय्यप्पन, महानिदेशक, भारतीय कृषि अनुसंधान परिषद् एवं सचिव, कृषि अनुसंधान एवं शिक्षा विभाग के संस्थान के अनुसंधान एवं विकास कार्यो में सतत सहयोग, मार्गदर्शन और प्रोत्साहन के लिये आभारी हूँ। मैं डा. (श्रीमती) बी. मीनाकुमारी, उपमहानिदेशक (मात्स्यिकी), डा. एस डी सिंह, सहायक महानिदेशक (अंतर्स्थलीय मात्स्यिकी), डा. मदन मोहन, सहायक महानिदेशक (समुद्री मात्स्यिकी), डा. (श्रीमती) ऊषा मोजा, श्री अनिल अग्रवाल एवं श्री पी. के. बागे को संस्थान के कार्यकलापों में सतत सहयोग के लिये धन्यवाद देता हूँ।

मैं डा. पी. के. कटिहा एवं उनकी टीम के सदस्यों को इस प्रलेख के लिये धन्यवाद देता हूं। साथ ही मैं डा. एन पी श्रीवास्तव के हिन्दी कार्यो में मार्गदर्शन और सुश्री सुनीता प्रसाद एवं मो कासिम को हिन्दी रूपान्तरण के लिये धन्यवाद देता हूं।

बैरकपुर, कोलकाता
अगस्त 2012

अनिल प्रकाश शर्मा
निदेशक

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केन्द्रीय अंतर्स्थलीय मात्स्यिकी अनुसंधान संस्थान (के. अं. मा. अनु. संस्थान) की स्थापना एक छोटे से केन्द्र के रूप में 17 मार्च 1947 में कलकत्ता में हुई। अपने अनुसंधान और विकास के बल पर यह केन्द्र अंतर्स्थलीय मात्स्यिकी एवं जलीय पारिस्थितिकी के क्षेत्र में राष्ट्रीय और अंतर्राष्ट्रीय दोनों स्तर पर एक प्रमुख अनुसंधान संगठन में परिणत हो चुका है। इसके वैज्ञानिकों ने अतिशय प्रसिद्धि प्राप्त की जिसका एक प्रबल उदाहरण है, डा. एस अय्यप्पन का सचिव, कृषि अनुसंधान व शिक्षा विभाग तथा महानिदेशक, भारतीय कृषि अनुसंधान परिषद जैसे महत्वपूर्ण पद पर दिनांक 31 दिसम्बर 2009 को आसीन होना। डा. अय्यप्पन ने अपने सेवा काल का प्रारंभ हमारे ही संस्थान से किया था।

के. अं. मा. अनु. सस्थान का मुख्यालय बैरकपुर, कोलकाता में स्थित है। इसके क्षेत्रीय केन्द्र/स्टेशन देश के विभिन्न भागों में फैले हुये हैं जैसे : उत्तर में इलाहाबाद केन्द्र, दक्षिण में बैंगलोर और काच्चि केन्द्र, उत्तर–पूर्व में गुवाहाटी केन्द्र और पश्चिम में वडोडरा केन्द्र। संस्थान में आवंटित पदों की संख्या है– 95 वैज्ञानिक, 86 तकनीकी 67 प्रशासनिक एवं 153 सपोर्टिंग तथा वर्तमान में 56 वैज्ञानिक, 70 तकनीकी 52 प्रशासनिक एवं 105 सपोर्टिंग स्टाफ कार्यरत है। संस्थान नें इस वर्ष में योजना व गैर–योजना के अंतर्गत आवंटित वित्त का लगभग शत प्रतिशत उपयोग किया।

अनुसंधान सलाहकार समिति और पंचवार्षिक पुनरीक्षण दल के सुझावों के आधार पर संस्थान में आठ अनुसंधान कार्यक्रमों का समावेश किया गया है जिनमें कई परियोजनायें सम्मिलित हैं। ये परियोजनायें विजन 2025 तथा 11वीं पंचवर्षीय योजना के ई. एफ. सी. के अनुसार अनुमोदित हैं एवं सभी परियोजनाओं को तीन प्रभागों – नदीय पारिस्थितिकी व मात्स्यिकी, मात्स्यिकी संसाधन व पर्यावरणीय प्रबंधन और जलाशय व आर्द्रक्षेत्र मात्स्यिकी में कार्यान्वित कर दिया गया है। संस्थान ने अपनी एवं बाहरी संस्थाओं द्वारा प्रायोजित सभी परियोजनाओं का सफलतापूर्वक कार्यान्वयन किया है। साथ की संस्थान ने अन्य महत्वपूर्ण कार्य जैसे मानव संसाधन विकास, सलाहकार व मात्स्यिकी विकास जैसे कार्यों में भी उल्लेखनीय योगदान दिया है।

नदीय मात्स्यिकी

- यमुना नदी में विदेशी प्रजातियों, *Cyprinus carpio* और *Oreochromis niloticus* की उपलब्धता देखी गई। इलाहाबाद में विदेशी प्रजातियां 39 प्रतिशत थीं और वर्ष 2011 के दौरान मत्स्य उपज 140.83 टन थी।
- केन नदी की जैव विविधता का आंकलन किया गया तथा 53 जेनेरा, 24 वर्ग और 10 आर्डर के 80 मत्स्य प्रजातियों को दर्ज किया गया। इसी प्रकार, बेतवा नदी से 41 जेनेरा, 20 वर्ग और 9 आर्डर के 64 मत्स्य प्रजातियों को दर्ज किया गया। 63 मत्स्य प्रजातियां दोनों नदियों में पाई गईं जिसमें 17 प्रजातियां केन नदी और बेतवा में केवल एक प्रजाति को देखा गया। केन नदी से प्रथम बार कुल 18 मत्स्य प्रजातियों को दर्ज किया गया।
- सोन नदी में मत्स्य विविधता पर घटते जलप्रवाह के प्रभाव का आंकलन किया गया। ईन्द्रपुरी बराज से हाने वाली जलप्रवाह में 5.2 प्रतिशत की कमी हुई है और इससे निचले स्तर में मत्स्य विविधता और उनके उपलब्धता पर प्रतिकूल प्रभाव पड़ा है। 1950 की दशक में उपलब्ध प्रजातियों में से कुल 21 प्रजातियों की उपलब्धता वर्तमान में समाप्त हो चुकी है जबकि 13 नई और 4 विदेशी प्रजातियों को प्रादुर्भाव हुआ है।

ज्वारनदमुख मात्स्यिकी

- हुगली ज्वारनदमुख के लवणीय क्षेत्रों में परिवर्तन हुआ है, यह लगभग 80 कि.मी. सागर की तरफ चला गया है। मानसून के समय अधिक वर्षा के कारण भी लवणीयता में कमी

आई है। मीठाजल ज्वारीय क्षेत्र और नीचली ज्वारनदमुख में उपलब्ध पोषक तत्वों, नाइट्रेट, फॉस्फेट और सिलिकेट की मात्रा कम पाई गई।

- इस ज्वारनदमुख में 44 जंतुप्लवक और 94 मोलस्क प्रजातियां देखी गई।
- नवद्वीप और बालागढ़ के बीच उपस्थित प्रधान छोटी मीठाजल प्रजातियां, *Salmophasia bacaila*, *S. phulo*, *Aspidoparia morar*, *Corica soborna*, *Puntius sophore*, *Puntius conchonius* और *Ailia coila* थीं जबकि त्रिवेणी और गोदाखाली के बीच गोबोइड मछलियां जैसे, *Glossogobius giuris*, *Apocryptes bato* और *Odontamblyopus rubicundus* की प्रधानता देखी गई। डायमंड हार्बर क्षेत्र से आगे मुलेट मछलियां (*L. parsia* और *L. macrolepis*) एवं एनकोविस प्रजातियों (*Coilia dussumieri*, *C. ramcarati* और *Stolephorus spp.*) को देखा गया।
- हुगली ज्वारनदमुख से नई मत्स्य प्रजातियों, *Pinniwallago bhagirathiensis sp nov.* और झींगा प्रजातियों, *Macrobrachium hooghliense sp nov.* की उपस्थिति को दर्ज किया गया और इन्हे भारतीय प्राणी विज्ञान सर्वेक्षण (ZSI) में जमा कर दिया गया है।
- हिल्सा मत्स्य बीज की उपलब्धता, इसकी गोनेडोसोमैटिक इंडेक्स एवं अभिगमन के आंकड़ें बताते हैं कि हिल्सा के प्रजनन क्षेत्र समुद्री मुहाने से 250–300 कि.मी. दूर है। साथ ही तीन नये प्रजनन क्षेत्रों का पता चला है।
- मत्स्य पालन से युक्त महिलाओं की आजीविका विविधता आंकड़ें बताते हैं कि हुगली ज्वारनदमुख के दो विस्तार क्षेत्रों में पालन क्षेत्र में 29 प्रतिशत, फिश ग्रेडिंग क्षेत्र में 27 प्रतिशत और पशुधन पालन क्षेत्र में 15 प्रतिशत महिलायें कार्यरत हैं।

मत्स्य स्वास्थ्य एवं पर्यावरण

- ब्राह्मणी वेदव्यास से अलापुआ के मध्य 850 कि. मी. विस्तार क्षेत्र का परीक्षण नदी के पारिस्थितिकी का अध्ययन विभिन्न जैवसूचकों की मदद से किया गया। ब्राह्मणी नदी किसी भी प्रकार के धातु प्रदूषण (कैडमियम, कॉपर, लेड, मैंगनीज और जिंक) से रहित है। वेदव्यास और जेनापुर के बीच जल एवं तलछट की गुणवत्ता उत्तम है पर दार्जिंग और बिजीगोल के बीच प्रदूषण पाया गया। इस विस्तार क्षेत्र में उपस्थित 61 प्रजातियों में 19 फैमिली और 42 जीनस दर्ज किया गया। साप्रिनिडस वर्ग की प्रधानता (36.53 प्रतिशत) देखी गई। इसके बाद बेग्रिड (9.61 प्रतिशत) और शिलबिड कैटफिश (9.61 प्रतिशत) थे। प्रधान मत्स्य प्रजातियां 63.46 प्रतिशत थीं।
- प्रथम बार लेबियो रोहिता, कतला कतला और रीता रीता के लेंस और मांसपेशियों के प्रोटीन का प्रोटियोम मैप प्राप्त किया गया। इसमें रीता रीता में 32 क्रिस्टलीय धब्बें देखे गये।
- क्लोरोफिल ए एवं अन्य बैण्डों से SWIR और हरित बैण्ड का एक दूसरे से परस्पर संबद्ध से क्लोरोफिल रंजक की सांद्रता का पूर्वानुमान किया गया।
- 16S-rDNA सिक्वेंसिंग प्रणाली द्वारा फेनोल के प्रभाव को कम करने वाले जीवाणु की पहचान की गई। ये जीवाणु हैं– *Pseudomonas aeruginosa*, *Achromobacter xylooxydans*, *Pseudomonas putida*, *Bacillus megaterium*, *Microbacterium sp.*, *Staphylococcus epidermidis* और *Klebsiella* sp.
- जंतु मॉडेल में बैक्टीरिया के चार धब्बों के परीक्षण से देखा गया कि एक घब्बा शरीर में व्याप्त विशाक्तता एवं आर्सेनिक को अवशोषित करने के साथ–साथ आर्सेनिक संदूषण से भुक्त प्राणियों के रोग निदान में अत्यन्त प्रभावी है। अतः बैक्टीरिया में आर्सेनिक के प्रभाव को कम करने की क्षमता है।
- भारतीय मेजर कार्प प्रजाति, *कतला कतला* के मांगपेशियों के प्रोटियोम में नदीय प्रदूषण के अनुमापन हेतु इसको प्रोटियोम मैप को प्राप्त

किया गया और विभिन्न तकनीकों की मदद से 70 प्रोटीन की पहचान की गई। साथ ही बड़ी नदीय कैटफिश, *Sperata seenghala* और *Sperata aor* के मांगपेशियों के प्रोटियोम मैप को प्राप्त किया गया। इन सूचनाओं के आधार पर एक डेटाबेस, *"CifriFishProt"* का विकास किया गया है।

मात्स्यिकी संसाधन का आंकलन

- उत्तर एवं दक्षिण भारत की प्रमुख नदियों जैसे, गंगा, यमुना, चंबल, बेतवा, पूर्वी बनास, सोन, केन, रूपनारायण, अजय, सुवर्णरेखा, कंसावती, ताप्ती, नर्मदा, गोदावरी, कृष्णा, कावेरी, तावा, तुंगभद्रा, हेमावती, महानदी और पेन्नार नदियों के प्रजाति वितरण मैप को टी एन टी मिप्स सॉफ्टवेयर में चित्रित किया गया। इसके साथ गंगा, नर्मदा, ब्रह्मपुत्र, कावेरी, कृष्णा, और गोदावरी नदियों के मत्स्य प्रजाति संबंधित डेटाबेस भी बनाया गया है।
- मछली में उपलब्ध आर्सेनिक तत्व ($p<0.01$), तालाब के जल ($r = 0.388, n = 294$) और तलछट ($r = 0.462, n = 294$) के बीच होने वाले सकरात्मक पारस्परिक संबंधों को दर्ज किया गया।

जलाशय मात्स्यिकी

- संस्थान द्वारा प्रलेखित निर्देशों के आधार पर वर्ष 2008–11 के दौरान कर्नाटक के मेलाघाटा जलाशय में 13.82 लाख मत्स्य बीजों (औसत लंबाई – लगभग 4.0 से.मी.) को डाला गया। फरवरी 2011 से जनवरी 2012 तक 22.47 टन मत्स्य उपज प्राप्त किया गया। औसत प्रति इकाई उत्पादन (CPUE) 15.9 कि.ग्रा. प्रति हे. प्रति दिन और आंकलित उपज 59 कि.ग्रा. प्रति हे. हुआ।
- केरल के केलवरापल्ली जलाशय में हाइड्रोकॉस्टिक सर्वे किया गया और मत्स्य वितरण अध्ययन के अनुसार 2 से 682 मछलियों की पहचान की गई। इस जलाशय में मोनोफिलामेंट गिल नेट के अध्ययन से यह पता चला के यह गिल नेट से प्रति दिन 14–20 मछलियों को पकड़ने में सक्षम है। इस जलाशय की मछलियों के लिये सबसे अधिक खतरा अफ्रीका कैटफिश से है अतः पूरे राज्य में इनके पालन एवं विपणन पर रोक लगा दिया गया है।
- केरल के कारापुझा जलाशय में मास बैलेंस मॉडेल एवं फूड वेब के सम्मिलित प्रयोग से यह पता चला कि गांगेय क्षेत्र में पाई जाने वाली कार्प प्रजातियों से इस जलाशय के देशज प्रजातियों को किसी प्रकार का खतरा नहीं है। संस्थान द्वारा दिये गये सुझाव पर केरल सरकार ने जलाशयों में गांगेय कार्प प्रजातियों का संग्रहण मत्स्य उत्पादन संवर्धन हेतु किया जा रहा है।
- संग्रहण जलाशयों में मात्स्यिकी दोहन हेतु Verhulst-Schaffer मॉडेल का विकास किया गया है जबकि इससे पहले अधिकतम ईष्टतम उत्पादन (MSY) और अधिकतम आर्थिक उपज (MEY) का आंकलन जीव आर्थिकी मॉडेल द्वारा किया जाता था।

बाढ़कृत मात्स्यिकी

- विभिन्न पारिस्थितिकियों से होने वाली मत्स्य उपज के आंकलन के लिये एक मॉडेल का विकास किया गया है। इस मॉडेल के अनुसार, परितंत्रों की स्थिति के अनुसार जल निकायों का संभावित मत्स्य उपज 435–4190 कि.ग्रा./हे./वर्ष अनुमानित की गई।
- मौसमी बाढ़ वाले क्षेत्र में सामुदायिक भागेदारी द्वारा वैज्ञानिक पद्धति से मत्स्य उत्पादन किया जाता है। धान–सह–मत्स्य पालन से उत्पादन 4948 कि.ग्रा/हे. और मत्स्य आधारित तकनीक द्वारा पालन से उत्पादन 4130 कि.ग्रा/हे. प्राप्त हुआ। दोनों पालन से लाभ प्राप्ति को अनुपात क्रमशः 1.99 और 2.99 हुआ।
- असम के मोरीगांव के चरन बील में *सिरहिनस मृगला* के अंगुलिकाओं के पालन के लिये जनसंख्या घनत्व 300 फ्राई प्रति वर्ग मी. का

मानकीकरण किया गया।

- चरन बील में मत्स्य उपज के संग्रहण के प्रभाव का आंकलन से यह पता चला कि मत्स्य उपज में 228 कि.ग्रा./हे./वर्ष (2000–01) से 740 कि.ग्रा./हे./वर्ष (2010–11) हो गया। इस उपज में मेजर कार्प का प्रतिशत 62.8 था।
- आर्द्रक्षेत्रों में बंद एवं खुले बील का तुलनात्मक अध्ययन तथा मत्स्य विविधता यह बताते हैं कि खुला बील की तुलना में बंद बील में अधिक मत्स्य उपज और जल की मात्रा, तलछट एन्जाइम एवं सूक्ष्मजीवी पोषक तत्वों में कमी पाई गई।
- चयनित ज्वारनदमुखों, नदियों, जलाशयों और आर्द्रक्षेत्रों में 13 विदेशी प्रजातियां पाई गई जिनमें से 13 प्रजातियां (*Hypophthalmichthys molitrix, Hypophthalmichthys nobilis, Ctenopharyngodon idella, Cyprinus carpio, Barbonymus gonionotus, Oreochromis niloticus niloticus, O. mossambicus, Clarias gariepinus, Piaractus brachypomus, Osphronemus* sp.) खाद्य मूल्य की दृष्टि से महत्वपूर्ण और 3 प्रजातियां (*Pterygoplechthys disgunctivus, P. pardalis, Gambusia affinis*) कम महत्वपूर्ण थीं। इन विदेशी प्रजातियों का प्रतिशत 8 से 54 तक था।

खुला जल क्षेत्रों का आर्थिक मूल्यांकन

- गुवाहाटी में ब्रह्मपुत्र नदी के 22 कि.मी. विस्तार क्षेत्र में किये गये आर्थिक मूल्यांकन से पता चला है कि इस क्षेत्र में 124.7 करोड़ रू. का व्यवसाय हुआ है – ईंट निर्माण (46 प्रतिशत), पर्यटन (23 प्रतिशत), पेय जल (18 प्रतिशत) एवं रेत खनन (13 प्रतिशत)।
- सुन्दरवन में दक्षिण 24 परगना के गोसाबा द्वीप का कुल आर्थिक मूल्यांकन 85.89 करोड़ रू. किया गया। इसमें सबसे अधिक प्रतिशत इको–पर्यटन (39 प्रतिशत) का था। इसके बाद मैंग्रोव (22 प्रतिशत) एवं मात्स्यिकी (15 प्रतिशत) क्षेत्र आते हैं।

आउटरीच परियोजना

भोजन के प्रयोग से पिंजरे एवं पेन में कार्प पालन

- जलाशयों में स्थापित पिंजरें में कार्प पालन किया गया और भोजन में समाहित तत्वों की लाभदायक भूमिका का अध्ययन किया गया। साथ ही, ग्रीष्म और शीत ऋतु में भोजन का समय, उन्हे देने की बारंबरता और भोजन की मात्रा को निर्धारित किया गया।

मत्स्य स्टॉक संबंधी कार्य –

एन सी बी आई जीन बैंक में 29 सिक्वेंस को जमा कर दिया गया।

आहारी संघटक और पोषक तत्वों का प्रोफाइलिंग के रूप में मछली का मूल्यांकन

- *स्पेराटा सिंघाला* के न्युट्रियेन्ट प्रोफाइलिंग से यह पता चला है कि इसमें स्वास्थ्य के लिये उपकारी तत्व जैसे जिंक एवं आयरन उपस्थित होते हैं।
- *टेनुआलोसा इलिशा* के फैटी एसिड प्रोफाइलिंग यह बताते हैं कि मध्यम आकार के हिल्सा मछली में अनसैचुरेटेड फैटी एसिड, ω-3 प्युफा, ई पी ए सह डी एच ए अधिक एवं सैचुरेटेड फैटी एसिड (SFAs) कम पाया जाता है। अतः मध्यम आकार के हिल्सा मछली का सेवन अत्यन्त लाभकारी है।

परिषद् की नेटवर्क परियोजना

जलवायु परिवर्तन का भारतीय कृषि पर प्रभाव

पश्चिम बंगाल में अंतर्स्थलीय मात्स्यिकी के आंकलन से यह पता चला कि नदिया और मुर्शिदाबाद जिलों में जलवायु परिवर्तन का प्रभाव सबसे अधिक पड़ा है। लगभग 66 प्रतिशत मात्स्यिकी इससे प्रभावित हुये हैं।

अंतर्स्थलीय खुला मात्स्यिकी में सुक्ष्मजैविकी फॉस्फोरस रूपांतरण

बाढ़कृत आर्द्रक्षेत्र का तलछट फॉस्फोरस समृद्ध है। ये अधिकतर जैव तत्व के रूप में उपलब्ध हैं तथा ग्रीष्म काल में सूक्ष्मजीवों के अपघटन से प्राप्त होते हैं। अतः जैव एवं अजैव तत्व तथा तलछट में उपलब्ध सूक्ष्मजीवों से फॉस्फोरस को अलग कर इनकी पहचान की गयी।

मत्स्य प्रजातियों के स्पान का अध्ययन तापमान वृद्धि के लाभदायक परिणामों का जानने के लिये किया गया। इसके लिये आंध्र प्रदेश, मध्य प्रदेश, उत्तर प्रदेश, पश्चिमत बंगाल, असम और त्रिपुरा के मत्स्य हैचरियों का सर्वेक्षण किया गया। प्राप्त सुचनाओं से यह पता चलता है कि भारतीय मेजर कार्प प्रजातियों के प्रजनन काल में वृद्धि हुई है। असम के हैचरियों में प्रजनन एंव अंडजनन संबंधी आंकड़ों पर आधारित ई–एटलस बनाया गया है।

कृषि में आधारभूत नीतिनिर्माण और अनुसधान हेतु वित्तीय सहायता

तीन मीठाजल मत्स्य प्रजातियों पर जैव दबाव का प्रभाव

तीन अलग–अलग मीठाजल प्रजातियों पर जैव दाब का अध्ययन किया गया। लीवर प्रोटीन के प्रोटियोमिक विश्लेषण से पता चला है कि 36 डिग्री सें.ग्रे. तापमान पर प्रोटीन का नियमन आसानी से किया जाता है। पहचान की गया प्रोटीन हैं – glyceraldehyde-3-phosphate dehydrogenase, ferritin, glutathione S-transferase, superoxide dismutase, HSP-60, -actin और phosphoglycerate kinase ।

राष्ट्रीय कृषि नवोन्वेशी परियोजना

खाद्य श्रृंखला में आर्सेनिक – कारण, प्रभाव एवं निराकरण

परियोजना में अध्ययन द्वारा जंतुओं में उपस्थित आर्सेनिक निकाकरण गुणों की पुष्टि हुई है और प्राप्त परिणाम को एम टी सी सी/आई डी ए में जमा कर दिया गया है। आर्सेनिक प्रभावित क्षेत्रों से लेबियो रोहिता के प्रोटियोम प्रोफाइल को प्राप्त कर 2–डी इमेज एनालिसिस सॉफ्टवेयर द्वारा इसका अन्य जल निकायों से तुलनात्मक अध्ययन किया गया। इससे प्रोटियोम मैप में होने वाले परिवर्तन को जाना गया।

अजैविक दाब सहन क्षमता को जानने के लिये जीन एवं एलेली माइनिंग का बायो–प्रास्पेक्टिंग

इस वर्ष लवणीय जल में उपलब्ध लवणीयता सहन करने वाली 252 बैक्टीरिया को अलग कर 16S rRNA जीन सिक्वेंस विश्लेषण द्वारा उनका जीनोटाइप तैयार किया गया। कुल 21 ऐसी बैक्टीरिया की पहचान की गई जो लवणीयता सहन कर सकते हैं।

कैटफिश जैसे एच फोसिलिस और सी बेट्राकस के *TLR21*, MyD88, IL8 और *IL-1β* का डी एन ए सिक्वेंसिंग किया गया।

बिहार के अविकसित जिलों में एकीकृत पालन द्वारा ग्रामीणों के लिये आजीविका का विकास किया गया। इसके लिये विदेशी कैटफिश, *Pangasius sutchi* का पालन किया गया है। इससे मत्स्य उपज 4.59 टन प्रति हेक्टयर प्राप्त किया गया।

मात्स्यिकी क्षेत्र में डेटाबेस एवं भौगोलिक सूचना प्रणाली का विकास

छः जिलों के 10 हे. से कम तालाबों से सूचनायें प्राप्त की गईं। कुल 14227 हे. क्षेत्र में से केवल 12212 हे. को उपयोग जलकृषि हेतु किया जाता है। आंकलित उत्पादन 5267 कि.ग्रा. प्रति हे. है। इसी प्रकार बिहार, त्रिपुरा, महाराष्ट्र, मिजोरम और मणिपुर से सूचनाओं को प्राप्त कर उनका मैप बनाया गया और मध्य प्रदेश पर एक इलेक्ट्रोनिक मैप की सीडी जारी की गई है।

भारत के मत्स्य पालकों के साक्षरता, आय एवं स्वास्थ्य का आंकलन

देश के 12 राज्यों के लगभग 1000 अंतर्स्थलीय मत्स्य पालकों से एकत्रित आंकड़ों के अनुसार, औसत पारिवारिक सदस्य 4.68, साक्षरता 71 प्रतिशत, जनम के

समय शिशु का औसत भार 2.58 कि.ग्रा., प्रति परिवार औसत वार्षिक आय रू. 30720/– है। इसमें मात्स्यिकी द्वारा प्राप्त आय का प्रतिशत 52 है। औसत वार्षिक व्यय रू. 26,200/– रहा।

परामर्शक परियोजनायें

- कर्नाटक के कावेरी नदी पर शिवामुद्रम सिजनल पावर प्लांट के पर्यावरणीय प्रवाह का आंकलन
- तवांग के न्यामजंग चू नदी के पारिस्थितिकी एवं जैवविविधता के संपोषण के लिये न्यूनतम पर्यावरणीय प्रवाह का अध्ययन
- केन नदी के जलीय जैवविविधता का अध्ययन
- इटालिन जलविद्युत परियोजना हेतु दराई और तागोन नदियों के न्युनतम पर्यावरणीय प्रवाह का अध्ययन
- एट्युनलि जलविद्युत परियोजना हेतु दराई और तागोन नदियों के न्यूनतम पर्यावरणीय प्रवाह का अध्ययन
- अरूणाचल प्रदेश के लोंडा (तालोंग) जलविद्युत परियोजना हेतु कामेंग नदी के मत्स्य अभिगमन का परीक्षण एवं सुझाव उपाय
- चिलिका झील के पारिस्थितिकी एवं मत्स्य जैवविविधता के पुनरूत्थान का आंकलन

मानव संसाधन विकास

संस्थान ने रिपोर्ट अवधि के दौरान मानव संसाधन विकास कार्य, सलाहकार एवं मात्स्यिकी विकास संबंधी कार्य किया है। इस दौरान 27 प्रशिक्षण कार्यक्रम, 14 जन जागरूकता कार्यक्रम, 22 प्रदर्शनी, 5 शैक्षिक भ्रमण और 5 विशेष त्योहार आयोजित हुये।

Hkfedk

संक्षिप्त इतिहास

केन्द्रीय सरकार की कृषि, वानिकी तथा मात्स्यिकी से संबंधित उप–समिति के प्रस्ताव पर 17 मार्च 1947 को भारत सरकार के खाद्य व कृषि मंत्रालय के अंतर्गत केन्द्रीय अंतर्स्थलीय मात्स्यिकी अनुसंधान केन्द्र की स्थापना कलकत्ता में हुई। एक छोटे पैमाने पर प्रारंभ इस केन्द्र को अपने कार्यकलापों के बल पर वर्ष 1959 में एक पूर्ण संस्थान का दर्जा प्राप्त हुआ तथा यह बैरकपुर, पश्चिम बंगाल के नवनिर्मित भवन में स्थापित हुआ। कालान्तर से यह संस्थान समूचे राष्ट्र की अंतर्स्थलीय मात्स्यिकी एवं जलकृषि के सर्वश्रेष्ठ अनुसंधान में अग्रणी रहा है। वर्ष 1967 से यह संस्थान भारतीय कृषि अनुसंधान परिषद्, कृषि अनुसंधान एवं शिक्षा विभाग, भारत सरकार के अंतर्गत कार्यरत है।

प्रारम्भ में संस्थान का मुख्य उद्देश्य देश के अंतर्स्थलीय मात्स्यिकी संसाधनों का उचित मूल्यांकन तथा इनके संरक्षण व अधिकतम समुपयोजन के लिए उपयुक्त प्रणालियों का विकास करना था। इस उद्देश्य पूर्ति के लिए संस्थान ने देश में उपलब्ध सभी अंतर्स्थलीय जल संसाधनों की पारिस्थितिकी एवं इनकी उत्पादन क्षमताओं के साथ साथ तालाबों की पारिस्थितिकी एवं उत्पादन से संबंधित कृषि पद्धतियों का अध्ययन किया जिससे प्रति यूनिट इकाई मत्स्य उत्पादन में वृद्धि की जा सके।

1960 और 1970 के दशक में संस्थान ने भारत सरकार के योजनागत जलकृषि अनुसंधान एवं विकास पर अपना ध्यान केन्द्रित करना आरम्भ किया। देश की मात्स्यिकी अनुसंधान एवं कृषि पद्धति में महत्वपूर्ण उपलब्धियों को प्राप्त करने के बाद संस्थान ने अखिल भारतीय समन्वित अनुसंधान परियोजनाएं प्रारम्भ कीं। ये परियोजनायें थीं – मिश्रित मत्स्य पालन, नदीय मत्स्य बीज उत्पादन, वायु श्वासी मत्स्य पालन, जलाशयों की पारिस्थितिकी व मात्स्यिकी प्रबंधन तथा खाराजल मत्स्य पालन। वर्ष 1974 में प्रारम्भ की गई मिश्रित मत्स्य पालन व नदीय मत्स्य बीज उत्पादन नामक संयुक्त परियोजना की सफलता, भारत में मत्स्य पालन के लिए एक ऐतिहासिक घटना थी जिसे देश के मीठाजल जीव पालन के विकास का आधार स्तम्भ माना जाता है। इस सफलता के परिणामस्वरूप वर्ष 1977 में धौली, उड़ीसा में केन्द्रीय मीठाजल जीवपालन अनुसंधान एवं प्रशिक्षण केन्द्र की स्थापना हुई जो वर्ष 1987 में केन्द्रीय मीठाजल जीवपालन अनुसंधान संस्थान के रूप में परिणत हुआ। इसी प्रकार संस्थान से अलग होकर केन्द्रीय खाराजल जीवपालन अनुसंधान संस्थान तथा राष्ट्रीय शीतजल मात्स्यिकी अनुसंधान केन्द्र की स्थापना हुई जिनका कार्य खाराजल जीव पालन एवं शीतजल मात्स्यिकी अनुसंधान करना है। अतः के. अं. मा. अनु. संस्थान को तीन प्रमुख अनुसंधान संस्थान के जन्म का श्रेय प्राप्त है।

अंतर्स्थलीय मात्स्यिकी संसाधन व उत्पादन में बदलते पर्यावरणीय, संस्थागत एवं संचालन संबंधी परिवर्तन के कारण संस्थान ने अनुसंधान की भावी चुनौतियों के लिये विभागों/प्रभागों का पुनरीक्षण किया है। वर्तमान में संस्थान के मुद्दों में निम्नलिखित परिवर्तन किये गये हैं।

> ''इष्टतम उत्पादन'' से ''धारणीय उत्पादकता ''
> ''मछली ही एकल लाभ'' से ''पारिस्थितिकी स्वास्थ्य व इससे लाभ ''

इस परिवर्तन से संस्थान के दृष्टिकोण और लक्ष्य में भी परिवर्तन हुआ है।

दृष्टिकोण

जीविकोपार्जन और सामाजिक लाभ हेतु विवृत जल निकायों से अधितकम मत्स्य उत्पादन और उत्पादकता में वृद्धि।

लक्ष्य

मात्स्यिकी संवर्धन, जैव–विविधता संरक्षण तथा पारिस्थितिकी संबंधित सेवाओं के समायोजन के लिये सूचना आधारित प्रबंधन और अंतर्स्थलीय विवृत जल निकायों से अधिकाधिक सामाजिक लाभ प्राप्त करना।

पुनरीक्षित अधिदेश

- अंतर्स्थलीय विवृत जल क्षेत्र जैसे नदी, ज्वारनदमुख जिसमें लैगून, जलाशय एवं आर्द्रक्षेत्र भी सम्मिलित हैं, की मत्स्य व मात्स्यिकी पर वैज्ञानिक आंकड़ें तैयार करना ।
- जलाशय एवं आर्द्रक्षेत्र में दीर्घकालिक मात्स्यिकी के लिये पारिस्थितिकी पर आधारित प्रबंधन प्रणाली का विकास।
- मात्स्यिकी पर बदलते पारिस्थितिकी के प्रभाव का मूल्यांकन तथा उसे कम करने के लिये योजनायें

बनाना।

- अंतर्स्थलीय खुला जल क्षेत्र मत्स्य प्रबन्धन पर परामर्शक सेवायें उपलब्ध कराना, प्रशिक्षण देना, जन जागृति उत्पन्न करना आदि।

संगठन

भारतीय कृषि अनुसंधान परिषद् ने वर्ष 2009 में संस्थान की अनुसंधान गतिविधियों को तीन प्रभागों के अन्तर्गत विभाजित करने की स्वीकृति दी। इन प्रभागों के अध्यक्ष पद तथा इलाहाबाद एवं गुवाहाटी प्रादेशिक केन्द्र के लिए दो प्रभारी पदों को भी अनुमोदित किया गया। इन पदों पर नियुक्ति हो गयी है। इन प्रभागों को विभिन्न अनुसंधान कार्यों में अन्य अनुभाग भी सहायता प्रदान करते हैं। इलाहाबाद एवं गुवाहाटी प्रादेशिक केन्द्रों के प्रभारी उनके केन्द्रों में चल रही अनुसंधान परियोजनाओं के कार्यान्वयन में प्रशासनिक दायित्व संभालते है तथा इन परियोजनओं की तकनीकी देख–रेख तीनों प्रभागाध्यक्षों द्वारा की जाती हैं।

नदीय पारिस्थितिकी एवं मात्स्यिकी प्रभाग

बैरकपुर स्थित यह प्रभाग देश की नदीय तथा ज्वारनदमुख की पारिस्थितिकी तथा मात्स्यिकी के प्रबंधन हेतु प्रभावकारी योजनाओं के विकास तथा उनमें मत्स्य संरक्षण पर अनुसंधान करता है। इस प्रभाग की अनुसंधान परियोजनाएं बैरकपुर, कोलकाता, वडोदरा तथा इलाहाबाद प्रादेशिक केन्द्र से कार्यान्वित होती हैं।

मत्स्य संसाधन एवं पर्यावरणीय अनुमापन प्रभाग

बैरकपुर स्थित यह प्रभाग निम्नलिखित विषयों पर अनुसंधान करता है–

- विवृत जल मत्स्य संसाधन जैसे नदी, आर्द्र क्षेत्र, जलाशय तथा ज्वारनदमुखों में मत्स्य स्वास्थ्य एवं पर्यावरण से संबंधित पहलू, जलीय परितंत्रों का अनुमापन तथा सुधार के उपाय करना।
- मत्स्य सम्पदा एवं मत्स्य संसाधन से संबंधित डेटाबेस तैयार करना। इस डेटाबेस का मुख्य उद्देश्य है – अंतर्स्थलीय मत्स्य सम्पदाओं के सतत उपयोग हेतु मॉडल का विकास करना।

जलाशय एवं आर्द्र क्षेत्र मात्स्यिकी प्रभाग

इस प्रभाग का मुख्य उद्देश्य देश के बड़े, मध्यम और छोटे जलाशयों में मत्स्य उत्पादन वृद्धि हेतु प्रबंधन प्रणालियों का विकास करना है। यह प्रभाग आर्द्र क्षेत्र परितंत्रों की उत्पादन प्रक्रियाओं पर अनुसंधान तथा जैव विविधता संरक्षण पर पर्याप्त ध्यान देते हुए मत्स्य उपज की वृद्धि हेतु अनुसंधान करता है। बैरकपुर, बैंगलोर तथा गुवाहाटी व इलाहाबाद प्रादेशिक केन्द्रों से इस प्रभाग का अनुसंधान कार्य होता है।

कृषि आर्थिकी अनुभाग

यह अनुभाग देश के विभिन्न अंतर्स्थलीय जल संसाधनों में सामाजिक–आर्थिक, संस्थागत एवं अन्य विषयों पर अनुसंधान करता है। इस अनुभाग द्वारा जलाशयों, नदियों, आर्द्रक्षेत्रों और ज्वारनदमुखों पर निर्भरशील मछुआरों के सामाजिक–आर्थिक जीवन स्तर का मूल्यांकन करता है। यह कक्ष बैरकपुर में स्थित है पर देश के अन्य कई भागों में इसकी परियोजनायें चल रही हैं।

संस्थान की विभिन्न गतिविधियों में निम्नलिखित अनुभाग / कक्ष / इकाई सहायता करते हैं –

प्राथमिकता, अनुमापन व मूल्यांकन कक्ष (PME) – इस कक्ष का कार्य संस्थान एवं इसके अनुसंधान कार्यकलापों की प्राथमिकता तय करना और इनका अनुमापन व मूल्यांकन करना है। इस कक्ष द्वारा पंचवार्षिक पुनरीक्षण दल (QRT), अनुसंधान सलाहकार समिति (RAC) और संस्थान सलाहकार समिति (IRC) के समन्वयन और दिये गये सुझावों के अनुपालन में सहयोग देना है। यह कक्ष विभिन्न प्रकार की तकनीकी रिपोर्ट, छमाही न्यूजलेटर, पैम्फलेट, ब्रोसर, लिफलेट और वार्षिक प्रतिवेदन को प्रकाशित करने का कार्य करता है साथ ही यह आर. पी. एफ. फाइल एवं वैज्ञानिक प्रकाशनों आदि की देख–रेख भी करता है। इस कक्ष के अन्य कार्यों में संसदीय प्रश्नों, लेखा परीक्षक प्रश्न और परिषद् द्वारा पूछे गये प्रश्नों का उत्तर देना है। संक्षेप में, यह कक्ष निदेशक को संस्थान के उत्तम प्रबंधन में संस्थान के विभिन्न कार्यकलापों में योजना एवं कार्यान्वयन द्वारा सहयोग प्रदान करता है। इस कक्ष को विभिन्न अनुसंधान विभाग, प्रशासनिक एवं वित्त अनुभाग द्वारा सहयोग दिया जाता है।

परियोजना अनुमापन एवं प्रलेखन कक्ष – प्रलेखन कक्ष द्वारा वर्ष 2010–11 के दौरान इस कक्ष द्वारा 11 वैज्ञानिक बुलेटिन एवं वार्षिक रिपोर्ट, 2 न्यूजलेटर तथा कई ब्रोशर, पुस्तिका एवं पैम्फलेट इत्यादि का प्रकाशन किया गया।

तकनीकी कक्ष – तकनीकी कक्ष द्वारा परिषद् तथा मात्स्यिकी प्रभाग को भेजी जाने वाली सभी प्रकार की रिपोर्ट तैयार की जाती हैं।

विस्तार व प्रशिक्षण कक्ष – इस कक्ष से प्रशिक्षण, प्रदर्शनियां, निरूपण कार्यक्रम, मत्स्य पालक दिवस आदि का आयोजन होता है और अंतर्स्थलीय मात्स्यिकी से संबंधित विविध तकनीकी प्रणालियों को मत्स्य पालकों, मछुआरों, उद्यमियों, विस्तार कार्यकर्ताओं तक पहुँचाया जाता है। यह कक्ष बाहरी प्राधिकरणों और संगठनों से सम्पर्क बनाये रखता है। संस्थान में यह कक्ष मानव संसाधन विकास कार्य का कार्यान्वयन करता है।

पुस्तकालय व सूचना अनुभाग – संस्थान का पुस्तकालय मुख्यालय व अनुसंधान केन्द्रों में कार्यरत वैज्ञानिकों की आवश्यकताओं के अलावा अन्य संगठनों के शोधकर्ताओं, अध्यापकों, विद्यार्थियों तथा अधिकारियों को भी अपनी सेवायें उपलब्ध कराता है। वर्ष 2011–2012 के दौरान संस्थान के पुस्तकालय में 67 पुस्तकें, 15 विदेशी जरनल और 25 भारतीय जरनल की वृद्धि हुई है। इस समय पुस्तकालय में कुल 12729 पुस्तकें, 1800 हिन्दी पुस्तकें और अन्य प्रकाशन जैसे पुनर्मुद्रित लेख, मानचित्र और विविध प्रकाशनों का संग्रह है। वर्तमान में पुस्तकालय में आधुनिक साफ्टवेयर लगाये गये हैं और उपलब्ध पुस्तकों एव अन्य सामग्री का पूर्ण डिजिटाइजेशन कार्य भी किया जा रहा है।

सूचना प्रौद्योगिकी एवं ऐरिस कक्ष – यह कक्ष सूचना प्रौद्योगिकी के उपयोग हेतु प्रोत्साहित करता है तथा संस्थान के अधिकारियों को 24 घंटे इंटरनेट की सुविधा प्रदान करता है। इस कक्ष द्वारा कम्प्यूटर उपयोग हेतु आवश्यक तकनीकी सहायता भी दी जाती है।

संस्थान प्रौद्योगिकी प्रबंधन इकाई – इस इकाई द्वारा संस्थान के आइ. पी. आर. सम्बधित कार्य किये जाते हैं।

एक्वेरियम और हैचरी इकाई – संस्थान में स्थापित एक्वेरियम तथा हैचरी की देख–रेख इस इकाई द्वारा की जाती है।

हिन्दी कक्ष – यह कक्ष तकनीकी प्रलेखों, वार्षिक रिपोर्ट, न्यूजलेटर तथा अन्य रिपोर्टों को हिंदी में प्रकाशित करता है। यह कक्ष हिंदी को राजभाषा रूप में स्थापित करने एवं इसे लोकप्रिय बनाने के लिए सतत् प्रयासशील है।

प्रशासनिक अनुभाग – यह अनुभाग संस्थान मुख्यालय और इसके विभिन्न केन्द्रों के संपूर्ण प्रशासनिक कार्यकलापों को नियंत्रित करता है। इस अनुभाग के अंतर्गत कार्यरत अन्य भाग संस्थान के निदेशक, अनुसंधान और समस्त अधिकारियों एवं कर्मचारियों के प्रशासनिक कार्यों की देखभाल करता है।

वित्त एवं लेखा अनुभाग – इस अनुभाग द्वारा संस्थान एवं इसके विभिन्न केन्द्रों के संपूर्ण वित्तीय रेकार्ड का रखरखाव और वित्तीय कार्यकलापों को नियंत्रित किया जाता है।

संस्थान का प्रमुख अनुसंधान प्रबंधन पद निदेशक का होता है। संस्थान प्रबंधन का सम्पूर्ण दायित्व निदेशक की अध्यक्षता में गठित प्रबंधन समिति का है। अनुसंधान सलाहाकार समिति संस्थान के अनुसंधान तथा विस्तार कार्य हेतु विशेष आवश्यक सुझाव देती है जो संस्थान की अनुसंधान परियोजनाओं के विकास एवं सुधार में सहयोग देता है। संस्थान की अनुसंधान परियोजनायें मुख्यालय बैरकपुर तथा प्रादेशिक केन्द्रों इलाहाबाद और गुवाहाटी तथा अन्य अनुसंधान केन्द्र बैंगलोर, वडोदरा, कोच्चि और कोलकाता से कार्यान्वित होती हैं। संस्थान के संगठनात्मक ढांचे को अगले पृष्ठ पर दिखाया गया है –

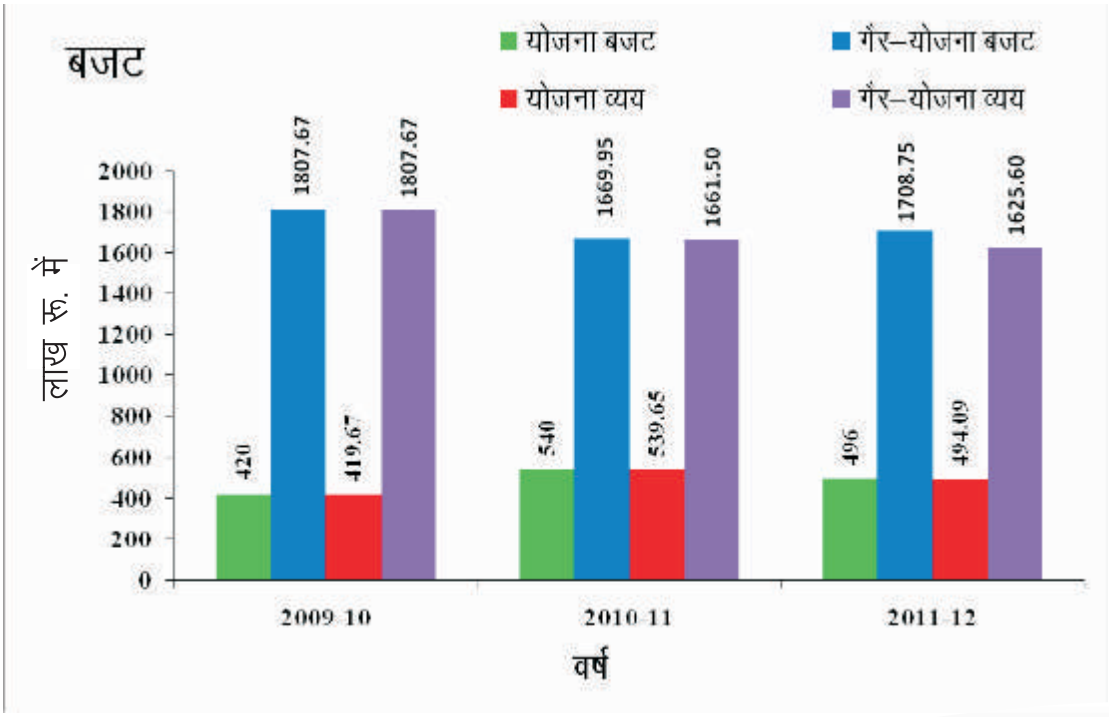

Organogram of CIFRI
vuqla/kku lykgdkj lfefr
funs'kd
lLFkku izca/ku lfefr
vuqHkkx@vuqHkkx
unh; ikfjLFkfrdh o ekfRL;dh
ekfRL;dh lalk/ku o i;koj.k; izca/ku
tyk'k; o vkn[kr ekfRL;dh
dh"k vkfFkdh vuqHkx
{k=h; dUnz
bykgkckn
xbkg Vh
cxykj
oMkMjk
dkydkrk
dkfPp
i'kq lu
lkekU;
HkMkj o ifjogu
oDlh o ;fV yVh
foÙk
yf[kk ijh{kk o yf[kk
ifj"kn dk i'ku d{k
lg;ksxh d{k@vuqHkkx@bdkbZ
iLrkdky; o lpuk vuqHkkx
if'k{k.k o foLrkj d{k
vkbZ- Vh- o ,fj l d{k
rduhdh d{k
fgUnh d{k
,Dofj e o gjp h bdkbZ
lLFkku ikl|kfxdh izca/ku bdkbZ

बजट

संस्थान का बजट : वर्ष 2011–12

(लाख रू. में)

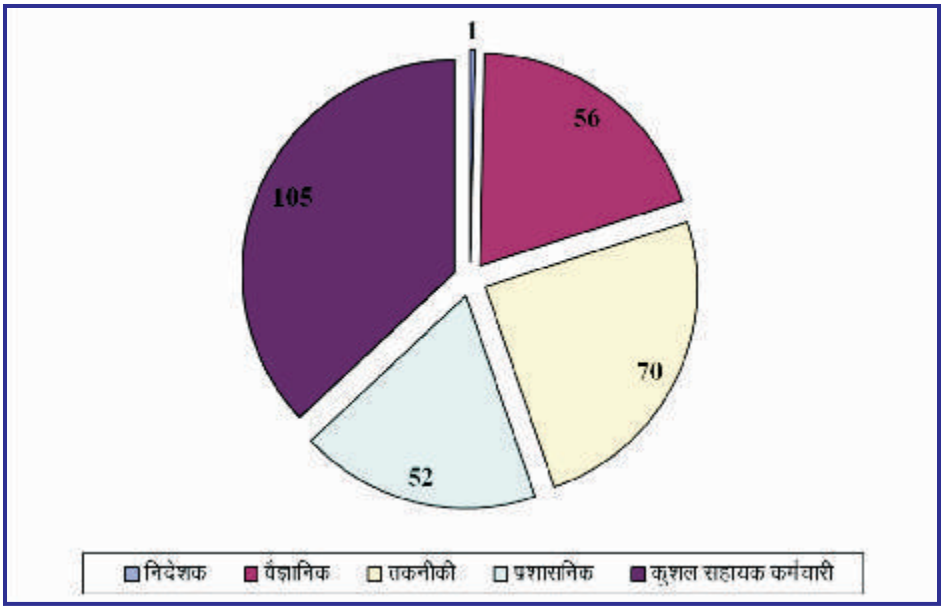
लेखा शीर्ष	संशोधित बजट		व्यय	
	योजना	गैर–योजना	योजना	गैर–योजना
वेतन व अन्य भत्ते (समयोपरि भत्ता सहित)	0.00	1576.67	0.00	1516.67
यात्रा भत्ता	41.00	6.00	40.85	5.79
अन्य खर्च (सूचना प्रौद्योगिकी एवं मानव संसाधन विकास सहित)	310.00	126.75	308.93	103.01
वर्क्स	145.00	0.00	144.31	0.00
कुल योग	**496.00**	**1708.75**	**494.09**	**1625.60**



संस्थान के अधिकारी व कर्मचारी

दिनांक 31 मार्च 2012 तक संस्थान में अधिकारियों व कर्मचारियों की संख्या

वर्ग	स्वीकृत पदों की संख्या	भर्ती हुये पदों की संख्या	रिक्त पदों की संख्या
निदेशक (अनुसंधान प्रबंधन पद)	1	1	-
वैज्ञानिक	95	56	39
तकनीकी	86	70	16
प्रशासनिक	67	52	15
सपोर्ट स्कील्ड स्टाफ	153	105	48
कुल	**402**	**284**	**118**



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