ANNUAL REPORT
2001-02

Central Inland Fisheries Research Institute
(Indian Council of Agricultural Research)
Barrackpore, Kolkata-700 120.

वार्षिक प्रतिवेदन

ANNUAL REPORT

2001-2002

केन्द्रीय अंतर्स्थलीय मात्स्यकी अनुसंधान संस्थान

(भारतीय कृषि अनुसंधान परिषद्)

बैरकपुर कोलकाता-700 120 पश्चिम बंगाल

Central Inland Fisheries Research Institute

(Indian Council of Agricultural Research)

Barrackpore Kolkata-700 120 West Bengal

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- The activities and achievements reflected in this Annual Report covers the period April 2001 to March 2002 only.
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CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
BARRACKPORE-743101, WEST BENGAL

1 PREFACE

The Annual Report of Central Inland Fisheries Research Institute (CIFRI) for the year 2001-2002 contains comprehensive information on the achievements of the various research projects and other activities undertaken by the Institute.

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

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

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

Director

2 EXECUTIVE SUMMARY/SALIENT ACHIEVEMENTS

1 Ecological investigations with major thrust on the evaluation of production potential of four southern Rajasthan reservoirs viz. Jawai, West Benas, Nandsamand and Gambhiri were conducted. Based on the production potential ranging from 300 in West Benas to 450 kg/ha in Jawai, these reservoirs could be categorized as highly productive. Stocking of Indian Major Carps @ 550 fingerlings in West Benas to 850 fingerlings/ha in Jawai reservoirs, is suggested.

2 A complete inventory and mapping of water bodies above 10 ha in the state of West Bengal have been done through digital image processing technique by using satellite data (IRS-IC & ID) acquired from National Remote Sensing Agency, Hyderabad. GIS, is being developed for geographically referenced spatial data and corresponding water quality attribute information to the identified water bodies.

3 Cage culture experiment has been initiated to convincingly demonstrate the possibilities of fish production in cage from an open water system. A cage having dimension of 9 ft x 6 ft made of netlon of 1 cm mesh size has been constructed and installed in Mathura beel. Fish growth increment in 45 days of period has been recorded as 50 gm in *Catla catla* and 44 gm in *Labeo rohita*. The crop will be harvested after 120 days of operation.

4 Pen culture system has been identified as one of the reliable means for solving the problem of raising healthy fingerlings of desired size. Hence pen culture experiment has been taken up in Oduthurai reservoir of Tamil Nadu. Here grass carp registered the highest growth and reached the target size of 100 mm in 30 days. Catla attained this size within 40 days of stocking.

5 Experiments conducted on reproductive physiological response of fish *R. rita* to aquatic pollutants revealed accumulation of ovarian and hepatic cholesterol and reduction in hormone 17 β estradiol level indicating reduced steriodogenesis and consequent reproductive incompetance.

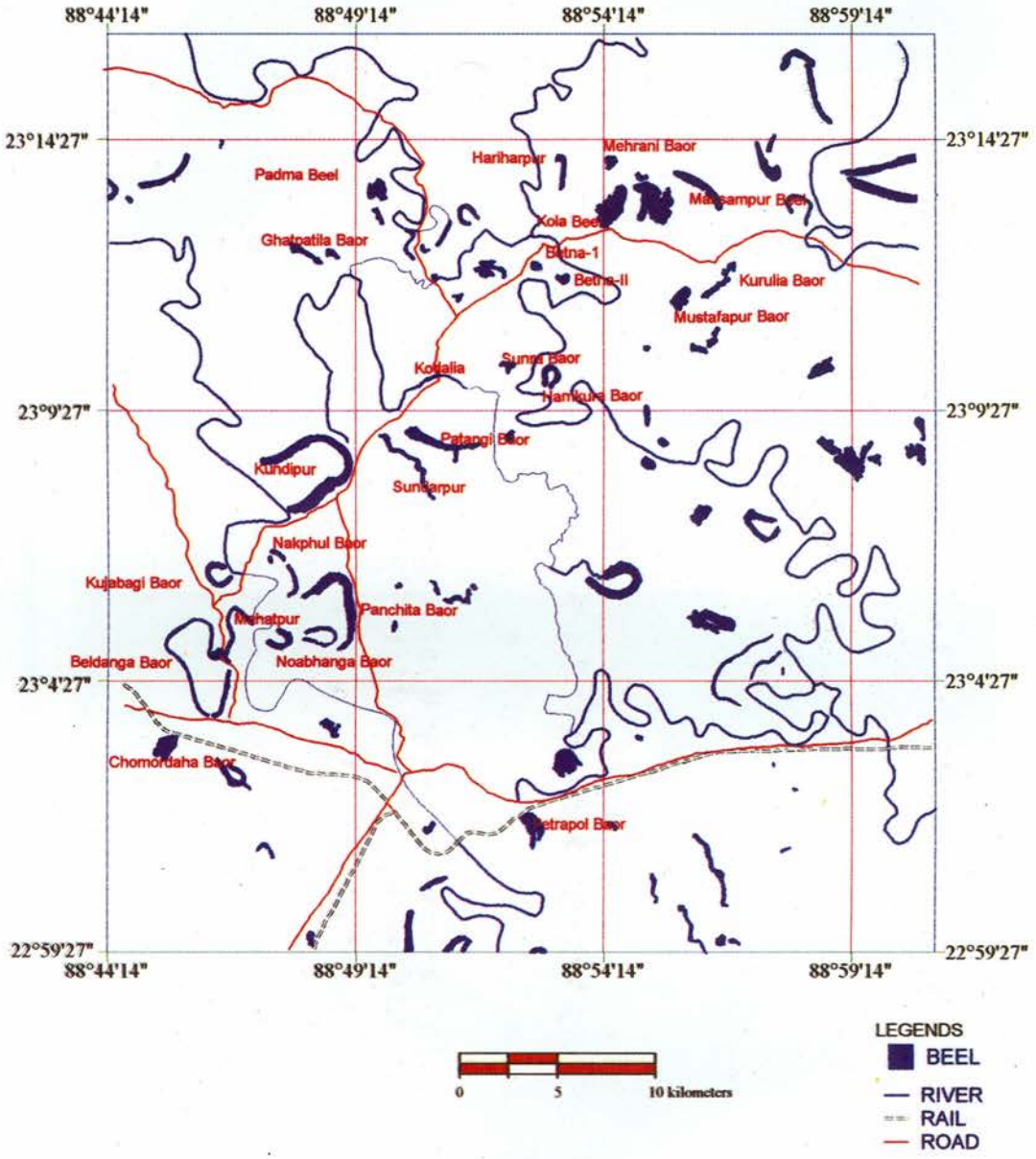
6 Captive breeding of an endemic ornamental fish *Colisa fasciata* was standardized. Food preference studies for five different endemic ornamental species viz., *C. fasciata, C. lalia, Badis badis, Nandus nandus* and *Botia dario* were conducted using feed pellets, mosquito larvae and live worms.

7 Total catch of winter migratory bag net fishery in lower estuary amounted to 28116.9 t with an average CPUE of 47.5 kg showing a moderate increase of both catch (by 15.8%) and CPUE (by 17.3%) in comparison to last winter.

8 Documented various socio economic constraints in yield optimization of beels of Assam. Dynamics of livelihood system of fishermen dependent on beels and Brahmaputra river of Assam were investigated.

9 The laboratory and office complex of Northern Regional Centre was inaugurated during November 2001. The laboratory complex comprised 4 laboratories including two biology and one each of biochemistry and chemistry. These laboratories are equipped with highly sophisticated and modern scientific instruments.

Vector map of study area showing the distribution of water bodies of West Bengal



Cage and Pen culture of fish and prawn

Aplocheilus panchax (Hamilton – Buchanan)
Indigenous Ornamental Fishes
Puntius conchonius (Hamilton – Buchanan)

Fishing in beels of Assam

Loktak lake in Manipur

3 INTRODUCTION

The Government of India, in a memorandum brought out in 1943, stressed the need for having a separate central department in the best interest of the development of fisheries resources of the country .This memorandum was later endorsed by the Fisheries Sub-Committee of the Central Government Policy Committee on Agriculture, Forestry and Fisheries. Based on this, the Central Inland Fisheries Research Station was formally established on 17th March, 1947 in Calcutta under the Ministry of Food and Agriculture, Government of India. From the modest beginning as an interim scheme, the organisation has since grown to the status of a premier research institution in the field of inland fisheries in the country and has completed 54 years of its service to the nation on March 17, 2001. By the year 1959, the Station acquired its status as Central Inland Fisheries Research Institute (CIFRI) and moved to its own building at Barrackpore, West Bengal. Since 1967, the Institute is under the administrative fold of Indian Council of Agricultural Research (ICAR).

The main objectives of the Institute were to conduct investigations for a proper appraisal of inland fisheries resources of the country and to evolve suitable methods for their conservation and optimum utilization. While fulfilling the above objectives, the Institute directed its research efforts towards understanding the ecology and production functions of inland water bodies available in the country like the river systems, lakes, ponds, tanks, reservoirs and floodplain wetlands. These studies have unravelled the complex trophic structure and functions *vis-a-vis* the environmental variables in different aquatic ecosystems. During the early 1970s, the Institute expanded its activities by initiating various All India Coordinated Research Projects; such as composite fish culture and fish seed production, airbreathing fish culture, ecology and fisheries management of freshwater reservoirs and brackishwater fish farming.

The Institute has the distinction of evolving and popularising technologies on fish seed prospecting from rivers; fish seed transportation; induced breeding and nursery management of carps; bundh breeding of Chinese carps; composite fish culture; aquatic weed control; air-breathing fish culture; integrated fish farming; sewage fed fish culture; fisheries management of small reservoirs; brackishwater fish farming and farming of edible snails. The country has witnessed a phenomenal increase in production of inland fish (0.22 million t in 1950-51 to 2.8 million t in 2000-2001) which can be mainly attributed to the above technologies.

At the beginning of Seventh Five Year Plan, three Institutes (Central Institute of Freshwater Aquaculture, Central Institute of Brackishwater Aquaculture and National Research Centre on Coldwater Fisheries) were carved out from this Institute and the parent Institute was rechristened as Central Inland Capture Fisheries Research Institute (CIFRI) with effect from 1st April 1987. Under the changed set up, CIFRI is entrusted with the responsibility to conduct research on open water bodies where the fisheries management norms are closely associated with environmental monitoring and conservation.

Mandate

The CIFRI is presently mandated to :

1 study fish population dynamics of exploitable inland water bodies exceeding 10 ha in water area;

2 evolve management systems for optimising fish production from such water bodies;

3 investigate causes, effects and remedies of their degradation/pollution and provide research support for mitigation and for conservation of such resources;

4 study the impact of river valley projects on the fisheries of the basins concerned and evolve strategies for their management;

5 act as national data centre on inland fisheries; and

6 conduct training and provide extension/consultancy services.

Organizational set-up (chart)

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

The ***Riverine Division,*** with its headquarters at Allahabad, strives to develop systems for effective management of the vast riverine fisheries resources of the country with adequate emphasis on the conservation of riverine environment. The research projects under the Division cover the rivers Ganga, Brahmaputra, Mahanadi, Narmada and Godavari and their important tributaries.

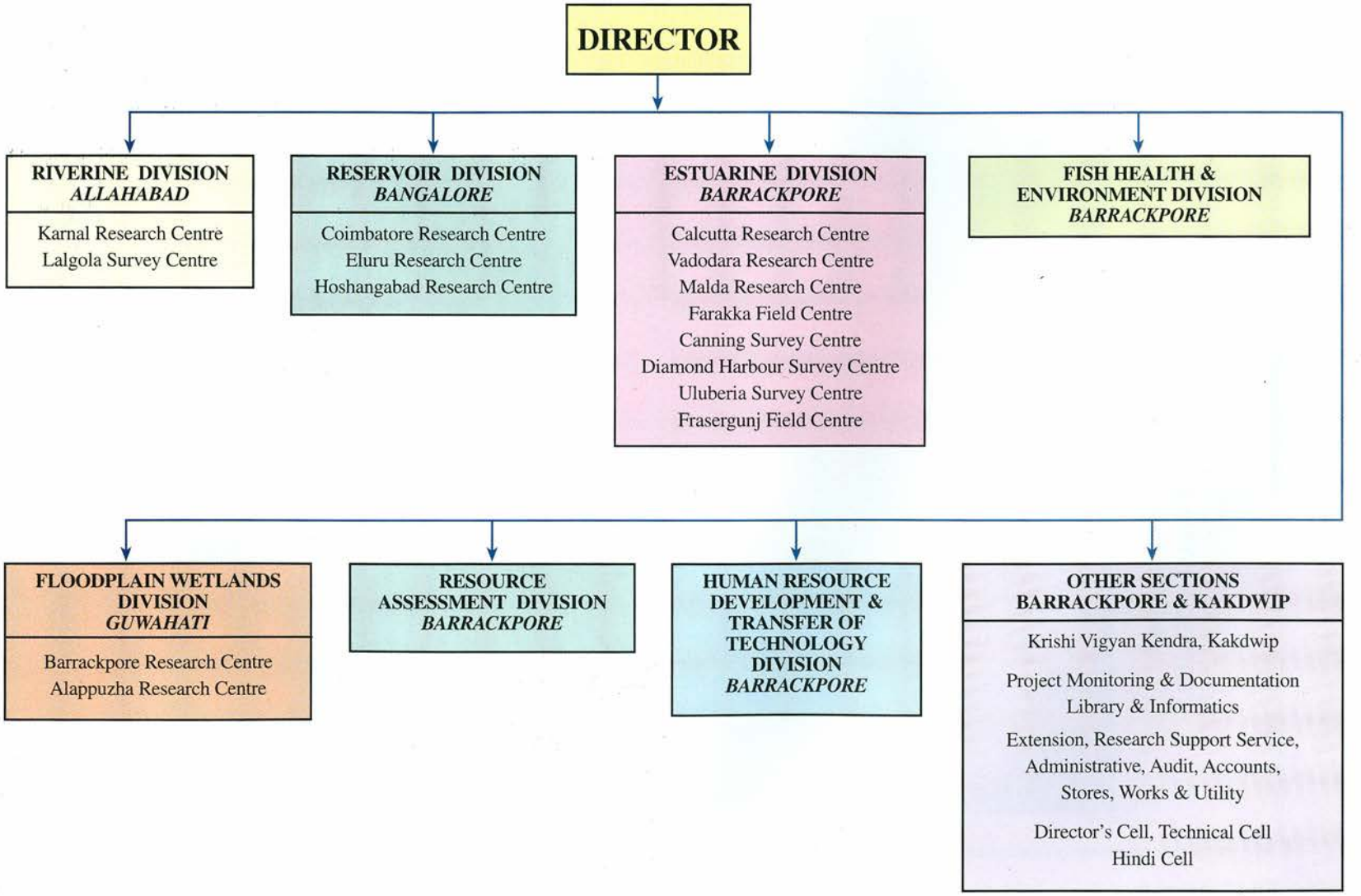
The ***Reservoir Division*** is based at Bangalore with centres in Tamil Nadu, Andhra Pradesh and Madhya Pradesh. The investigations being carried out at the Division are aimed at developing management norms for optimising fish yield from large, medium and small reservoirs of the country.

The Barrackpore-based ***Estuarine Division,*** presently works on the Hooghly- Matlah and Namada Estuarine systems. Biotic and abiotic features of estuarine tributaries and mangroves of Sunderban region are also being studied.

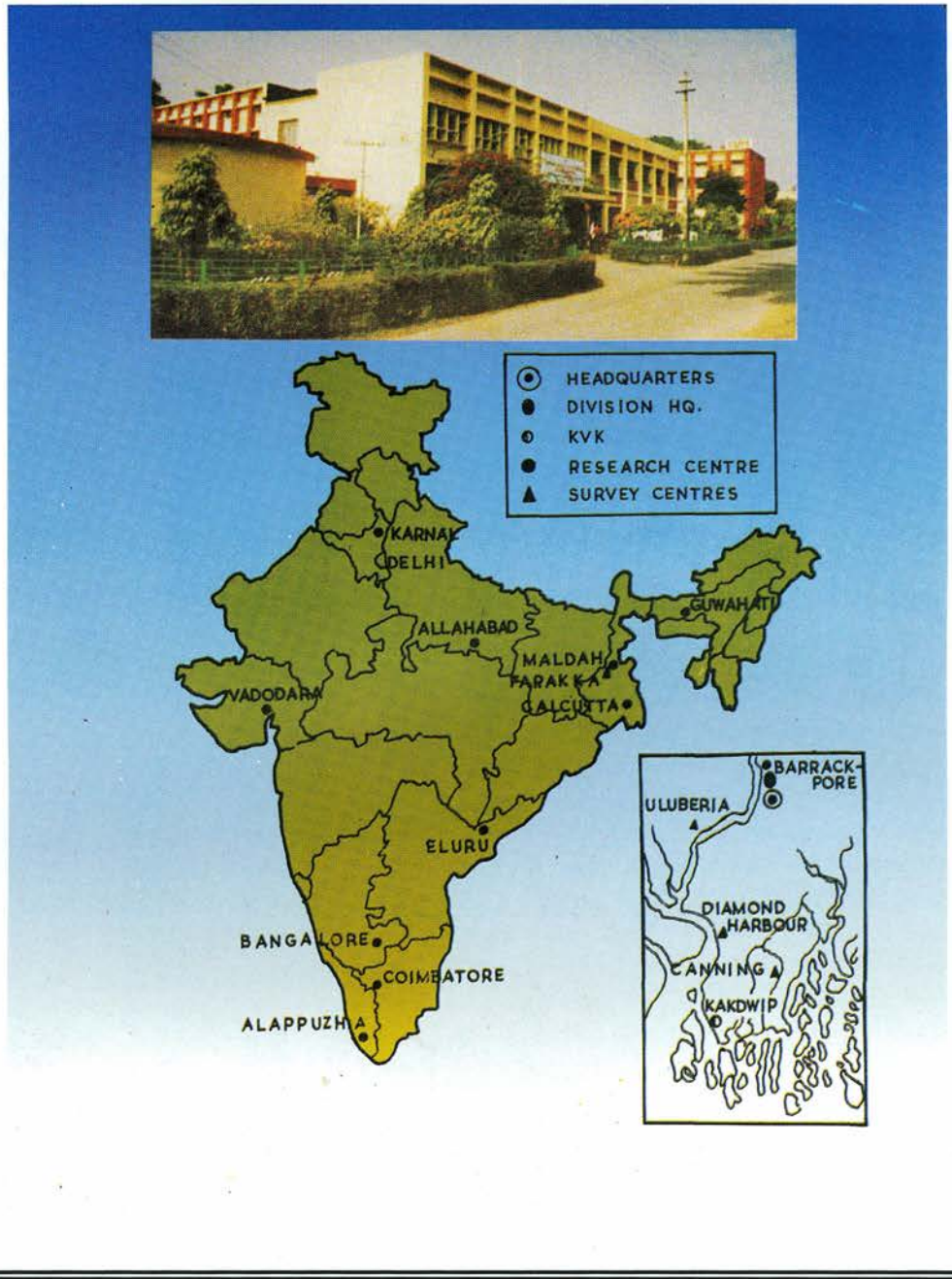
Research on biology and migratory behaviour of hilsa, aims at development of measures for the recovery of its fishery in the depleted stretches of the river Ganga. It is also undertaking study on genetic characteristics of hilsa from different stretches to know its population structure.

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

ORGANIZATIONAL SET-UP OF CIFRI



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



The ***Floodplain Wetlands Division*** has its headquarters at Guwahati. The ecodynamics of wetlands spread over the floodplains of Ganga-Brahmaputra basins are being studied in order to evolve management norms for their sustainable development. The wetlands associated with the floodplains of Ganga and Brahmaputra rivers are not only unique in their rich biodiversity, but also constitute an important fishery resource in the states of Bihar, West Benga1 and Assam. The Division carries out research on the ecosystem processes and fish productivity from this resource with special attention on protection of biodiversity and development of environment-friendly technologies.

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

The **Human Resource Development and Transfer of Technology Division** is located at Barrackpore, and looks after the transfer of technologies developed, mass awareness programmes and up gradation of skills through training courses. The Transfer of Technology wing undertakes on regular basis the dissemination of various technologies of inland fisheries to the fish farmers, fishermen, entrepreneurs, extension functionaries through training, demonstration, advisory service, fish farmers' day, camp discussion, film show, exhibition, etc.

The Institute's research activities are organised under 17 research projects which are operated from the Headquarters at Barrackpore, 12 Research centres, 6 Survey Centres and a Krishi Vigyan Kendra covering 10 states of the country. The distribution of research and survey HRD centres and different sections are shown in the organization chart.

Library services

CIFRI library provides its services to the scientists of the Headquarters and Centres as well as to the research scholars, teachers, students and officials from other organizations. The library added 495 books, 104 miscellaneous publications and 650 loose issues of journals to its collection and subscribed 19 foreign and 64 Indian journals during the year. The current total holding of the library comprises : 8988 books, 4277 reprints, 1221 maps and 4050 miscellaneous publications.

The library maintained free mailing of the Institute's publications to various research organizations, universities, entrepreneurs and farmers to keep them abreast with the latest developments in fisheries research. As a part of resource sharing, it extended inter-library loan to other libraries. Rs. 22,70,354.00 was spent during the year 2001-2002 for procuring library books, journals and other reading materials. Library also brought out Indian Fisheries Abstracts, Vol.34(2-4), 2000 & Vol. 35(1), 2001 and Current Contents for the period January-December, 2001.

Project Monitoring and Documentation Service

The section monitored the progress of Research Projects of the Institute and organized Staff Research Council Meeting. It also assisted the Director in policy formulation and technical guidelines on plan and scheme preparations, apart from publishing reports, writeups, bulletins, project programmes, and newsletters. The section processed the research papers submitted by the scientists for their publications in different journals and for presentation in symposia/workshops/summer school, etc. Participation of scientists in seminars, symposia, conferences, *etc.* was also monitored by the section.

The section maintains an active DTP, photocopy, lamination, duplicating (cyclostyling), and binding units to cater to the needs of the Institute.

Research Project Files

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

Technical Reports/queries

More than 25 Technical reports highlighting the progress of research under various projects were compiled and sent to the Council, Ministry of Agriculture and other agencies. Technical queries regarding the activities of the Institute from various quarters of the country and abroad were attended to by the section.

Personal Information System (PIS)

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

Publications

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

Annual Report

1 Annual Report 2000-2001

Newsletter

1 The Inland Fisheries News (Vol.6, No.1, January 2001 to June 2001)
2 The Inland Fisheries News (Vol.6, No.2, July 2001 to December 2001)

Bulletin

1 Bull.No.97 : Ecology and production dynamics of river Brahmaputra with special emphasis on its tributaries

2 Bull.No.98 : Success stories of fisheries management in small reservoirs .

3 Bull.No.98 (Hindi): *Chota Jalasay ke matsyaki prabandhan myen sansthan upalabdhiya – Ek jhalak*

4 Bull.No. 99: CIFRI's environment impact assessment (EIA) technology – finding users

5 Bull.No.99 (Hindi): *CIFRI dwara vikashit paryavaraniya prabhab ankalan (EIA) padhati – viswa manyata ki aor*

6 Bull.No. 100: Ecology and Fisheries of Tawa Reaservoir (Hoshangabad, M.P.)

7 Bull.No. 101: Environmental Impact Assessment of Inland Waters for Sustainable Fisheries Management and Conservation of Biodiversity.

8 Bull.No. 102: River Godavari -Environment and Fishery

9 Bull.No. 103: Ecology and Fisheries of *Beels* in West Bengal

10 Bull.No. 104: Ecology and Fisheries of *Beels* in Assam

11 Bull.No.105 : Training on Pen Culture of Fish and Prawn

12 Bull.No.106 : Management of Fisheries in Small Reservoirs

Current Contents

Jan.-Dec., 2001.

Indian Fisheries Abstracts

Vol.34(2-4), 2000 & Vol. 35(1), 2001

Financial statement *(Rs. in lakhs)*			
For the year 2001-2002			
	B.E.	**R.E.**	**Actual expenditure**
Plan	213.68	329.18	328.85
Non-Plan	760.00	790.70	773.46
TOTAL	**973.68**	**1119.88**	**1102.31**

Staff Position

Statement showing the total number of employees in the CIFRI, Barrackpore pertaining to the employees under Scheduled Castes and Scheduled Tribes categories (Period from 1.4.2001 to 31.3.2002

Sl. No.	Class of Posts	Total No. of posts sanctioned	Total No. of employees in position	Total No. of Sch. Caste among them	S.C. in % of total employees	Total No. of Sch.Tribe among them	S.T. in % of total emplo -yees	Remarks
1	**SCIENTIFIC POSTS**							
	Experimental Scientist							
	Scientist	76	59	5	8.47	-	-	
	Sr.Scientist/Scientist (Sel.Grade)/ Scientist (Sr.Scale)	16	5	-	-	-	-	
	Principal Scientist	8	7	1	12.50	-	-	
	RMP Scientist	1	1	-	-	-	-	
	TOTAL	**101**	**72**	**6**	-	-	-	
2	**TECHNICAL POSTS**							
	Category – I	58	53	11	20.75	3	5.66	This includes 2 (two) posts under C.S.S. and 5 (fifteen) posts under KVK
	Category – II	53 + 5	51	12	23.52	4	7.84	
	Category – III	1	5	-	-	-	-	
	TOTAL	**112+5=117**	**109**	**23**		**7**		

3	**ADMINISTRATIVE POSTS**							
	Sr.A.O.s/A.Os/Accounts Officer, etc.	2	2	-	-	-	-	This includes 1 (one) Assistant, 1 (one) Stenographer and 1 (one) L.D.C. posts under C.S.S., 1 (one) Asstt., 1 (one) Jr. Steno. Under KVK and 1 (one) L.D.C. under N.F.
	A.A.Os/Superintendent (Accounts)/Supdt.	7	7	3	42.85%	1	14.28%	
	Assistant Director (O.L.)	1	1	-	-	-	-	
	Assistants	23	20	4	20.00%	1	5.00%	
	P.S., P.A.	5	3	2	66.66%	-	-	
	Jr. Steno., Sr. Clerk/U.D.Cs	44	43	11	25.58%	-	-	
	L.D.Cs/Hindi/Time Keeper	14	13	2	15.38%	1	7.69%	
	TOTAL	**96**	**89**	**22**		**3**		
4	**SUPPORTING STAFF**							
	Grade - I	82	80	27	33.75%	6	7.5%	This includes 1 (one) post of SSG under C.S.S. and 7 (seven) post of SSG under KVK
	Grade - II	59	62	20	32.26%	4	6.45%	
	Grade - III	35	36	12	33.33%	3	8.33%	
	Grade - IV	18	17	10	58.82%	2	11.76%	
	TOTAL	**194**	**195**	**69**		**15**		
5	**AUXILLIARY POSTS**	4	4	2	50.00%	-	-	

4 RESEARCH ACHIEVEMENTS

PROJECT : RI/A/1

ECOLOGY AND PRODUCTION RELATIONSHIPS IN PENINSULAR RIVER SYSTEMS

Sub-Project : **Investigations on ecology, bio-diversity and production functions in river Krishna**

Personnel : *Scientific :*
D.N. Singh, D.S. Krishna Rao, M. Karthikeyan, A.K. Das, R.K. Manna

Duration : April 2001-March 2003

Location : Bangalore

The Krishna river course was divided into two stretches - upper stretch (Maharashtra and Karnataka) and lower stretch (Andhra Pradesh). From first and second stretch 14 and 9 centres were chosen for sampling respectively. At each centre sampling was done for various limnological parameters and primary productivity. Data on fish and fisheries and socio-economic status of fishers were collected. Post-monsoon sampling was done during October - November, 2001.

Soil and water quality

Soil reaction was moderately alkaline (7.68 to 8.03) and increased from upstream towards downstream. Specific conductance (µmhos/cm) registered low to moderate values (0.12 to 0.62 µmhos/cm). Organic carbon content was fairly rich (0.21 to 1.95%). C/N ratio was in the productive range (3.18 to 19.09). Total-N content fluctuated from 0.598% to 0.011% and available-N from 12.15 to 85.68 (mg/100g). Available-P content was fairly rich 0.78 to 6.76 (mg/100g). Water temperature ranges from 24.8 to 31.3°C. pH was neutral at the origin (7.09) and moderately alkaline in rest of the river stretch. Sp. conductance ranged between 278 to 628 µmhos/cm barring Penumudi (1270). Bicarbonate ranged from 124-420 mg/l and total hardness (TH) from 136 – 264 mg/l. Ca^{++} was fairly rich (14.43 to 56.11 mg/l) and Mg^{++} from 8.21 to 46.63 mg/l. Cl^{-} content was higher in tributaries. Nitrate-N was observed in all stations. Phosphate-P ranged from 31 to 252 µg/l and Silicate ranged from 4.92 to 7.10 µg/l.

Primary productivity

The gross primary production (GPP, $mgC/m^3/h$) increased progressively as the distance from the origin increased. Significantly higher production was registered in the downstream

barring Haripur (150), Jamakhandi (184) and Galgali (155.83) in the upstream and Bispalli (164.05) in the downstream.

P:R ratio (GPP:CR) an indicator of organic pollution registered moderate amplitude of variation between Mahuli and Thummalapalayam (1.8 to 4.8) and in the extreme down stations viz. Gajullanka, Amudhurlanka and Penumudi it fluctuated to the tune of 10.0 to 13.5 reflecting that contribution to respiration component was predominantly by phytoplankton biomass.

Biotic communities

Plankton : Plankton study showed the dominance of phytoplankton (85.86%) over zooplankton (14.14%). Among Phytoplankton Bacillariophyceae (42.53%), Chlorophyceae (30.16%), Myxophyceae (12.16%) and Desmidiaceae (1.0%) were recorded. Copepoda (8.16%), Cladocera (1.81%) and Rotifera (4.16%) constituted the zooplankton.

Periphyton: Periphytic population was dominated by Bacillariophyceae (88.86%) followed by Myxophyceae (7.09%), Chlorophyceae (2.91%) and Desmidiaceae (1.14%).

Benthos : Benthos was dominated by gastropoda (77.90%) followed by bivalves (14.74%) and worms (7.36%). *Viviparus bengalensis and Melanoides tuberculatus* were the dominant forms.

Fishery : Fishery in the upper stretch comprised of *C. catla, C. carpio, C. mrigala, P. sarana, L. calbasu, Mystus* sp., *Rita* sp., *Ompok* sp., *P. jerdoni, L. fimbriatus, W. attu, M. armatus* etc. and lower stretch exhibited catla, rohu, mrigal, calbasu, *Mystus, B. bagarius, P. pangasius, S. childernii, E. suratensis, C. reba, P. kolus, P. sarana, P. ticto, L. boga, L. gonius, S. nukta, R. pavimentata, Wallago, M. aor, Channa* sp., *N. notopterus, O. kotio, G. giuris, M. armatus, M. rosenbergii,* and *X. cancillus etc.* Main craft was plank-built boat.

Indian Major carps form an important fishery all along Krishna River from Srisailam up to the point of tidal influence. Endemic *carps P. kolus, L. boga, L. gonius, S. nukta, C. reba, L. fimbriatus* and *P. sarana* are also important. Important catfishes are *A. seenghala, M. aor, P. pangasius, S. childreni, B. bagarius, W. attu.* Prawns are prevalent below Amaravathy.

Pollution status of river Krishna

A number of molasses and sugar factories are located mostly on the catchment of the tributaries as well as main Krishna in the upper stretch. The factory effluents find their way into the rivers through first monsoon flood. During rest of the period, they keep these effluents in small lagoons nearby the factory sites. So, heavy fish mortality is a regular phenomenon in Krishna upper stream from Wai up to Jamakhandi particularly during onset of monsoons every year. In post-monsoon, the biological oxygen demand (BOD) level in the entire stretch was low barring downstream where it ranged from 0.4 to 1.6 mg/l (Penumudi, 0.2 mg/l). Chemical oxygen demand (COD, mg/l) was comparatively higher at Haripur (48), Jamakhandi (40), Shaktinagar (40) and Amaravathy (40) due to local pollution and increased order of anthropogenic activities.

Toxic heavy metals were not detected in water and were in low concentration in the sediments. In general, the concentration of heavy metals in fish tissues did not exceed the limit as furnished by FAO.

PROJECT : RI/B/2

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

Sub-project : Evaluation of ecology and fish community structure of river Sutlej.

Personnel : *Scientific :*
D.N. Mishra, UshaMoza
Technical :
C. Lakra, Kuldeep Singh

Duration : June 1999-March 2002

Location : Karnal

Survey of Sutlej in lower most stretch within India (from Harike to Hussaniwallah) and at Habibke in Ferozpur district was conducted.

Characterisation of effluent load : The physico-chemical characterisation within 3 main channels entering Sutlej showed that the water was slightly acidic in nature, pH (6.83 to 6.95). Dissolved oxygen within all channels was critical ranging from 2.0 to 4.0 mg/l. Hardness of water ranged between 295.8 to 497.5 mg/l with high specific conductance ranging from 882.7 to 1,440 µmhos/cm.

The soil characteristics of 3 Nallas showed that channel bed of Budda Nalla entering Sutlej at Ludhiana has acidic pH 5.15 with highest specific conductance of 916.7 µmhos/cm.

The characterisation of effluent load within channels this year showed more deteriorating condition than previous year wherein all Nallas were almost anerobic having 2.0-4.0 mg/l of oxygen.

Water and soil quality

Water : The physical characteristics of water within Sutlej showed that river at Slapper have temperature ranging between 10-23° C with high D.O. (10.4 ppm), high pH 8.55 and with total alkalinity (103.3 ppm) and transparency of 38.7 cm. The physical characteristics of the river

start deteriorating with induction of effluent loaded channels. River water showed recovery at AOF Ludhiana having high transparency (60.3 cm), D.O. (8.5 ppm) and low conductance (205.3 µmhos/cm). Ecology of river deteriorates from OF Ludhiana onwards due to induction of pollution load via Budda Nalla and Chitti Bein at Ludhiana and Gidderpindi respectively. The effect persists right upto the tail end of Sutlej.

Primary productivity : The gross primary production values at non-discharge points ranged from 93.75 to 114.58 mg C/m^2/hr.

Sediment quality : Sutlej sediment is alkaline in nature throughout its course from Slapper (pH 7.9) to Gidderpindi (pH 7.33) except at tail end having pH 6.94.

Chemical nature of soil in this region categorised Sutlej into 2 zones one above Budda Nalla (OF Ludhiana) and other after OF Ludhiana. Like water characteristics upper segment had low range of specific conductance, (178-191.3 µmhos/cm), organic carbon 0.345-0.375%, available nitrogen (10.3-15.43 mg/100 g) and available phosphorus (0.43-0.61 mg/100 g).

Soil texure of river Beas shows it to be alkaline having pH 7.4, containing comparatively less sand (64.4%), more silt (23.4%) and clay (12.3%) thereby having more water retention capacity than Sutlej. Nutrient characteristics within Beas show it substrata less eutrophic than Sutlej.

Biotic communities

Plankton : The standing crop of plankton within Sutlej was maximum at non-effluent points (AOF) stations ranging from 183-200 u/l. At effluent loaded sites (OF stations), plankton crop was observed only at Roopnagar having a density of 83 u/l. Standing crop of plankton in river Beas (tail end) was, 284 u/l showing the river to be comparatively clean.

Periphyton : The total periphyton density like plankton was low at Slapper, (184 u/cm^2), high at all non-effluent loaded stations ranging between 234 to 350 u/cm^2. Density decreased sharply at all OF stations ranging between 17 to 83 u/cm^2, under the impact of pollutants which persists up to BOD sites having low density range of 116-199 u/cm^2.

Macrobenthos : Macrobenthic density within Sutlej showed gradual increase from Slapper (133 u/m^2) onwards, the density was comparatively low (477-455 u/m^2) between Roopnagar-Ludhiana stretch except at OF sites. Thereafter a high density range of 8308-942 u/m^2 was observed at all sites between Gidderpindi and Harike.

Macrophytes : Macrophytes within Sutlej were present all along.

Comparative data of two years showed that availability of water in Sutlej within plains this year was low compared to last year (15.76 to 43.85%). The depletion of water resource this year have caused degraded conditions as observed by abiotic and biotic characteristics especially at effluent loaded sites.

Fish catch statistics : The average fish catch per month ranged between a minimum of 3.12 t at Ludhiana to 12.95 t at Harike. The change in estimated catch from last year showed a drastic decrease at Sultanpur from 12.89 (2000-01) to 5.37 t (2001-02) due to segregation of catch of river Beas. Substantial increase in catch was observed at Roopnagar from 2.5 t (2000-01) to 5.01 (2001-02) due to more effort and also due to adverse environment in and around Roopnagar.

Catch composition : The overall fishery of Sutlej as shown was dominated by major carps, 12.01 t (32.73%); followed by miscellaneous group 10.24 t (28.73%); common carp, 5.76 t (15.71%); minor carps 5.38 t (14.66%) and catfishes 3.07 t (8.37%).

Sectorial variation in fish composition along Sutlej

Station	Total landing (t)	Percentage composition (%) IMC (%)	Minor carps (%)	Common carp (%)	Catfish (%)	Mahseer (%)	Misc. (%)
Roopnagar	5.01	25.94	51.10	11.38	5.98	1.20	4.40
Ludhiana	3.12	28.84	7.69	2.24	10.58	-	50.65
Sultanpur	5.37	36.32	6.52	8.38	10.80	-	37.98
Harike	12.95	37.92	6.33	18.07	7.26	-	30.42
Ferozpur	10.24	28.82	13.77	22.75	8.98	-	25.68

PROJECT : RI/B/3

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

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Technical :
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Duration : April 2001-March 2006

Location : Allahabad

Sediment quality

Among the physical parameters sand was maximum at Haridwar (99.0%) and showed a gradual decline reaching minimum at Farakka (65.0%). Silt which was 0.5% only at Haridwar gradually increased to 33.0% at Farakka. Sediment was alkaline in reaction throughout the stretch with pH ranging from 7.35 to 7.85 and conductance between 99.0 and 254.0 µmhos. Organic carbon was poor throughout the stretch (0.048 to 0.29%) but available nutrients *viz.* nitrogen and phosphorus were moderate with values ranging between 19.28 and 32.20 mg/100 g and 1.28 and 3.69 mg/100 g respectively.

Water quality

Among the physical parameters water temperature ranged from 10.0 to 20.5°C and transparency from 32.0 to 120.0 cm. Dissolved oxygen was fairly high in the entire stretch (7.1 to 10.8 mg/l) with complete absence of carbon dioxide. Water was alkaline in reaction with pH ranging from 8.0 to 8.4 and the alkaline pH was always associated with the presence of carbonate throughout the stretch (1.0 to 10.0 mg/l). Bicarbonate, conductance, dissolved solids, calcium, hardness and chloride were within the range of 50.0 to 216.7 mg/l, 131.0 to 465.3 µmhos, 65.0 to 232.0 mg/l, 16.0 to 42.0 mg/l, 48.0 to 219.5 mg/l and 4.0 to 35.0 mg/l respectively. All the parameters were minimum at Deoprayag and showed a gradual increase downwards reaching maximum at Kanpur after which they again showed a declining trend up to Farakka.

Primary productivity

The rate of carbon synthesis by producers in river Ganga between Deoprayag and Farakka showed gross and net production rates ranged from 244.2 to 992.0 mgC/m^2/day, and 168.7 to 700.0 mgC/m^2/day respectively between the entire stretch. Production rate was lower in the upper stretch upto Haridwar after which it showed a gradual increase reaching maximum at Kanpur.

Pollutional status

Toxicant accumulation : The levels of Cu, Cr, Cd, Pb and Zn in the sediment phase were comparatively low in the upper stretch (3.23 µg/g, 8.98 µg/g, 3.37 µg/g and 40.0 µg/g respectively) and showed sharp increase in the down stream (23.41 µg/g, 25.3 µg/g, 5.56 µg/g, 8.75 µg/g and 72.83 µg/g respectively.

The accumulations of BHC- ranged from 3.08 $x10^{-5}$ to 8.2 x 10^{-3} mg/l and DDE from 1.6 x 10^{-5} to 1.8 x 10^{-3} mg/l in the entire stretch.

Plankton : Plankton population ranged between 16 u/l (Deoprayag) and 25 u/l (Rishikesh) and their species diversity (Ĥ) indices in rhithron zone revealed oligotrophic and oligosaprobic condition of the main river Ganga. Species diversity (Ĥ) indices ranged mostly between 2.2 and 3.31 bits/unit.

Periphyton : Species diversity of periphytic community indicated that the values of H varied between 1.25 bits/unit (Deoprayag) and 3.44 bits/unit (Farukkabad) which shows mild pollution in certain areas.

Benthos : The benthic population was moderate at upper stretch of the river from Rishikesh to Kanpur, which ranged from 44 u/m^2 Kalindri confluence to 528 u/m^2 Kanpur. The benthic population was also moderate at lower stretch which ranged from 88 u/m^2 Manikchak ghat to 1452 u/m^2 Gandhighat, Patna. The molluscan population was dominated in the whole stretch 54.1% followed by annelida 39.4% and insecta 65%.

Fish biology

Studies pertaining to biological aspects of the two most commercially important giant river catfish *Aorichthys seenghala* (Sykes) and *Aorichthys aor* (Ham.) and Indian major carps viz. *L. rohita* and *C. mrigala* is in progress.

Biochemical studies

The mean serum protein concentration of *Rita rita* and *Labeo rohita* were found to be 1.7 g/dL and 2.2 g/dL, respectively. The albumin content of serum in *R. rita* were found to be 0.9 g/dL. The albumin/globulin ratio is found to be 1.12 in *R. rita*.

SDS-Page profile of the serum proteins of *R. rita* and *L. rohita* and muscle proteins of *R. rita* have been analyzed.

Estimation of fish catch

Fish landings at Allahabad were estimated at 69.65 t. In total major carps contributed-10.45%, selected catfishes- 15.88%, hilsa- 1.78% and others 71.89%. Among major carps *C. catla* and *L. calbasu* were the dominant species with almost equal contribution (3.02-3.10%). *M. aor* (10.12%) contributed the maximum among large size catfishes. Others group was mainly composed of smaller species (45.75%) with low economic returns, followed by *C. garua* (10.97%), *E. vacha* (6.23%) and *R. rita* (4.84%). The details are presented in the following table

Fish landings (t) at Sadiapur, Allahabad

Species	Catch (t)	(%)	Production (kg/km)
C. mrigala	0.98	1.4	4.26
C. catla	2.16	3.1	9.39
L. rohita	2.04	2.9	8.87
L. calbasu	2.10	3.0	9.13
Major carps	**7.28**	**10.4**	**31.65**
M. aor	7.05	10.1	30.65
M. seenghala	2.88	4.1	12.52
W. attu	1.13	1.6	4.91
Selected catfishes	**11.06**	**15.8**	**48.08**
H. ilisha	1.24	1.8	5.39
Miscellaneous	50.07	72.0	217.71
Total	**69.65**		**302.83**

Development of application programme for database management on ecology and fisheries of river Ganga

Before developing application software, studies were made in whole system of riverine ecology. The parameters of ecology was classified broadly in 5 categories i.e. Morphological (6 parameters), Sediment (16 parameters), Water quality (28 parameters), Species diversity indices of biotic communities and fish catch data. The user friendly menu driven software of data entry was developed using Visual Foxpro.

PROJECT : ES/B/1

INVESTIGATIONS ON THE FISHERIES OF HOOGHLY ESTUARINE SYSTEM AND ITS WETLANDS

Sub-projects : **1 Investigations on the fisheries of Hooghly estuarine system**

2 Ecological changes in the estuarine wetland impoundments and its effect on production potential

Personnel : *Scientific :*
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Duration : May 1998-March 2003

Location : Barrackpore and Calcutta

Sub-project 1 : Investigations on the fisheries of Hooghly Estuarine System

Estimation of catch statistics of Hooghly estuarine system and Digha centre

Catch of 44761.3 t of fish and prawn were estimated from the Hooghly estuary, whereas at Digha centre it amounted to 22163.1 t (combined catch being 66924.4 t) during the period from February, 2001 to January,2002. The combined catch showed a decrease of 6451.9 t (8.8%). The prime factor for the marginal increased yield from the Hooghly estuary was moderate increase in winter migratory bag net catch in lower estuary by 3842.1 t (15.8%) as compared to 2000-2001. The lower estuarine zone, like previous years, accounted major share, 97.6% and 96.4% of the total catch including and excluding Digha centre respectively.

Estimation of Winter Migratory Bagnet Fishery (WMBF) in lower estuary

Total estimated catch of WMBF in lower estuary during November,2001 to January,2002 amounted to 28116.9 t accounting 42.0% of total catch of Hooghly estuary with an average CPUE of 47.5 kg. The principal factor for the enhanced fish catch from the WMBF was sharp increase of catches of some species viz. *Harpodon nehereus* by 2111 t (30.2%), *Setipinna* spp. by 1572.7 t (45.2%) and *Pama pama* by 780.5 t (53.8%).

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

An estimated catch of 7750.5 t (17.3% total catch) of Hilsa was netted out from the Hooghly estuarine water while at Digha centre it amounted to 3786.9 t (17.1% total catch of Digha centre) (combined catch : 11537.4 t,17.2% of total catch) during 2001 – January, 2002

Without taking into account Winter migratory bag net catch, Hilsa continued to be the major component of estuarine fishery contributing 47% of the total yield from the Hooghly estuary and 30% of combined catch of Hooghly estuary and Digha centre. The decline in Hilsa catch was also reflected in catch per unit effort (CPUE). Average CPUE of Hilsa gear in the lower marine zone, which contributes nearly 90% of the total Hilsa catch, during monsoon was 201 kg during 2001-2002 as compared to 235 kg during monsoon 2000-2001, a decrease at about 14.5%. Wanton destruction of Hilsa juvenile by indiscriminate exploitation through small meshed nets particularly bag net and seine net in the upper stretch of the Hooghly estuary was estimated as 114.6 t during February 2001 – January 2002.

Water quality

The physico chemical characteristics and primary production in the Hooghly estuary is given in Table. Heavy metals, Cu, Cr, Zn, Cd, Pb, Mn, Fe were estimated in soil and water.

Biotic communities

Plankton

The annual abundance of plankton population varied between 112 – 364 u/l at different sampling sites. Seasonal abundance of plankton indicated relatively higher production during winter (248 u/l) followed by summer (212 u/l) and post-monsoon (193 u/l).

Members of Bacillariophyceae (*Coscinodiscus, Rhizosolenia, Pleurosigma, Navicula, Melosira, Nitzschia, Asterionella, Gyrosigma, Pinnularia*) were the predominant among the phytoplankton assemblage of the estuary throughout the year. *Cyclops* and Nauplei were the predominant zooplankton at all the centres.

Benthos

The benthic abundance in this estuary fluctuated between 56-1004 no/m^2 being the highest during post-monsoon at Nabadwip ant lowest in summer at Moipeeth. The seasonal abundance fluctuated as summer (56-689 no/m^2), Monsoon (19-317 no/m^2), post-monsoon (130-782 no/m^2) and winter (132-726 no/m^2). The qualitative texture of benthic population showed the greater dominance of gastropods (more than 90%) in the total abundance.

Estuarine fin and shell fish seed prospecting

The availability of prawn seed varied between 2,534 and 4,638 nos. per man day whereas fish seed varied between 327 and 508 nos. per man day. Out of the collected prawn seeds, number of *Penaeus monodon* seed ranged between 6 and 612. The general practice of destruction of fish/prawn seed after assorting *P. monodon* has been checked to some extent through mass awareness campaigns of the Institute.

Occupational health hazards

Motivated with regular cash income, about 4 lakh people of Sundarbans irrespective of religion, cast, age and sex have wholeheartedly accepted collection of fish and prawn seed as an important source of income for their livelihood. During collection of seed, the collectors remain in waist-deep water for hours together. Thus, a sizeable section of such collectors have been observed to fall victim to some diseases.

Sub-Project 2 : Ecological changes in the estuarine wetland impoundments and its effect on production potential

Ecology of Estuarine Wetlands

Investigations were continued in the low-saline and high-saline wet-lands at Machhibhanga and Sarberia respectively. Investigations on the ecology of the freshwater sewage-fed wetland at Jhagrashisha and biology of *Pangasius pangasius* from sewage-fed impoundments have been initiated.

Jhagrashisha (Sewage-fed, Freshwater)

Water : The DO of the wetland goes as high as 19.6 mg/l during mid day. The wetland has mean annual value of phosphate of 2.94 mg/l, alkalinity (218.77 mg/l), Nitrate nitrogen (3.4 mg/l), NH_4N (2.36 mg/l), CO_2 (trace to 28.0 mg/l), and pH (7.87).

The pH of wet soil was (7.47). The available N and P ranged from 28.56-44.30 (mg/100g) and 8.02-32.0 (mg/100 g) respectively. The Organic carbon ranged between 1.24 and 2.21%.

Table - Average physico-chemical characteristics of Hooghly estuary for the period April 2001 to March 2002

Centre	Unit	Jharkhali	Bakkhali	Bhaga Batpur	Moipeeth	Harwood point	Dama Khali	Haldia	Hasnabad	Nabadwip
Air Temp	(°C)	27.2	25.1	26.5	26.6	26.9	28.4	26.55	28.25	25.5
Water temp	(°C)	25.6	23.8	24.8	24.9	25.2	27.45	25.95	30.325	24.06
Trans.	(cm)	24.3	21	30.7	33.5	21	15.63	17.12	21	22.16
D.O.	(mg/l)	6.6	6.3	6.89	7	6.8	6.95	7.82	6.62	6.68
pH		8.1	8.09	8.1	8.1	8.1	7.725	7.775	8.03	8.06
Sp.Cond	(m.mhos/cm)	27.2	26.03	22.6	24.03	11.45	15.87	7.925	7.925	0.5
TDS	g/L	17.7	16.9	14.7	15.62	7.43	10.32	5.171	5.156	0.325
T.A.	(mg/l)	106.3	96.3	112.7	116	124.5	123.25	120.5	130.5	118
Free Co_2	(mg/l)	4.3	3.7	4.5	5.05	4.55	4.2	3	5.1	4.46
Chlorinity	(g/L)	14.5	14.4	11.15	10.5	4.86	6.4	3.26	2.525	0.006
Salinity	(g/L)	26.3	25.9	20.16	18.99	8.82	11.59	5.914	4.564	0.0466
NO_3	(mg/l)	0.3	0.16	0.17	0.218	0.2305	0.167	0.1285	0.2165	0.2193
Total N	(mg/l)	0.7	0.47	0.4	0.379	0.422	0.337	0.408	0.514	0.596
PO_4	(mg/l)	0.06	0.06	0.07	0.073	0.119	0.1035	0.1605	0.134	0.116
Sulphate	(mg/l)	247.4	267.8	234.3	224	191.68	216.12	128.1	10.6	18.82
Silicate	(mg/l)	4.6	4.2	6.8	7.4	7.57	7.5	8.2	7.375	10.966
Hardness	(mg/l)	4975	4766.7	4237.5	4187.5	1812.5	2523.7	1475	1525	105.3
Ca	(mg/l)	1331	342.1	284.55	295.7	174.3	208.33	112.94	122.15	33.13
Mg	(mg/l)	994.4	938.9	846.3	842.7	330.32	495.2	286.3	292.705	5.42
Gross p.p.	($mgC/m^3/hr$)	66.7	61.12	77.1	85.95	64.58	49.99	1004.21	69.825	86.1
Net p.p.	-do-	37.5	38.9	35.43	61.975	35.43	31.26	61.61	37.5	36.1
Resp	-do-	38.8	26.7	50	28.75	35	50	51.25	38.75	48.3

Plankton : The zooplankton had an overall dominance except in the months of November when phytoplankton had a share of 80.58%. Amongst the zooplankters rotifers and copepods were the principal contributors.

Macrozoobenthos : Principally constituted of gastropods (Annual Av. 1074 nos./m^2). Annelids were found only in the winter and post winter months.

Biology of *Pangasius pangasius*

Investigations on the biology of *Pangas* have been initiated. Data on length weight, RLG, gut contents etc.have been collected. The RLG is found to be below1.0 and in these water bodies *pangas* has been found to consume fishes and prawns.

Effect of monoculture of the species on growth was found to be highly significant at 1% level ($P< 0.01$) when fed with Tubifex and molluscan (*Achatina*) meat.

Machhibhanga (Low-saline *bheri* receiving diluted sewage mixed water)

Water : The DO of the wetland ranged between 2.88 and 14.21 mg/l. The salinity of water ranged from 0-.36 ppt to 7.99 ppt. The mean PP was observed to be 226.82 mgC/m^3/hr.

Plankton : The plankton population was found to be almost equally shared by zooplankton and phytoplankton.

Macrozoobenthos : Principally constituted of gastropods of which *Thiara* spp. were the major forms. Tanaids, amphipods, mysids etc. were the other forms encountered.

Sarberia (High saline)

Water : The DO of water ranged between 3.33 to 14.21 mg/l. The salinity of water ranged from 3.842 ppt to 29.350 ppt. Total alkalinity had a mean value of 206.08 mg/l. The mean PP was found to be 158.36 mgC/m^3/hr. The pH of wet soil ranged from 7.5 to 8.0.

Plankton : The plankton population was found to be dominated by phytoplankters contributing 68.05% whereas zooplankters contributed 31.95%.

Macrozoobenthos : Mainly constituted of Tanaids (3299 nos./m) followed by amphipods (1334 nos./m) mysids (960 nos./m) and gastropods(639 nos./m)

Assessment of Production

Estimated total annual yield from two selected wetlands at low saline zone were observed to be 555.128 kg/ha. (*P.monodon* : 224,432 kg/ha) and 633.084 kg/ha (*P.monodon* : 224.432 kg/ha). The average yield at low saline zone was 584.551 kg/ha (*P.monodon* : 247.612 kg/ha). While estimated total annual yield from two selected wet land at high saline zone were found to be 374.936 kg/ha (*P.monodon* : 69,086 kg/ha) and 451.485 kg/ha/yr (*P.monodon* : 159-01 kg/ha). The average production at high saline zone was 399.055 kg/ha (*P.monodon* :97-421 kg/ha).

Thus the average total yield and av. *P. monodon* yield at low saline zone were46.5% and 154.0% higher in comparison to high saline zone.

The production in the freshwater sewage fed wetland under investigation at Jhagrashisa was observed to be 5,000 kg/ha/yr. and carps contributed 70% of the total production.

Socio-economic studies of wetlands

Investigations conducted in a 55 ha privately owned sewage-fed wetland revealed that composite fish culture is adopted for producing fish employing multiple stocking – harvesting. system. The production ranges from 4,000-5000 kg/ha/yr. Studies also revealed that most of the fishes were employed as permanent labourers (salaried employees of the Lessee) of the farm owners who provided all the inputs and managed the fisheries.

On an average the per ha cost of production was Rs 50000/- and the gross returns were Rs 149000/- leaving a net margin of 198%, i.e. BC ratio was 2.98.

PROJECT : ES/B/2

ECO-STATUS OF SELECTED WEST COAST ESTUARIES OF INDIA

Sub-Projects : (a) **Eco-status of Mandovi-Zuari estuarine complex and other estuaries of west coast.**

(b) **Confirmation of the endemic population of *Tenualosa ilisha* in Ukai reservoir, Dist. Surat, Gujarat**

Personnel : *Scientific* :
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Technical :
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Duration : Apri11998-March 2003

Location : Vadodara (Gujarat)

Sub-Project (a) : Eco-status of Mandovi-Zuari estuarine complex and other estuaries of west coast

Water Quality

In the Tapti estuarine system the pH ranged from 6.98 to 7.16 for the system as a whole. Dissolved oxygen content (5.0 to 8.6 mg/l) was congenial in fresh water expanse while Chowpati

site representing the estuarine extent had drastically low D.O level (av. 0.75 mg/l) and this seems to be a potential "Hot Spot". Free CO_2 was also detected high at this site (4.0 to 10.0 mg/l). Based on the average salinity level, Chowpati and Hazira are categorized as meso and poly–haline sites respectively. The total alkalinity content (141.0 to 177.0 mg/l) reflected productive nature of the system.

The nutrient's status of Tapti estuarine system was explored in terms of availability of nutrients, viz. phosphate , nitrate and silicate . Phosphate content varied from 0.035 to 0.055 mg/l while the nitrate content was by and large evenly distributed (0.043 to 0.063 mg/l) and the nutrient regime of these two nutrient's indicated poor status.

Sediment Quality

The soil pH varied from 6.91 to 7.20. The conductance at lower estuarine sites were higher (av. 3.53 to 6.70 m S/m) as compared to upper sites (0.325 to 0.615 m S/ m). The C:N ratio denoted a long range of variation (1.28 to 17.36). The available phosphorus was higher at lower estuarine sites (av. 8.0 to 12.7 m/100 g) in comparison to upper expanse (4.8 to 5.1 mg/100g).

Biotic communities

Plankton : The average planktonic abundance of Tapti estuarine system as a whole varied from 253 (Chowpati) to 4071 nos./l (Unkhad). Phytoplankton was the mainstay of this abundance which varied from 74.70 to 95.70%. Bacillariophyceae was dominant. The zooplankton comprised mainly of Copepoda and Rotifera.

Macro-benthos : The average macro-benthic abundance of Tapti estuarine system as a single entity drifted between 88 (Chowpati) to 4643 nos/m (Jahangirpura). Mollusca (68.07 to 90.91%) was the most prevalent macro-faunal element at the fresh water zone while Oligochaeta/polychaeta emerged predominant at Hazira and Jahangirpura sites.

Organic production studies

Higher gross production (75.53 to 156.25 mg $C/m^3./hr$) was recorded at freshwater and was low at estuarine sites where it varied from 7.82 to 62.5 mg $C/m^3/hr$.

Sub Project (b) : Confirmation of the endemic population of *Tenualosa ilisha* in Ukai reservoir, Dist. Surat, Gujarat

Fish landings at Shelud landing centre revealed the occurrence of young ones of *T.ilisha* varying from 60.0 to 100.0 mm in length and 1.70 to 9.54 g in weight. The specimen encountered at Navapura and Sonegarh indicated availability of specimen from 113.0 to 275.0 mm and 9.74 to 227.32 g in weight.This corroborated the last year's inference that an endemic population of this fish species thrived in Ukai reservoir.

PROJECT : ES/B/3

STUDIES ON HILSA FISHERIES IN THE STRETCH BETWEEN FARAKKA AND SAGAR ISLAND

Personnel : *Scientific :*
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Duration : April, 2000-March, 2003

Location : Malda

Catch studies of hilsa

General assessment of fish landing at the Farakka region : The total fish landings from the Farakka region, above and below the Farakka barrage, has been estimated to the tune of 173.85 t. Taltala contributed 47.51% to the total fish landing of the region followed by Beniagram (27.49%) and Feeder Canal (25.00%).

Miscellaneous varieties of fishes formed the bulk (34.52%) of the total fish landing of the region followed by catfishes (29.63%), Indian Major Carps (17.05%), Prawns (6.24%), Featherbacks (5.35%), Hilsa, *(Tenualosa ilisha)* (3.91%) and Murrels (3.28%).

Fish landing at the Farakka region

Feeder Canal Fish Landing Centre

This centre contributed 25.0% to the total fish landing of the Farakka region during the period under report. Miscellaneous varieties of fishes formed the bulk of the catch of the centre (35.05%) followed by catfishes (31.11%), Indian Major Carps (19.59%), Hilsa (5.77%), Prawns (5.67%) and Featherbacks (2.8%).

Beniagram Fish Landing Centre

The centre contributed (27.49%) to the total fish landing of the Farakka region. Catfishes formed the bulk of the catch, contributing about 35.22% to the total catch of this Centres followed by miscellaneous catfishes (28.55%), Indian Major Carps (16.45%), Prawns (7.74%) and Featherbacks (3.06%). Hilsa contributed only 8.99%.

Taltala Fish Landing Centre

The centre contributed 47.51% to the total fish landing of the region. Major catch of the centre was dominated by the miscellaneous fishes (37.7%) followed by catfishes (25.63%),

Indian Major Carps (16.07%), Murrels (6.90%), Featherbacks (6.90%) and Prawns (5.67%). Hilsa catch was not recorded during the year.

Hilsa Fishery at the Farakka Region

The total catch of hilsa, from the Ganga River System at the Farakka region during the period under report has been estimated to the tune of 6.80 t forming 3.91% of the total fish landing from the region. Beniagram Fish Landing Centre contributed 62.87% to the total catch of hilsa from the region followed by Feeder Canal (37.13%).

Manikchak Fish Landing Centre

Fish landing from the centre during the period under report has been estimated to be of 46.61 t. Miscellaneous fishes formed the bulk (73.02%) of the total fish landing. The other major contributions were from Catfishes (21.83%), Indian Major Carps (3.39%), Featherbacks (0.89%), Murrels (0.77%). Hilsa, contributed only 0.1%.

Rajnagar Fish Landing Centre

The total fish landing from the Centre during the period under report has been estimated to the tune of 49.36 t. Miscellaneous varieties of fishes formed the bulk (68.16%) of the total fish landing followed by Catfishes (27.69%), Indian Major Carps (2.79%), Featherbacks (1.10%), and Murrels (0.21%). Hilsa contributed 0.04% of the total catch. The total catch of hilsa during the period has been estimated to be 18 kg solely represented by adults.

Behrampur Fish Landing Centre

The total estimated landing was recorded to the tune of 40.15 t. Miscellaneous fishes dominated the catch (38.93%) followed by Catfishes (22.8%), Prawn (14.48%), Carps (10.93%), Hilsa (9.17%), Featherbacks (3.4%) and Murrels (0.27%).

The total estimated catch of hilsa during the period was 3681.28 kg contributing 9.17% of total catch which was mostly represented by adults. There were some juveniles at this centre in the size range of 101-200 mm.

Nabadweep Fish Landing Centre

The total landing was 41.48 t. At this centre also miscellaneous fishes formed the bulk (36.49%) of the total catch which was followed by Catfishes (26.25%), Prawn (15.08%), Carps (8.82%), Featherbacks (6.85%), Hilsa, *Tenualosa ilisha* contributed only 5.83% and Murrels (0.68%) to the total catch. The total catch of hilsa has been estimated to be of 2418.95 kg where major portion was shared by adult (2160.2 kg) and very little was supported by juveniles (258.75 kg).

Physico-chemical characteristics of water of River Ganga during 2001-2002 (around Farakka)

Parameters	MANICKCHAK GHAT			TALTALA GHAT			BENIAGRAM		
	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter
Air tem. °C	29.4	29.0	23.0	30.6	28.5	24.5	30.0	28.0	24.0
Water tem. °C	28.2	27.2	13.0	29.0	28.0	14.5	28.5	27.5	15.0
Transparancy (cm)	26.0	14.0	17.0	25.0	13.0	22.0	28.0	12.0	26.0
Free CO_2 (mg/l)	NIL	2.0	NIL	NIL	2.0	NIL	NIL	2.0	NIL
Carbonate (mg/l)	2.0	NIL	2.0	2.0	NIL	3.0	3.0	NIL	2.0
Bicarbonate (mg/l)	85.0	89.0	90.0	98.0	103.0	97.0	102.0	107.0	103.0
D.O. (mg/l)	8.0	7.6	9.8	8.8	8.0	10.2	8.96	8.6	10.2
Hardness (mg/l)	94.0	90.0	96.0	97.0	93.0	98.0	98.0	92.0	96.0
Chloride (mg/l)	28.0	32.0	23.0	24.0	23.0	25.0	27.0	25.0	26.0

Physico-chemical characteristics of water of river Ganga during 2001-2002 (Lower Zone)

Parameters	NABABGAJN			DIAMOND HARBOUR		
	SUMMER	MONSOON	WINTER	SUMMER	MONSOON	WINTER
Air tem. °C	32.1	31.5	26.0	32.6	31.0	29.0
Water tem. °C	31.2	30.8	24.2	31.3	31.0	24.2
Transparancy (cm)	15.0	10.0	7.0	-	-	18.5
Free CO_2 (mg/l)	NIL	NIL	NIL	NIL	NIL	NIL
Carbonate (mg/l)	3.0	2.0	6.0	6.0	5.0	7.0
Bicarbonate (mg/l)	140.0	84.0	158.0	132.0	75.0	159.0
D.O. (mg/l)	8.0	9.0	6.4	8.4	9.2	6.8
Chloride (mg/l)	25.0	17.0	20.0	69.0	52.0	67.5
pH	7.4	7.0	8.0	7.2	7.0	7.0
Calcium (mg/l)	29.4	25.6	64.0	51.2	64.12	56.12
Magnesium (mg/l)	6.8	8.6	4.7	5.84	249.5	3.26
Silicate (mg/l)	9.4	10.1	9.0	12.0	12.4	12.2
Nitrate (mg/l)	0.201	0.308	0.128	0.211	0.296	0.112
Phosphate (mg/l)	0.09	0.10	0.082	0.078	0.084	0.072

Histological Studies of the Kidney of hilsa

Studies on the histology of the kidney of *T. ilisha* collected from Farakka, Nababganj, Diamond Harbour and lower estuary (Frazerganj) have been initiated.

PROJECT : RS/A/1

ECOLOGY AND FISHERIES OF FRESHWATER RESERVOIRS

Sub Project :
- **1 Ecology and fisheries management of Hemavathi reservoir (Karnataka)**
- **2 (a) Ecology and fisheries management in a small reservoir in Tamil Nadu**
- **2 (b) Impact of seasonal phosphorus influx on phytoplankton community and growth in a productive reservoir**
- **3 Ecological investigations in selected reservoirs in Madhya Pradesh**
- **4 Ecological investigations in selected reservoirs in Rajasthan**
- **5 Monitoring of fish catch and effort in selected reservoirs of Andhra Pradesh**

Personnel : *Scientific :*
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Duration : Sub-project 1 August, 2000-March 2004
Sub-project 2 a April 2000-March 2002
Sub-project 2 b April 2001-March 2002
Sub-project 3 April 2001-March 2002
Sub-project 4 April 1998-March 2002
Sub-project 5 April 2001-March 2002

Location : Bangalore, Coimbatore, Hosangabad, Karnal, Eluru

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

Sediment and water quality

Soil was sandy clay in nature comprising 70-75% sand. Soil reaction was near neutral (pH 6.80) to moderately acidic (pH 5.52); lentic left (Yagachi side) exhibited more acidic character. Organic carbon content was fairly rich (1.23 – 1.65%, mean : 1.47%). Available – P

was a limiting factor due to acidic bottom sediment like previous year. Presence of free $CaCO_3$ was very meagre (0.54 – 0.88%) because of moderate acidic nature of basin soil.

Water temperature fluctuated sinusoidally from 22.0 to 28.5°C. Euphotic zone extended between 2.25 and 6.5 m (mean : 5.0 m). Secchi depth was minimum in June (0.9 – 1.2 m).

Surface water was near neutral to moderately alkaline in reaction (pH 7.05 – 8.12, mean : 7.63). Specific conductance (µS/cm) did not vary widely (78-129).

Amongst dissolved gases, dissolved oxygen (DO, mg/l) was moderate (6.5 – 7.8, mean : 7.4) in surface waters. DO dropped with depth. Contributed solely by bicarbonate, total alkalinity (mg/l) registered low values (24-29) in monsoons.

Free CO_2 was present year round both at surface as well as in column waters (1-3 mg/l). Like other Cauvery basin reservoirs, Hemavathi is also a soft-water one with total hardness ranging between 12 and 36 mg/l (mean : 27 mg/l). Barring monsoon (TH : 12-20 mg/l), seasonal variations of total hardness at surface and in column waters was not wide.

The clinograde distribution of oxygen was well marked specially during April, September, October 2001 and March 2002 with anoxic bottom in summer months.

Nutrient status of water

The catchment of Hemavathi is covered with acidic to moderately acidic red soil limiting availability of of phosphorus from soil to water phase. Silicate, the basic constituent of diatoms showed low values with an overall range of 0.20-4.0 mg/l (mean : 2.25 mg/l).

Primary productivity in Hemavathi

The hourly gross production (mgC/m^2) exhibited wide fluctuations between 178.5 and 292.5. The daily integral production varied from 1428 to 2340 mgC/m^2 with an annual mean of 1741 $mgC/m^2/d$ signifying that the reservoir is moderately productive.

The hourly net production (NPP, mgC/m^2) also varied widely (105-222.5) and was distributed over a much narrower depth than gross production. On an average, CR ranged between 64 and 113. Gross production to community respiration ratio (P : R) exhibited wide fluctuations (2.0-4.2) on an average basis indicating that the reservoir is in the medium productive category.

Biotic communities

Plankton : Phytoplankton (84.14%) dominated over zooplankton (15.86%). Among phytoplankton Myxophyceae (39.37%), Chlorophyceae (34.50%), Bacillariophyceae (6.51%), Dinophyceae (92.68%) and Desmidiaceae (1.08%) were encountered. Zooplankton was represented by Copepoda (5.34%), Nauplii (4.13%), Cladocera (3.52%) and Rotifera (2.87%).

Periphyton : Periphytic population remained dominated by Bacillariophyceae diatoms (87.07%) followed by Chlorophyceae (11.17%), Myxophyceae (1.58%) and Desmidiaceae (0.18%).

Benthos : Gastropoda (71.19%) dominated over other forms like chironomids (14.95%), worms (12.87%) and nymphs (0.99%). *Viviparus bengalensis* and *Lymnaea accuminata* were the main forms available throughout the year.

Fish and fishery

Biology and fishery of the catfish, *Mystus cavasius*

Three species of the genus *Mystus* occur in Hemavathi reservoir *viz. M. cavasius, M. malabaricus* and *M. punctatus. M. cavasius* is the most abundant in the commercial fishery. *M. cavasius* is intermediate in size whereas *M. punctatus* is the largest and *M. malabaricus* the smallest. *M. cavasius* contributed 13.4% to the commercial fishery. Food and feeding habits, sex ratio and maturity cycle of *Mystus cavasius* was studied.

Though the endemic species *L. calbasu, C. reba* and *P. sarana* breed in the reservoir, their contribution to the commercial fishery is negligible, probably due to their feeble recruitment. The reservoir harbours a wide variety of fish (over 30 species). The commercial fishery is supported mainly by major carps (rohu predominant, catla and mrigal very rare), common carp, medium carps (mainly reba and sarana), catfishes (mainly *M. cavasius, O. bimaculatus* and *H. fossilis*) and others (murrels, notopterids, mastacembelids). The only major piscivore in W. attu, but its abundance is very low.

Catch and effort

The estimated total landings for the year 2001-02 was around 106 t. The fish species composition was dominated by the common carp which formed 50.1% of the total catch. The next in importance was rohu which contributed 23.1%. The contribution of other major carps like catla, mrigal and calbasu was negligible. Among the catfish, *M. cavasius* contributed 13.4% and was closely followed by *O. bimaculatus* 8.6%. The rest of the landings (4.8%) included among others, a number of species like catla, mrigal, reba, sarana, calbasu, *H. fossilis, M. armatus.* The estimated fish yield was a low of 19.3 kg/ha/yr. The mean annual CPUE was 3.8 kg/unit. The fishing effort (coracle-days) ranged from a low of 1500 (July-August, January-February) to a high of 3750 (May).

Sub Project 2 (a) : Ecology and fisheries management in a small reservoir in Tamil Nadu

Pen culture system has been identified as one of the reliable means for solving the problem of raising healthy fingerlings of desired size. Hence pen culture experiment has been taken up in Oduthurai reservoir of Tamil Nadu during this year. Two sets of three pens each (a total of 6 pens) with an area of 200 m^2 per pen were erected. The pens were fertilised with cowdung for accelerating plankton production. The pens were stocked with the seeds of catla, rohu, mrigal and common carp.

In order to controll the luxuriant and the growth of aquatic plants in the pens, 100 grass carp seed (50 mm per 4.5 g) were also added to each pen. Supplementary feed with a mixture of groundnut cake, rice bran and soya nuggets was given twice a day *ad libitum* in the form of wet balls kept in plastic trays hung in the four corner of the pens.s In a few days, it was observed that grass carps were consuming major portion of the supplementary feed, leaving very little to other carps. To over come this problem, changes were made in the feeding schedule. The aquatic weed collected from open reservoir was spread on a floating bamboo frame kept inside each pen to serve as feed for grass carp. The supplementary feed was given 2-3 hours later so that the gorged grass carp may not compete with other carps for supplementary feed.

Grass carp registered the highest growth and reached the target size of 100 mm in 30 days. Catla attained this size within 40 days of stocking. The growth rates were less in the other three species. While rohu and mrigal took about 2 ½ months for reaching this size, common carp measured from 50 to 90 mm while concluding the experiment on 4th April, 2002. The survival percentage was the highest (94.7%) in grass carp, followed by rohu (92.2%), common carp (67.8%), catla (67.3%) and mrigal (66.0%). The survival percentage can be further improved by stocking healthy fry for rearing operation.

Sub Project 2 (b) : Impact of seasonal phosphorus influx on phytoplankton community and growth in a productive reservoir

A small reservoir (Sulur tank : 33.2 ha) at the bank of river Noyyal was selected to study the impact of phosphorus concentration on the growth and species diversity of phytoplankton prevalent in that water body.

Phosphorus : During the month of July, phosphorus concentration registered an average of 0.125 mg/l, which drastically increased to an average of 0.590 mg/l during August and further increased to 1.060 mg/l during September. The increase in phosphorus concentration may be due to the reduction in the water level, from an average depth of 2 m in July to 0.4 m in September. This higher concentration almost remained same in the following months, by recording 1.166 mg/l, 1.106 mg/l and 1.252 mg/l in October, November and December respectively. During the period, the monsoon rain started and flushed the sewage and municipal wastewater into the reservoir.

Phytoplankton : a considerable change in the number and species diversity of plankton took place in this reservoir. During the month of July and August, a wide spectrum of plankton species belonging to the family of Chlorophyceae and Bacillariophyceae were observed. During August, when the P concentration increased to 0.590 mg/l from 0.125 mg/l (July), *Microcystis* sp. and *Closterium* sp. appeared in the water sample, which indicated the gradual pollution of the water. In the successive months (September, October), species belonging to Chlorophyceae and Bacillariophyceae reduced drastically. However, *Cosmarium* sp. (Desmidiaceae) bloomed abundantly, and their count ranged from 42460 to 83220 nos/l. Myxophyceae also appeared during this period with representatives of *Microcystis* sp., *Polycystis* sp. and *Anabaena* sp. Increased nutrient input from point (Noyyal river) and non-point (Municipal waste water) sources led to the formation of these noxious bloom and depletion of dissolved oxygen in bottom waters (1.27 mg/l in December).

Sub Project 3 : Ecological investigations in selected reservoirs in Madhya Pradesh

Ecological investigations in Halali reservoir (Dist. Raisen) in Madhya Pradesh were carried out during 2002-02, the studies with regard to reservoir morphometry, soil and water quality, primary production, biotic communities, fish yield, catch structure, fishing effort and fish seed stocking were undertaken.

Fishery

Annual fish yield of Halali varied from 73.5 t (15 kg/ha) to 350.7 t (73 kg/ha) during 1990-91 to 2000-01.

Indigenous fishes have a strong foothold in this reservoir. Local minor (36.3%) and Local major (30.9%) were predominant. Major carps contributed 17.3% and the minnows accounted for 15.5% only.

Despite regular stocking of the reservoir (213 nos/ha/y) with major carps, there was no reflection of its fishery in the fish landings. The stock of major carps could not be built up. The retrieval in relation to stocking of major carps was very poor being 2% only.

The catch per unit of effort (CPUE) worked out to be 17.4kg.

Biotic communities

Phytoplankton was dominant in Halali. Dipterans and gastropods formed the mainstay of macro-benthos. Sectoral variations in benthic communities were observed in Halali. Prevalence of molluscs was noticed in lentic sector whereas the occurrence of dipterans was more in lotic and intermediate sectors. Diatoms were significant among periphyton.

Macrophytes were abundant with the dominance of *Potamogeton crispus*. The occurrence of *Hydrilla, Vallisneria, Ceratophyllum* and *Najas* was also observed.

Based on primary production studies, TPFY (targeted potential fish yield) was estimated at190 kg/ha/y. The maximum fish yield recorded was 73 kg/ha. This is only 38% of the potential. Thus, the reservoir offers tremendous scope for further development of enhancing its fish yield.

Sub Project 4 : Ecological investigations in selected reservoirs in Rajasthan

Water quality

Water quality in terms of physical and chemical features is presented in Table.

Physico-chemical characteristics of water of selected reservoirs of Rajasthan

Reservoirs/Parameters	Jawai	West Benas	Nandsamand	Gambhiri
Water temp (°C)	23.5 (22.0-26.5)	22.8 (20.5-27.0)	22.5 (20.0-26.5)	22.0 (19.0-25.0)
Transparency (cm)	89.0 (54.0-150.0)	40.0 (23.0-51.0)	61.7 (56.0-68.0)	38.7 (11.0-58.0)
pH	7.9 (7.5-8.5)	7.9 (7.8-8.2)	7.5 (7.0-8.2)	7.1 (6.2-7.7)
D.O. (mg/l)	7.2 (5.3-8.8)	6.4 (5.5-7.6)	6.9 (6.0-7.6)	6.0 (5.6-6.8)
Free CO_2 (mg/l)	0.5 (Nil-1.6)	Nil	Nil	1.3 (Nil-4.0)
Total alkalinnity (mg/l)	98 (90-110)	86 (82-90)	99 (64-120)	90 (60-110)
El. Conductance (µmhos/cm)	296 (248-322)	235 (202-269)	314 (244-362)	292 (261-331)
Hardness (mg/l)	156 (142-176)	120 (114-125)	116 (112-120)	133 (112-172)
Calcium (mg/l)	29.3 (24.6-35.3)	27.0 (22.4-28.8)	28.0 (23.2-32.0)	26.4 (22.0-32.0)
Magnesium (mg/l)	15.7 (6.8-21.0)	9.7 (5.6-12.0)	8.4 (6.2-11.4)	13.3 (5.2-22.1)
DOM (mg/l)	1.7 (1.0-2.2)	2.8 (1.2-3.8)	2.7 (1.6-3.4)	2.3 (1.0-3.2)
Phosphate (mg/l)	0.03 (0.02-0.04)	0.07 (0.03-0.09)	0.07 (0.06-0.10)	0.08 (0.06-0.10)
Silicate (mg/l)	0.5 (0.2-0.9)	0.40 (0.24-0.60)	0.27 (0.16-0.40)	0.26 (0.24-0.30)
Chloride (mg/l)	4.9 (4.2-5.6)	4.0 (2.5-5.0)	4.8 (3.6-6.5)	4.7 (4.2-5.2)

The gross production (mgC/m^2/hr) was in the range 104.2 (West Benas) to 154.6 (Jawai). Winter season invariably exhibited higher rates, which could be due to concentration of ions. The assimilation efficiency was high varying between 54 and 68, exhibiting productive character of the reservoirs.

Biotic Communities

Plankton : The density of plankton was lowest in Gambhiri (2940 u/l) while it was highest in West Benas (4503 u/l). Phytoplankton was dominant varying from 69.8% in Gambhiri to 80.0% in West Benas.

Periphyton : The mean periphytic population ranged between 2061 in West Benas and 2170 u/cm^2 in Gambhiri. Bacillariophyceae formed 67.1% (Jawai) to 74.6% (Gambhiri) of the population.

Macrobenthos : The standing crop (No./m^2) of macrobenthos was rich in West Benas (2684) with peak in winter. Jawai (350 No./m^2) was poorest in benthic organisms due to its rocky strata.

Macrovegetation **:** Submerged, emergent and marginal weeds were observed in Nandsamand only. The absence of macrophytes in Jawai is attributed to rocky strata while their absence in Gambhiri may be due to wide fluctuation in the water level.

During the period April 2001-January 2002, the total catch varied from 32.42 t in Nandsamand to 126.18 t in Jawai. The fish yield (kg/ha) declined in West Benas while it increased in Nandsamand and Gambhiri. Indian major carps constituted 36.3% in Nandsamand and 79.8% in Jawai. The species composition thus revealed that Indian major carps accounted for fairly good proportion in the catches. Obviously it was the impact of stocking which varied from 517 in West Benas to 2200 number per hectare in Jawai.

Productivity status

The potential fish production (kg/ha) on the basis of carbon assimilation has been estimated at 300 kg in West Benas, 400 kg in Nandsamand, 440 kg in Gambhiri and 450 kg in Jawai. All the reservoirs thus fall under the high productive category.

Sub Project 5 : Monitoring of fish catch and effort in selected reservoirs of Andhra Pradesh

During the period August-December 2001, an estimated fish catch of 63.6 t was recorded at Wyra reservoir. The highest catch of 18.5 t was observed during October 2001 whereas December 2001 recorded the lowest catch of 6.9 t. Carps (*L. rohita, P. ticto, Puntius* sp., *C. catla, C. mrigala*) contributed 31.2% to the total catch, followed by gobids 20.6%, catfishes (*M. gulio, O. bimaculatus, A. seenghala, A. aor*) 11.5%, *E. suratensis* 7.4%, *M. guentheri* 6.6% and others (*N. kapirat, R. cotio, C. punctatus, C. striatus*) 22.7%. In dragnet collection from Wyra reservoir, *M. malcolmsonii* dominated in number whereas the species dominant by weight was *C. bacaila.*

PROJECT : RS/A/2

STUDIES ON ECOLOGY AND FISHERIES OF RESERVOIRS OF EASTERN UTTAR PRADESH

Personnel **:** *Scientific* :
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Duration : May 1999-March 2002

Location : Allahabad

Soil and water quality

The percentage of sand was found to be maximum (93.96%) in Mushakhar reservoir whereas it was minimum (60-66%) in Sirsi reservoir with higher value of silt (23%) and clay (17%) . There was high content of organic carbon (1.54 to 1.63%) in Khajuri reservoir whereas its presence was poor (0.065 to 0.072%) in Mushakhar reservoir and moderate in Ahirora (0.45-0.53%, Jirgo (0.42%) and Latifshah (0.45-0.48%). High level of Calcium as calcium carbonate (3%) was found in Latifshah. Available phosphorus and Sp. conductance varied from 4.53 to 7.8 mg/100g and 133.0 to 211.0 µmhos/cm, respectively.

The pH of water was alkaline in reaction (8.0 to 8.52) with high content of D.O. (7.0 to 12.4 mg/l). Total alkalinity (81-106 mg/l), hardness (40-68.0 mg/l), Sp. conductance (84-228 µmhos/cm), Total dissolved solids (42-114 mg/l), Dissolved Organic Matter (0.45-2.62 mg/l) and Calcium (14.9-16.83 mg/l) were comparatively higher at Ahiraura reservoir. The higher value of phosphate was observed at Mushakhar (0.22 mg/l) and Ahiroura (6.13 mg/l) during Autumn.

Primary productivity

Primary productivity indicated higher value (Gross production 36-187.5 mg $C/m^3/hr$) at Ahiroura and Lower Khajuri (Gross Production 46.8 to 125.0 mg $C/m^3/hr$).

Biotic communities

Lower Khajuri

Plankton population ranged between 330 u/l (Jan) to 608 u/l (June). Abundance of species both in phyto and zooplankton indicated this reservoir to be more productive.

Periphytic density recorded at Lower khajuri was 7525 U/cm^2. Higher density was recorded during summer and lowest during monsoon.

Numerical abundance of macrobenthic organisms ranged from 44 n/m^2 to 176 n/m^2 (Av. 121 n/m^2), and comprised *B. bengalensis* 81.8%, *L. marginalis* and dipteran larvae 9.1% each. The benthos was poor during winter months.

Sirsi

Plankton population ranged between 448 u/l (March) and 1400 u/l (Jan.).

The periphytic assemblages recorded at Sirsi was 3780 U/cm^2 which showed maximum peak in winter and minimum during monsoon. Diatom were the dominant groups followed by green, blue-green and Dinophyceae.

Benthic population ranged between 132 n/m^2 (monsoon) and 484 n/m^2 (summer). The molluscs population 86.5% was dominating.

Musakhar

Plankton population ranged between 102 u/l (Jan.) and 240 u/l (March).

Benthic communities ranged between 88 nm^{-2} (autumn) and 440 n/m^2 (summer) mainly dominated by gastropoda followed by diptera and oligochaete.

Latifshah

Plantkon population ranged between 240 u/l (Jan.) and 526 u/l (July). Plankton population and the rich zooplankton diversity indicated this reservoir to possess good fish production potential.

The periphytic assemblages recorded at Latifshah was 5240 U/cm^2 . The highest density of flora was recorded during winter and the minimum density during monsoon month.

Benthic population comprised *B. bengalensis* 50.0%, *L. stagnalis* 23.3%, and *Gyraulus spp.* 11.1% among gastropoda, *L. marginalis* and *L. corianus* 55% amongst pelecypoda and chironomous larvae among diptera. The population ranged between 44 n/m^2 to 308 n/m^2.

Ahiroura

Plankton population ranged between 120 u/l (July) and 700 u/l (Jan).

The periphytic abundance recorded at Ahiraura reservoir was 3930 U/cm^2. During their seasonal distribution, highest density was recorded during winter 1790 U/cm^2 and the lowest during monsoon season (530 U/cm^2).

Benthic communities comprised *B. bengalensis* 46.4%, *Lymnaea stagnalis* 21.4%, *M. plotia scarbra* 7.2%, *Gyraulus spp.* and *L. marginalis* 3.6% each and constituted the molluscan community. It was dominating over dipteran (14.3%) and oligochaete population. The population ranged between 220 n/m^2 (summer and autumn) to 528 n/m^2 (monsoon).

Jirgo

Plankton population ranged between 599 u/l (Sept) to 79 u/l (March).

Periphytic population was recorded 3450 U/cm^2 . The density of flora had a major peak in summer 1640 U/cm^2. Diatoms were the dominant form followed by Chlorophyceae, Myxophyceae and Dinophyceae.

The benthic fauna was moderate 880 n/m^2 during autumn and poor 220 n/m^2 during monsoon months. The gastropoda community 84.9% was dominating over the dipteran community.

PROJECT : FW/A/3

ECOLOGY, FISHERY BIOLOGY AND FISH PRODUCTION DYNAMICS OF FLOODPLAIN WETLANDS IN INDIA

Sub-project : 1 Assam centre
2 West Bengal centre

Personnel : *Scientific :*
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Duration : April 1999-March 2002

Location : Guwahati, Assam
Barrackpore, West Bengal

Sub Project – 1 : Assam Centre

Development of appropriate population model for the culture based fishery of *beel* ecosystem

To develop a suitable model for culture based fishery in open water such as floodplain wetlands *(Beels)* attempts were made to collect some related critical inputs such as the species of fishes stocked, their number and ratio, size at stocking, catch structure, tonnage, size at capture, catch composition and harvesting pattern from Samaguri, Haribhanga and Kumri beel.

The study of these *beels* revealed that stocking density was very low with smaller sized seed, and therefore, the same was poorly reflected in the form of yield. The bulk of the fish was harvested between December and June, which was after six to ten months after stocking.

With the onset of harvesting, space and food becomes increasingly available. Favourable trends of water temperature (28-35 °C) and high planktonic productivity for faster fish growth from March onward till August-September are available at the time when carp biomass in beels is low. This means the hot season and spring-summer surge of primary productivity are under-utilized under present management practice. To make use of this increasingly available space, food and favourable environment a second lot of stocking during January-February is proposed which will lead to high fish yield. The stocking size and density should be 80-120 mm and 5000/ha respectively. The second lot of stocking will supplement the harvest during July-August, the time when catch from previous stock start declining.

Studies on ornamental fish

Captive breeding of *Colisa fasciata* was tried in outdoor breeding pool with both submerged and floating aquatic plants. A total of 103 fry measuring 6-10 mm in length were collected from the pool.

Acceptance of food items by native ornamental fishes

Species	Mosquito larvae	Live worms	Pelleted food
Colisa fasciata	Good	Good	Good
C. lalia	Do	Do	Do
Badis badis	Moderate	Good	Do
Botia dario	Poor	Moderate	Very poor
Nandus nandus	Do	Moderate	Do

Biology of an indigenous fish species from beel ecosystem

Work on the biology of *Gadusia chapra* continued for this year also. Data pertaining to the biology of this species were collected from Samuguri beel to understand their biological feature in beel environment. Specimens ranging from 77-145 mm in length and 3.2-28.5 g in weight exhibited a linear length-weight relationship. The relationship was positively correlated and highly significant (r = 0.96).

The relative condition factor K_n ranged from 0.95 to 1.1.

Studies on detrital dynamics in beel

Macrophyte biomass

Macrophyte cover was estimated through eye estimation. Monthly variations in macrophyte cover of the water body range from 65-85% and growth reaches peak during the month of August. Basically two ecological categories comprise macrophyte community *viz.* submerged and floating. *Eichhornia* dominated the floating variety while *Hydrilla, Ceratophylum* and *Najas* dominated the submerged category.

To quantify the settled benthic load of detritus the top 10 cm of the sediment was collected and different fractions were isolated as per their particle size using sieves of different pore size. A direct trend in organic matter content is noticeable with the fraction size. The top 10 cm of the bottom collection comprised mainly (> 90%) of less than 150 μ particle size which contain very little organic matter (mean = 13.76%) indicating this fraction as silt in nature. Highest amount of organic matter was recorded with > 1000 μ fraction size which form only 1% of the deposit.

Primary productivity

Planktonic productivity was at its maximum during April to July followed by low rates of productivity in the rest of the year. Primary productivity of submerged macrophyte estimated through diurnal variation of oxygen concentration indicated that annual average carbon fixation is more than four times greater than the carbon fixed by phytoplankton. Rate of carbon fixation by

macrophytes proportionately increases with its biomass increase reaching maximum 538 mgC/hr^{1}/m^{3} during August. However, the annual cumulative average rate of carbon fixation was 422 mgC/hr^{1}/m^{3}.

Econometric models for beel fishery resources

Socio-economic constraints in yield optimization of the beels of Assam

The work to document the socio-economic constraints in yield optimization of the beel fisheries of Assam has been continued this year. In this context 5 more beels were studied. Primary data on the management, organization was collected.

Livelihood system of the fishery of Assam

The study on dynamics of the livelihood system of the fisheries of Asssam continued this year. The observations indicates the livelihood of the fisheries depending upon the riverine fishing is more vulnerable to collapse than the beel fishery dependent ones. The data shows extreme vulnerability of the community to the changes in the fisheries resources and the institutional and economic environment.

Fisheries and ecological survey of pats in Manipur

Two *pats* viz. Uttra *pat* and Waithou *pat* in the district of Bishnupur and Thoubal have been selected for ecological and fisheries investigation.

Soil and water quality of two pats of Manipur

Parameters	Uttra *pat*	Waithou *pat*
Water		
Water temp. ℃	24	22
Depth (cm)	190	120
Transparency (cm)	6.8	6.8
pH	B.V.	B.V.
Dissolved oxygen (mg/l)	7.0	6.7
Free CO_2 (mg/l)	4.8	5.7
Total alkalinity (mg/l)	46.6	48.4
Hardness (mg/l)	47.25	57.75
Sp. conductivity (µmho./cm)	31.8	77.1
Calcium (mg/l)	8.4	6.3
Magnesium (mg/l)	6.4	10.2
Total diss. Solids (mg/l)	16	38.8
Chloride (mg/l)	40.5	40.5
Silicate (mg/l)	2	4
Iron (mg/l)	0.4	0.1
PO_4-P (mg/l)	Trace	trace
NO_3-N (mg/l)	0.26	0.19
Diss. Org. carbon (mg/l)	2	1.89
Net primary productivity (mg.C/hr/m^{3})	36.46	55.21
Soil		
Sand	78	80
Silt	17	15

Clay	5	5
pH	4.88	4.5
Organic carbon (%)	1.87	1.55
Phosphorus (mg/kg)	10.0	18.0
Total nitrogen (%)	0.29	0.18
C/N ratio	6.5	8.3

B.V. = Bottom Visible

Plankton population of Waithou and Uttra *pat*

Name of the *pat*	Plankton counts (u/l)	Phytoplankton (%)	Zooplankton (%)	Group composition of phytoplankton (%)	Group composition of zooplankton (%)
Waithou	131	65	35	Chlorophyceae (86) Myxophyceae (7) Bacillariophyceae (7)	Copepoda (62) Cladocera (24) Rotifera (14)
Uttra	86	34	66	Chlorophyceae (79) Myxophyceae (Nil) Bacillariophyceae (21)	Copepoda (68) Cladocera (21) Rotifera (11)

Density and diversity of macrophytes in the Pats of Manipur

Name of the *Pat*	Macrophyte cover (%)	Biomas g/m2 (Dry weight)	Dominants of Macrophytes (%)		
			Floating	Emergent	Submerged
Waithou	90-95	1123-1132	(45-70) Glyceria Sp. Ipomia Sp. Salvinia Sp.	(5-10) Scirpus Sp Nymphaea Sp	20-30 Hydrilla Najas Vallisneria
Uttra	75-80	671-665	10-15 Eichhornia Salvania Ipomia Ludhrdigia	50-55 Nymphea Spp. Euryl ferox	30-40 Hydrilla Najas Chara

Fish and Fisheries :

The faunistic composition of fishes in Uttra *pat* is similar to that of Waithou *pat.* The fishing activities in this *pat* continue throughout the year with a peak during February-March. Fishes commonly recorded from these *pats* are air-breathing fishes manily *Anabas,* four species of *Channa, Clarias* and *Heteropneustes.* Other fishes recorded are *Puntius, Colisa, Esomus, Glossogobius, Chanda, Mastacembelus, Monopterus, Amphipneus* etc.

Sub-Project - 2 : West Bengal Centre

Development of appropriate model for the culture-based fisheries in beel ecosystem

Data collection for construction of models for culture-based was continued during 2001-2002 also in Bhomra beel of West Bengal. Data on size at stocking and size at harvesting were recorded for *Catla catla, Cirrhinus mrigala* and *Labeo rohita.* The year 2001-2002 recorded a much higher catch per kg of stocking.

Total stocking and yield of fishes of Bhomra (2001-2002)

Year	Stocking (kg)	Yield (kg)	CP UE	Yield/kg stocking
1999-2000	7,929	42,436	3.87	5.35
2000-2001	9,242	40,718	3.71	4.40
2001-2002	5,690	39,160	3.57	6.88

Identification and cataloguing of potential ornamental fish species

Breeding and rearing of selected ornamental fish species

Colisa chuna bred under controlled condition in the laboratory. About 13 sets were bred in the laboratory aquarium (size 18"x15"x12") of 20 l capacity during August to September 2001. The optimum water temperature ranged from 26-28 °C and pH ranged from 6.5-7.5 for breeding. The fishes attained maturity within 8-9 months and were kept in the aquarium for 2nd generation breeding. Further experiments to standardize the aquarium environment are in progress.

Brood rearing of other fishes having ornamental value viz. *Puntius* spp., *Colisa* spp., *Ambassis* sp., *Brachydanio rerio* are being continued.

Biology of selected ornamental fish

Biological studies of *Colisa fasciata* commonly known as stripped gourami were initiated during August 2001.

Food and feeding habits

Gut contents of 164 fishes were studied which indicated that *C. fasciata* basically was an omnivorous fish with an extremely long coiled intestine with an average R.L.G. value of 2.63 like other omnivorous species reported.

Biological traits of *Gudusia chapra* and *Amblypharyngodon mola*; food and feeding habits, breeding biology; age and growth were continued.

Studies on detritus dynamics

Since macrophytes are the main source of primary producer in closed, shallow beels they have profound influence on ecology and fisheries of beel ecosystem. The study was

undertaken in a shallow beel, Bhomra in Nadia district of West Bengal to know their contribution to the ecosystem in terms of biomass and detritus formation.

Seasonal variation in the percentage rate of decomposition of detritus

Season	Variety	7 days	21 days	42 days
Premonsoon	Floating	22.23	72.00	97.11
	Submerged	87.46	93.57	98.92
Monsoon	Floating	19.09	57.97	85.26
	Submerged	87.29	95.13	97.99
Postmonsoon	Floating	10.99	24.06	50.99
	Submerged	54.18	69.75	92.05

The rate of decomposition also varied with the texture of the plant. As observed in floating *Eichhornia* decomposition was slower (55.46%) as compared to *Pistia* (94.46%) during the same period. Similarly rate of decomposition in *Alternanthera* was very slow as compared to marginal variety *Ipomea* and *Ludwigia*.

Econometric model development for beel fishery resources

Collection of input information including nets, crafts, labour, seed and various other management and processing

On the basis of information gathered from the ox-bow lakes in Bihar, two questionnaries were prepared, pre-tested and finalised. These were utilised to collect data from Bahura and Rajora oxbow lakes (mauns) in Begusarai district. The first questionnaire was for collecting data on various features of oxbow lakes and second was for the fishers covering the socio-economic aspects leading to development of econometric models.

The primary data collected from the fishers towards developing econometric model is analyzed. Its results are summarized in following table.

The mean and production function estimates for fishers of beels

Variable	Mean			Regression coefficient		
	Without boat	With own boat	Overall	Without boat	With own boat	Overall
Area (ha)	46.92	44.08	45.50	-	-	-
Stocking rate (no./ha)	3365.08	3677.92	3521.50	3.578	0.117	0.025
Age of fisher (year)	47.92	43.75	45.83	0.151	0.184	0.022
Gear weight (kg)	1.75	24.20	13.03	4.056*	8.852***	0.527***
Effort (days/year)	168.08	255.42	211.75	0.189	0.199**	0.576***
Annual catch (kg)	269.43	886.25	577.84			
Adjusted R^2				0.455*	0.840***	0.899***

*** Significant at 1% probability level ** Significant at 10% probability level

* Significant at 15% probability level

To develop an econometric model for fish production in the mauns, the primary data on fishers' age, quantity of gears, annual fishing effort and annual catch; and secondary data on area and stocking rate was analysed. Different types of linear, quadratic, and log functions were tried to identify the most important factors of production. Depending upon the adjusted R2 values, linear function was found to be the best fit. The analysis was carried out in SPpS software.

Fisheries and ecological survey of beels in Bihar

In the year 2001-2002 two beels, Rajora and Bahuara from Begusarai district of Bihar were selected for the studies.

Water quality of Rajora and Bahuara abeels, Bihar (2001-2002)

Parameters	Rajora	Bahuara
pH	7.95-8.5 (8.3)	7.82-8.55 (8.35)
Sp. Con. us/cm	179-360 (268.66)	259-367 (331.33)
Depth (m)	1.1-4.0 (2.68)	0.8-3.5 (2.675
Trans. (m)	0.65-1.45 (1.04)	0.25-1.54 (0.86)
Water temp. (°C)	18.5-29.5 (22.5)	18.5-33.0 (23.08)
D.O. (mg/l)	4.4-10.5 (8.35)	7.4-12.0 (9.175)
Free CO_2 (mg/l)	Nil-4.0	Nil-4.5
TDS (mg/l)	116.35-205.4 (174.63)	168.35-238.55 (215.37)
Carbonate (mg/l)	8.0-16.0 (11.36)	8.0-28.0 (15.67)
Bi-carbonate (mg/l)	80.0-154.0 (126.67)	88.0-174.0 (143.67)
Total alkalinity (mg/l)	88.0-164.0 (138.0)	112.0-184.0 (159.33)
Total hardness (mg/l)	64.0-148.0 (116.67)	84.0-156.0 (133.33)
Calcium (mg/l)	12.82-38.5 (28.87)	19.24-40.9 (33.15)
Magnesium (mg/l)	7.78-15.1 (10.88)	8.75-14.6 (12.36)
Chloride (mg/l)	13 0-21.3 (17.7)	13.0-32.66 (23.48)
PO_4-P (mg/l)	Tr.-0.02 (0.016)	Tr.-0.07 (0.05)
NO_3-N (mg/l)	Tr.-012 (0.06)	Tr.-1.31 (0.22)
Silicate (mg/l)	2.0-3.5 (2.35)	8.0-14.6 (10.58)

Primary productivity studies

The rate of primary production by phytoplankton varied greatly depending upon climatic factors and turbidity of water. The net production in both the lakes ranged within 41.67-140.63 $mgC/m^3/hr$. Bahuara was the most productive with an average carbon fixation rate of 91.15 $mgC/m^3/hr$.

Ranges, mean values and diversity indices of phyto and zooplankton of two oxbow lakes of Begusarai, Bihar

PARAMETER(S)	RAJORA		BAHUARA	
	Phytoplankton	Zooplankton	Phytoplankton	Zooplankton
Total Species	9	5	13	8
Total individuals	356	196	270	76
Mean (X)	39.55	39.20	20.76	9.5
Sample SD (Xdn-1)	51.57	32.31	33.96	9.48
Population SD (Xdn)	48.62	36.12	32.63	8.87
Variety Index (d)	10.417	5.797	16.39	12.36
Concentration of dominance ©	0.278	0.334	0.265	0.232
Diversity Index (H)	2.275	1.677	2.438	2.355
Evenness Index (J)	7.921	7.981	7.276	8.663

Benthos

Benthic fauna of both the beels were dominated by oligochaetes and gastropods. The number of population and diversity index was higher during winter. The gastropod represented by *Gabia orcula, Gyraulus convexiusculus, Bellamya bengalensis, B. dissimilies, Lymnea accuminata, Lamelledens* sp.

Macrophytes

About 75-80% of the beels were infested with macrophytes during winter. Macrophyte biomass was 1.542 kg/m^2 in Rajora and 0.600 kg/m^2 in Bahuara beel. The former beel dominated with submerged *Vallisneria* and latter with marginal variety *Hygrophila polysperma* and patches of *Hydrilla.*

Studies on fish and fisheries including fish species diversity management practices, crafts and gear, release and yield etc.

The two beels selected for the study were Rajora and Bahuara in Begusarai district of Bihar. The study showed that the dominant species in the catch consisted of Indian Major Carps along with exotic carps in Rajora beel (70%) and in Bahuara beel (75%). The list of fish species recorded in the catch is given below. The species diversity was of the same for both the beels.

Fish species diversity of Rajora and Bahuara

Species
Carps *C. catla, L. rohita, C. mrigala, L. calbasu, C. idella, L. bata, C. carpio*
Catfishes *W. attu, C. batrachus, M. aor, M. vittatus, C. marulius, C. striatus*
Miscellaneous fishes *P. sophore, P. ticto, A. mola, C. ranga, A. nama, M. puncalas, M. armatus, X. cancilla, G. chapra,* prawns.

Sub Project 3 : Pen culture technology its adoption in beels

Pen and Cage culture was undertaken at Mathura and Kujerbogi beels in West Bengal.

Pen culture of Prawn and Fish

The demonstration in pen culture of *Macrobrachium rosenbergii* and polyculture of carps with catla, rohu, mrigal and silver carps have been initiated in a 0.08 ha pen. The results are as follow :

Species	Stocking density & ratio	Initial wt. gm	Feed %	Duration (days)	Average wt. g
M. rosenbergii	26,000 nos/ha	8	4	45	26
C. catla	10,000 nos/ha 2.5:3.2:5.2	123			175
L. rohita		100	2	45	111
C. mrigala		77			91
H. molitrix		86			112

Cage culture

Cage culture experiment was initiated in a 9 X 6 X 6 ft cage of netlon 1 cm mesh size in Mathura beel. The cage was stocked with fingerlings of *C. catla* 20 nos (104 g), *L. rohita* 20 nos. (80 g). The growth increase was 50 g in *C. catla* and 44 g in *L. rohita* after 45 days.

PROJECT : FW/A/5

FISH PRODUCTION DYNAMICS OF FLOODPLAIN WETLANDS OF UTTAR PRADESH

Personnel : *Scientific :*
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Technical :
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Duration : May 1999-March 2002

Location : Allahabad, Uttar Pradesh

Description of beels

District	Name	Area (ha)	River basin
Allahabad	Dahital	24	Yamuna
	Alwara Jheel	250	
Unnao	Gagnikhera Jheel	80	Ganga
	Mohane Jheel	38	
Hardoi	Bhadayal Jheel	200	Ganga
Bareilly	Dabri Jheel	140	Ramganga

Soil and water quality

Sediment of all the beels was neutral to alkaline in reaction (7.05-7.40), rich in organic carbon (0.87-1.79%) and available nutrients nitrogen (29.8-61.8) and phosphorus (5.00-17.45 mg/100 g).

Water quality parameters like alkalinity, conductance, dissolve solids, calcium, magnesium total hardness and chloride showed considerable variations ranging from 103.3-285.0 mg/l, 233.7-705.7 µmhos, 116.9-3453.0 mg/l, 15.3-23.0 mg/l, 11.8-32.2 mg/l, 19.3-197.7 mg/l and 9.3-43.0 mg/l respectively.

Biotic communities

Plankton population ranged between 223 and 343 u/l. Benthic communities varied from 344 to 1027 n/m^2. Maximum abundance of periphyton was observed in Dahital (5021 u/cm^2) and minimum in Gagnikhera (3358 u/cm^2). The abundance of associated micro flora and fauna was in the range of 3526 u/g (Bhadayal Jheel) to 5486 u/g (Alwara Jheel) and 111 u/g (Bhadayal) to 240 u/g (Dabri Jheel) respectively. Beels were mostly infested by macrophytes (20-85%).

Gross and net primary production

The rate of gross and net production ranged from 2768.0-4461.6 mgC/m^2/day and 1970.0-3144.7 mgC/m^2/day respectively. 21.5-34.0% of the total production was contributed by phytoplankton and 66.0-78.5% by macrophytes. The rate of net energy fixed by producers was in the range of 19,345-30,881 cal/m/day being maximum in Dabri and minimum in Gagnikhera beel. The detritus energy was in the range of 21.0x10 cal/m^2 – 48.52x 10 cal/m^2. Fisheries of beels was dominated by IMC (39-65%) excepting in Dahital, where catfishes dominated. Fish production potential in 6 beels was estimated at 669.8-1069.2 kg/ha/yr but actual fish production was in the range of 52.5-357.0 kg/ha/yr and thus only 6.5-33.4% of potential was actually harvested.

PROJECT : FW/A/6

FISHERY OF SELECTED PRAWN SPECIES IN KAYAMKULAM BACKWATER

Personnel : *Scientific :*
P.K. Sukumaran
Technical :
C.K. Vava

Duration : April 2000-March 2002

Soil and water quality

Sediment of all the beels was neutral to alkaline in reaction (7.05-7.40), rich in organic carbon (0.87-1.79%) and available nutrients nitrogen (29.8-61.8) and phosphorus (5.00-17.45 mg/100 g).

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PROJECT : FW/A/6

FISHERY OF SELECTED PRAWN SPECIES IN KAYAMKULAM BACKWATER

Personnel : *Scientific :*
P.K. Sukumaran
Technical :
C.K. Vava

Duration : April 2000-March 2002

Location : Alappuzha, Kerala

During the year, three commercially important prawns viz., *Penaeus indicus, Metapenaeus dobsoni* and *M. monoceros* along with other minor prawns and fishes collected from the Kayamkulam backwater were investigated for their fishery and population characteristics. Nine major landing centres targetting these species were surveyed during the year. The total landing estimated for the 10 months of the survey (May-2001 to February 2002 was worked out to be 226.765 t for the *Penaeus indicus*, 567.397 t for *Metapenaeus dobsoni,* 72.960 t for *M. monoceros,* 21.797 t for other prawns and for the fishes 1086.449 t . Exorbitant quantity of the very young prawns landed through the seine nets is not included in this landings. The CPUE in respect of each gear and Centre-wise was also estimated.

Based on a ten months survey (May.01-February -02), the percentage contribution by these three species along with other prawns and fishes to the total landings was 11.48 %, 3.69 %, 28.72 % and 1.16 %and 55.01 % respectively. The species were subjected to both recruitment overfishing and growth overfishing. The indiscriminate fishery has been mainly due to the use of the fine mesh seine nets and the gill nets. About 58 % of the landings of these species were fished by these two gears. Strict regulation of the exploitation is suggested by enhancing the mesh size of the seine nets and restricting the number of the gill nets and seine nets.

Pollution study

Bi-monthly samples were collected from the vicinity of effluent discharge from thermal plant, Kayamkulam to ascertain the effect of the discharge on the water and sediment quality, plankton and biota in the lake. The study reveals no significant effect on aquatic life from the discharge of thermal plant. This may be due to the frequent tidal effect.

Average physico-chemical parameters of water and soil near the effluent discharge of NTPC

Centres	AOF2	AOF1	OF	BOF1	BOF2		AOF2	AOF1	OF	BOF1	BOF2
WATER PHASE						**WATER PHASE**					
Physical features						**Nutrients**					
Water temperature (°C)	26.9	27.1	28.5	28.4	28.6	Phosphate (mg/l)	0.05	0.07	0.06	0.07	0.07
Depth (m)	1.5	1.3	1.1	1.2	1.6	Nitrate (mg/l)	0.26	0.24	0.24	0.24	0.31
Transparency (m)	1.3	1.2	1.1	1.1	1.2	Silicate (mg/l)	5.3	5.0	5.6	5.4	5.2
Chemical features						**SOIL PHASE**					
Salinity (‰)	7.3	7.4	7.1	6.6	6.7	pH	5.5	5.5	5.1	5.1	5.1
Dissolved oxygen (mg/l)	5.6	6.4	5.7	6.0	5.6	$CaCO_3$ (%)	3.2	2.4	3.3	4.3	4.3
pH	7.3	7.4	7.2	7.2	7.1	P_2O_5 (mg/100 g soil)	0.16	0.17	0.18	0.16	0.21
BOD (mg/l)	7.8	6.1	9.0	6.2	7.0	Available nitrogen (mg/100g)	3.4	2.9	2.5	1.4	2.4
COD (mg/l)	14.5	15.8	21.8	24.0	14.5	Organic carbon (mg/100 g)	2.1	2.8	2.8	4.3	5.6

PROJECT : EM/B/1

ASSESSMENT OF ENVIRONMENTAL IMPACT ON BIOTIC COMMUNITY IN RIVERS AND ASSOCIATED ECOSYSTEMS

Personnel : *Scientific :*
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Duration : April 1998-March 2003

Location : Barrackpore, Allahabad, Karnal, Vadodara

To assess the environmental perturbations and its impact on hydrology of rivers Ganga,Yamuna, Hooghly, Haldi and Tapti at various points. Studies were undertaken during monsoon, post-monsoon and winter season at all the rivers excepting rivers Haldi and Hooghly where sampling were done bi monthly. Survey of River Tapti from upper stretches to its merger in the Arabian sea near Surat District of Gujarat was initiated.

Studies in River Yamuna

Water quality

Most of the physiochemical parameters did not indicate any alarming situations at all the sampling sites, however, zonal variations were observed in respect of Sp. conductance, pH, Dissolved oxygen, CO_2, nitrates and phosphates which showed higher values at the outfall regions of sewage/ industrial discharges at all the sites observed.

Biotic communities

Plankton

The average plankton density was higher in Ganga (1717 u /l) than Yamuna (884 u/l). Amongst phytoplankton both diatoms and green algae were almost equal in Ganga but diatoms, were dominant forms in Yamuna.

Significant decline in quality and quantity of planktonic population was observed at this stretch when compared with earlier studies. Abundance of plankton at sewage polluted zone of Rajghat (Varanasi) was observed indicating nutrient enrichment.

Plankton population at Patna stretch indicated dominance of Chlorophyceae (36.87%). The distribution pattern of plankton at Bhagalpur stretch was similar to that of Patna except absence of Myxophyceae indicating better water quality. Presence of Chlorophyceae (49.65%) also support the above observation. At Farakka stretch the dominance of Bacillariophyceae (42.53- 63.37%) followed by Chlorophyceae (15.38- 43.02%) was observed. The planktonic population at Hooghly estuary indicated dominance of Bacillariophyceae (44.36-72.19%) followed by Myxophyceae (0.23- 42.0%) and Chlorophyceae (8-81%).

Benthos

Benthic density of river Ganga at upper stretches of Rishikesh indicated highest values 88.88 u/m^2 (winter months) followed by 33.33% u/m^2 (postmonsoon) and 11.11 u/m^2 (pre-monsoon). The macrobenthic fauna at Varanasi at upper stretch of Ganga indicated 154 u/m^2. Macrobenthic fauna was poor at Patna stretch. It was 92 u/m^2 at AOF and 483 u/m^2 at downstream of river Ganga.

At Bhagalpur stretch the macrobenthic fauna was present only at downstream of river Ganga and was absent at all other centers. At Farakka stretch the macrobenthic population was present at Feeder canal 92 u/m^2 and was represented by Pelycepoda (*Corbicula striatella, Noviculina gangetica*). Macrobenthic population was very poor at the Haldia oil Refinery stretch which is generally a common feature associated with the estuaries due to prevalence of high and low tides. The dominant fauna comprised of polychates represented by *Nepthys oligobranchia* and followed by bivalve (*Corbicula striatella*). The Shannon Index (H) fluctuated between 0-0.67 indicating prevalence of industrial pollution at this stretch.

Fish Diversity and composition of River Ganga

The main landing center is at Kulal (Ponta Sahib). The fish composition was *Tor* sp.; (52.78%), followed by *L. calbasu* (36.11%), *L. dero* (5.55%), Miscellaneous group (4.17%) and *Glyptothorax* sp. (1.39%).

The fish population at Varanasi was represented by *C. mrigala, L.rohita, L. calbasu* and *C. catla* amongst major carps and amongst catfishes *Rita rita, M.seenghala,* were dominant .

A total number of 64 genera of fishes were recorded at Patna. Indian major carps formed 3.21% followed by miscellaneous fishes 63.14% (minnows, small clupeids, feather backs, live fishes and small silurids) and large catfishes 33.93%.

At Bhagalpur Indian major carps formed 3.13% , followed by catfishes 33.73% and miscellaneous fishes 63.13%.

Assessment of toxicants.

The highest pesticide residue was detected in *Rita rita* (1.6 kg)(90.4 ppb. *A. aor* (7.5 kg) at Farakka was also found to accumulate 73.6 ppb of organochlorine pesticides. It was interesting to observe that in *Tor tor* at Haridwar and Rishikesh the residue of pesticide was recorded to be (20.0 ppb).

The metal bioaccumulation in aquatic food chain for lead , cadmium, zinc and copper were within permissible limit at most of the centers excepting a few. The bioaccumulation of metals followed the trend being maximum in kidney , followed by gonad, gills and flesh.

The Fish *Pama pama* recorded high concentration of Copper (18.9 mg/l) in kidney at Haldia, while in liver of *A gagora* it was as high as 32.5 mg/l..

Histological manifestations of toxicant accumulation in test fish.

Histological observations of gills and kidney of *Arias gagora* and *Pama pama* collected from Haldi river revealed moderate hyperplasia in gills. Kidney showed necrotic hematopoietic tissue and epithelial degeneration in renal tubule. Gill, kidney of *Rita rita* and kidney of carp collected from Ganga at Farakka also showed mild hyperplasia in gill. No stress impact was noticed in kidney tissue in both the fishes.

Fish biology

Food and feeding habits of certain commercially important fishes viz; *Aoricthys aor*, *A. seenghala, Rita rita*, and *C. mrigala* were studied.

The condition factor (K) of *A. aor* and *A seenghala* at Patna were estimated at 0.8423 and 0.9314 respectively indicating that both fishes are living under slightly stressed environment and condition of *A. seenghala* is better than *A. aor* but it was reverse at Bhagalpur, *A. seenghala* 'K' value was estimated (0.7617) and *A. aor* (0.9176) Indicating bad condition of fishes., particularly of aor. The condition factor 'K' of *Rita rita* of Ganga at Bhagalpur was high (1.5) indicating good health of the fish.

Biochemical markers in stressed Riverine Ecosystems

The enzyme activity in blood and brain remained high in the upper stretches of Ganga (Hardwar- Rishikesh) and Yamuna (Hathnikund- Dakpathar), the values depressed at Haldi-Hooghly confluence at Haldia. The brain exhibited more depression of the activities compared to the blood.

Screening of macrophytes for the toxicant removal

Studies were conducted on the uptake of Lead and copper by water hyacinth under five different concentrations in the laboratory (5,10,15, and 20.0 mg/l) for a detention period of 7-days. Efficiency of metal removal was determined .The general health condition of water hyacinth was affected at concentration above 15.0 mg/l in both the metals. The metal removal efficiency was higher at concentrations of 5-10.0 mg/l.

PROJECT : EM/B/2

AETIOLOGY AND PATHOPHYSIOLOGY OF ENVIRONMENTAL STRESS AND DISEASES IN FISH/PRAWN. DEVELOPMENT OF HEALTH ASSESSMENT AND CONTROL METHODS

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Technical :
S. Bhowmick

Duration : April 1998-March 2003

Location : Barrackpore

During the period under report during 2001-2002 disease investigations were conducted in the undermentioned water areas

Site	Amda beel	Kalyani	Kharibari
Water quality			
Transparency (cm)	25-30	40-42	20-23
pH	8.2-8.8	7.1-7.2	8.3-8.4
Alkalinity (mg/l)	110-122	165-170	130-142
Hardness (mg/l)	70-72	169-172	130-142
UIA (mg/l)	Nil	Nil	0.1-0.2
DO (mg/l)	6.8	7.2	7.0-8.5
Salinity (ppt)	Nil	Nil	nil
Fish/prawn species affected	*L. rohita* *C. catla* *C. mrigala*	*C. mrigala* *C. catla*	*L. parsia* *C. mrigala* *P. monodon*
Pathogens isolated & identified	*Argulus* sp. *Dactylogyrus* sp. *Neothelohanellus catlae* *Thelohanellus rohitae* *Aeromonas hydrophila*	*Tripartiella bulbosa* *Myxobolus indicum* *Dactylogyrus* sp. *Myxobolus catlae*	*Vibrio* sp.

Experiments conducted on fish stress assessment

Experiments on reproductive physiological response to pollutants

Sexually maturing *R. rita* were exposed for 30 days to sublethal concentrations of phenol and sulfide and the cholesterol content of ovary and liver and the Estradiol level in plasma were measured. Both contaminants caused an increase in hepatosomatic index and the cholesterol content of ovary and liver. Gonadosomatic index (GSI) values on the other hand decreased. Accumulation of ovarian and hepatic cholesterol resulted from reduced steroidogenesis as evidenced by the gradual decrease in the Estradiol levels.

Use of integumentary chromatophores and mucous glands on fish scale for stress diagnosis

L. rohita juveniles were exposed to (i) stress due to crowding, (ii) unionised ammonia (UIA) of 0.13 mg/l and the changes in the structure of chromatophores and mucous glands in the scales were studied. The results showed that UIA has aggregating action on the chromatophores during period of exposure. For mucous gland there is a gradual decrease in number and increase in area with increasing exposure period. Hypertrophy of the mucous glands occur resulting in excessive secretion of mucous as a defence against pollutants.

The quantitative health assessment index for rapid evaluation of fish condition in the field was tried to evaluate the general health status of fish populations in river Hooghly from a polluted and a non-polluted site.

Health assessment index (HAI) values for *R. rita* from Hooghly river (Samudragarh and Barrackpore)

Hooghly River (downstream)	HAI	SD	Coefficient of variance %)
Samudragarh, km 275 (Reference site)	23	25.709	111.77
Barrackpore, km 170 (Contaminated site)	60	36.055	60.092

Isolation and identification of microbial pathogens in fish and shell fish

Disease symptoms : Fishes *C. mrigala* and *Puntius* sp. had surface haemorrhages and ulceration with mortality. Reddening of tissue and ulcers were seen on head, around mouth and body muscle.

Microbial analysis could detect (I) *Aeromonas hydrophila,* 11 isolates (ii) *Pseudomonas aureoginosa* (1 isolate).

Disease symptoms : Prawn, *P. monodon* affected by sudden mortality disease were analysed for presence of pathogens. Bacteriological analysis of tissue samples indicated presence of the following isolates.

(i) *Vibrio alginolyticus* – 2 isolates
(ii) *V. parahaemolyticus* – 8 isolates
(iii) *V. harveyi* – 1 isolate
(iv) *Vibrio* sp. – 3 isolates

Antibiotic sensitivity of all the above isolates to different antibiotics were also carried out. Results indicated higher sensitivity of isolates to Ciprofloxacin, Chloramphenicol, Norfloxacin but resistant to Ampicillin and Oxytetracycline.

PROJECT : BT/B/1

GENETIC CHARACTERIZATION AND MIGRATION RELATED BIOCHEMICAL CHANGES OF INDIAN SHAD, *TENUALOSA ILISHA*

Personnel : *Scientific* :
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Duration : Apri1 2000-March 2005

Location : Barrackpore, Maldah, Allahabad, Vadodara

Migration related biochemical changes in hilsa

During the year under report, determination of physiological changes in *Tenualosa ilisha* has been carried out during the monsoon migration period in the river stretch starting from the mouth of Hooghly estuary (Fraserganj) upto Farakka.

Freshly captured matured hilsa of either sex of average body weight of 1.180 kg (range 0.900-1.400 kg) and mean length of 396 mm (range 371-418 mm) were taken up for the investigations.

Physiological changes in Tenualosa ilisha during spawning migration in the river stretch between the mouth of Hooghly estuary (Fraserganj) and Farakka in monsoon season, 2001

Parameters	Sampling points					
	Mouth of Hooghly estuary (Fraserganj)	Kakdwip	Diamond Harbour	Nabadwip	Farakka (Feeder Canal)	Farakka (Down stream Ganga)
Hydration level (%)	(M) 64.0 (F) 63.0	66.0 65.0	66.5 65.0	68.0 67.5	68.5 69.0	69.5 69.9
Blood glucose (mg/100 ml)	(M) 50.0 (F) 53.0	52.0 53.0	53.5 53.0	53.0 52.0	55.0 54.0	55.0 56.0
Liver glycogen (mg/g wet tissue)	(M) 17.0 (F) 16.0	15.8 15.0	12.5 14.0	8.0 8.5	8.5 9.5	8.0 7.5
Muscle glycogen (mg/g wet tissue)	(M) 1.3 (F) 1.4	1.2 1.2	1.0 1.0	0.7 0.65	0.60 0.75	0.60 0.60
Blood serum protein (g/100 ml)	(M) 5.1 (F) 5.9	4.6 5.2	5.3 5.1	5.7 5.0	5.2 5.8	6.1 5.0
Muscle protein (mg/g wet tissue)	(M) 170 (F) 165	160 150	155 150	130 125	120 120	110 110
LIPID PROFILE						
Muscle total lipid (triglyceride) (mg/g wet tissue)	(M) 125 (F) 120	125 110	110 100	90 80	90 70	80 65
Mean red muscle/white muscle (RM/WM) lipid storage ratio	1.85	1.80	1.75	1.80	1.60	1.60
Gonadal lipid (% wet tissue) Testis ovary	9.514.0	11.0 15.8	12.0 15.8	12.5 18.0	12.0 19.0	12.5 19.5

The blood serum glucose content had recorded variation between 49.5-56.0 mg/100 ml in the test fishes. The levels were found to remain slightly elevated in hilsa during the various migratory phases, compared to the sample obtained from Fraserganj.

The liver glycogen (7.5-17.0 mg/g wet tissue) as well as the muscle glycogen (0.60-1.4 mg/g wet tissue) contents recorded depletion in the levels as hilsa performed its ascending migration through the mouth of Hooghly estuary undergoing swimming journey and muscular activities towards the breeding and spawning events. Either sex recorded depletions of tissue glycogen reserves.

Level of blood serum protein (albumin and globulin) recorded least variation ranging between 4.6-6.1 g/100 ml.

Muscle protein, on the other hand, recorded exhaustions for either sex for the whole range of migration from Fraserganj to Farakka and varied between 110-170 mg/g wet tissue.

The lipid profile has also been investigated in the present study. It has been observed that muscle total lipids (triglycerides) recorded a steady decline in level for both the sexes during the phases of spawning migration.

Genetic Characterization of hilsa

With respect to genetic characterization of *Tenualosa ilisha,* samplings of hilsa were done from Nawabganj (river Hooghly), Beniagram at Farakka (Downstream Ganga/Padma), Feeder canal at Farakka (Bhagirathi), Lalgola (Padma), Bhadbhut (Narmada), Ukai reservoir (Tapti) and Digha (Bay of Bengal). However sampling could not be done from Allahabad (Ganga-Yamuna).

Blood, liver, muscle, gonad and heart tissues were separated and isolation of DNA from the tissue were done following the phenol extraction procedure. The DNA thus isolated, were scrupulously purified from all sort of contaminants. These genomic DNAs were used for RAPD work. Individual primers were initially screened for small number of samples using PCR reaction.

Among the 40 primers tested (OPA series, 20 numbers and OPB series, 20 numbers), only some (3 numbers) gave scorable number of bands (OPA 10-3 bands, OPA 11-11 bands and OPA 19-number of bands require further enhancement.

PROJECT : BT/B/2

DEVELOPMENT OF IMMUNOLOGICAL AND MOLECULAR TECHNIQUES FOR RAPID DIAGNOSIS OF BACTERIAL AND VIRAL DISEASES OF FISH AND SHELLFISH

Personnel : *Scientific :*
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Duration : April 2000-March 2005

Location : Barrackpore

Isolation and molecular characterization of bacterial isolates

From microbiological analysis of samples collected from infected fish with ulceration and haemorrhages and mass mortality in shellfish, *Aeromonas hydrophila* 11 isolates, *Pseudomonas aureoginosa,* 1 isolate, *Vibrio alginolyticus,* 2 isolates, *V. parahaemolyticus,* 8 isolates, *V. harveyi,* 1 isolate and other *Vibrio* sp., 3 isolates were obtained. These isolates were used for molecular characterization on the basis of their protein profile, genomic DNA restriction pattern and plasmid profile. Antiserum raised against a standard *A. hydrophila* isolate was used in Nitrocellulose Enzyme immunoassay or Dot immunoassay (DIA) for screening of bacterial isolates. Positive detection of *A. hydrophila* was obtained in DIA.

Protein profile determination

Proteins extracted from bacterial isolates were analysed on 10%, 11%, 12% and 7.5% to 20% gradient SDS-PAGE and protein banding pattern and molecular weight were estimated. Protein bands of *A. hydrophila* were transferred to nitrocellulose paper and developed as per Western blotting technique and 8 major immunogenic bands were revealed.

Extraction of bacterial plasmids and DNA

Only 2 *A. hydrophila* isolates, one *P. aureoginosa* and one *V. harveyi* revealed presence of 2 plasmids and 12 plasmids were recorded in standard *E. coli.* Genomic DNA were extracted from all above bacterial isolates and were digested with BamHI and Pst I restriction endonucleases. A variation in DNA banding pattern were recorded with bacterial isolates.

Standardization and use of PCR for selected bacterial pathogens

PCR was used for detection of both Kanagawa positive (K+) and Kanagawa negative (K-) *V. parahaemolyticus* isolates, which are responsible for gastroenteritis. Primers specific for a specific 387 bp gene in genomic DNA was targeted for PCR amplification. The results indicated successful amplification of all *V. parahaemolyticus* isolates but not *A. hydrophila* isolates. Similarly RAPD-PCR was used for detection and differentiation of *A. hydrophila* isolates. Great variation in DNA banding pattern indicated a high genomic variation in 11 *A. hydrophila* isolates used in the study. The amplified 387 bp fragment of *V. parahaemolyticus* was labelled *in vitro* using Alkphos direct labelling and detection system (Amersham Pharmacia Biotech, UK Ltd.). A number of bacterial samples spotted on Nitrocellulose paper were reacted with labelled probe using DNA hybridization technique and the results were recorded on X-ray film using autoradiography. Results indicated high sensitivity and specificity of labelled probes for detection of *V. parahaemolyticus* in tissue/culture samples.

Cell culture of fish tissue

Different organs of fish like gill tissue, liver, kidney, gonadal tissue were used in vitro for primary cell culture using L-15 medium containing 10% fetal calf serum. Initial trials indicated multiplication of cells in culture flasks. Contamination with bacteria and fungi was noted to be the major limiting factor for maintenance of cell culture.

PROJECT : RA/A/1

INLAND FISHERIES RESOURCE EVALUATION THROUGH REMOTE SENSING TECHNIQUES

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Duration : April 1995-March,2002

Location : Barrackpore

A complete inventory and mapping of water bodies above 10 ha in the state of West Bengal have been done through digital image processing technique by using satellite data (IRS-1C & 1D) acquired from National Remote Sensing Agency, Hyderabad. GIS, being a system with capability of recording, storage, processing and retrieval of data, is being developed for geographically referenced spatial data and corresponding water quality attribute information to the identified water bodies.

Observations on water quality and soil characteristics have been taken from the selected water bodies of West Bengal, Chhattisgarh and Bihar. Analysis techniques were developed to extract brightness (value), hue (colour) and saturation (colour purity) for each pixel which are correlated with actual on-site data on water quality.The average reflectance of red, green, blue and infra-red has been calculated from satellite image of IRS-1D of West Bengal and the degree of association with water quality parameters has been measured. The values of correlation coefficient were calculated. It is seen that chlorinity, salinity, PO_4, NO_3, total N, silicate, hardness, Ca, gross primary productivity, net primary productivity, respiration and temperature have shown significant correlation with at least one of the bands.

Multiple correlation coefficient has been computed for regression of these water quality parameters on reflectance of four bands. The significant values have been observed in case of water temperature, pH, chlorinity, salinity, NO_3, total N, silicate, Ca, GPP and respiration. The results, presented in Table, indicate that Multiple regression may help in predicting the above mentioned parameters using satellite data.

Table Multiple regression equations for different parameters

Parameter	Const.	Red	Green	Blue	NIR	Multiple Correlation coefficient
1.Water temp.	-12.7602	0.0644	-0.4961	0.7332	0.0087	0.8064**
2. pH	7.3223	-0.0305	0.0087	0.0203	-0.0002	0.2567*
3.Chlorinity	-37.0012	0.3743	-0.8654	1.3281	-0.4903	0.3082**
4.Salinity	-67.5631	0.7861	0.4965	1.4520	-0.8385	0.3445**
5.NO_3	-0.3021	0.0060	0.0160	-0.0032	-0.0021	0.6001**
6. Total(N)	-0.3272	0.0079	0.0186	-0.0020	-0.0047	0.3824**
7.Silicate	16.2606	0.0689	-0.5091	0.2428	-0.1373	0.2615*
8. Ca	-79.4068	0.1065	1.6652	0.8938	-0.1381	0.2684*
9.GPP	-222.043	-5.1192	-6.3833	10.4789	2.8927	0.4386**
10.Respiration	-233.067	-1.8276	-8.0753	9.3656	0.7668	0.6866**

**-Significant at 1% level, *-Significant at 5% level

The data on water quality parameters and soil characteristics have been collected during post monsoon period from some selected water bodies of Patna, Samastipur and Begusarai of Bihar. The analysis of satellite data is under progress.

PROJECT : RA/A/2

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

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Duration : April 1999- March, 2004

Location : Barrackpore

The data on catch and effort collected from various centres of the institute adopting sampling methodologies suitable for the prevailing condition have been utilized to develop database.

Estimates of monthly catch from Hooghly-Matlah estuarine system have shown that the significant contributors are *Tenualosa ilisha*, *Harpodon neherius*, *Pama pama*, *Setipinna* sp.and *Trichurus* sp. during 2001-2002. The gearwise catches have shown that the bagnet catch is maximum in the estuary followed by the drift net catch.

The catch data are being collected from Ganga river system at Allahabad from Sadiapur in order to know the trend of fish catch and catch structure. The species landed is dominated by *C.garua* followed by *Mystus aor*, *Rita rita*, *E.vacha* and *M.seenghala*. The catch recorded is high during September and October.

The catch data from Narmada river are being collected from various landing centres as well as markets. It is observed that the catch brought to the market is dominated by prawn and followed by *L. rohita*, *C. catla* and *T. ilisha*. The various types of gears operated in the river are drag net, gill net, cast net, bagnet and hook and lines.

The catch from Yamuna river and West Yamuna canal near Karnal in Haryana is not of high order. However, catch data are being collected at selected places to know the trend of catch and catch structure. The centres are Panipat, Yamuna Nagar and Karnal. The catch at Panipat is higher than the other two centres. Among the species *Tor* sp. is dominant at Yamuna Nagar, *Cyprinus carpio* at Karnal and Panipat. The catch from Yamuna river canal is dominated by *C. carpio*.

One centre has been selected for recording the catch from the river Bramhaputra at Guwahati. Systematic sampling is followed for the selection of days in a month. Complete record

of catch is taken on the dates of sampling from Uzanbazar where most of the catch is disposed. The data reveal that catch ia dominated by *L.bata*, *A.morar* and *G. chapra*.

Database structure has been created on Oracle Relational Database Management System platform to provide multiuser access facility. User Interface for the same using SQL forms is under development.

5 TECHNOLOGY ASSESSED AND TRANSFERRED

KRISHI VIGYAN KENDRA

Krishi Vigyan Kendra, Kakdwip

During the year 2001-2002, Krishi Vigyan Kendra of Central Inland Fisheries Research Institute have conducted On-Farm "Testing of integrated Rice-Cum-Fish culture technique" for refinement of technology on 20 farmers and covering 10 ha land to increase production and productivity. The results show a total paradigm shift because of integration of prawn with Indian Major Carp in rice cultivation. Rice variety CR-1017 has given a grain yield of 50.00 q/ha and 24.9 quintal and 4.10 quintal fish and prawn respectively, giving an income of Rs.74,000 above the control variety NC-492, giving an yield of 42 q/ha grain with 23 q/ha fish. In economic dimension the four variety tested under OFT viz. IET-5656, Ranjit, MTU-7029 and CR-1017 in integration with fish and prawn culture has given respectively Rs.64,000, Rs.57,200, Rs.57,200 and Rs.74,000 over and above the control, NC-492 grown in integration with fish only. Under Frontline demonstration on Kharif Rice, three rice varieties IET-5656, CR-1017 and NC-492 were demonstrated giving an average yield of 49.50 q/ha, 48.75 and 43.50 q/ha respectively which shows an increase of 59.67, 57.23 and 40.32 percent above Control Dudheswar during kharif season with 140-160 days crop duration.

During 2001-2002, Kendra has imparted 29 On-Campus and 72 Off-Campus training programmes for 290 and 1767 trainees respectively, comprising practising farmers, farm women, rural youth, school dropouts and extension functionaries under Vocational Training Programmes in discipline of fishery, crop production, horticulture and home science. A total 2057 beneficiaries were involved under OFT, FLD, vocational training and training of extension functionaries.

Varietal suitability in rice-cum-fish culture and increased production

Sl.No.	Varieties	Production		Cost of production (Rs/ha)	Return from Rice & Fish (Rs/ha)	Income in profit (Rs./ha)
		Rice	Fish & Prawn (Qtl/ha)			
1	IET-5656	48.75	22.90+4.90	1,46,250.00	2,25,000.00	65,000.00
2	Ranjit	46.00	24.90+4.10	1,42,000.00	2,17,200.00	57,200.00
3	MTU-7029	51.00	22.00+4.90	1,53,000.00	2,17,200.00	57,200.00
4	CR-1017	50.00	24.90+4.10	1,50,000.00	2,34,000.00	74,000.00
5	NC-492	42.00	23.00	1,26,000.00	1,60,000.00	Control

Result of frontline demonstration of paddy

Sl. No.	Crop & Variety	Duration (days)	Grain/seed character	Grain yield (g/ha)	NPK	% increase in production
1	Kharif rice Swarna (IET-5656)	142	Bold Coarse	49.50	60 : 30 : 30	59.67
2	Dharitri (CR-1017)	158	Bold Coarse	48.75	60 : 30 : 30	57.25%
3	Sabita (NC-492)	158	Long Fine	31.00	60 : 30 : 30	40.32%
4	Dudheswar	148	Bold Fine	31.00	60 : 30 : 30	Control

Result of Frontline demonstration on oilseeds and pulses

Sl. No.	Crop & Variety	Year & Season	Area (ha)	Farmers (No.)	Yield (q/ha)	Local cheak (q/ha)	Increase in yield (%)
1	Seasamun Imp. Set 5	2001 Summer	5	35	8	6	33.33
2	Green gram PDM-54, K-851	2001 Summer	2	15	9.5	6.5	46%
3	Sesamum Imp. Set 5	2002 Summer	5	35	Crop is standing in good condition in the field		
4	Green gram K-851	2002 Summer	3	35			

Details of Extension Activities

Sl. No.	Activities	No. of days	No. of Beneficiaries			No. of Extension functionaries		
			Men	Women	Total	Men	Women	Total
1	Field days	06	495	380	875	05	03	08
2	Oil Seed day	03	80	50	130	01	01	02
3	Pulse day	02	18	07	25	01	-	01
4	Fish Farmers day	02	25	15	40	02	02	04
5	Kishan Mela	04	750	250	1000	08	06	14
6	FLD Training	07	80	55	135	10	08	18
7	Film/Slide show	10	100	70	170	03	02	05
Total		**34**	**1548**	**827**	**2375**	**30**	**22**	**52**

Extension activities

Individuals who called on office

A total 218 clientele owning 256 ponds, 8 bheries, 4 jheels, 18 entrepreneurs, 9 extension functionaries of State fisheries departments and 12 officers of State development departments/NGOs called on office during the period.

Exhibition

The Institute participated in 9 exhibitions organized in various parts of the country with charts and posters to depict CIFRI activities and achievements.

1. The Institute participated in the Science & Agriculture Fair at Chakdah, Nadia, Organized by "Gandhi Seva Sanga" during July 4-15, 2001. Thousands of fish farmers/fishermen and interested persons visited the pavilion.

2. The Institute participated in an exhibition " Kishan Pardashani" at Karnal, Haryana organised on the occasion of birth anniversary of Jannayak Ch. Devilal, at Jarbakm Gartaba during September 9 to 23, 2001 by the Directorate of Fisheries Govt. of Harayana. Fish farmers, fishermen and interested people visited the pavilion.

3. The Institute organised an exhibition in Guwahati during November 4 to 6, 2001 in connection with the inauguration of CIFRI Regional Centre, Guwahati. Various films on fisheries were screened for the benefit of the fish farmers, fishermen and other interested persons.

4. Participated in the Exhibition "Fish for Nutritional Security in 21st Century" held during December 4 to 6, 2001, at Central Institute of Fisheries Education, Mumbai to depict Institute's works and achievements.

5. The Institute participated in the Banga Sanskrit Utsav o Kalayni Mela, Kalyani Town Club at Kalyani during January 3 to 12, 2002.

6. Exhibits were supplied to the State Fisheries Department, Govt. of West Bengal for participating in an exhibition "Rajya Vigyan Mela" 2001.

7. Participated in All India Agriculture and Science Industrial Expo-2002 at Jangipur, Murshidabad during January 26 to February 6, 2002, to depict Institute's works and achievements.

8. The Institute particiated in the Sundarban Gramin Mela 2002 at Sarberia, South 24 Parganas during February 6 to 15, 2002. Thousands of people visited the pavilion.

9. The Institute participated in Krish o Hastoshilpa Mela, 2002, Nilganj during February 15 to 21, 2002 to depict Institute's works and achievements.

Mass awareness campaigns

Six campaigns were organised in coastal districts of West Bengal for mass awareness towards conversation of fish/prawn seed. Large numbers of fish seed collectors of the area were educated to stop destruction of fish/shell fish seed. Proper linkage was established with the local Panchyat bodies to monitor the same. Leaflets were distributed to the mass for strengthening the approach towards conservation.

6 EDUCATION AND TRAINING

► Regional Consultation on inland fisheries development in the northeast

A regional consultation on research needs for inland fisheries development in the northeast was organised by CIFRI at its Northeastern Regional Centre, Guwahati, during 6 & 7 November, 2001.

Training Programmes

1) A 10- day On-job training course on Inland Fisheries was organized for the students of Industrial Fisheries of Ganga Singh College, Chhapra, Bihar, during April 24 and May 3, 2001.

2) An off-campus training course on " Management of Estuarine wetlands" was organized at Hatgachia *Bheries,* Salt lake during October 27 to 31, 2001. A total of 56 fish farmers from different *bheries* in and around Kolkata underwent the training. The trainees also participated in activities like group action and identified relevant constraints towards management of wetlands. The practical classes were conducted in different *bheries* to acquaint themselves in various location. Films on fisheries were also screened for the benefit of the trainees.

3) 5-day On-job training course on Inland Fisheries was organized for the students of Industrial Fisheries of Srikrishna Mahila College, BiharBegusrai, during March 4 and 9,2001.

Man Power Development

- Dr. P.K. Katiha, Senior Scientist was deputed to Penang, Malaysia for attending the First Regional Workshop for ADB-RETA project entitled "Strategies and options for increasing and sustaining fisheries and aquaculture production to benefit poor households in Asia", from 20-25 August, 2001.

- Sri Utpal Bhaumik and Dr. M.K. Das, Principal Scientists participated in the Seminar cum Training on Intellectual Property Rights held at Indian Institute of Sugar Cane Research, Lucknow, organized by IndianCouncil of Agricultural Research, during 5-7 September, 2001.

- Dr. V. V. Sugunan, Director and Dr. B.C. Jha, Principal Scientist, participated in the National Seminar on "Use of Hindi in ICAR Fisheries Research Institutes" organized by CMFRI, Kochi during 12-13 October, 2001.

- Dr. V. V. Sugunan, Director, participated in the International Seminar on "Sustainable Fisheries for Nutritional Security" organized by CIFE, Mumbai during 4-6 December, 2001.

- Sri S.K. Sahu, Scientist, attended NNRMS sponsored certificate course on "Remote Sensing and GIS Application in Water Resources Management" at Indian Institute of Remote Sensing, Dehradun from June 4 to July 27, 2001.

- Sri D. Das, Scientist, attended the training on Java (advance), RDBMS, Networking essentials and Oracle at NIIT, New Delhi under NATP-INARIS from 15 March to 30 March, 2002.

- Dr. B.P. Mohanty, Scientist participated in the Hands-on Training Course on Molecular Markers : Tools for Fish Population Genetic Analysis, jointly organised by National Bureau of Fish Genetic Resources (ICAR) and National Agricultural Technology Project (NATP) from October 29 to November 10, 2001.

- Dr. U. Moza, Principal Scientist, acted as Expert on "National Biodiversity Strategy and Action Plan" of Haryana State, fisheries segment.

- Dr. P.K. Sukumaran, Principal Scientist, performed as the member of the Scientific Advisory Committee, Regional Station of the Kerala Agriculture University, Kumarakom, Kottayam.

CIFRI's pavelion at CIFE, Mumbai

Mass Awareness Programme for Conservation of fish

Interaction session among trainees and scientists at farm site

Students of Industrial Fisheries being imparted training

7 AWARDS AND RECOGNITIONS

➢ Dr. V. V. Sugunan, Principal Scientist (presently Director), was awarded the Fisheries Technocrats Forum Annual Award for the year 2001 in recognition of his outstanding contribution to Reservoir Fisheries Management. The award, consisting of a plaque and a certificate, was given at a function held at the Library Hall of the Directorate of Fisheries, Govt. of Tamil Nadu, Chennai on 12 May, 2001.

➢ Sri P. Muraleedharan, LDC received best men athelet award winning four individualGold Medals, two Silver and one bronze in the ICAR Zonal Sports Mewet held at CRRI, Cuttack. He also received one Gold as a member of 4 x 100 m relay team and a Silver at the Inter Zonal Meet held at ICAR Headquarter, New Delhi.

➢ Dr. B.P. Mohanty, Scientist was awarded Doctor of Philosophy (Biotechnology) of the Jawaharlal Nehru University (JNU), New Delhi in January, 2002.

8 LINKAGES AND COLLABORATION IN INDIA ABROAD INCLUDING EXTERNALLY FUNDED PROJECTS

Consultancy projects

□ A consultancy project captioned "Fish conservational and hydrobiological perspectives of River Narmada with reference to Sardar Sarovar Project" is being pursued at Estuarine Fisheries Research Centre of CIFRI, Vadodara, Gujarat.

□ The Commissionerate of Fisheries, Government of Gujarat, Gandhinagar has identified a sponsored project on "Feasibility Studies for Fish Production Enhancement in Selected Reservoirs of Gujarat State" and is being executed at Vadodara Centre of the Institute. The work on the project has already been initiated and Inception cum 1st Quarterly Progress Report has been submitted.

□ A Consultancy Project with NHPC explored the possibility of fisheries development and suitable design for fish pass in Teesta Low Dam Hydroelectric Project Phase III & IV. Dr. V. V. Sugunan, Director and Sri U. Bhaumik, Principal Scientist visited Project site, Siliguri, West Bengal.

Collaborative project

The Floodplain Wetlands Division is a collaborating Centre for the NATP Project, Germplasm inventory and gene banking of freshwater fishes run by the National Bureau of Fish

Genetic Resources, Lucknow. The project comprises a systematic survey of the fisheries resources of the North-Eastern region. The scheme gives special emphasis on the topical and commercial importance of fish germplasm of the region, which needs to be carefully conserved and protected.

Linkages

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

The Calcutta Centre of the Estuarine Division is providing teaching assistance to the Calcutta Centre of CIFE. The Division is also providing technical guidance to the private entreprenurs, farmers and farm managers involved in estuarine wetland fisheries including sewasge fed fisheries.

9 AICRP/COORDINATION UNIT/NATIONAL CENTRES

Nil

The Fisheries Technocrats Award for Dr. V.V. Sugunan, Director, CIFRI

Shri P. Muruleedharan receiving the best athelete award in the sports meet

OFT of Rice-cum-fish culture

On Campus training in Home Science, being conducted at KVK, Kakdwip

10 LIST OF PUBLICATIONS

Anon (2002). Pen culture in floodplain lakes. *Bull. Cent. Inland Capture Fish. Res. Inst.*, Barrackpore. No.**112 :** 19p.

Bandopadhyay, M. K. & M. A. Hassan (2002). Floodplain wetlands (beels) an important aquatic resource for enhancement . *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.) *Bull. Cent. Inland Capture Fish. Res. Inst.*, Barrackpore. No.**113** : 102-107.

Barik, N. K. (2002). Livelihood issues of the fisheries in the culture. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI Barrackpore 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.*, Barrackpore. No.**113** : 175-180.

Bhattacharyya, B. K.(2002). An effective process approach and responsible fishery management in the context of inland fisheries. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das(eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.*, Barrackpore. No.**113** : 181-186.

Bhaumik, Utpal (2002). Role of participatory rural appraisal and co-management in sustainable cultured-based fisheries. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.*, Barrackpore. No.**113** : 145-154.

Bhaumik, Utpal (2001) Role of social & culture aspects towards sustainable fisheries (in Bengali). *Matsya Samachar*, **1** (2)

Bhaumik, Utpal, S. K. Saha & A. Mitra (2001). Intended aquaculture technology development and transfer in resource-poor condition. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 168-170.

Bhaumik, Utpal (2001). Status of freshwater prawn farming in West Bengal. *Fishing Chimes*, **21**(1) : 84-87.

Bhaumik, Utpal & S. K. Saha (2002). Participatory rural appraisal for management of sustainable fisheries in estuarine wetlands. *In* Management of Estuarine Wetlands, Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.*, Barrackpore. No.**111 :** 42-53.

Das, A. K. (2000). Energy dynamics in the beels of West Bengal. *Proc. Nat. Acad. Sci. India,* (B), **70**(2) : 139-146.

Das, A. K. (2000). Limno-chemistry of some Andhra Pradesh reservoirs. *J. Inland. Fish. Soc. India*, **32**(2) : 37-44.

Das, A. K. & D. S. Krishna Rao (2001). Nutrient regime in Karnataka reservoirs. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 17-23.

Das, A. K., Ch Gopalakrishnayya & M. Ramakrishniah (2001). Guidelines for management of Andhra Pradesh reservoirs. *Fishing Chimes*, **21**(5) : 25-28.

Das, A. K.(2002). Chemical indicators of productivity in small water bodies. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.) *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 38-47.

Das, A. K. (2002). Phytoplankton primary production in some selected reservoirs of Andhra Pradesh. *Geobios*, **29** : 52-57.

Das, D. & R. A. Gupta (2000). Electronic communication system and network informatics in agricultural services. *J. Inland Fish. Soc. India*, **32**(1-2) : 45-48.

Das, D.(2001). GIST application in agricultural development. *J Interacad.*, **5**(4) : 582-585.

Das, D. (2001). Selection of crops in given agroclimatic condition using SQL/RDBMS. *J Interacad*, **5**(3) : 398-401.

Das, M. K., S. Manna, S. Bhowmick & S. P. Ghosh (2001). Changes in the haematological profile of fish in response to some abiotic and biotic stressors. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 63-67.

Das, M. K.(2002). Fish health management in culture based fisheries. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development, CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.) *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113 :** 119-130.

Das, Manas Kr. (2001). Monitoring of fish health and control of diseases in sewage fed bheris. *In* Management of Estuarine Wetlands, Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**111** : 36-41.

Das, Manas K., R.K. Das and S.K. Mondal (2002). Some stress sensitive parameters of young major carp, *Labeo rohita* (Hamilton-Buchanan). *Indian J. Fish.,* **49**(1) : 73-78.

Dutta, Tanusree & M. K. Das (2001). Plasma cortosol levels of *Labeo rohita* fingerlings at rest and subjected to confinement, handling of hypoxia. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 73-77.

Dwivedi, R. K., M. A. Khan, H. P. Singh, D. N. Singh & R. K. Tyagi (2000). Production dynamics and fisheries development in Naktara reservoir, Madhya Pradesh, India. *J. Inland Fish. Soc. India*, **32**(1-2) : 81-86.

Dwivedi, R. K. & R. K. Tyagi (2001). Spawn prospecting and fisheries from river Yamuna - a case study. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 149-152.

Ghosh, A. K., Amitabha Ghosh, H. C. Karmakar, P. K. Pandit & R. N. Misra (2001). Ecotypic differences and fisheries of saline wetlands of West Bengal. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 9-12.

Ghosh, A. K.(2002). Present status of inland fishery resources in India and the need for their enhancements. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.) *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 10-18.

Ghosh Amitabha & D. K. De (2001). Some aspects of dietary srift in *Tenualosa ilisha* (Ham.) in the freshwater zone of Hooghly estuary. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha(eds.), *Inland Fisheries Society of India,* Barrackpore : 116-119.

Ghosh, Amitabha (2002). Fisheries development of estuarine wetlands in West Bengal. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 108-113.

Ghosh, Amitabha (2002). Ecology and fisheries of estuarine wetlands of West Bengal. *In* Management of Estuarine Wetlands, Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**111 :** 1-9.

Ghosh, Amitabha (2002). Possibility of rearing *Pangasius pangasius* (Ham - Buchn) in sewage fed wetlands of Calcutta spill area. *In* Management of Estuarine Wetlands, Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**111 :** 23-26.

Ghosh, Amitabha, Utpal Bhaumik & Tapas Paria (2002). *Macrobrachium rosenbergii* (Galda) as a possible candidate species for rearing in sewage-fed wetlands. *In* Management of Estuarine Wetlands, Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**111 :** 27-31.

Gorai, B. K., P. N. Pandey & B. C. Jha (2001). Abundance and fluctuations of plankton population in relation to certain physico-chemical properties of a wetland. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 144-148.

Gupta, R. A., S. K. Mondal, Dhirendra Kumar, D. Nath, & D. Das (2001). Inventory of flood plain lakes using remotely sensed data. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India*, Barrackpore : 180-182.

Jha, B. C. (2000). Fish and diatom sampler - a case study from certain Indian reservoirs. *J. Inland Fish Soc. India*, **32**(1-2) : 63-67.

Jha, B. C. (2002). Aquatic biodiversity in inland fishereis management. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development, CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.) : *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 67-75.

Jha, B. C. (2002). Biotic communities in small reservoir fisheries with special reference to plankton and benthos. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.) *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 48-54.

Karmakar, H. C., P. K. Pnadit, & A. K. Ghosh (2001). A study in the present socio-economic status of the fisheries engaged in three ecologically different zones of estuarine wetlands. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 164-167.

Kathia, Pradeep K. (2001). Management of reservoir fisheries - a study in Himachal Pradesh. *J. Inland Fish Soc. India*, **33**(2) : 15-22.

Katiha, P. K. (2002). Institutional arrangements in culture-based fisheries management. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore, No.**113** : 165-174.

Katiha, P. K. (2002). Socio-economic aspects of culture based fisheries. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development, CIFRI, Barrackpore, 18th July to 17th August, 2001. V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 155-164.

Kaushal, D. K. & V. K. Sharma (2001). Ecology based fisheries management in some reservoirs of eastern Rajasthan. *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**108 :** 61p.

Kaushal, D. K. & V. K. Sharma (2001). Significance of ecological parameters in fisheries management of Dholbaha reservoir. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India*, Barrackpore : 28-33.

Kaushal, D. K., H. C. Joshi & S. Kumar (2001). Limnological features of Pandoh reservoir, Himachal Pradesh. *Indian J. Fish.,* **48**(2) : 217-220.

Khan, M. A. & M. Sinha (2000). Status of mahseer fisheries in north and north-eastern India with a note on their conservation. *J. Inland Fish. Soc. India*, **32**(1-2) : 28-36.

Khan, M. A., Dhirendra Kumar & Ranjana Sinha (2001). On some biological aspects of *Hilsa* (*Tenualosa*) *ilisha* (Hamilton-Buchanon) from Hooghly estuary, India. *J. Inland Fish. Soc. India,* **33**(1) : 38-44.

Khan, M. A., R. S. Panwar, A. Mathur, & Rekha Jetly (2001). Macrobenthos of middle stretch of the river Ganga and its role as an indicator of environmental quality. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 153-160.

Khan, M. A. (2002). Small reservoirs of India and their suitability for development of culture-based fishery. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI Barrackpore 18th July to 17th August, 2001.(V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 83-91.

Kumar, Dhirendra (2001). Fish productivity of ecologically different ponds with reference to carps and air-breathing fishes. *J. Inland Fish. Soc. India*, **33**(1) : 8-16.

Kumar, Dhirendra (2001). Studies on the macro-zoobenthic production from two ecologically different fish culture ponds at Patna. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 107-115.

Lorenzen, K., U. S. Amarasinghe, D. M. Bartley, J. D. Bell, M. Bilio, S. S. de Silva, C. J. Garaway, W. D. Hartmann, J. M. Kapetsky, P. S. Laleye, J. Moreau, V. V. Sugunan & D. B. Swar. Strategic review of enhancements and culture-basaed fisheries. *In* Aquaculture in the Third Millennium - Technical Proceedings of the Conference on Aquaculture in the Third Millennium, Rohana P. Subasinghe & ors.(eds.), Network of Aquaculture Centres in Asia-Pacific, Dept. of Fisheries, Thailand & FAO of the U. N 221-237.

Mandal. S. K. (2002). Quantitative population models for management of inland fisheries-conceptual framework. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI,Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 137-144.

Manna, S. K. M. K. Das, S. Bhowmick & S. P. Ghosh (2001). White spot disease outbreak in *Penaeus monodon* in some bheris of West Bengal. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 83-87.

Mishra, D. N. & Usha Moza (2001). Evaluation of fish and fishery resources in river Yamuna; Part - I. *J. Inland Fish Soc. India*, **33**(1) : 93-99.

Mishra, R. N., & A. K. Mukhopadhyay (2001). Charge characteristics of soil as affected by phosphate absorption. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 50-52.

Mitra, Krishna (2002). Role of biotic factor for enhancing the fish production in sewage fed fishery. *In* Management of Estuarine Wetlands, Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**111 :** 14-18.

Mitra, Krishna (2002). Role of macrophytes and associated fauna of floodplain wetlands and their management. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development, CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 55-61.

Mitra, P. M. (2001). Length-weight relationship of some commercially important fish speeies of Hooghly estuary. *J. Inland Fish Soc. India*, **33**(2) : 12-14.

Mitra, P. M. & S. K. Mondal (2001). Studies on stock assessment of *Setipinna phasa* (Hamilton) of Hooghly-Matlah estuarine system. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds), *Inland Fisheries Society of India,* Barrackpore : 13-16.

Mitra, P. M., H. C. Karmakar, A. K. Ghosh, N. C. Mondal, H. K. Sen & B. N. Das (2001). Fisheries of Hooghly-Matlah estuarine system ; Further appraisal (1994-95 to 1999-2000). *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**109 :** 61p.

Mohanty, B. P.(2001). Wolbachia : potential targets of filariases. *Curr. Sci.*, **80**(5) : 614-616.

Mukhopadhyay, M. K., K. Mitra, S. Samanta, S. Bandopadhyay & D. K. Biswas (2001). In *situ* toxicity of industrial effluents in Hooghly estuarine system - a comparative evaluation on early life stages of major carp. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 53-57.

Murugesan, V. K. & S. Monoharan (2000). Management of reservoir fisheries through private enterpreneurs - case studies. *J. Inland Fish. Soc. India*, **32**(1-2) : 68-75.

Murugesan, V. K. (2002). Yield optimization in small reservoirs - a case study in Tamil Nadu. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 76-82.

Nath, D.(2001). Water and soil characteristics of the Narmada estuary before commissioning of Sardar Sarovar dam. *J. Inland Fish. Soc. India*, **33**(2) : 37-41.

Nath, D.& N. P. Srivastava (2001). Primary productivity of Narmada for the stretch Sandia to Mola in the context of construction of dams on the river and its tributaries. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 37-40.

Nath, D.& N. P. Srivastava (2001). Physico chemical characteristics of Narmada for the stretch Sandia to Mola in M. P. State in the context of construction of reservoirs on the river or its tributaries. *J. Inland Fish Soc. India*, **33**(1) : 17-24.

Nath, D., M. K. Mukhopadhyay & H. C. Joshi (2001). Effect of sublethal pesticides on the moulting frequency of *Penaeus monodon*. *J. Inland Fish. Soc. India*, **33**(2) : 70-72.

Nath, D. (2002). Methods of evaluating primary productivity in small water bodies. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 31-37.

Nath, D. (2002). Role of abiotic factors for increasing fish production in sewage-fed wetlands. *In* Management of Estuarine Wetlands. Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**111 :** 10-13.

Nath, D. (2002) Role of primary production for enhancing fish yield in sewage fed wetlands. *In* Management of Estuarine Wetlands. Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**111 :** 19-22.

Palui, D., V. K. Srivastava & B. C. Jha (2001). Physico-chemical features of Bishnupur ox-bow lake in Begusarai, Bihar. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 46-49.

Paria, Tapas & S. K. Konar (2001). Impact of environmental parameters of impounded waters on fish production in the District North 24 Parganas, West Bengal. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 88-92.

Pathak, V., L. R. Mahavar & Alok Sarkar (2001). Ecological status and production dynamics of a stretch of river Mahanadi. *J. Inland Fish. Soc. India*, **33**(1) : 25-31.

Pathak, V., A. Sarkar & L. R. Mahavar (2001). Hydrology and productivity of some important tributaries of Brahamaputra. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 41-45.

Pathak, V., Alok Sarkar & B. K. Bhattacharya (2001). Ecological status and fish production potential of Siang, Dibang and Lohit - The three forerunners of river Brahamaputra. *J. Inland Fish. Soc. India*, **33**(2) : 23-28.

Pathak, V.(2002). Energy dynamics and estimation of fish production potential in small reservoirs. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 23-30.

Ramakrishniah, M., P. S. C. Bose & M. Karthikeyan (2001). Fisheries of Vengalarayasagar and impact of stocking major carps on the fish productivity. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 138-143.

Rao, D. S. Krishna & D. N. Singh (2001). Ecostatus of mahseers in the rivers and reservoirs of Karnataka. Proc. National Workshop on Biodiversity and Genetic Conservation of Mahseer, 24-25 Aug., 2001, Lonavala, Maharashtra.

D. S. K. Rao, A. K. Das, M. Karthikeyan & M. Ramakrishniah (2001). Phytoplankton primary production and fish production efficiency of Manchanbele reservoir. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India*, Barrackpore : 1-8.

Sagar, R. L. & Ojha, S. N. (2001). Goat farmers perception of the merits and demerits from middlemen in the marketing of goats. *Indian J.Small Ruminants*, **7**(1) : 38-40.

Sagar, R. L. & Kunzru. O. N. A scale to measure livestock owners attitude towards feeding of concentrates. *Indian Psychological Review*, **56**(2) : 39-45.

Saha, P. K., V. Pathak & Alok Sarkar(2001). Chemical properties of soil and water of beels of Assam. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha(eds.), *Inland Fisheries Society of India,* Barrackpore : 58-62.

Saha, P. K. (2002). Role of soil quality parameters in culture-based fishery management. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.(V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.*, Barrackpore. No.**113** : 19-22.

Seth, Ravindra N.(2001). Prospects of giant river catfish (*Aorichthys seenghala*) culture. *Fishing Chimes*, **21**(3) : 31-34.

Seth, R. N. (2001). Tangra machhli *Aorichthys seenghala* (Sykes) utpadan ki Sambhawanai. *Vijnana Parishad Anusandhan Patrika*, **44**(2) : 73-99.

Seth, R. N. & P. K. Katiha (2001). Observations on riverine seed resources of a large catfish *Aorichthys seenghala*(Sykes). *J. Inland Fish. Soc. India*, **33**(1) : 81-86.

Seth, R. N. & P. K. Katiha (2001). The riverine fisheries of large sized siluroids with special reference to Aorichthys seenghala (Sykes). *J. Indian Fish. Asso.*, **28** : 1-9.

Seth, Rabindra N. & R. S. Panwar(2001). Changing scenario of riverine fisheries of River Ganga around Allahabad. *Fishing Chimes*, **21**(7) : 53-54.

Seth, R. N., A. Hajra, R. S. Panwar & L. R. Mahavar (2001). Effect of certain heavy metals on carbohydrate metabolism in the serum, muscle and liver of *Cirrihinus mrigala* (Ham.) fingerlings. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha(eds.), *Inland Fisheries Society of India,* Barrackpore : 78-82.

Seth, R. N., R. S. Panwar & P. K. Katiha (2001). Pragrahan matsya ki vyvasay mein mahilaon ka yogdan (In Hindi) Contribution of Women in Capture Fisheries Enterprise) *In* Proceedings, National Seminar in Official Language (Women in Fisheries) held during August at Central Institute of Fisheries Technology, Matsyapuri, Cochi ; 1-4.

Seth, R. N. & Suresh Chandra (2002). Pradesh mein vipul matra mein uch gudvata kay matsya beej ka utpadan - sambhwanai & chunuteja (in Hindi). (Mass production of high quality seed in Uttarpradesh - possibilities and challenges) Souvenir, Fish Seed Quality Brood Stock Management Fish Farmer's Development Agency, 16th March 2002, Varanasi, 61-63.

Shree Prakash & Kalpana Srivastava (2001). Studies on bacterial diversity in river Yamuna. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha (eds.), *Inland Fisheries Society of India,* Barrackpore : 133-137.

Singh, Balbir (2001). Machhyon ki bimariya - Pahechan ebom upchar (in Hindi).(Diseases of fish - diagnosis and remedy). *Bull. Cent. Inland Capture Fish Res. Inst.,* Barrackpore No.**110** : 35p.

Singh, D. N.(2001). Management measures to develop fish production in ox-bow lakes - a case study. *Geobios,* **28**(1) : 25-28.

Singh, D. N., A. K. Das & P. K. Sukumaran (2001). Participation production in river Godavari. *In* Riverine and Reservoir Fisheries of India, SOFT, Cochin, : 30-34.

Singh, D. N., A. K. Das, N. P. Srivastava & P. K. Sukumaran (2001). Status of plankton in river Godavari. *In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha(eds.), *Inland Fisheries Society of India,* Barrackpore : 128-132.

Sinha, Ranjana, Tanusree Dutta & M. K. Das (2001). Impact of stress on blood parameters and interrenals of *Labeo rohita. In* Eco-Friendly Management of Resources for Doubling Fish Production - Strategies for 21st century, M.Sinha, Dhirendra Kumar & P. K. Katiha(eds.), *Inland Fisheries Society of India,* Barrackpore : 68-72.

Srivastava, Kalpana & R. N. Seth (1999). Biotechnology in conservation of aquatic biodiversity. *Flora & Fauna*, **5** : 2-3.

Sukumaran, P. K. (2001). Water transparency and its impact on plankton production in a lentic habitat. *Environ & Ecol.*, **19**(2) : 449-453.

Sukumaran, P. K. & A. K. Das (2001). Distribution of plankton in some freshwater reservoirs of Karnataka. *J. Inland Fish Soc. India*, **33**(2) : 29-36.

Sukumaran, P. K. (2002). Aquatic microflora in a perennial tank in Bangalore. *Environ. & Ecol.,* **20**(1) : 8-12.

Sugunan, V. V. (2001). Culture-based fisheries in reservoirs and lakes in India. *In* Utilizing Different Resources for Livelihood in Asia : A resource Book. IIRR, IDRC, FAO, NACA & ICLARM, Philippines, Oct. 2001 : 159-165..

Sugunan, V. V. (2001). Integrated development of floodplain wetlands in India. *In* Utilizing Different Resources for Livelihood in Asia : A resource Book. IIRR, IDRC, FAO, NACA & ICLARM, Philippines, Oct. 2001 : 315-318.

Sugunan, V. V. & M. Sinha (2001). Sustainable capture and culture-based fisheries in freshwater in India. *In* Sustainable Indian Fisheries, T. J. Pandian (ed.) National Academy of Agricultural Sciences, Madurai : 43-70.

Sugunan, V. V. (2002). Advances in enhancement and culture-based fisheries. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 187-197.

Sugunan, V. V. (2002). Enhancement : An effective tool for increasing inland fish production. *Fishing Chimes*, **21**(10&11) : 21-26.

Sugunan, V. V. (2002). Enhancement and culture-based fisheries-conceptual framework. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 1-9.

Tyagi, R. K. (2002). Need for stock assessment in culture-based management. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 130-136.

Unnithan, V. K. ed. (2001). Ecology and fisheries investigations in Vembanad lake. *Bull. Cent. Inland Capture Fish. Res. Inst.*, Barrackpore, No.**107** : 38p.

Vinci, G. K. (2002). Development of management guidelines for culture-based fisheries in beels. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development, CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 92-101.

Vinci, G. K.(2002). Pen Culture- an effective tool in fish yield optimization in floodplain wetlands. *In* Summer School on Culture-based Fisheries for Inland Fisheries Development , CIFRI, Barrackpore, 18th July to 17th August, 2001.V. V. Sugunan, B. C. Jha & M. K. Das (eds.), *Bull. Cent. Inland Capture Fish. Res. Inst.,* Barrackpore. No.**113** : 114-118.

Vinci, G. K. & K. Mitra (2002). Scope and prospects of pen culture in estuarine wetlands of West Bengal. *In* Management of Estuarine Wetlands. Amitabha Ghosh & Utpal Bhaumik (eds.), *Bull. Cent. Inland Capture Fish Res. Inst.*, Barrackpore, No.**111** : 32-35.

Vinci, G. K., K. Mitra, M. K. Bandopadhyay, M. A. Hassan & D. K. Biswas (2002). Pen culture of *Macrobrachium rosenbergii* in a beel of West Bengal. *Environ. & Ecol.,* **20**(1) : 4-7.

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

Project No.	Name of Project
RI/A/1	ECOLOGY AND PRODUCTION RELATIONSHIPS IN PENINSULAR RIVER SYSTEMS
RI/B/2	ASSESSMENT OF ECOLOGY, BIODIVERSITY AND PRODUCTION POTENTIAL OF INDUS RIVER SYSTEM
RI/B/3	EVALUATION OF HABITAT DEGRADATION IN THE CONTEXT OF FISHERIES ECOLOGY IN RIVER GANGA
ES/B/1	INVESTIGATIONS ON THE FISHERIES OF HOOGHLY ESTUARINE SYSTEM AND ITS WETLANDS
ES/B/2	ECO-STATUS OF SELECTED WEST COAST ESTUARIES OF INDIA
ES/B/3	STUDIES ON HILSA FISHERIES IN THE STRETCH BETWEEN FARAKKA AND SAGAR ISLAND
RS/A/1	ECOLOGY AND FISHERIES OF FRESHWATER RESERVOIRS
RS/A/2	STUDIES ON ECOLOGY AND FISHERIES OF RESERVOIRS OF EASTERN UTTAR PRADESH
FW/A/3	ECOLOGY, FISHERY BIOLOGY AND FISH PRODUCTION DYNAMICS OF FLOODPLAIN WETLANDS IN INDIA
FW/A/5	FISH PRODUCTION DYNAMICS OF FLOODPLAIN WETLANDS OF UTTAR PRADESH
FW/A/6	FISHERY OF SELECTED PRAWN SPECIES IN KAYAMKULAM BACKWATER
EM/B/1	ASSESSMENT OF ENVIRONMENTAL IMPACT ON BIOTIC COMMUNITY IN RIVERS AND ASSOCIATED ECOSYSTEMS
EM/B/2	AETIOLOGY, PATHOPHYSIOLOGY OF ENVIRONMENTAL STRESS AND DISEASES IN FISH/PRAWN. DEVELOPMENT OF HEALTH ASSESSMENT AND CONTROL METHODS

BT/B/1 GENETIC CHARACTERIZATION AND MIGRATION RELATED BIOCHEMICAL CHANGES OF INDIAN SHAD, *TENUALOSA ILISHA*

BT/B/2 DEVELOPMENT OF IMMUNOLOGICAL AND MOLECULAR TECHNIQUES FOR RAPID DIAGNOSIS OF BACTERIAL AND VIRAL DISEASES OF FISH AND SHELLFISH

RA/A/1 INLAND FISHERIES RESOURCE EVALUATION THROUGH REMOTE SENSING TECHNIQUES

RA/A/2 ASSESSMENT OF FISH CATCH AND CATCH STRUCTURE FROM DIFFERENT INLAND OPEN WATER SYSTEMS IN INDIA

AP Cess Fund Scheme

1 Algal diversity of Hooghly-Matlah estuarine system with special reference to Sundarbans mangrove wetlands

2 Ecological status and fishery potential of riverine fishery resources of six North-eastern states

3 Techno-socio economics status of fisheries of river Ganga

4 Development of clinical blood and tissue profiles and standard methods for diagnosing stress in the fish and prawn

NATP Projects

1 Integrated National Agricultural Resources Information system.

2 Enhancing freshwater fish production and providing food security in tribal, backward and hilly areas under Jai Vigyan National Science & Technology Mission on House-hold and Nutritional Security..

3 Fishery Management in Lentic Water System : Stocking of reservoir with fish seed.

4 Germplasm inventory, evaluation and gene banking of fresh water fishes.

National Fellow Scheme

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

12 CONSULTANCY, PATENTS, COMMERCIALISATION OF TECHNOLOGY

Ongoing consultancy

Title of project	Name of funding agency	Date of start
1. Feasibility studies for fish production in selected reservoirs	Govt. of Gujarat	31 March, 2001
2 Fisheries development in Kurichu Reservoir	NHPC, Kurichu, H.E. Project, Bhutan	10 September, 2001

13 MEETINGS

Research Advisory Committee Meeting

The Research Advisory Committee Meeting of the Institute was held at CIFRI, Barrackpore on 30th & 31st May, 2001 under the Chairmanship of Prof. J.S. Dutta Munshi and attended by Dr. B.N. Singh, Dr. V.S. Sharan, Dr. P. Das, Dr. S.P. Ayyar and Dr. M. Sinha. After comprehensive discussion the Committee identified research priorities and gave recommendations for future research programme.

Meeting of ICAR Regional Committee No.II

The fifteenth meeting of ICAR Regional Committee No.II comprising the states of West Bengal and Assam was held on 15 and 16 June, 2001 at Central Inland Capture Fisheries Research Institute, Barrackpore, West Bengal. Shri Kiranmay Nanda, Hon'ble Minister of Fisheries, Aquaculture, Aquatic Resources and Fishing Harbour, Government of West Bengal attended the inaugural session on 14 June, 2001 as Chief Guest, where Dr. (Mrs.) Hemaprabha Saikia, Hon'ble Minister of Fisheries, Government of Assam was the Guest of Honour. The inaugural ceremony was presided over by Md. Anisur Rehaman, Hon'ble Minister of Animal Resource Development, Government of West Bengal. Dr. R.S. Paroda, Secretary, DARE, Government of India and Director General of ICAR, the Members of ICAR Governing Body and ICAR Society, the Vice-Chancellors, Deans and Faculty Members from SAUs, located in the Region, Senior Officers from the States of West Bengal and Assam, a number of DDGs and ADGs from ICAR Headquarters, Directors and Scientists of various ICAR Institutes, representatives from financial Institutions like NABARD, NGOs representiatives and a large number of local dignitaries graced the inaugural function besides participating in the technical sessions.

Annual Staff Research Council Meeting

The Annual Staff Research Council meeting of the Institute, was held on 28 and 29 May, 2001. The meeting was commenced with the welcome address by Dr. M. Sinha, Director, CIFRI . The project leaders presented the progress achieved under all the seventeen projects implemented during 2000-2001. After extensive deliberation work programme for 2001-2002 were finalised.

Joint Staff Council Meeting

The meeting of the Joint Staff Council of CIFRI was held on 22nd June 2001 at Barrackpore under the Chairmanship of Dr. Ajoy Kumar Ghosh, Acting Director. The members, official side as well as the staff side attended the meeting and deliberated on the agenda.

Brain-storming session on the possibilities of fisheries projects in the Eastern & North-eastern Region

A brain-storming session was organized on March 7, 2002 at CIFRI, Barrackpore in collaboration with the Technology Information, Forecasting and Assessment Council (TIFAC), New Delhi, to discuss the possibilities of fishery projects in the Eastern and North-Eastern region. Dr. S. A. H. Abidi, Member Agricultural Scientists' Recruitment Board, New Delhi and Chairman, TIFAC Fisheries Panel, presided over the function.

Hindi Week

The Institute observed the Hindi Week during 14-20 September, 2001 by organising meetings and various competitions for essay writing, official letter writing and drafting. The week long celebrations culminated in a meeting attended by all members of staff. While addressing the gathering, the Director appealed for progressive use of Hindi in the day to day activities of the Institute.

CIFRI hosts the 15th meeting of ICAR Regional Committee No.II at Barrackpore

RAC meeting in progress

Presentation of reports in SRC

The Brain Storming Session in progress

Hindi week being observed at CIFRI

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

The scientists and technicians of the Institute participated in various conferences/symposia/seminars/workshops and meetings held during April 2001 to March 2002, wherein they presented their research findings and exchanged views with the other delegates. List of scientists who participated/presented papers in such gatherings are given below :

Conference/Symposium/Seminar/ Workshop, etc.	**Paper presented**	**Authors/Participants**
National Seminar on Riverine and reservoir Fisheries of India, CIFT Cochin, Kerala during 21-24 May, 2001	Periphyton production in river Godavari	D.N. Singh, A.K. Das amd P.K. Sukumaran
Workshop on Kharif Frontline Demonstration on Oilseeds and Pulses, held at R.K. Ashram, KVK, Nimpith, South 24 Parganas on 30 May, 2001	Presented report of Frontline Demonstration of Oilseeds & Pulses, Rabi & Summer, 2000-2001	Mr. G. Chandra & Dr. P.K. Dhara
ICAR constituted streamline committee meeting for KVKs of West Bengal for smooth functioning held at R.K. Ashram, KVK, Nimpith, South 24 Parganas on 6 July, 2001	-	R.L. Sagar, G. Chandra, A.K. Chattopadhyay
Scientific Advisory Committee meeting of KVK, Kakdwip held at KVK of CIFRI, Kakdwip on 20 July, 2001	Presented progress report of KVK, Kakdwip from January, 2001 to July, 2001	R.L. Sagar & staff of KVK
Workshop on Captive breeding of prioratized culturable ornamental fishes for commercializtion and consumption, held at NBFGR, Lucknow, during 29-30 July, 2001	-	V.V. Sugunan
First Regional Workshop for ADB-RETA project entitled "Strategies and options for increasing and sustaining fisheries and aquaculture production to benefit poor households in Asia", held in Penang, Malaysia, from 20-25 August, 2001	-	P.K. Katiha
National workshop on The Mighty mahseer held at Lonawala, 24-25 August, 2001	Ecostatus of mahseers in the rivers and reservoirs of Karnataka	D.S. Krishna Rao and D.N. Singh
Seminar cum Training on Intellectual Property Rights held at Indian Institute of Sugar Cane Research, Lucknow during September 5-7, 2001 and was organized by ICAR.	-	Utpal Bhaumik & M.K. Das

State level workshop-cum-training programme on oilseeds & pulses for KVKs of West Bengal held at R.K. Ashram KVK, Nimpith on 30 September, 2001	Presented Annual Progress Report of KVK, Kakdwip from October, 2001 to September, 2001 Presented Action Plan for Frontline Demonstration of Oilseeds & Pulses, Rabi 2001-2002	A.K. Chattopadhyay P.K. Dhara
Workshop on Integrated National Agricultural Research Information System-Fisheries, held at National Bureau of Fish Genetic Resources, Lucknow, on 26-27 September, 2001	-	S.K. Mandal
Recruitment analysis workshop of NATP Project on Integrated National Agricultural Research Information System-Fisheries, NBFGR, Lucknow, 26-27 September, 2001	-	R.K. Tyagi
Utilizing Different Resources for Livelihood in Asia : A resource Book, IIRR, IDRC, FAO, NACA &ICLARM, Philippines, October, 2001	Culture-based fisheries in reservoirs and lakes in India	V.V. Sugunan
-do-	Integrated development of floodplain wetlands in India	V. V. Sugunan
National Seminar on Croping with natural hazards, in Pune on 5-7 October, 2001	Periodicity and abundance of plankton in Cauvery river	D.N. Singh & A.K. Das
Seventyfirst Annual Session of The National Academy of Sciences, India (5-7 October, 2001), University of Pune	-	R.N. Seth
National Seminar on Use of Hindi in ICAR Fisheries Research Institutes, organised by CMFRI, Kochi during 12-13 October, 2001	-	V.V. Sugunan
National Workshop on Conservation of rivers and floodplains in India, organised by School of Environmental Sciences, JNU, New Delhi and Ministry of Environment and Forests, Govt. of India, New Delhi on 23-24 November, 2001	-	D.N. Mishra
Workshop to discuss EFC Budget at S.M.D. held at JNU, Delhi, during 23-27 November, 2001	-	V.V. Sugunan
National Workshop on Conservation of River and Floodland in India at Jawaharlal Nehru University, New Delhi from 23-24 November, 2001	-	R.S. Panwar

International Seminar on Sustainable Fisheries for Nutritional Security, organized by CIFE, Mumbai, during 4-6 December, 2001	-	V.V. Sugunan
Workshop on Lake management in India, organised by Global Water Partnership (GWP) and IAAB, Hyderabad on 12-13 December, 2001 at Hyderabad	Ecology of Sarni reservoir (M.P.) in the context of fisheries	A.K. Das and N.P. Srivastava
Bengal State Medical Conference organised by Indian Medical Association,Chakraberia Branch, at Science City, Kolkata, during 19-20 January, 2002	-	Utpal Bhaumik, S.K. Saha, A. Mitra
Science Day organised by National Academy of Sciences, Allahabad on 28 February, 2002 at Allahabad	-	R.S. Panwar, A.K. Laal & R.N. Seth
National Seminar on HRD in Fisheries & aquaculture for Eastern and North-Eastern India, held at CIFE Centre, Kolkata, during 15-16 March, 2002	-	V.V. Sugunan
-do-	Water pollution in river Narmada in M.P. State	D. Nath
Training Programme on Development of Reservoir Fisheries in India, held at CIFRI, Barrackpore, during 12-16 March, 2002	Fisheries Statustics in Reservoirs	S.K. Mandal
Instructional Workshop on "Soft Computing with MATLAB (IWSC 2002) convened by the Department of Applied Mathematics, Faculty of Technology and Engineering: M.S. University of Baroda, Vadodara	-	S.N. Singh
National Seminar on HRD in Fisheries and Aquaculture for Eastern and North-Eastern India, organized by CIFE at Kolkata, during 14-15 March, 2002	-	Utpal Bhaumik
Annual Zonal Workshop of KVKs of Zone II, held at Rajendra Agricultural University, Pusa, Bihar, from 16-19 March, 2002	Presented Annual Report from April, 2001 to March, 2001 of KVK, Kakdwip and Action Plan for the year 2002-2003	G. Chandra
Workshop on Fish Seed Quality and Brood stock Management organised by State Fisheries Department, Uttar Pradesh and Fish Farmers' Development Agency, Lucknow, in Varanasi on 16 March, 2002	-	R.N. Seth & B.K. Singh

15 WORKSHOPS, SEMINARS, SUMMER INSTITUTES, FARMER'S DAY ETC.

Summer School on "Culture-based Fisheries for Inland Fisheries Development"

A Summer School on **'Culture-based Fisheries for Inland Fisheries Development'** was conducted at CIFRI, Barrackpore, from 18 July to 17 August, 2001, twenty-five participants from various states representing Fisheries Departments,Universities, Agricultural Universities, and Research Organizations took part in the one-month programme. The Summer School was inaugurated by Dr. S. A. . Abidi, Member, Agricultural Scientists' Recruitment Board, New Delhi on 18 July 2001 at a function attended by Prof. A. K. Bhattacharya, Vice-Chancellor, West Bengal University of Animal and Fishery Sciences. During the inaugural function, Dr. V. V. Sugunan, Course Director welcomed the participants and explained the background and relevance of the Summer School. The course included definitions and concepts of culture-based fisheries, its relevance in the Indian context and the scope of adopting it for fisheries development of the country. Lectures, laboratory work, field trips, dissertation and seminars were part of the course. Apart from the Faculty comprising the scientists of CIFRI, many experts from other organizations were also invited as Resource persons. In the valedictory function held on 17 August 2001 to mark the end of the Summer School the certificates were distributed by Prof. Debabrata Dasgupta.

Fish Farmer's Day

Two Fish farmer's day were organised where 246 numbers of fish farmers/fishermen and interested persons participated.

National Fish Farmers' Day

The **National Fish Farmers'** Day was organized at Sukanta Sadan, Barrackpore on July 10, 2001 by CIFRI to commemorate first success of induced breeding by Dr. Hiralal Choudhuri. The function was inaugurated by Sri Kiranmay Nanda, Hon'ble Minister of Fisheries, Govt. of West Bengal. The function was attended by eminent persons like Prof. Ashim Bhatrtacharya, Vice-Chancellor, West Bengal University of Animal & Fishery Sciences, Prof. Debabrata Dasgupta, Vice-Chancellor, Bidhan Chandra Krishi Viswavidyalay, Dr. P. Das, Ex-Director, NBFGR, Prof. S.K. Konar & Prof. A.R. Khudabux, Kalyani University, Scientists of CIFRI, CIFA, CIBA, CIFE, Officials of State Fisheries Department and NGOs. About 300 fish farmers participated in the interaction session. Hon'ble Minister, Sri Kiranmay Nanda, Dr. H. Chaudhuri and veteran fish farmer Sri Nilratan Ghosh were felicitated on the occasion for their outstanding contribution for the development of fisheries in the country.

National Fish Farmer's Day function at CIFRI

Inaugural session of the Summer School

16 DISTINGUISHED VISITORS

Shri Hukum Deo Narayan Yadav, Union Minister of State for Agriculture, Government of India

Hon'ble Union Minister of State for Agriculture, Government of India, Shri Hukum Deo Narayan Yadav visited the Allahabad Research Centre of CIFRI. Dr. R.S. Panwar, Principal Scientist & Head of Division, along with scientists of the Riverine Division extended a warm welcome when he paid his visit to Riverine Division of the Institute on 10 February, 2002. The minister evinced keen interest in various research activities of this division and appreciated the work being carried out by the scientists.

Other visitors :

Dr. Panjab Singh, Director General, ICAR, New Delhi
Sri Sailen Sarkar, Minister-in-Charge, Horticulture & Food Processing, Govt. of West Bengal
Mr. S.S. Palanimanickam, Chairman, Standing Committee on Agriculture
Dr. K. Gopakumar, DDG(Fy), ICAR, New Delhi
Dr. B.N. Singh, ADG(Fy), ICAR, New Delhi
Dr. M. Mahadevappa, Chairman, ASRB, New Delhi
Dr. Sena S. De Silva, Deakin University, Victoria, Australia
Prof. M.N. Kutty, Task Force Member, NACA, Bangkok
Dr. Dilip Kumar, NACA, Bangkok
Ms Nita Chowdhury, IAS, Joint Secretrary (Fisheries), Government of India
Prof. Dinesh Marothia, Ex-Chairman (CACP), Govt. of India & Prof. & Head (DANRE), Raipur
Dr. A.G. Sawant, Member, ASRB, New Delhi
Dr. D.N. Borthakur, Member, Governing Body, ICAR
Mr. Sunder Lal Bahuguna, Environmentalist
Dr. S. Ayyapan, Director, CIFE, Bombay
Prof. K. Swarup, National Academy of Science
Prof. D.N. Saxena, Head, Dept. of Zoology, Jivaji University, Gwalior
Dr.S A.H. Abidi, Member, ASRB, New Delhi
Dr. C. Saha, Act. Director, CIFA, Kausalyaganga, Bhubaneswar
Dr. M.M. Verma, Director, Sheila Dhar Research Institute of Soil Science, Allahabad
Dr. N.A. Vhora, IAS, Commissioner of Fisheries, Govt. of Gujarat, Gandhinagar
Dr. Amitava Ghosh, Deputy Project Director (T&I), DRD Cell, Govt. of West Bengal, South 24 Parganas
Dr. M. Misra, Joint Director, Dept. of Extension, Ministry of Agriculture, Govt. of India, New Delhi
Dr. S.K. Waghmare, Principal, Extension Education Institute, Govt. of India

Dr. S.S. Ghosh, Zonal Coordinator, Zonal Coordination Unit Zone II, ICAR TOT Project, Kolkata

Shri K.R. Chaudhary, Dy. Commissioner of Fisheries, Government of Gujarat, Gandhinagar

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

Dr. K. Ramamoorthy, Associate Ecologist, Gujarat Ecological Society, Vadodara

Prof. H.R. Singh, Prof. & Pro-Vice-Chancellor & Head, Dept. of Zoology, Allahabad University, Allahabad

Prof. K. Swarup, F.N.A., General Secretary, National Academy of Sciences, Allahabad

Dr. Y.R. Tripathi, Ex-Director, U.P. State Fisheries Department

Dr. H.C. Pathak, Chief General Manager, NABARD, Mumbai

Dr. M.M. Verma, Director, Sheila Dhar Institute of Soil Sciences, Allahabad

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

Dr. Vyas M. Dixit, Managing Director, Analchem Pvt. Ltd., India, Allahabad

Shri M.P. Chaturvedi, I.A.S., Secretary, Fisheries, West Bengal, Calcutta

Dr. B.P. Singh, Joint Director, Central Potato Research Institute, Campur, Meerut, U.P.

Dr. R. Sahai, Ex-Director, N.B.A.G.R., Karnal

Dr. D. Kapoor, Director, N.B.F.G.R., Lucknow

Mr. B.S. Saharan, Director, Haryana Fisheries, Chandigarh

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

Shri Chand Ram, CEO, State Fisheries Deptt., Kurukshetra distt.

17 PERSONNEL *(MANAGERIAL POSITION ONLY)*

Director, CIFRI, Barrackpore, West Bengal

Dr. A.K. Ghosh, Director (Acting), upto 31st July, 2001

Dr. V. V. Sugunan, Director (Acting) from 1st August, 2001

Riverine Division, Allahabad, Uttar Pradesh

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

Reservoir Division, Bangalore, Karnataka

Dr. M. Ramakrishniah, Principal Scientist, Head of Division (Acting)

Dr. D.N. Singh, Principal Scientist. Head of Division (Acting) 14th June, 2001

Dr. Panjab Singh, Director General ICAR interacting with scientists of CIFRI

Dr. M. Mahadevappa, Chairman ASRB addressing scientists

Estuarine Division, Barrackpore, West Bengal

Dr. D. Nath, Principal Scientist, Head of Division (Acting) from 31st July 2001 (A.N.)

Fish Health & Environment Division, Barrackpore, West Bengal

Dr. Krishna Chandra, Principal Scientist, Head of Division (Acting) upto 6th September, 2001

Dr. Manas Kr. Das, Principal Scientist, Head of Division (Acting) from 11th September, 2001

Floodplain Wetlands Division, Guwahati, Assam

Dr. V.V. Sugunan, Principal Scientist, Head of Division (Acting)

Resource Assessment Division, Barrackpore, West Bengal

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

Senior Administrative Officer, CIFRI, Barrackpore

Shri D. Moitra

Finance & Accounts Officer, CIFRI, Barrackpore

Shri V.S. Subramanian

18 ANY OTHER RELEVANT INFORMATION SUCH AS SPECIAL INFRASTRUCTURAL DEVELOPMENT

►The Governor inaugurates CIFRI's Regional Centre at Guwahati

A new Office-cum-Laboratory building has been developed at Guwahati for housing the Northeastern Regional Centre of the Institute. The 16,400 sq ft ready made building complex was purchased from the HOUSEFED, a State owned undertaking. This new premises is located near Janata Bhavan, the Assam State Secretariate.

The new laboratory and office complex of the Northeastern Regional Centre of Central Inland Fisheries Research Institute (ICAR) at Guwahati was inaugurated by His Excellency, Lt.

Gen. (Retd.) S. K. Sinha, Governor of Assam at a function held at the HOUSEFED Complex, Dispur on 6 November, 2001. Speaking on the occasion, His Excellency expressed immense pleasure that the CIFRI was making all efforts to provide research, extension and training support to the northeastern region.

Earlier, Dr. V. V. Sugunan, Director, CIFRI extended a warm welcome to His Excellency Lt. Gen. (Retd.) S. K. Sinha, Hon'ble Minister of Fisheries, Md. Nazibul Umar, Dr. S. A. H. Abidi, Member, ASRB, Dr. K. Gopakumar, DDG (Fisheries), ICAR, and Mr. M. K. Barua, Secretary & Commissioner Fisheries, Assam and all other dignitaries to the regional centre.

* The dyke of Block D of KVK, Kakdwip, was repaired at a cost of Rs.77,435/- only with a special grant from CIFRI to check the inundation with saline water during cyclonic storm.

The Governor of Assam unveils the plaque commemorating inauguration of the new building at the Northeastern Regional Centre of CIFRI

Biology Laboratory (NERC)

Chemistry Laboratory (NERC)

19 SUMMARY IN HINDI

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

1. प्रस्तावना

संस्थान के वार्षिक रिपोर्ट 2001-2002 में विभिन्न अनुसंधान परियोजनाओं की उपलब्धियों तथा अन्य कार्यकलापों का व्यापक चित्रण है ।

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

i) गंगा, यमुना तथा कावेरी नदियों, जलाशयों, आर्द्र क्षेत्रों की मात्स्यकी स्त्रोतों एवम् उत्पादन क्षमताओं का आंकलन ।
ii) हुगली, नर्मदा तथा अन्य ज्वारनदमुखों की पारिस्थितिकी तथा मात्स्यकी का मूल्यांकन ।
iii) गंगा एवम् यमुना के पर्यावरण एवम् मात्स्यकी स्तर का प्रबंधन ।
iv) हिल्सा मछलियों की अनुवांशिकी का अध्ययन ।
v) मछलियों तथा झींगों के स्वास्थ्य अनुमापन एवम् मत्स्य रोगों के प्रादुर्भाव के नियंत्रण हेतु विभिन्न प्राचलों का मानकीकरण ।

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

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

निदेशक

2. महत्वपूर्ण उपलब्धियाँ

1. राजस्थान के चार जलाशयों जैसे जवाई, प.बेनास, नंदसमंद तथा गंभीरी में पारिस्थितिक अन्वेषण कार्य विशेष रूप से इनकी उत्पादन क्षमता आकलन हेतु सम्पन्न किया गया है । इनकी उत्पादन क्षमता प.बेनास में 300 कि.ग्रा. प्रति हेक्टर तथा तथा जवाई में 450 कि.ग्रा. प्रति हेक्टर के आधार पर इन्हें उच्च उत्पादन वाली जलाशयों की श्रेणी में रखा गया है । इनके संग्रहण हेतु भारतीय मेजर कार्प मत्स्य बीज प. बेनास में 550 अंगुलिकाएँ प्रति हेक्टर तथा जवाई में 850 की दर से संग्रहित करने की सिफारिश की गई है ।

2. प. बंगाल में 10 हेक्टर से अधिक क्षेत्रफल वाले सभी निकायों को सूचीबद्ध एवम् मानचित्रीकरण कार्य *डिजिटल इमेज प्रोसेसिंग टेकनिक* द्वारा *नेशनल रिमोट सेंसिंग एजेन्सी*, हैदराबाद से प्राप्त सेटिलाइट डाटा के उपयोग से सम्पन्न किया गया । पहचान की गई जल निकायों की जलीय गुणवत्ता एवम् स्पेशियल डाटा हेतु GIS का विकास किया जा रहा है ।

3. विवृत जलीय तंत्रों में केज कल्चर पद्धति द्वारा मत्स्य उत्पादन की संभावनाओं को प्रदर्शित करने हेतु केज कल्चर प्रयोग प्रारंभ किए गए हैं । मथुरा बील में नेटलॉन से बने 9 फीट X 6 फीट आकार की एक पिंजरा को स्थापित किया । इस प्रणाली में 45 दिनों के दौरान *कतला-कतला* में 50 ग्रा. तथा *लेबियो रोहिता* में 44 ग्रा. की वृद्धि देखी गई है । इस पिंजरे से मत्स्य उपज 120 दिनों की अवधि के पश्चात प्राप्त की जाएगी ।

4. वांछित आकार की अंगुलिकाओं की उत्पत्ति की समस्या के समाधान के रूप में पेन प्रणाली की पहचान की गई है । अतः तमिलनाडु के ओधुथुराई जलाशय में पेन प्रणाली प्रयोग का प्रारंभ किया गया है । इसमें ग्रास कार्प अंगुलिकाओं की तेजी से वृद्धि हुई और 30 दिनों में वांछित आकार 100 मिमी. प्राप्त हुई है । इस वांछित आकार की प्राप्ति के लिए कतला मछली की अंगुलिकाओं को 40 दिनों का समय लगा है ।

5. जलीय प्रदूषकों का *आर.रीता* मछली पर प्रभाव के मूल्यांकन हेतु जननेन्द्रीय संबंधी अध्ययन से ज्ञात होता है कि ओवारियन एवम् हेपाटिक कोलेस्ट्राल एकत्रित होना तथा हारमोन में कमी देखी गई है । इसके परिणामस्वरूप इनकी जनन क्षमता प्रभावित हुई है।

6. ऑरनामेंटल फिश *कोलिसा फेससियेटा* का कैपटिव ब्रीडिंग का मानकीकरण किया गया है । ऑरनामेंटल फिश के पाँच प्रजातियों जैसे *सी.फेससियेटा*, *सी.लालिया*, *बादिस बादिस*, *नंदुस नंदुस* तथा *बोटिया डेरियो* के आहार वरीयता का अध्ययन किया गया । इस अध्ययन में फीड पैलेट, *मस्किटों लार्वा* तथा *लैव वार्म* का उपयोग किया गया है ।

7. ज्वारनदमुख के क्षेत्र में *विंटर माइग्रेटरी बेग नेट फिशरी* की कुल उपज 28116.9 टन आंका गया है, जिसमें प्रति युनिट प्रयास से प्राप्त उपज 47.5 कि.ग्रा. है। इस आकलन में पिछले

वर्ष की तुलना में कुल उपज एवम् प्रति यूनिट प्रयास से प्राप्त उपज दोनों मे ही हल्की सी बढ़ोतरी देखी गई है ।

8. असम के बीलों में मत्स्य उत्पादन को अधिकतम करने में उत्पन्न समस्याओं को सूचीबद्ध किया गया है । असम के बीलों में एवम् ब्रह्मपुत्र नदी पर आश्रित मछुआरों की सामाजिक व आर्थिक स्थितियों का भी अध्ययन किया गया है ।

9. नार्थन रीजनल सेन्टर के प्रयोगशाला एवम् कार्यालय परिसर का उद्घाटन नवम्बर, 2001 में सम्पन्न हुआ । इस परिसर में 2 जीवविज्ञान, 1 जैव-रसायण प्रयोगशाला तथा एक प्रयोगशाला रसायण विज्ञान के लिए है । इन प्रयोगशालाओं में अत्याधुनिक वैज्ञानिक उपकरण उपलब्ध हैं ।

3. परिचय

भारत सरकार ने सन् 1943 के अपने एक ज्ञापन में देश के मात्स्यिकीय संसाधनों के विकास के लिए एक केन्द्रीय विभाग की स्थापना पर विशेष बल दिया था । तत्पश्चात्, केन्द्रीय सरकार की कृषि, वानिकी तथा मात्स्यकी से संबंधित उप-समिति ने भी इस प्रस्ताव का पृष्ठांकन किया था । फलस्वरूप भारत सरकार के खाद्य एवम् कृषि मंत्रालय के अन्तर्गत केन्द्रीय अन्तर्स्थलीय मात्स्यिकी अनुसंधान केन्द्र की स्थापना 17 मार्च 1947 को कलकत्ता में हुई । एक अंतरिम योजना के रूप में प्रवर्तित यह केन्द्र अब देश की अन्तर्स्थलीय मात्स्यकी क्षेत्र में एक प्रमुख अनुसंधान संस्थान का रूप ले चुका है तथा यह संस्थान 17 मार्च 2002 को 55 वर्ष पूरा किया । वर्ष 1959 में इस केन्द्र को केन्द्रीय अन्तर्स्थलीय मत्स्य अनुसंधान संस्थान का पूर्ण दर्जा प्राप्त हुआ तथा पश्चिम बंगाल के बैरकपुर स्थित नवनिर्मित भवन में इसका स्थानान्तरण हुआ । वर्ष 1967 में यह संस्थान भारतीय कृषि अनुसंधान परिषद् का विधिवत् सदस्य बना ।

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

1970 के दशक में संस्थान ने चार अतिविशिष्ट समन्वित राष्ट्रीय परियोजनाओं का कार्य आरंभ किया, ये परियाजनाएँ थीं *मिश्रित मत्स्य पालन व मत्स्य बीज उत्पादन, वायुश्वासी मत्स्य पालन, अलवणीय जलाशयों की पारिस्थितिकी* एवम् *मात्स्यिकी प्रबंधन* तथा *लवणीय जल मत्स्य पालन* ।

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

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

उपर्युक्त तकनीकों एवम् शोध प्रणालियों के फलस्वरूप ही आज देश का अन्तर्स्थलीय मत्स्य उत्पादन 2.2 लाख टन 1950-51 से बढ़कर 2.8 लाख टन 2001-2002 ।

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

अधिदेश

केन्द्रीय अन्तर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान का अधिदेश निम्नलिखित है :

1. 10 हेक्टर क्षेत्रफल से बड़े जलीय संसाधनों में मत्स्य संख्या गतिकी का अध्ययन ।
2. उक्त प्रकार के जलीय संसाधनों से अधिकतम मत्स्य उत्पादन प्राप्त करने हेतु प्रबंध प्रणालियों को विकसित करना ।
3. इन जलीय संसाधनों में अपकर्षण, प्रदूषण के कारण एवम् उनके प्रभाव का अध्ययन कर इन जलीय संसाधनों का संरक्षण के लिए कार्य करना।
4. नदीय परियोजनाओं के कारण संबंधित बेसिन की मात्स्यिकी पर पड़ने वाले दुष्प्रभावों का अध्ययन के लिए प्रणालियों को विकसित करना ।

5. अन्तर्स्थलीय मात्स्यकी से संबंधित आंकड़ों के संदर्भ में राष्ट्रीय केन्द्र के रूप में कार्य करना ।

6. प्रशिक्षण कार्यक्रमों का आयोजन, परामर्शक सेवाएँ उपलब्ध कराना आदि।

संगठन

उपर्युक्त अधिदेश की पूर्ति एवम् देश की मात्स्यिकी विकास हेतु केन्द्रीय अन्तर्स्थलीय प्रग्रहण मात्स्यिकी अनुसंधान संस्थान के अनुसंधान कार्यों को प्रमुख मात्स्यिकीय स्त्रोतों के अनुरूप सात प्रभागों के अनुरूप सात प्रभागों के अन्तर्गत संगठित किया गया है ।

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

बंगलोर स्थित ***जलाशय प्रभाग*** के केन्द्र तमिलनाडु, आंध्रप्रदेश एवम् मध्यप्रदेश राज्यों में हैं । इस प्रभाग की कार्य दिशा छोटे मध्यम तथा बड़े जलाशयों में मत्स्य उत्पादन की वृद्धि हेतु प्रबंधन प्रणालियों को विकसित करने की ओर है ।

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

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

बैरकपुर स्थित ***मत्स्य स्वास्थ्य एवम् पर्यावरण प्रभाग*** को अधिदेश दिया गया है कि नदीय, जलाशय एवम् ज्वारनदमुखी परितंत्रों में मानवीकृत परिवर्तनों का अनुमापन करे, एवम् उपयुक्त सुधारात्मक उपायों को विकसित करें । प्राकृतिक स्त्रोतों से प्राप्त सूचनाओं के निर्धारण के लिए प्रयोगशाला स्थितियों में भी अन्वेषण कार्य किया जा रहा है । प्रभाग द्वारा किए गए अध्ययनों से मत्स्य निवास स्थान की विभिन्नता, जैव-विविधता तथा ज्ञात सूचकों के माध्यम से दुष्प्रभाव का शिनाख्त करना, नियंत्रित स्थितियों में विषैले पदार्थों को परखना, जलीय पर्यावरण में कार्बनिक

पदार्थों के परिमाण के लिए सूक्ष्म जैविकी का अध्ययन और मत्स्य रोगों की पहचान तथा इनके उपचार से संबंधित मौलिक सूचनाएँ भी सम्मिलित हैं । इस प्रभाग को जलीय परितंत्रों के सुधार के लिए एक कार्य योजना तैयार करने का दायित्व भी सौंपा गया है।

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

मत्स्य स्त्रोत मूल्यांकन प्रभाग बैरकपुर में है और इस प्रभाग का लक्ष्य मत्स्य सम्पदा और मात्स्यिकीय स्त्रोतों में उपलब्ध मछलियों की संख्या निर्धारण कार्य का दायित्व सौंपा गया है ताकि इन अन्तर्स्थलीय मत्स्य स्त्रोतों का वैज्ञानिक समुपयोजन किया जा सके ।

बैरकपुर स्थित ***मानव संसाधन विकास एवम् प्रौद्योगिकी हस्तांतरण प्रभाग*** संस्थान में विकसित प्रौद्योगिकियों के हस्तांतरण, जनजागरण कार्यक्रम तथा प्रशिक्षण कार्यक्रमों द्वारा कुशलता बढ़ाने की दिशा में कार्य करती है । प्रौद्योगिकी हस्तांतरण शाखा प्रशिक्षण कार्यक्रम, प्रदर्शनी, सलाहकार सेवा, मत्स्य पालक दिवस, फिल्म प्रदर्शनी आदि द्वारा नित्य ही विभिन्न मत्स्य पालकों, मछुआरों, उद्यमियों, विस्तार कार्यकर्ताओं तक प्रौद्योगिकियों को पहुँचाती रहती है ।

संस्थान का अनुसंधान कार्य कुल 17 अनुसंधान परियोजनाओं में विभाजित किया गया है । इन अनुसंधान परियोजनाओं का कार्य मुख्यालय के अलावा 10 राज्यों में फैले संस्थान के 12 अनुसंधान एवम् 6 सर्वेक्षण केन्द्र तथा एक कृषि विज्ञान केन्द्र से किया जा रहा है ।

पुस्तकालय सेवाएँ

संस्थान का पुस्तकालय मुख्यालय एवम् अनुसंधान केन्द्रों में कार्यरत वैज्ञानिक की आवश्यकताओं के अलावा अन्य संगठनों के शोधकर्ताओं, अध्यापकों, विद्यार्थियों तथा अधिकारियों को भी अपनी सेवाएँ मुहैया कराती है । इस रिपोर्ट की अवधि के दौरान पुस्तकालय में अपने भंडार में 495 पुस्तकें, 104 विविध प्रकाशनों तथा जनरलों के 650 अंक संग्रहित किया तथा 19 विदेशी एवम् 64 भारतीय जनरलों के लिए शुल्क जमा दिया । इस समय पुस्तकालय में कुल 8988 पुस्तकें, 4277 पुनर्मुद्रित लेख, 1221 मानचित्र, 4050 विविध प्रकाशन तथा 7053 शोध प्रबंधों का भंडार है ।

इस वर्ष पुस्तकों व अन्य पठन सामग्री हेतु 22,70,354/- रूपये खर्च हुए हैं । पुस्तकालय द्वारा इंडियन फिशरीज एब्सट्रैक्ट तथा करेंट कंटेंट्स भी प्रकाशित किया गया है ।

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

निदेशक

नदीय प्रभाग, इलाहाबाद

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ज्वारनदमुख प्रभाग, बैरकपुर

कलकत्ता अनुसंधान केन्द्र
बदोदरा अनुसंधान केन्द्र
कैनिंग सर्वेक्षण केन्द्र
डायमंड हार्बर सर्वेक्षण केन्द्र
उलूबेरिया सर्वेक्षण केन्द्र
फ्रेजरगंज केन्द्र

पर्यावरणीय अनुमापन एवं मत्स्य स्वास्थ्य परिरक्षण प्रभाग, बैरकपुर

बाढकृत मैदानी आर्द्र क्षेत्र प्रभाग, गुवाहाटी

बैरकपुर अनुसंधान केन्द्र
अलापुजा अनुसंधान केन्द्र

मत्स्य स्त्रोत मूल्यांकन प्रभाग, बैरकपुर

अन्य अनुभाग, बैरकपुर व काकद्वीप

कृषि विज्ञान केन्द्र, काकद्वीप
परियोजना अनुमापन एवं प्रलेखन अनुभाग
पुस्तकालय एवं सूचना अनुभाग
विस्तार, अनुसंधान सहायक सेवा अनुभाग
प्रशासन, लेखा परीक्षा, लेखा, भंडार, कार्य व अनुभाग निदेशक कक्ष, तकनीकी कक्ष व हिन्दी कक्ष

परियोजना अनुमापन व प्रलेखन सेवाएँ

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

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

प्रकाशन

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

1. वार्षिक प्रतिवेदन 2000-2001
2. इनलैंड फिशरीज न्यूज (खण्ड 6, सं.1, जनवरी 2001 से जून 2001)
3. इनलैंड फिशरीज न्यूज खण्ड 6 सं. 2 जुलाई 2001 से दिसंबर 2001
4. अन्तर्स्थलीय मात्स्यकीय (खण्ड 4, संख्या 2/3, जुलाई 1999 से जून 2000 हिन्दी) ।
5. बुलेटिन संख्या 97 : Ecology and production dynamics of river Brahmaputra with special emphasis on its tributaries.
6. बुलेटिन संख्या 98 : Success stories of fisheries management in small reservoir.
7. बुलेटिन संख्या 98 : (हिन्दी) छोटा जलाशय के मात्स्यिकी प्रबंधन में संस्थान उपलब्धियाँ - एक झलक ।
8. बुलेटिन संख्या 99 : CIFRI's environment impact assessment (EIA) technology-finding users.
9. बुलेटिन संख्या 99 : (हिन्दी) सी.आई.एफ.आर.आई. द्वारा पर्यावरणीय प्रबंधन आकलन (EIA) पद्धति-विश्व मान्यता की ओर ।
10. बुलेटिन संख्या 100 : Ecology and Fisheries of Tawa Reservoir (Hoshangabad, M.P.)
11. बुलेटिन संख्या 101 : Environment Impact Assessment of Inland Waters for Sustainable Fisheries Management and Conservation of Biodiversity.
12. बुलेटिन संख्या 102 : River Godavari - Environment and Fishery.
13. बुलेटिन संख्या 103 : Ecology and Fisheries of *Beels* in West Bengal.
14. बुलेटिन संख्या 104 : Ecology and Fisheries of *Beels* in Assam

15. बुलेटिन संख्या 105 : Training on Pen Culture of Fish and Prawn (December, 11-15, 2000)
16. बुलेटिन संख्या 106 : Management of Fisheries in Small Reservoirs.
17. करन्ट कन्टेनट्स (जनवरी-दिसम्बर 2001)
18. इंडियन फिशरीज एब्सट्रेक्ट-संख्या 34 (2-4) 2000 तथा 35 (1) 2001

वर्ष 2001-2002 का वित्तीय विवरण (रूपये लाख में)			
	बी.इ.	**आर.इ.**	**वास्तविक खर्च**
योजना	213.68	329.18	328.85
गैर योजना	760.00	790.70	773.46
कुल	**973.68**	**1119.88**	**1102.31**

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