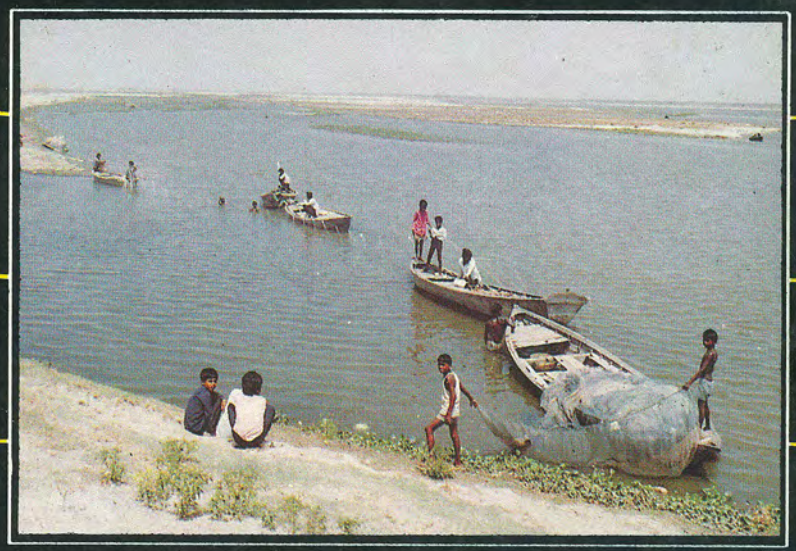
ANNUAL REPORT 1990-91



ICAR

CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Barrackpore - 743 101 West Bengal

ANNUAL REPORT
1990 - 91

भाकृअनुप
ICAR

CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
Barrackpore 743 101 West Bengal INDIA

Credits

Edited and compiled by :	V.V. Sugunan G.K. Vinci V.K. Unnithan
Assisted by :	Anjali De H. Chaklader
LASER Composing :	H. Chaklader Sefali Biswas
Hindi Translation & LASER Composing (Hindi) :	P.R. Rao
Printing :	Md. Quasim
Cover design :	A.R. Majumder

Published By :
The Director,
CICFRI Barrackpore

Printed at :
Documentation Section
CICFRI Barrackpore

ISSN 0970-6267

CONTENTS

ANNUAL REPORT 1990-91

CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE
BARRACKPORE

BRIEF HISTORY

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

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

The mandate of the Institute was later modified giving added emphasis on capture fisheries resources of the country and the Institute was rechristened as **Central Inland Capture Fisheries Research Institute (CICFRI)** with effect from 1.4.1987. Under the changed set up, the CICFRI 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 CICFRI has a mandate to conduct research for *developing systems for monitoring and improving fish production in natural and man-made inland water resources through stocking, optimum exploitation and conservation.*

ORGANISATION

In order to achieve the above mandate, the research at CICFRI has been organised under three Divisions, corresponding to the major fishery resources of the country. The Riverine Division, with its headquarters at Allahabad, strives to develop systems for effective management of the vast riverine fisheries resources of the country with adequate emphasis on the conservation of riverine environment. The research projects under the Division cover the rivers Ganga, Yamuna, Brahmaputra and Narmada. The Lacustrine Division has its headquarters at Bangalore with centres in Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Himachal Pradesh and Maharashtra. The investigations being carried out at the Division aim at developing management norms for optimising fish yields from large tanks, lakes, and reservoirs. The Estuarine Division is based at Barrackpore and it covers the entire Hooghly-Matlah estuarine system and the Narmada Estuary. The effluents from a number of industrial units, agricultural wastes, municipal wastes etc. make the Hooghly Estuary one of the most polluted stretches of the Ganga river system which is being investigated by the Division. Hilsa, the most important estuarine fish is being subjected to intensive research. The Institute also conducts investigations on oxbow lakes of West Bengal, Assam and Gandak basin *(mans)*. Other areas covered include cage and pen culture systems in open waters, the ecology and production biology of inland molluscs, engineering aspects of cage and pen structures and investigations on fisheries economics and statistics. The Institute's researches have been organised under 20 research projects and a Central Sector Scheme. The projects are operated from the Headquarters at Barrackpore, 12 Research Centres, 6 Survey Centres and a Krishi Vigyan Kendra covering 11 states of the country. The distribution of research and survey centres and different sections are shown in the organisation chart.

IMPORTANT ACHIEVEMENTS

Observations on Hilsa migration

Recent observations conducted by the Estuarine Division give positive indications towards the upstream migration of hilsa across the Farakka Barrage. Monsoon catches of hilsa juveniles above the barrage were estimated at 15 to 35 kg/day covering a size range of 65-218 mm (1.96-98.50 gm). Yield rate of this magnitude together with the wide range in size confirms the possibility of upsream migration of hilsa during the breeding season, which coincides with the monsoon discharge of floodwaters.

Artificial fecundation of hilsa

Experiments on the artificial fecundation of hilsa, *Tenualosa ilisha*, and its rearing were continued during the current season at Farakka. The highlights of this year's observations were:

i) the fabrication of a new hatchery model;
ii) rearing of spawn in specially prepared hilsa nurseries; &
iii) a positive indication to confirm role of thyroxine on the survival of hilsa spawn.

New design of hatching unit of hilsa

Hatchery: A new portable hatching-cum-rearing unit for hilsa has been designed and installed at Farakka during the current hilsa breeding season. This **Circular Grid Hatchery (C. G. Hatchery)** consists of a plastic pool (4' dia and 3' height) with provision for water outlet, a revolving sprinkler and a circular grid. The grid is made of two G.I rings of 3' diameter, connected to each other by six circumferal bridges (each of 6" long). The grid is covered with net on sides (2 mm mesh) and the bottom (1.8 mm mesh).

Operation: For operating the hatchery, the inner side of the plastic pool is covered with a round markin *hapa*. The sprinkler with its inlet pipe from the overhead plastic pool is placed at the bottom of the plastic pool. After the plastic pool is filled with the water, the grid is placed in its centre, 6" below the water surface. The grid of the hatchery unit is now ready to receive hilsa eggs for hatching. Each unit of hatchery has a capacity of 1.5 lakh water-hardened eggs (3 hrs after stripping). Eggs are placed in the grid and a feeble circular water current is maintained through the revolving sprinkler (10 RPM). The hatchlings come out of the egg shells within 18 - 21 hrs at an average water temperature of 28°C(27-29°C) and find their way to plastic pool through the side wall of the grid.

The grid, along with the bad eggs and egg shells, is then removed from the hatchery unit.

Effects of thyroxine on the survival of hilsa spawn

A preliminary experiment was conducted to assess the effects of thyroxine on the survival of hilsa hatchlings. Five hundred two-day old hilsa spawn were stocked and treated with synthetic thyroxine ELTROXIN (Allenburys) daily @ 0.2 ppb. Eltroxin was given in finely powdered form along with the feed (mustard oil cake & rice powder, 1:1). After 15 days of treatment, the stock exposed to eltroxin treatment was more active and showed better survival rate (92%) than the control (84%).

Epizootic Ulcerative Syndrome in Kolleru Lake

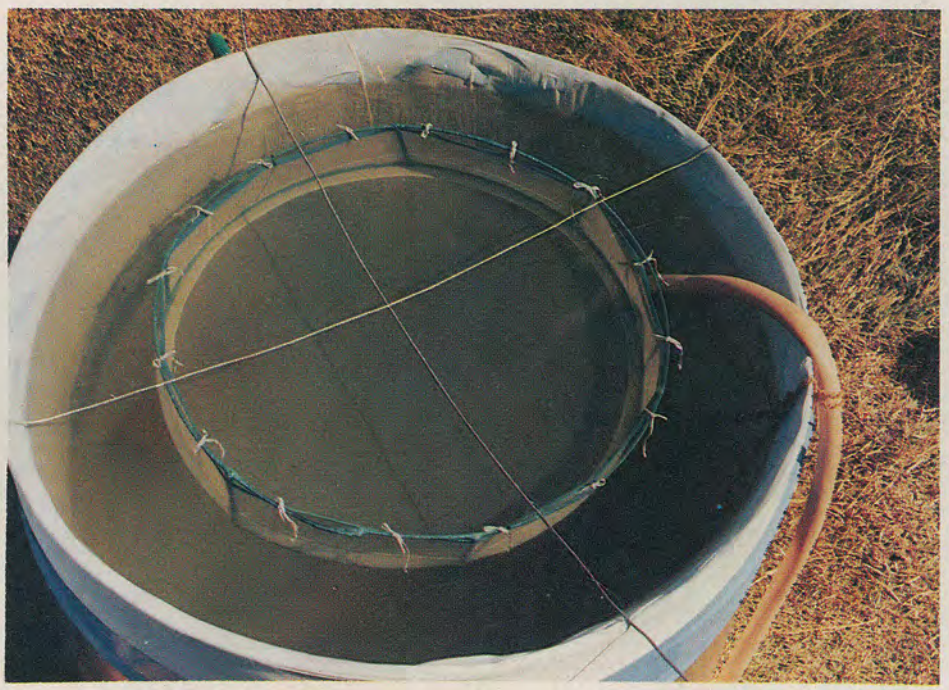
Incidence of the dreaded killer disease of fish, Epizootic Ulcerative Syndrome(EUS) has been reported from the Kolleru fishes in epidemic proportion, affecting various species of fish. While the impact of the disease was minimum in major carps, other commercial species like *Channa striatus*, *Channa punctatus* and *Puntius sarana* (80-90% loss) were severely affected. The infection was, however, restricted to the north, east, central and south-eastern regions of the lake.

Outbreak of EUS in Tamil Nadu : The disease has also been reported from the State of Tamil Nadu. The areas affected include Chingalpet, Thanjavur and Trichy districts; the Poondi reservoir; the Kovilpathagai lake and the Sekkadu lake. Mostly, large water bodies are affected by the Epizootic in Tamil Nadu. While *Channa* sp., *Mystus* sp., *Mastocembelus* sp., *Puntius* sp. and *Ctenopharyngodon idella* were the more notable victims, Indian major carps were mildly affected. The overall percentage of infestation in the affected areas is estimated at 15 - 30%. Detailed investigations on microbiological and the environmental parameters are in progress at the Fish Pathology Laboratory at Barrackpore.

Present status of Epizootic Ulcerative Syndrome in India

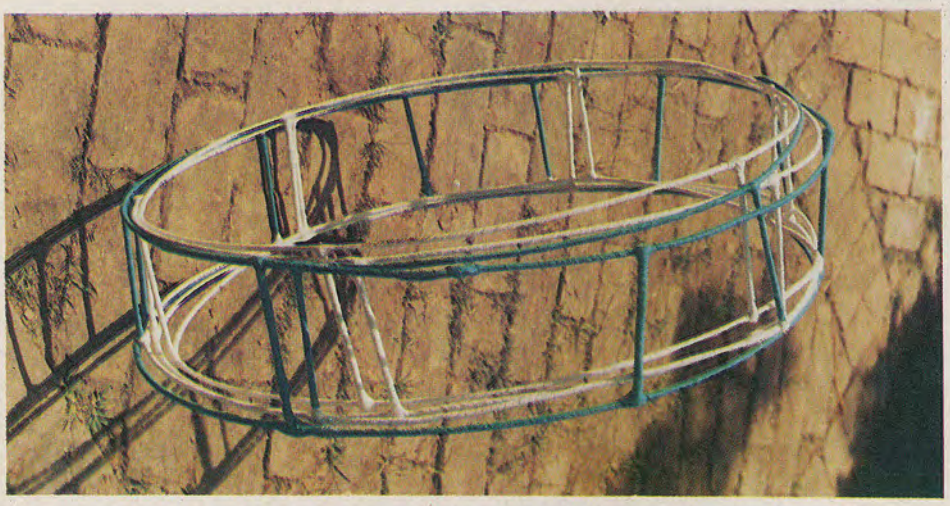
A meeting was convened in Delhi by the Ministry of Agriculture and Cooperation, Govt. of India on 18th January, 1991 to review the outbreak and spread of Epizootic Ulcerative Syndrome in India and chalk out the strategy to be adopted for containing the disease outbreak. CICFRI presented a report on the present status of EUS outbreak; reviewed the monitoring of the disease in India and enlightened the participants on the remedial measures to be adopted.

Improved model of the Hilsa Hatchery



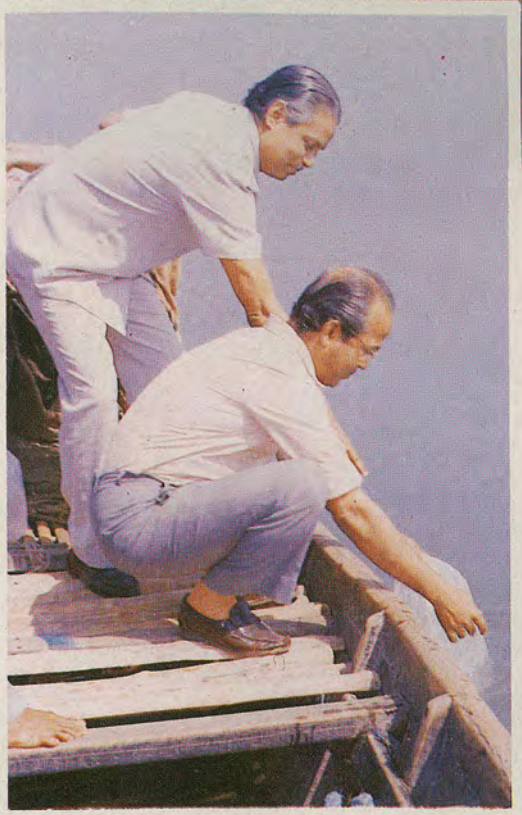
Hatching chamber of the improved model of the hilsa hatchery

Metalic frame of the grid hatchery



Hilsa Hatchery

Hilsa seed production and stocking



Top : Hatchlings being reared in a pond at Farakka
Left : A consignment of hilsa fry being released into the depleted stretch of the river Ganga to initiate the hilsa ranching programme

Artificial recruitment of hilsa in the Ganga

Central Inland Capture Fisheries Research Institute has initiated a programme to restock the depleted stretches of the Ganga with the seed of *Tenualosa ilisha*, the prized Indian shad. The programme was inaugurated by Mr. B. B. Ghosh, General Manager, Farakka Barrage Project, on 23rd February, 1991. Mr. U. Bala, Superintending Engineer, Farakka Barrage Project, was also present on the occasion.

A token consignment of 170 fry was stocked in the river stretch above the Barrage, marking the beginning of the CIFRI's ambitious restocking programme. The Institute has initiated steps to construct a hatchery at Farakka for mass production of hilsa fry to sustain a regular stocking programme. The material stocked in the river was raised in two nursery ponds of 0.1 ha each at Farakka, which were stocked with 7 day old spawn of hilsa. During a rearing period of 95 days, the spawn grew to an average size of 74.5 mm/ 4.13 g, when the stocking was done.

Important Events

THE DEPUTY PRIME MINISTER LAYS THE FOUNDATION STONE FOR THE NEW LABORATORY BUILDING

The Hon'ble Deputy Prime Minister of India, Shri Devi Lal has paid an exclusive visit to the Allahabad Centre of the Central Inland Capture Fisheries Research Institute and laid the foundation stone for a new three-storied building on 31 st May 1990. The modern laboratory complex to be constructed at a cost of Rs. 46 lakhs would fulfil a long-cherished need of the Institute. The Deputy Prime Minister spent more than two hours at the Centre and held discussions with Dr. P. V. Dehadrai, Deputy Director General (F), ICAR and Dr. Arun G. Jhingran, Director, CICFRI on various activities of the Institute. A large gathering of fishermen, assembled on the occasion, met the Deputy Prime Minister and discussed their problems with him.

Earlier, while laying the foundation stone for the new laboratory, the Hon'ble Deputy Prime Minister made an appeal to the scientific community to identify and concentrate on problems which have a direct bearing on the socio-economic upliftment of our rural masses. He said that our country diverts a substantial part of its GNP on basic and applied research and therefore, the scientists are duty-bound to weigh the investments against the benefits that accrue to the poor and the deprived. He noted with satisfaction that the country could achieve a six-fold increase in inland fish production during the last four decades against a four-fold increase in the world, largely due to the technologies developed by the Institiute.

Shri Janeshwar Misra, Hon'ble Minister for Communications presided over the function and Smt. Sukhda Misra, Hon'ble Minister for Rural Development, Govt. of Uttar Pradesh was the Chief Guest. She also read out a message from Shri Mulayam Singh Yadav, Hon'ble Chief Minister of Uttar Pradesh. Mrs. Misra described inland fisheries as an important rural economic activity employing over 1.7 million people. Therefore, technological advancement in this sector has the potential to improve the standards of life of a large section of our society. She pointed out that the country has to optimise production from all conceivable water bodies in order to meet the projected requirement of 12.5 million t of fish per year by the end of this century.

Speaking on the occasion, Shri Misra congratulated the scientists and advised them to be in constant touch with fishermen who are the ultimate beneficiary of the research being conducted in the laboratories. He was optimistic that the research priorities would be moulded to ensure accrual of maximum benefits to the poor fishermen. He expressed the hope that the new laboratory will act as a catalyst in the endeavour to develop new technologies leading to increased productivity from our rivers , reservoirs, lakes and the estuaries.

A large number of dignitaries including Vice-Chancellors, top officials of the State and the Central Government participated in the ceremony.

Training on Snail Farming

The Institute has conducted a Training Programme on Snail Farming for three fishery officials from the State of Mizoram for 7 days from 16.9.1990 to 22.9.1990. The training included lectures, field visits and demonstrations on various aspects of snail collection, breeding, hatching and rearing in terraria. Techniques of breeding, hatching and rearing of snails in different culture systems were demonstrated to them. The course also included farm design, construction and management of terraria, snail houses and field snail farms. Processing and packing techniques were also demonstrated.

Mizoram is the only state in India with domestic demand for snails and snail products. Mizos relish some local varieties of snails. The Training Programme was intended to apprise the state officials about the latest development in snail culture so that they can adopt better farming systems for improved production.

HINDI WEEK

The Hindi Week was observed at the Institute during 14-20 September 1990. The highlight of the week-long Hindi implementation programme was a meeting organised at the Institute on 17th September. Speaking on the occasion, Dr. Arun G. Jhingran, Director of the Institute outlined the progress made by the Institute in using Hindi in official business and publications. Dr. Jhingran congratulated some of the members of staff from non-Hindi states who secured advance increments for completing the required Hindi examination and for winning prizes in the above examinations. Both Dr. Jhingran, Director and Shri S. Paul, Head of the office highlighted the significance of Hindi as an instrument to promote the spirit of national integration.

Deputy P. M. at CICFRI

Top: Sri Devi Lal
Left: Sri Janeswar Misra
Below : Smt. Sukhda Mishra, Hon'ble Minister for Panchayat Raj and Rural Development, Govt. of Uttar Pradesh being briefed on the activities of the Institute.

Shri Devi Lal, the Hon'ble Deputy Prime Minister of India laying the foundation stone for the new laboratory building of CICFRI at Allahabad on 31 May 1990.

An artist's view of the Proposed laboratory complex

Shri S. N. Jha, Deputy Director, Hindi Implementation Programme, Eastern Region, emphasised the need for a common link language for the nation. He welcomed the contribution of all regional languages in enriching the national language.

Dr. H. C. Joshi, In-charge of the Hindi Implementation Cell of the Institute, briefed the significance of the Hindi Week and Dr. V. V. Sugunan, Senior Scientist in his talk, reiterated that people from non-Hindi speaking states should acquire working knowledge in Hindi and try to transact in national language..

MEETINGS

STAFF RESEARCH COUNCIL MEETING

The Annual Staff Research Council Meeting of the Institute was convened at Barrackpore from 18-20 April 1990, under the Chairmanship of Dr. Arun G. Jhingran, Director, CICFRI. Dr. P. V. Dehadrai, Deputy Director General (F) and Dr. M. Y. Kamal, Assistant Director General (F), Indian Council of Agricultural Research, represented the Council . The SRC reviewed the progress of twenty ongoing research projects of the Institute. Individual projects were evaluated in the light of the Activity Milestones set for the year. A total of 21 projects were finalised for the year 1990-91.

MEETINGS OF THE TECHNICAL AND LEGISLATIVE SUB-COMMITTEES ON RESTORATION OF FISHERIES IN THE GANGA RIVER SYSTEM.

Recognising the contributions made by the CICFRI in the bio-diversity improvement and ecorestoration programmes in the Ganga River System, and its potential role on the proposed integrated river basin management, two sub-committees on technical and legislative aspects of the ecorestoration and fisheries have been constituted under the Chairmanship of Dr. Arun G. Jhingran, Director of CICFRI, Barrackpore. The meetings of the above committees were held at CICFRI, Barrackpore, on 10 & 11 July, 1990 and action plans and remedial measures were identified.

The Technical sub-committee identified the factors leading to the decline in the yield of commercial fishes in the river Ganga and recommended the steps for conservation of the fishery resources including the threatened, endangered and rare fish fauna, standardisation of breeding and reasons for combating fish diseases.

The Committee strongly recommended the representation of State Fishery Departments and the ICAR Fishery Institutes in Central and State Pollution Control Boards, Central Water Commission, and the Environmental Appraisal Committees of the Govt. of India.

The Committe felt the need for proper documentation of a State-of-the-art on the Ganga to be prepared by the Nodal Agency under a time-bound programme.

The Legislative Sub-Committee in strict adherence to its terms of reference, the Legislative Sub-Committee, took stock of prevailing regulatory provisions both relating to environmental protection and fisheries. A working paper styled as 'Riverine Environment, Fisheries and Legislative Support' was presented for discussion in the meeting. The Committee recommended the shifting of Fisheries from the State List to the Concurrent List, so that the Union Govt. could also frame laws for any part of the country. The Sub-Committee favoured the imposition of regulatory measures as assigned in various enactments of the States of U.P., Bihar and West Bengal.

MANAGEMENT COMMITTEE OF CICFRI

Fourth Management Committee Meeting of the Institute was held on 12th July, 1990 at Barrackpore under the Chairmanship of Dr. Arun G. Jhingran. As the members of the Committee, Dr. M.Y. Kamal, Assistant Director General, ICAR and Shri D.K. Srivastava, Director Finance, ICAR, attended the Meeting. The Committee expressed its full satisfaction over the programmes of the research work and approved the research programme for 1990-91.

The second meeting of the **Technical and Legal sub-committies** of the Ganga Action Plan were conducted at Barrackpore on 18th January 1991. Dr. Arun G. Jhingran, Director, CICFRI and Chairman of the two sub-committies presided over the meeting. The meeting reviewed the progress made by the two sub-committies.

MONITORING COMMITTEE OF GANGA ACTION PLAN

Dr. Arun G. Jhingran, Director, CICFRI attended the thirteenth Monitoring Committee of the Ganga Action Plan, convened at the Yojna Bhavan, in New Delhi on 25th July 1990. The progress made by the Ganga Action Plan was reviewed. The Committee appreciated the CIFRI's contributions towards monitoring the habitat variables and in the riverine environment for the last few decades. The data collected by the Institute have been recognised as the single largest source of information on the Gangetic environment. The Institute is actively associated with all programmes of the GAP in connection with the biological productivity, biological monitoring and ecorestoration of the Ganga and other river systems of the country.

Indo-Dutch Meeting on Biomonitoring

Dr. Arun G. Jhingran, Director attended an *Indo-Dutch Meeting on Biomonitoring - Yardstick Development*, during 4-5 March 1991, at the Jawaharlal Nehru University, New Delhi. The meeting reviewed the available data

on water quality management and discussed a theme paper on yardstick development for water quality, using biological parameters. The legislative and scientific framework of the yardsticks was also discussed by the delegates comprising 20 renowned experts in various aspects of water quality management. Dr. Jhingran presented a review paper entitled *Fish in Relation to Water Quality.*

World Bank Meeting on Narmada Project

Dr. S. N. Singh, Scientist of the Vadodara Centre of Central Inland Capture Fisheries Research Institute, attended the World Bank Meeting on Environmental Protection at Narmada Control Authority, Indore on 4th, 13th and 14th February, 1991. The meeting, among other things, reviewed different proposals of Environment Protection (Fisheries Sector) as contained in the third modified *work plan* submitted by the Commissionerate of Fisheries, Gandhinagar, Gujarat.

XI Meeting of the Environmental Sub-Group of Narmada Control Authority

The XI Meeting of the Environmental Sub-Group of the Narmada Control Authority was held at New Delhi on 1 May 1991 under the Chairmanship of Sri Ranjitsinh, Secretary, Department of Environment. Sri P. K. Chakraborti, and Dr. S. N. Singh, Senior Scientists of CIFRI, participated in the meeting. The Sub-Group considered, among other items of the agenda, the draft report on **Sociological Survey of the Fishing Families of the Narmada,** prepared by CIFRI under a World Bank-sponsored consultancy assignment. A suggestion was also made to chalk out a strategy for restoration of fisheries after the dam construction.

COLLABORATION

The Institute collaborated with a number of national and international agencies during 1990-91 for research and training activities.

NATIONAL

The Government of Tamil Nadu has actively collaborated with Central Inland Capture Fisheries Research Institute (CICFRI) in the execution of the project *Ecology and fisheries of the small reservoir in Aliyar basin* at Aliyar Reservoir, Tamil Nadu, by extending the farm and transport facilities.

The Institute collaborated with the Governments of Himachal Pradesh and Arunachal Pradesh in delineating the priority areas in both the capture and culture fisheries of the coldwater regions of the country. Some new projects were identified where ICAR and the respective State Governments could collaborate.

The Institute, in collaboration with All India Institute of Hygiene and Public Health and School of Tropical Medicine, Calcutta launched a joint project for the identification of aetiological agent of Epizootic Ulcerative Disease Syndrome in exotic and indigenous freshwater fishes.

Apart from these, CICFRI is engaged in assisting different state Governments and agencies associated with the fishery developmental activities through its consultancy services.

Consultancy Services Provided by CICFRI

Sociological Survey of the Fishing Families of the Narmada

Central Inland Capture Fisheries Research Institute has completed a sociological survey of the fishermen community in the Narmada basin. Launched in the Year 1990-91 under a consultancy assignment with the Narmada Control Authority (NCA), the survey extended to 1312 km long riverine stretches covering 17 districts in the states of Madhya Pradesh, Gujarat and Maharashtra.The Final Report of the survey; featuring the demographic profile of fishermen in the Narmada basin, and inventory on crafts and gear used by them; has since been submitted to the NCA. This document has an exhaustive coverage on the identification of ethnic and social status of fishermen, their education and income levels, and their attitude towards change in profession and alternative vocation, in the event of an adverse impact of Narmada basin development on their traditional vocation. The study also probes into the social awareness among fishermen, and their access to modern technologies. The report forms a dependable baseline information for assesssing the possible socio-economic impact of the Narmada impoundments on the fishermen community. It also focuses attention on many vital questions that may arise while formulating the rehabilitation programmes for the Narmada fishermen community

Monitoring of Epizootic Ulcerative Syndrome in Fishes

EUS spreads to Maharashtra: As a part of an eleven-nation international project on **Epizootic Ulcerative Syndrome(EUS)**, the Central Inland Capture Fisheries Research Institute is constantly monitoring the spread of this killer fish disease. During the month of December 1990, the incidence of EUS has been reported from the State of Maharashtra for the first time. So far, the states of West Bengal, Orissa, Bihar, Uttar Pradesh, Madhya Pradesh, Tamil Nadu and Karnataka were affected. The scientists of CICFRI have conducted detailed investigations on the infected fishes in Maharashtra and the preliminary results indicated that the pathogens responded positively to treatment with lime(CaO) and potassium permanganate($KMnO_4$). Affected fishes like *Channa punctatus* and *Anabas testudineus* were examined for isolation of viral and bacterial pathogens. While no viral agents were isolated on the mammalian cell-line, bacterial pathogens *viz.*, *Klebsiella* and *Pseudomonas* were detected from these fishes. The

fish samples are being subjected to biochemical and serological tests to establish the identity of pathogens upto the species level.

Feasibility Study for Reservoir Fisheries

The Institute has taken up the consultancy assignment with the NEC to prepare feasibility studies for fisheries development for Nongmahir and Kyrdamkulai reservoirs at Meghalaya. The preliminary investigations have been initiated and the work is expected to be completed by June 1991.

INTERNATIONAL

Central Inland Capture Fisheries Research Institute has actively collaborated with the Network of Aquaculture Centres in Asia (NACA) in their Regional Research Project entitled "Environmental Monitoring and Ulcerative Syndrome in Fish" was initiated at CICFRI, Barrackpore, India along with 11 other countries.

Collaborative Project on Fish Diseases

A collaborative research project on fish parasites has been envisaged under the auspices of the Central Inland Capture Fisheries Research Institute and the Sterling University, U K. Dr. R. Wooten and Dr. C. Somerville of the Sterling University, who visited CIFRI in this connection during 27- 3- 91 to 31- 3- 91, held detailed discussions with the Director and the Scientists of the Fish Pathology Section of the Institute. It has been agreed in principle to undertake a collaborative project entitled *ODA Fisheries Research Project* with an objective to study the effects of parasitism on Indian open water fisheries. The British Scientists have visited some of the brackishwater impoundments (*bheries*) near the Salt Lake city, Calcutta and tentatively selected the Gobala and Nalban *bheries* owned by the West Bengal State Fisheries Development Corporation. These *bheries* are known to have good population of *Argulus* and other fish parasites.

MANPOWER DEVELOPMENT

Visit of Scientists to the People's Republic of China

Dr. Arun G. Jhingran, Director and **Dr. M. Ramakrishniah,** Senior Scientist of the Institute attended the *2nd Aisan Reservoir Fisheries Workshop,* held at the Peoples' Republic of China from 15th to 19th October, 1990. Dr. Jhingran presented a paper entitled "Significant advances in reservoir fihseries management in India". He discussed at length the status of reservoir fisheries resources in India and their utilisation. Dr. Ramakrishniah presented a paper entitled "Morpho-drainage index to predict the fish yield in tropical man-made reservoirs".The papers presented by both the participants generated active discussions in the workshop.

Training Abroad

Shri R. A. Gupta, Senior Scientist was deputed by the Institute to undergo nine months training course leading to the award of *Post-Graduate Diploma in Development Economics* of the University of Manchester, U. K. which commenced from 2nd October, 1989 and ended on 10th July, 1990. The course comprised specialised training in micro and macro-economic modelling, quantitative economics and techniques of cost-benifit analysis of agricultural projects. Emphasis was given on various aspects of inland capture fisheries wherein due to commmon property nature of fishery resource every individual tries to maximise his benefits causing over exploitation of the resourse, and methods were discussed to deal with such problems for maximisation of net social benefits.

Dr. H. C. Joshi, Senior Scientist of the Institute was awarded *Commission of the European Communities (CEC) Fellowship* consequence to his successful completion of the *International Water Law and Management Course* at the International Institute for Hydraulic and Environmental Engineering, Delft, Netherlands, during 12-30 November, 1990. The course centred around the theme '*the rational water resource management for sustainable development within the frame work of principles of International Water Law* '. This was attended by 29 experts from seven South and South East Asian countries.

Dr. K.R. Naskar, Scientist (SG) participated in the International Symposium on Mangroves and related eco-systems, organised by the Dept. of Zoology, University of Nairobi, held at Mombasa Beach Hotel, Kenya, from 24-30 September 1990.

Shri A.C. Nandy, Principal Scientist underwent training at NAARM, Hyderabad from 17-28 July 1990 on the course on Agricultural Project Management.

Ms. Mira Sen, T-6 underwent training on Research Management in Home Science at NAARM, Hyderabad from 11-27 September 1990.

HONOURS, AWARDS, ETC

Shri Mahadev Choudhury qualified for the degree of Doctor of Philosophy in the University of Gauhati, Guwahati, Assam in the Faculty of Science (Zoology) in the year 1989 for his thesis entitled *Some aspects of Bio-statistical studies on catch growth and ecological parameterrs of freshwater Indian major carps in the lower reach of the River Brahmaputra.*

Shri Balbir Singh awarded the Ph.D. Degree under the Faculty of Science on the topic *Limnology of a pond ecosystem near Allahabad and its bearing on fish production* by the Kanpur University.

Shri G.K. Bhatnagar has been awarded the Ph.D. Degree in Zoology on the topic entitled *The study of Biology, behaviour and sexual dimorphism of* Labeo fimbriatus *(Bloch)* by the Agra University.

Shri V.V. Sugunan is awarded Ph.D. (Sc.) Degree by the University of Calcutta on the topic entitled *Temporal and spatial distribution of some biotic communities in Nagarjunasagar and their role in the limnology and fisheries of the reservoir.*

Shri Dhirendra Kumar, has been awarded Ph.D. Degree from Bhagalpur University for his thesis entitled *Comparative studies on the ecology of air-breathing and carp fish ponds.*

Shri P.K. Sukumaran was awarded Ph.D. Degree from Bangalore University in March 1991 on his thesis *Observations on the ecology of plankton in a freshwater tank in Bangalore.*

Shri B.K. Singh, Scientist (SG) at Pune Centre of the Institute has been conferred the Fellow of the Academy of Environmental Biology by the Academy of Environmental Biology, Muzaffarnagar, U.P.

Shri Sk. S.S. Hameed, T-5, at Bangalore Centre was awarded M.E. Degree (Electrical & Eletronics) with a specialization of control and instrumentation engineering from Annamalai University, Madras in May 1990.

TRANSFER OF TECHNOLOGY

EXTENSION AND NATION-BUILDING ACTIVITIES

Research/Survey

(i) Technology adoption by farmers of Sunderbans

A survey was undertaken covering 160 families in a cluster of 10 villages in South 24-Parganas district, West Bengal. The study revealed that 63% of the farmers were of marginal category and 34% of small category. The maximum adoption level (58.4%) was by medium farmers. The prodcuction of paddy, fish and prawn ranged from 2501-3500 kg/ha, 401-500 kg/ha respectively as against the paddy production of 1400-2000 kg/ha under the traditional method. The constraints identified were lack of resources, inadequate irrigation facilities and support system, extension gap, social evils, etc.

(ii) Economic appraisal of the fish seed collection at Sunderbans.

A total of 314 seed collectors at Namkhana-Kulpi areas were interviewed to assess their socio-economic status and the remunerativeness of the finfish and shellfish seed collection. They belonged to 14-62 years age group; 65.3% were scheduled castes, 25% were females; and 25% were illiterates. The primary occupation of 79.6% was the seed collection. Peak seed collection season is January to September when 90% of the seed is collected. A person spends an average time of 4 hrs a day operating two shooting nets. After segregating the tiger prawn seed, usually the seed of other species are thrown out which amount to 1800 million per year. The segregated and selected seed

are transported generally (95.5%) in aluminium hundies. The earning per man in a month amounts to Rs. 801-1000 during the peak season.

Extension activities : The Section continued with its advisory services , extension lectures and demonstrations to the visitors, students, trainees and farmers. Twenty four batches of students and trainees, 99 fish farmers and several visitors, entrepreneurs and extension officers were attended by the section.

Training Programme :

Eleven short term need-based training course were conducted by the Institute during 1990-91. About 373 fish farmers /fishermen and 44 extension officers were benefited by the programmes.

TRAINING FOR BANK OFFICIALS ON INLAND FISHERIES DEVELOPMENT

An eight day training course on **Inland Fisheries Development** was organised for the senior officers of the Bank of Baroda during 5-12 September, 1990. The pivotal role of the banking sector in inland fisheries development has long been recognised. However, evolving criteria for securities, sureties and collaterals in inland fisheries ventures is a challenging job for the bankers. It has been the endeavour of CICFRI to disseminate inland fisheries technologies to the banking personnel through training courses. This training programme was conceived for the senior officers of the bank and was aimed at familiarising them with various fisheries ecosystems and their management. This will better equip the banking personnel to judge and finance fisheries projects.

The programme was inaugurated by Prof. D. K. Dasgupta, Vice-Chancellor, Bidhan Chandra Krishi Viswavidyalaya at Barrackpore on 5. 9. 1990. The inaugural ceremony was attended by Shri D. K. Mukhopadhyay, Deputy General Manager, Bank of Baroda, and Shri V. B. Trivedi, Faculty Member, Staff Training College, Ahmedabad. On successful completion of the training, all the 25 participants were awarded with the certificates at a valedictory function held on 12. 9. 1990. The valedictory session was chaired by Shri A. B. Dasgupta, Member, West Bengal State Planning Advisory Board who distributed the certificates and the book 'Technologies for Inland Fisheries Development' to the participants.

CENTENARY CELEBRATION OF BABASAHEB DR. B.R. AMBEDKAR

Bangalore

A Fish Farmers' Day was organised commemorating Dr. B.R. Ambedkar Centenary Celebrations at the Reservoir Division, Bangalore in association with the Directorate of Fisheries, Karnataka, and Karnataka Inland Fisheries Development Corporation, Members of Fishermen Cooperative Societies, Fish Farmers, etc. were participants in the function. Later, a stock of 2,000 fingerlings (50-100 mm) of Indian major carps, catla and rohu were released in the Markonahalli reservoir.

West Bengal

In the backward areas of Sunderbans, 24-Parganas (North), a Fish Farmers Day, Kisan Mela and Field Day were organised. More than 700 fish farmers participated in the functions. With the aid of charts, posters, etc. the farmers were enlightened of the recent advances in the fish culture.

Women in Agriculture Day

Women in Agriculture Day was celebrated at Nischintpur, in the 24 Parganas (south)District. About 500 women participated. Besides the scientists of the Institute, officials of State Government and social workers also actively took part in the discussions that followed. Various technologies *Viz.* net weaving, wool knitting, preparation of pickles, jams, jelly and methodical transplantation of paddy etc. were demonstrated on the day.

Fish Farmers' Days : CIFRI organised/participated in six Fish Farmers' Days during 1990-91 for the benefit of 532 entrepreneurs.

Exhibitions/Film Shows : The Institute took part in four exhibitions held at Allahabad, Naihati, Patipukur and New Delhi. Exhibits were supplied to three other exhibitions. About 150 film shows on inland fisheries were organised during the year.

Arrangements were made to telecast/broadcast/publish the news items on the activities of Institute on few occasions.

KRISHI VIGYAN KENDRA

The Krishi Vigyan Kendra, Kakdwip was transferred to the administrative control of CICFRI with effect from August 1, 1989. Demonstration and extension services of KVK at Kakdwip during the year covered the areas: (i) Fisheries (ii) Crop production (iii) Horticulture & (iv) Home Science.

Emphasis in fisheries were on seed raising, carp culture, finfish and shellfish culture in brackishwater ponds, integrated farming and control of fish diseases.

Paddy, sunflower, mustard, betelwine, fodder crops, soil management and plant protection devices were the chief areas covered under crop production.

Agro practices in chilli, gourd, mango and other vegetables were demostrated under horticultural programmes. Plant protection measures, diseases and pest management received special attention.

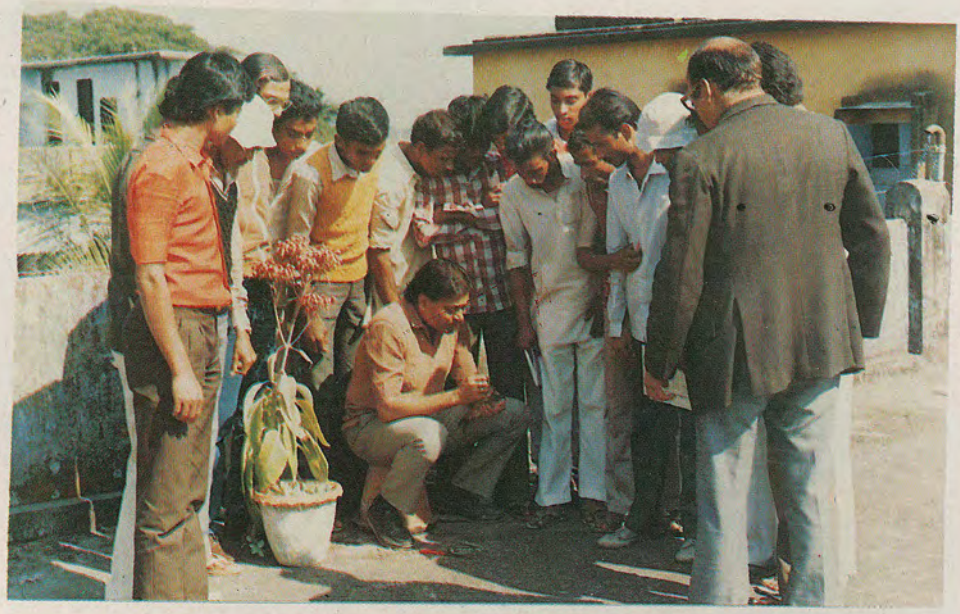
Fruit preservation, preparation of fruit products like jam, jelly, pickles, etc., embroidery, tailoring, knitting of chairs, child care, health and hygiene, adult literacy and floral decoration were covered under home science.

KVK ACTIVITIES

Women being trained in Home Science on the occasion of the *Women's Day*

A training programme on Mushroom cultivation was organised on the *Women's Day* at KVK Kakdwip

KVK Activities



Demonstration on removal of fish pituitary glands

Pituitary extract being prepared by the trainees

Demonstration of mustard cultivation in a farmer's plot under the First Line Demonstration Programme

The extension and training programmes of the Institute lay special emphasis on the role of women in aquaculture and allied activities. Women are being trained in kitchen gardening on the occasion of Women's Day

Gujarat Minister visits the Institute

Sri Dilip Sangani, Hon'ble Minister for Fisheries, Govt. of Gujarat paid an official visit to CICFRI. The picture above shows the Hon'ble Minister visiting the pesticide pollution laboratory

Dr. S. Jayarajpuri, Director, Zoological Survey of India being briefed on the activities of the Institute.

Altogether 98 short-term training courses were conducted by the KVK during the year. The details are as follows.

Discipline	No. of training programme	
	On-campus	Off-campus
Fisheries	6	15
Crop production	4	16
Horticulture	6	18
Home Science	7	26
Total	**23**	**75**

The training courses were need-based and location-specific, decided after village and family surveys. Orientation of the course depended on the economic capacity of the farming community. In addition, twenty seven lectures in the above focussed disciplines were delivered on various occasions by the extension staff of KVK in different villages.

Under **Oil seeds production programme,** mustard seed (var. B-9) were distributed to 160 farmers to cover a crop area of 10 hectares. The yield ranged from 800 to 1500 kg/ha. Sunflower seed were distributed to 65 farmers.

The KVK arranged telecast of four programmes in Doordarshan, Calcutta and participated in two exhibitions. A total of 574 families were surveyed for their socio-economic survey and adoption trial of paddy-cum-fish culture and composite fish culture.

Lab to Land Programme

The Lab to Land Programme of ICAR was implemented at the Institute adopting 100 farm families of village Nischintapur, Kakdwip, Narayanpur and Nandabhanga of the district South 24 Parganas. The dissemination of various technologies in fish culture and crop production in the 3rd year of the Vth phase of the programme have brought out a radical change in yield even more than double both in fish culture as well as in crop production. The production obtained under various farming systems are given below :

Sl.	Name of enterpriser/crop	Average yield(Q/ha) under traditional system	Production levels after transfer of technology (Q/ha)
1	Kharif rice	10.0	41.0
2	Boro rice	25.0	47.0
3	Dry chilli	7.5	22.0
4	Capsicum	-	100.0
5	Potato	30.0	120.0
6	Watermelon	250.0	536.0
7	Fish seed production	-	15 million spawn, 10 lakh fry and 5 lakhs fingerlings
8	Composite fish culture	8.0	33.0
9	Brackishwater fish and prawn production	1.50	8.5
10	Mushroom production (*Pleurotus* sp. Straw bed)	-	250 g/sq.ft.

LIBRARY & DOCUMENTATION SERVICE

The CICFRI library added 112 books and 63 miscellaneous publications and reprints of 8 scientific papers to its collection and subscribed 34 foreign and 63 Indian journals. The library has a total holding of 6425 books, 4124 outside reprints, 753 maps and 2837 miscellaneous publications. Eight new exchange relationships with leading national and international research information centres were established during the year.

The Institute continued the free mailing of its 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 lent out 146 publications to other libraries on inter-library loan. The total expenditure incurred by the library during the year was Rs.4,12,371.00.

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

Technical Reports

More than 30 technical reports on the progress of research activities of the Institute were compiled. Research publications of the Institute scientists were scrutinised before publication in various journals. Technical queries regarding the activities of the Institute from various quarters of the country and abroad were attended to by the section.

Participation of scientists in seminars, symposia, conference etc. was monitored by the section.

Research Project Files

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

Publications

The following departmental publications were brought out by CICFRI during the year April 1990 to March 1991.

1 **Annual Report** for the year 1989-90.
2 **Book** entitled **Technologies for Inland Fisheries Development** ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI.
3 **Book** entitled **Manual on farming processing and marketing of giant African snail *Achatina fulica*** by G.K. Vinci, V.K. Unnithan & V.V. Sugunan, CICFRI, Barrackpore and MPEDA, Cochin.

4 **Indian Fisheries Abstracts -**
Vol.25(3), 1986.
Vol.26(1-3), 1987.
Vol.27(2), 1988.
Vol.28(1), 1989.

5 **Newsletter**
Special Symposium number (Vol.10, April 1987)
Special Commemorative issue (January, 1990)
Special Commemorative issue in Hindi (May, 1990)

6 **Important Occasional Publications**
Memorandum submitted to the Quinquennial Review Team 1989 (1982-86)
Restoration of fisheries in the Ganga River System, proposed Action Plan by Arun G. Jhingran (Working paper for the Meeting of the Technical Sub-committee of the Co-ordination Committee on Restoration of Fisheries in the Ganga River System, 10-11 July, 1990)
Riverine Environment, fisheries and legislative support - A preliminary probe by S. Paul
Proceedings of meeting of the Technical and legislative sub-committees on Restoration of Fisheries in the Ganga River System
Research Project Programme 1990-91
Sar sher chas (Bengali Pamphlet)
Deputation report. FAO/DANIDA Seminar on Fishery Research Management, Phuket, Thailand, 11-12 September, 1989 by Arun G. Jhingran, 28 p.

CONFERENCES, SYMPOSIA, ETC.

The following important Meetings/ were organised by the Institute during April 1990 to March 1991.

Annual Staff Research Council Meeting of the Institute on 18th and 20th April 1990.

Fourth Management Committee Meeting of the Institute on 12th December 1990.

Meetings of the Technical and Legislative Sub-Committees on restoration of fisheries in the Ganga river system. The meetings of the above commities were held at CIFRI, Barrackpore on 10th and 11 July 1990 and action plans and remedial measures were identified.

The Deputy Prime Minister lays the foundation stone for the new laboratory buildings at Allahabad centre of the Institute on 31st May 1990.

Training course of the Inland Fisheries Development for the Officials of the Bank of Baroda, 5-12 September 1990.

Celebration of Women in Agriculture Day on 4th December 1990 at Nischintapur, Kakdwip.

Training on Snail farming for the officials from the State of Mizoram from 16-22 September at Barrackpore.

Hindi Week celebration during 14-20 September 1990.

Seminar on Conservation of Energy for National Development in collaboration with the Directorate of Field Publicity, Govt. of India on 6th March 1991.

Apart from the above, the scientists of the Institute participated/presented papers in the Second Asian Fisheries Forum held at Mangalore from 27-31 May 1990; VIIth International Congress of parasitology organised by the President, Convergences, 16, rue Jean - Jacques Roussean, 75001, Paris, France from 20-24 August 1990; Symposium on Statistics organised by Allahabad Mathematical Society, 2nd Biennial Conference from 7-9 April 1990; 4th National Conference on Agri. Marketing organised by the Secretary, Indian Society of Agricultural Marketing, 8-6-31, 5th Line, Nehru Nagar, Guntur 525001 from 2-4 June 1990; EIFAC Symposium on Production enhancement in still water pond culture, held at Prague, Czechoslovakia from 15-18 May 1990; The All India Seminar on Industrial Environment Management, organised by Indian Institute of Social Welfare and Business Management, Calcutta from 9-10 April 1990; National Seminar on Recent Advances in Hydrobiology, at Vikaram University, Ujjain 456010, M.P. from 1-3 October 1990; National Symposium on Rice in Wetland Ecosystem, held at Kerala Agricultural University, Kottayam, Kerala from 26-28 November 1990; International Conference on Extension Strategy for minimising risk in rainfed agriculture held at Indian Soc. Ext. Education, New Delhi from 12-17 November 1990; National Seminar on Recent Advances in Hydrobiology, at Athens American Fisheries Society, 5410, Grosvenor Lane, Suite 110, Bethesda, MD 20814, USA from 1-3 October 1990; National Seminar on Fish and their environment held at Udaipur from 27-29 December 1990; National Symposium on Remote Sensing on Agricultural Applications, held at Division of Agricultural Physics, IARI, New Delhi from 8-10 November 1990; Second Asian Reservoir Fisheries Workshop, sponsored by IDRC at Hangzhou, P.R.China from 15-19 October 1990; Science Seminar organised by OXFAM in the village Gazir Mahal, Nischintapur from 23-24 April 1990; Conference on Mashroom Production organised by Action Research Institute, Calcutta on 30 April 1990; Seminar on Environmental pollution and resources of land and water held at Aurangabad from 21-23 December 1990; National Seminar on Productivity constraints in Coastal areas, held at Calcutta (Indian Society of Coastal Aril. Res., CSSRI, Regional Res. Station, Canning Town from 18-21 January 1991; and International Seminar on Fisheries, Conducted by State Bank Staff College, High-Place 3-1188 Begumpet Rd., PB4, Hyderabad on 30th January 1991.

A total of 23 papers were presented by the scientists of the Institute in the above mentioned meetings.

VISITORS

A large number of distinguished personalities including national leaders visited the Institute's Headquarters and its different centres during 1990-91. They include **Shri Devi Lal,** Hon'ble Dy. Prime Minister & President, ICAR, **Shri Janeshwar Misra,** Hon'ble Union Minister of State for Telecommunication, Govt. of India, **Shri Hari Krishna Shastri,** Former Minister of State, DARE, **Smt. Sukhda Mishra,** Minister for Rural Development, U.P., Lucknow. **Shri Shyama Charan Gupta,** Mayor, Nagar Mahapalika, Allahabad, **Shri Dilip Sangani,** Hon'ble Minister for Fisheries, Gujarat, **Shri Tej Narayan Yadav,** Ex-Minister for Fisheries & Animal Husbandry, Bihar, and **Shri Jaidutta Shhirsagar,** Member of Legislative Assembly, Maharashtra State.

The following is the list of other distinguished visitors from India and abroad who visited the Institute.

Akthar, M.S. (Mr.), Asst. Director of Fisheries, Pong Dam, Dist. Kangra, Himachal Pradesh.

Atim (Miss), Fisheries Officer, Nigeria.

Awasthy, O.P. (Mr.), Journalist, The Times of India.

Bakshi, Rekha (Mrs.), Journalist, National Herald.

Bhattacharya, S.K. (Dr.), Dean, Faculty of Science, Allahabad Univ., Allahabad, U.P.

Boie (Miss), -do-

Chatterjee, K.N. (Mr.), Project Incharge, Pisciculture Training & Extension Section, SEDP.

Chatterjee, S. Kr. (Mr.), Reporter, Dainik Basumati.

Chowdhury, A. (Dr.), Head of the Dept., Marine Biology, Calcutta University.

Das Gupta, A.B. (Dr.), Member, W.B. State Planning Board.

Das, P. (Dr.), Director, NBFGR, Allahabad.

De Sarkar, Ranjit (Mr.), Producer, Calcutta Doordarshan Kendra (Pallikatha Ashar), Calcutta.

Dehadrai, P.V. (Dr.), Dy. Director General (Fy.), ICAR, New Delhi.

Demaine, Harvey (Dr.), Divn. of Human Settlements, AIT.

Dhulkhod, V.K. (Mr.), AFO, Tungabhadra Board, Mysore.

Dubey, G.P. (Dr.), Ex-Director, Dept. of Fisheries, Govt. of M.P.

Edwards, Peter (Dr.), Divn. of Agricultural & Food Engineering, AIT.

Ganguly, B. (Mr.), District Fishery Officer, Diamond-Harbour, West Bengal.

Ghatede, Sunil (Dr.), Journalist, National Herald.

Jaya Raj, U. (Mr.),Journalist, UNI.

Jayarajpuri S. (Dr.), Director, Zoological Survey of India, Calcutta

Jha, A.K. (Dr.), Associate Prof., Commerce College, M.U., Patna.

Jha, Siddi Nath (Mr.), Dy. Director (Impl.), Dept. of Official Language, Eastern Region, Calcutta.

John, (Mr.), Fisheries Officer, Nigeria.

Khan, Abdullah (Mr.), G6, 6th Floor, Hansuly Bldg., Barakhamba Rd., New Delhi, DANIDA.

Kim Han, Ly. (Dr.), General Director of Fishery, Cambodia.

Kulkarni, G.B. (Mr.), AFO, Tungabhadra Board, Mysore.

Kumar, Ranjeet (Mr.), NABARD, Patna.

Mac Mskee, (Mr.), Harza Engineering Co., Pune.

Maharaj, Swami Akhilatmananda, Asst. Secretary, R.K. Mission, Jamshedpur.

Maitra, Biplab (Mr.), TV Reporter, Calcutta.

Mareth, Mok (Dr.), Vice-Minister of Agriculture of Cambodia.

Mathew, P.M. (Dr.), Prof. of Fisheries, Kerala Agricultural Univ., Kochi.

Mazumder, Sushobhan (Mr.), Reporter, UNI.

Mishra, Rohit (Mr.), NABARD, Patna.

Mitra, Kakoli (Prof.), Faculty of Home Science, Calcutta University.

Mukhopadhyay, D.K. (Mr.), DGM, Bank of Baroda, Eastern Zone, 2/7 Sarat Bose Road, Calcutta.

Nigam, Ratanji (Mr.), General Manager, M.P. State Fisheries Corporation, Raipur, M.P.

Omafseye, C. (Mr.), Fisheries Officer, Govt. of Nigeria.

Pampapathi, H.M. (Mr.), F.D.O., Tungabhadra Board, Mysore.

Pandya, P.B. (Mr.), Sr. Manager (Training), Bank of Baroda Staff College, Ellisbridge, Ahmedabad 380 006.

Pati, T. (Dr.), Vice-Chancellor, Univ. of Allahabad, Allahabad, U.P.

Pereira, M.C. (Dr.), Agronomist, CIDSE-PNH, P.O. Box 2420, Bangkok 10500, Thailand.

Phillips, Mike (Mr.), Institute of Aquaculture, Univ. of Sterling.

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

Raju, H.V.K.(Mr.), I.F., Tungabhadra Board, Mysore.

Ronald W. Jones, (Mr.), CUSO Schalar, Canada, 57 Victoria St., Ottawa, Ont. Canada KIMI 58.

Roy, Elmore, (Mr.), Harza Engineering Co., Chicago.

Saggi, N. (Dr.), Director of Fishery, West Bengal.

Saha, Molay (Mr.), Reporter, Bharatkatha.

Saigal, B.N. (Dr.), Associate Dean, College of Fisheries, Dholi, Bihar.

Sakthidharan, (Mr.), Journalist, The Hindustan Times.

Seanetana, Tooch (Mr.), Administrator, Cambodia.

Sengupta, R. (Mr.), Dy. Director of Fisheries, Govt. of West Bengal.

Sharma, S.K. (Mr.), CPPRO, ICAR, New Delhi.

Sharma, S.K. (Mr.), Dy. Director of Fisheries , Fisheries Training School. Raipur, M.P.

Singh, Jitendra (Mr.), Chief Executive Officer, FFDA, Raipur, M.P.

Singh, N.K. (Mr.),Dy. Managing Director, FSDC, Bihar.

Sinha, J.P. (Mr.), Jt. Director (Fy), Patna, Bihar.

Sinha, S.K. (Dr.), Associate Prof., Patna Univ., Patna.

Srivastava, C.B. (Dr.), Dy. Director, ZSI.

Srivastava, C.B.L. (Dr.), Head, Dept. of Zoology, Allahabad Univ., Allahabad, U.P.

Srivastava, Uma Shankar (Dr.), National Academy of Sciences, Allahabad, U.P.

Swarup, Krishna (Dr.), Emeritus Scientist, National Academy of Sciences, Allahabad, U.P.

Tiwari, S.K. (Mr.), Dy. Director (Fy), Govt. of Bihar, Patna.

Tripathi, R.K. (Mr.), Commissioner of Fisheries, Gujarat.

Trivedi, Vipin (Mr.), Sr. Manager (Training), Bank of Baroda Staff College, Ellisbridge, Ahmedabad 380 006.

Tuli, R.P. (Mr.), Retd. Director of Fisheries, M.P.

Upadhaya, S.N. (Dr.), Prof. of Botany, Bhagalpur Univ., Bihar.

Upare, M.A. (Mr.), Dy. Manager, NABARD, Hyderabad.

Utin, Atim Ahang (Miss), -do-

Varadarajan, V.K. (Mr.), Journalist, The Hindu.

Veriwk, Johan Ing.(Dr.), AIT, Environmental Engineering Division.

Verma, B.S. (Mr.), Asst. Director of Fisheries, Govt. of Himachal Pradesh, Palampur, Dist. Kangra.

Verma, R.P. (Dr.), Head, Dept. of Botany, R.S. College, Muzaffarpur, Bihar.

Waibal, H. (Dr.), AIT, Ag. Economist, Divn. of Agricultural & Food Engineering.

Walimbe, R.B. (Mr.), Dy. Director, CTU, CWC, Pune.

Wootten, Rod (Dr.), Institute of Aquaculture, Univ. of Sterling, Scotland, U.K.

FINANCE

For the year 1990-91

(Rs. in lakhs)

		B.E. 1990-91 (Rs.)	R.E. 1990-91 (Rs.)	Actual Expenditure 1990-91 (Rs.)
Plan	:	70.00	61.00	61.00
Non-Plan	:	245.80	240.00	240.00
Total	**:**	**315.80**	**301.00**	**301.00**

PROGRESS OF RESEARCH

CENTRE-WISE LIST OF ONGOING PROJECTS 1990-91

BARRACKPORE	:	FC/A/4	FC/A/6	FC/A/13
		FC/A/17	BF/B/2	BF/B/3
		BF/B/8	BF/A/2	AN/A/12
		AN/A/9	CSS/1	AN/A/13
AGRA	:	FC/B/10		
ALLAHABAD	:	FC/A/14		
BANGALORE	:	FC/A/7	AN/A/9	
CALCUTTA	:	BF/B/2		
COIMBATORE	:	FC/A/10		
CANNING	:	BF/B/3		
DIAMOND HARBOUR	:	BF/B/3		
DIGHA	:	BF/B/3		
ELURU	:	FC/B/5		
GUWAHATI	:	FC/B/9	FC/A/16	
KANGRA	:	FC/A/7		
LALGOLA	:	FC/B/7		
PATNA	:	FC/B/7	FC/A/15	
PUNE	:	FC/A/7	AN/A/9	
RAIDIGHI	:	BF/B/3		
RAIPUR	:	FC/A/7		
ULUBERIA	:	BF/B/3		
VADODARA	:	BF/B/9		
KAKDWIP	:	KVK		

Research project merged during 1990-91

Nil

ONGOING PROJECTS

Project : **FC/B/5**

STUDIES ON THE ECOLOGY AND FISHERIES OF KOLLERU LAKE ECOSYSTEM AND DEVELOPMENT OF SUITABLE MANAGEMENT MEASURES FOR OBTAINING SUSTAINED FISH PRODUCTION

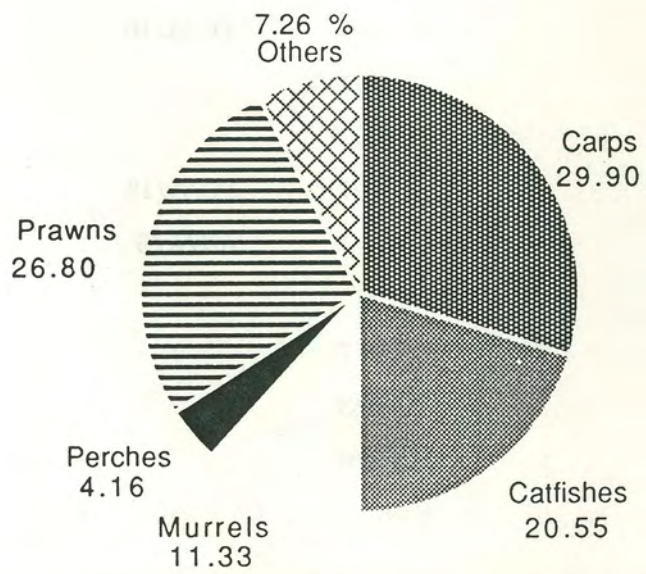
Personnel : K.V. Rao, R.S. Panwar, M. Ramakrishniah, J.B. Rao, T.S. Rama Raju, K.S. Rao, Ch. G. Rao

Duration : 1987-1991

Location : Eluru , Andhra Pradesh

Fish landing data was collected regularly once in a week from Eluru, Akivedu and Bhimavaram. The fish production during the year (90-91) was estimated to be 1894.51 t as against 2002.16 t during the year 1989-90 thus registering a decline of 5.38% over that of the preceding year. Out of this total, Eluru contributed 19.81%, Akivedu centre 59.69% and Bhimavaram centre 20.32%. The month-wise landings at different sampling centres are given in Fig.1.

Fig. 1 Percentage composition of fish landings from Kolleru lake



Among carps, *L. rohita*, *C. catla* and *C. mrigala* together contributed 95.90% though *L. calbasu* and *P. sarana* also contributed 1.08% and 3.02% respectively.

The species that contributed considerably to the total production were as follows in their order of abundance :

L. rohita	...	17.67%
M. monoceros .	.	14.60%
C. striatus	...	9.20%
W. attu	...	9.04%
M. malcolmsonii	...	8.62%
C. mrigala	...	6.41%
H. fossilis	...	5.72%
M. gulio	...	5.25%
C. catla	...	4.58%
A. oligolepis	...	3.33%

Fish sale :

The total fish and prawn sold during the year 1990-91 (April '90 to February '91) was estimated to be 3,529.69 tons as against 2,245.86 tonnes during 1989 (Jan.-Dec.). Murrels were generally sent to Secunderabad and prawns to Madras. Howrah Railway Station received the bulk of live fish. Of the total export, 61.87% comprised the iced fish, 25.09% iced prawn and 13.04% live fish.

Plankton

Volumetric analysis revealed a range of trace to 0.1 ml (Pedavedalagadi per 50 l) while the numerical estimation ranged from 4 u/l (Polraj drain) to 61 u/l (Pedavedalagadi, April, 1990) in the three centres.

In the new centres of Kolleru viz., Pandiripalligudem confluence point, P.P. Gudem village, Alapadu Rd. (Kolletikota), Pattikodulanks and Gudivakalanka. Observation on the abundance of plankton revealed richness in variety and quantity of species. Thus plankton count varied from 1 u/l (Feb.,Alapadu Rd.) to 131 u/l (Nov., P.P.Gudem). Volumetric analysis showed a range of trace to 0.3 cc (Nov., P.P. Gudem and Feb., Alapadu Rd.) per 50 l. Phytoplankton ranging from 60-99% dominated over zooplankton. Most dominant species among phytoplankton were *Spirogyra*, *Diaptoma*, *Oscillatoria* and *Spirulina*.

Benthos

Occurrence of bottom living animals ranged from 88 u m^{-2} to 494 u m^{-2} at the peripheral region of Kolleru while it ranged from 20 u m^{-2} to 546 u m^{-2} at the core sector. Thus, number of animals at the new centres ranged between 169 (Feb.1991) to 468 u m^{-2} (Nov. 1990) at Pandiripalligudem village area, 156 (Dec. 1990) to 410 u m^{-2} (Jan. 1991) at Alapadu Rd. Cross, 65 (Feb. 1991) to 546 u m^{-2} (Dec. 1990) at Pattikodulanka and 20 (Jan. 1991) to 468 (Dec. 1990) u m^{-2} at Gudivakalanka.

Benthos belonging to the Gastropoda dominated at all the centres within a percentage range of 67 to 100..

List of species recorded in Kolleru (Bottom biota) from the new centres are :

Bellamya dissimilis, Melania striatella tubereviata, Thiara (thiara) lineata, Thiara (Tarelia) scabra, Indoplanurbis exustus, Digoniostoma ceramcoya, Perreysia corugata, Coreula striatella, Aulophorus furcatus, Lacastis indica, Gammarus, Chironomid larvae.

Macrovegetation

Macrovegetation ranged from 2 kg m^{-2} (April, Polraj drain) to 9 kg m^{-2} (April, Tadinada). Maximum vegetation was recorded from Tadinada centre varying from 2.6 kg m^{-2} (July) to 9 kg m^{-2} (April) followed by Pedayedlagadi from 3 kg m^{-2} (October) to 6 kg m^{-2} (May) and Polraj drain in 2 kg m^{-2} (April) to 4.6 kg m^{-2} (September). *Eichhornia crassipes* was the most dominating macrophyte (free floating) followed by *Ipomea auatica* (floating leaves) in the western part of the Kolleru lake.

Physico-chemical features of Kolleru water and soil

Water :

The infestation of aquatic vegetation into peripheral region of Kolleru lake at Pedavedlagadi and Polraj drain affected the water quality. The chemical characteristic of water showed low concentration of dissolved oxygen ranging from 0.87 to 3.69 mg l^{-1} and 2.71 to 4.28 mg l^{-1} respectively. The value of primary productivity was found low, ranging from 3.12 to 21.31 mg C m^{-3} hr^{-1} except during the month of April (40.26 mg C m^{-3} hr^{-1} at Polraj drain).

The pH of water at different centres of the lake (Pandiripalligudem, Kolletikota, Pattikodulanka and Gudivakalanka) ranged from 7.3 to 7.7. The chemical characteristics of water showed low content of D.O. ranging from 1.08 to 3.64 mg l^{-1} except at Gudivakalanka and Pandiripalligudem where it was estimated to be 5.28 to 8.4 mg l^{-1} in November and December 1990 and 7.8 to 8.0 mg l^{-1} in December respectively during bright sunny days.

The quality of water did not show any remarkable six hourly change in chemical condition. The value of primary productivity was found to be low (10.94 C m^{-3} hr^{-1}). Other physicochemical parameters namely total alkalinity, hardness, specific conductance and total dissolved solids fluctuated in the range of 140.0 to 210.0 mg l^{-1} , 120.0 to 176.0 mg l^{-1} 680.0 to 956.0 µ mhos cm^{-1} and 340.0 to 476.0 mg l^{-1} respectively.

Soil :

The soil is quite rich in organic matter (0.68 to 2.65% organic carbon) with high ionisation capacity (770.0 to 1040.0 micro-mhos cm^{-1}).

Survey of Fishing Methods in Kolleru lake

Net fishing is mostly limited to Upputeru channel. The nets commonly used are cast net *(Visuru vala)* and bag nets *(Gidasa vala)* tied to stakes fixed across the channel in a series. In some pockets of Kolleru lake, especially in its eastern region, nylon set gill nets *(Silku vala)* are being operated since the last two years in the inundated regions during flood seasons and early winter.

The main fishing gears employed in Kolleru lake are traps which are set individually or in a series and by erecting barricades *(Dadi kattu)* across the fish path ways. All these are made of bamboo splinters bound together by a wild creeper, *Vippa teega* or a thin coir rope.

A screen like barrier made of bamboo splinters supported by wooden poles called *Dadi Kattu* extends to over a kilometer in length, across the lake is another method of fishing.

Another important method of fish capture is *'Kampa Goodu'* practised usually in deeper zones of the lake and Upputeru along the banks.

The maximum fish yield from Kolleru region is exploited through *Doddi* fishing.

The predominant fishing craft utilised in Kolleru lake is *Done*, the dug out canoe made from palmyra tree.

Biology of commercial Fishes

Biology of some important fishes was also carried out viz. *Anabas oligolepis, M. gulio, Channa* spp. and *W. attu.*

Fish fauna

Eight species of fish were the new records during the year taking the total fish species recorded from the lake system to 118. The new records are *Rasbora daniconius, Laubuca laubuca, Chela atpar, Puntius ambassis, P. gelius, P. phutunio, Earilius barna* and *Colisa fasciatus.*

Tilapia :

Oreochromis mossambicus, which was recorded in the lake for the first time during 1989-90, having been introduced accidentally, spread to several parts of the lake. It affected the culture fisheries and its effect on the capture fisheries of the lake is being investigated.

Bioassays :

Bioassays were conducted with the effluent of distillery factory (from Hanuman Junction) using test fish, *Labeo rohita.* The LC_{50} values of the effluent with respect to test fish for 24 hr., 48 hr., 72 hr. and 96 hr. exposure period were calculated at 4.51 mg l^{-1}, 3.94 mg l^{-1}, 3.20 mg l^{-1} and 2.87 mg l^{-1} respectively.

Pollution :

The concentration of pesticide residues in the sediments of Kolleru lake indicate that there was more concentration of BHC, 25.62 ppb in Gudivakalanka region of the lake whereas it was found to be 5.6 ppb in Singavapadu area of the lake. The total DDT residues in soil was detected more (25.4 ppb) in Singavapadu as compared to Gudivakalanka region (9.3 ppb). Mortality of fishes *viz.*, *C. punctatus*, *Mystus* sp., *Etroplus suratensis* etc. were recorded in the lake.

PROJECT **FC/B/7**

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

Personnel : Y. Rama Rao, Ravish Chandra, S.K. Wishard, D.N. Singh, R.K. Saxena, M.A. Khan, Balbir Singh, G.N. Srivastava, R.K. Dwivedi, R.K. Tyagi, H.P. Singh, P.K. Katiha,V. Pathak, K.P. Srivastava,V.R.Chitranshi,P.N. Jaitly, A.R. Chaudhuri, N.K. Srivastava, S. Bhowmick, D.N. Srivastava, B.D. Saroj, Ram Chandra, J.P. Misra, Bhai Lal, M.P. Singh, Saket Kumar

Duration : 1986-1991

Location : Riverine Division, Allahabad/Patna Research Centre and Lalgola Survey Centre

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

The fishery of hilsa which had showed signs of recovery from 1984 to 1987, experienced a setback in 1988-89 as the catch of hilsa from an average of 1.8 t sustained during 1984-87 dropped down to 1.2 t in 1988-89 and thereafter, a low profile of 0.7 t recorded in 1989-90 which further dwindled to 0.6 t during 1990-91. At Patna 10.6 kg hilsa was recorded as against 28.92 kg during 1989-90.

Observations on the spawning of hilsa around Allahabad

The breeding of hilsa, though restricted for two months viz. September and October only, was less intensive, confirming the previous years' trends. The stretch around Allahabad, appeared to have breeding potential. No spawning of hilsa was observed around Patna.

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

During the period April 1990 to February 1991, the total fish landings at Sadiapur, Daraganj and Patna fish landing centres were estimated at 70.94, 20.08 and 41.53 t respectively. The species-wise breakup is given in Table 1.

Table : 1. Fish landings (t) at different centres

Species	Sadiapur	Daraganj	Patna
C. mrigala	1.65 (2.53)	0.33 (1.64)	0.63 (1.52)
C. catla	2.00 (2.82)	0.13 (0.65)	1.13 (2.72)
L. rohita	1.96 (2.76)	0.03 (0.15)	1.34 (3.23)
L. calbasu	7.67 (10.81)	0.16 (0.80)	0.23 (0.55)
Major carps	13.28	0.65	3.33
M. aor	8.95 (12.62)	0.70 (3.49)	4.26 (10.26)
M. seenghala	9.62 (13.56)	2.57 (12.80)	5.98 (14.40)
W. attu	1.48 (2.09)	0.06 (0.30)	1.26 (3.03)
Selected catfishes	20.05	3.33	11.50
H. ilisha	0.50 (0.70)	0.11 (6.55)	0.01 (0.02)
Miscellaneous	37.11 (52.31	15.99 (79.63)	26.69 (64.27)
Total	**70.94**	**20.08**	**41.53**

(Figures in parenthesis indicate %)

As compared to the preceding year, the landings registered a slight decline of 7.5% at Sadiapur. Significant decline was observed in the landings of *C. mrigala* and *M. aor*. Patna and Daraganj centres did not reflect much change over the preceding period.

For catch per unit of effort, studies were conducted at four centres, two at Allahabad and two at Patna. The gear-wise estimated catch per boat per day is given in Table 2.

Table 2. Gear-wise average catch/boat/day (kg)

Gear	Gill net	Drag net	Cast net	Scoop net	Trap	Spear	Hook & line
Allahabad Centre							
Bakshimoda (Yamuna)	2.95	11.95	-	4.10	-	-	1.60
Lavain (Ganga)	3.55	16.00	-	-	-	2.85	-
Patna Centre							
Mahendraghat	4.41	12.60	-	-	5.62	-	9.50
Ghoghaghat	2.23	8.85	7.00	-	1.80	-	2.23

Sub-Project C : Studies on the breeding and recruitment of selected commercial and non-commercial fishes

Spawn availability investigations were carried out at Madhauka and Jhusi centres, on the rivers Yamuna and Ganga respectively. The centre-wise details are as follows :

Madhauka Centre : A total collection of 14,567 ml of spawn in five shooting nets, as against 3,600 ml collected in the previous year. The maximum catch/net/hr was estimated to be 15 ml. Microscopic analysis of spawn showed most desirable spawn (54.20%) in the third flood, followed by second (49.20%), the fourth (30.50%) and the first (18.60%).

Maximum availability of spawn was reported when the flood level was betweem 77 and 79 MSL (i.e. 80% of total spawn) and quality spawn when the flood level vacillated between 78-79 MSL. The velocity and turbidity values varied from 0.24 to 0.6 km/hr and 260 to 750 ppm respectively during availability period.

Jhusi Centre : Four low floods encountered in the Ganga contributed 491 ml spawn. The third flood contributed maximum (47.10%), followed by the second flood (26.50%) and first flood (26.40%). Maximum catch/net/hr was 5 ml, the average percentage of quality (desirable) spawn being 12%.

Estimation of fry and fingerlings : Estimation of fry and fingerlings of major carps was done by operating drag nets in the marginal areas of the main rivers, as well as, in cut-off waters. While no fingerlings were encountered in the main river, fingerlings were recorded in cut-off waters.

The growth per day of major carp fingerlings from rivers Ganga and Yamuna were estimated on the basis of 120 days growth and found to be as follows :

	C. catla	*C. mrigala*	*L. rohita*	*L. calbasu*
River Ganga				
Length (mm)	2.79	1.71	1.72	1.46
Weight (g)	4.70	1.49	1.09	1.04
River Yamuna				
Length (mm)	2.60	1.10	1.02	-
Weight (g)	5.20	0.60	0.54	-

Patna : Spawn was available mostly in the rising phase of the first flood only. A meagre total of 27 ml and about 3,500 numbers of major carps fry were collected at the flood level fluctuating between 0.65 and 1.69 m. Microscopic analysis of the samples revealed the dominance of minor carps (53.3%), followed by major carps (25.0%) and others (21.7%).

Estimation of fish catches of deep pools :

Kara ghat : A total of 6,542.7 kg of fish was caught during the period from December 1990 to March 1991. Catfishes dominated in the catches amongst which the contribution of *R. rita* was maximum (55.5%). This was followed by *M. seenghala* (18.1%), *M. aor* (2.1%), *C. garua* (1.9%) and *E. vacha* (1.2%), the contribution of major carps was almost negligible and represented by *L. calbasu* (1.3%) and *C. catla* (0.2%). Miscellaneous fishery represented by *Chela* sp., *M. cavasius* and *M. vittatus*, formed the remaining bulk of the catch (19.7%).

Fishing gears : A few selected gears like drag net, gill net, scoop net and cast net, were operated by the fishermen and the bulk of the catch was accounted for by hook and line catching mostly *Rita rita* and other catfishes.

Bakshiimoda :

Catch estimate : As compared to the catch estimate of 6.5 t at Kara Ghat deep pool, the catch estimated for Bakhimoda on river Yamuna was to the tune of 1.7 t only. Small catfish, *C. garua* constituted the bulk of the catch, recording 426.5 kg (24.6%) followed by *Mystus* spp. 293.0 kg (16.8%) and *E. vacha* 256.0 kg (14.7%). The rest of the catch of 755.25 kg (43.4%) was of miscellaneous group of fishes.

Fishing gears : The gears operated in this stretch were similar to that of Kara Ghat deep pool with the exception of scoop net and cast net which were absent in this area. Gill net, *phasla* was the most effective gear.

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

Physico-chemical properties of soil and water :

Soil : Soil samples were studied from Jajmau Tannery, Manaiya and Rajghat on River Ganga and Kakrahaghat on River Yamuna.

Water : Physico-chemical characteristics of polluted and non-polluted zones of rivers Ganga and Yamuna at Kanpur, Allahabad and Varanasi were studied. At Kanpur, Bhagwatghat, Tannery and Jajmau were selected while at Allahabad, Mehdauri Ghat and Mavaya (polluted) and Fatehpurghat and Manaiya (non-polluted) were studied.

On River Yamuna, Kakrahaghat (polluted) and Syhawab (non-polluted) centres were studied. At Varanasi Nagawa and Rajghat were studied. At Patna studies were conducted at four places *viz.* Dighabata, and Rajapur (River Ganga), Fatura and Hajipur (confluence of rivers Punpun and Gandak with Ganga).

Primary productivity :

Primary production was measured by conventional 'light and dark' bottle technique *in situ* at Kanpur, Allahabad, Varanasi and Patna.

Effect of industrial effluent on the aquatic biota :

Effect of Tannery effluent of Kanpur, on the test animals *Labeo bata* and *L. rohita* was studied by conducting bioassay experiments. Instant mortality was observed in 10% and 20% concentration of the effluent when *L. bata* fry (7.9-14 mm) were exposed. In 5% concentration 100% mortality was observed in 1 h. The effluent was found to be devoid of oxygen with pH 8.0.

Juveniles of rohu (TL 20-30 mm) were exposed in 2 l jars with concentrations of 2.5%, 2.0%, 1.5%, 1.0% and 0.5% of tannery effluent besides control. The 96 h observations gave an LC_{50} value of 1.77 (Feducial limits, 1.9838-1.5804).

Patna

Studies have shown that the quantum of discharge of effluents in Ganga was not sufficient enough to have any remarkable impact on the water quality of Ganga at Patna but it has considerable impact on the qualitative and quantitative abundance on plankton and benthos.

Micro analysis of heavy metals :

Soil : The concentration of Zn, AS and Cr ranged from 60.8 and 88.4 µg g^{-1}, 9.4 and 19.90 µg g^{-1} and 8.0 and 14.8 µg g^{-1} of soil respectively in Ganga showing highest value of Zn and AS at Rajghat (sewage) near Varanasi whereas Cr

was highest at Manaiya near Allahabad. Low values of Zn (30.4-31.9 μg g^{-1}, AS (6.4-7.2 μg g^{-1}) and Cr (2.88-3.40 μg g^{-1}) were observed at Kakrahaghat (city waste water) in Yamuna. Concentration of Zn and AS were high at Rajghat during current year which was not the case during last year.

Water : Water samples from OF of all the polluted centres were analysed for Zn, AS and Cr. AS and Cr fluctuated between 11.8 and 43.6 μg l^{-1}, 7.7 and 28.4 μg l^{-1} and 1.2 and 3.4 μg l^{-1} respectively in Ganga. Cr was not detected at Nagawa (city waste water) near Varanasi in both the months of observation. Highest concentration of Zn and AS was recorded at Rajghat whereas Cr at Manaiya.

Fish : Some of the fishes like *Mystus seenghala* and *Puntius* sp. were procured from polluted zones near Allahabad. Zn, AS and Cr fluctuated between 9.2 and 18.6 μg g^{-1}, 0.9 and 2.1 μg g^{-1} and 1.1 and 3.22 μg g^{-1} of fish flesh respectively. Lower values of these metals were observed in fishes caught near Kakrahaghat (Yamuna) and higher at Manaiya (Ganga).

Fish food organisms :

Some bottom biota (benthos) samples from Kanpur, Allahabad and Varanasi were collected and analysed for Zn, AS and Cr. Very little quantity of AS was found which was negligible.

Qualitative and quantitative estimation of plankton :

Kanpur : Three centres were selected *viz.*, Bhagavatghat, Tannery and Jajmau. At Bhagavatghat, the pressence of bacteria and low level of zooplankton indicated heavy pollution.

Allahabad (River Ganga) :

Enormous increase in chlorophycean population at OF and BOF point out towards the improvement in the condition of river water over the previous year.

Protozoans were encountered mainly at OF (9.7) and BOF (4.4) indicating pollutional stress in these points.

Fatehpurghat (Non-polluted upstream) :

The plankton population ranged between 24 ul^{-1} in April, 1990 to 8,200 u l^{-1} in January, 1991 and average being 2,107 u l^{-1}. This is 1.2 times lower when compared to previous year indicating less eutrophication.

Mawaiya

Bacteria, *Sphaerotilus* was observed at the OF and BOF in July 1990 and *Zoogloea ramigera* from January to March 1991 indicating organic pollution probably due to the mixing of sewage in the effluent discharged at Mawaiya.

Manaiya

In this freshwater zone of river Ganga, the average plankton population was 1,305 u l^{-1}, a little lesser than previous year (1,603 u l^{-1}). The bacteria, *Zoogloea ramigera* was observed only in July, indicating mixing of water in the monsoon months.

Allahabad (River Yamuna)

Kakrahaghat and Sujawan : Plankton study in the polluted stretch of river Yamuna around Allahabad showed the dominance of phytoplankton (99.60%) over zooplankton (0.40%). Study did not show any features of pollution in the stretch studied as green algae which regenerates oxygen have been recorded from the OF area.

Varanasi

Nagwaghat (sewage pollution, river Ganga) : The higher concentration of zooplankton at OF and BOF further suggest that these centres are mildly polluted that AOF.

Rajghat (sewage pollution) : Plankton population was of a high order at AOF (3,214 u l^{-1}) than of OF (445 u l^{-1}) and BOF (595 u l^{-1}).

Patna

Studies were made at Dighabata, where the effluents from Bata Factory are discharged in Ganga and Rajapur the sewage discharge point to evaluated the impact of pollutants on aquatic biota. It is evident that the impact of effluents on the plankton concentration was noticed at both the zones with drastic reduction in the OF regions reaching at its minimum.

Among the two tributaries Punpun showed much higher concentration (354 u l^{-1}) than Gandak (134 u l^{-1}) but the abundance was much lower when compared to Ganga.

The average concentration of plankton in Ganga at Patna (919 u l^{-1}) observed during the period under report was lower than that observed in 1989-90.

Qualitative and quantitative estimation of benthos fauna was conducted at Kanpur, Allahabad, Varanasi and Patna.

Energy dynamics of river Ganga :

The rate of energy transformation by producers was studied in the entire stretch of River Ganga from Gangotri down upto Patna using Radio isotope C^{14} technique. Studies in Gangotri were made in June 1990 while at Uttar Kashi, Deoprayag, Rishikesh, Haridwar, Garhmukteshwar and Dalmau were made during June and December 1990. The energy transformation rate at various places in the upper and middle stretches has been presented in Table 3.

Table 3. Energy transformation through primary production (light to chemical) in River Ganga in different stretches

Stretch	Range (Cal m^{-2} day^{-1})	Average (Cal m^{-2} day^{-1})
Gangotri	-	-
Uttar Kashi	32-247	139
Deoprayag	55-660	358
Tehri	-	719
Rishikesh	76-840	458
Haridwar	62-607	334
Barhmukteshwar	461-2398	1430
Kanpur	1628-13961	6066
Dalmau	2019-11318	6668
Allahabad	1040-3304	1867
Varanasi	989-1968	1380
Patna	92-6253	2901
Tributaries		
River Yamuna	272-3518	1568
River Punpun	247-5186	2389
River Gandak	91-3239	1416

Biochemical Oxygen Demand (BOD at 20°C, 5 days) and Chemical Oxygen Demand were measured at Kanpur, Allahabad and Varanasi.

Studies of pathogens and parasites

Epizootic Ulcerative Syndrome (EUS)

The outbreak of EUS was recorded in 20 districts of Uttar Pradesh during the year 1990-91 (September 1990-February 1991). The Districts of Agra, Aligarh, Firozabad, Etawah, Faizabad, Barabanki, Gonda, Deoria and Allahabad were visited in the month of January and February 1991. The water bodies affected were ponds, tanks, rivers, reservoirs, canals and rivers. The fish species affected were *Channa gachua, Nandus nandus, Puntius sophore, P. ticto, Ambassis ranga, Heteropneustes fossilis, Channa striatus, Puntius javanicus, Mystus aor, M. seenghala, M. vittatus, Cyprinus carpio, Hypophthalmichthys molitrix, Ctenopharyngodon idella, Labeo rohita, C. catla* and *C. mrigala.* The intensity of infection was mild to severe in all the water bodies. But the intensity of infection was observed to be mild in Indian major carps.

Sub-Project E : Economics of Riverine Capture Fisheries Operations

Higher price spread was found for carps than catfish. The fishermen's share in consumer rupee was increased, but not to a significant level. It has comparatively lower share for fishermen in retail price than in case of riverine catch. It may be due to lower wholesale and almost same retail price for the riverine catch.

The study of price behaviour in relation to market arrivals revealed higher prices for riverine catch from other water bodies. Carps continued to fetch better price than catfish and miscellaneous catch. The price difference across different size groups was also higher for the carps than for catfish.

PROJECT **FC/B/9**

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

Personnel : S.P. Singh, S.N. Mehrotra, D.K. Chowdhury, R.C. Singh, A. Sarkar, B.K. Biswas, D.K. Biswas

Duration : October 1985-March 1991 (Extended by one year)

Location : Guwahati

Estimation of fish landings : A total of 206.6 t and 61.0 t of fish were brought ashore at Uzanbazar and Jorhat landing centres respectively on the river Brahmaputra. This registers a 16.3% decrease at Uzanbazar and 67.6% increase at Jorhat compared to that of 1989-90. Monthly fluctuations could be observed between both the centres (Table I).

Table 1. Monthly catch (wt. in kg) at Uzanbazar and Jorhat centres in 1989-90 and 1990-91

Months	Uzanbazar		Jorhat	
	1989-90	1990-91	1989-90	1990-91
April	3650	8340	3475	4790
May	3969	8224	2688	4709
June	2785	5770	1800	4450
July	2295	35385	604	1733
August	13149	46707	3602	5500
September	29620	26325	3280	4915
October	31528	24574	3550	11766
November	38570	15105	6050	4910
December	25739	8848	3042	5928
January	50067	8921	2796	5008
February	24167	9434	2384	3569
March	21372	8961	3138	3721
Total	**246911**	**206594**	**36409**	**60999**

Crop-wise landings at both the places with their % contribution is givern in table 2.

Table 2. Fish landidngs at Uzanbazar and Jorhat landing centres during April 1990 to March 1991 (wt. in kg)

Species	Uzanbazar		Jorhat	
	Total	%	Total	%
L. rohita	23264	11.26	3012	4.94
C. catla	19025	9.21	3120	5.12
C. mrigala	1409	0.68	442	0.72
L. calbasu	4373	2.12	-	-
Total major carps	**48071**	**23.27**	**6574**	**10.78**
L. gonius	5763	2.79	2830	4.64
C. reba	34099	16.51	1719	2.82
L. bata	31288	15.14	552	0.90
Total minor carps	**71150**	**34.44**	**5101**	**8.36**
W. attu	14458	7.00	2199	3.60
M. seenghala	1626	0.79	3986	6.54
M. aor	516	0.25	1016	1.67
Total large catfish	**16600**	**8.04**	**7201**	**11.81**
N. chitala	5637	2.72	1700	2.79
N. notopterus	6189	3.00	-	-
Total feather back	**11826**	**5.72**	**1700**	**2.79**
Hilsa	7712	3.73	184	0.30
Others	51235	24.80	40239	65.97
Total	**206594**		**60999**	

Data on landings for a brief period is presented below :

Tezpur : 12.6 t of fish were landed during the period June through September 1990. Miscellaneous group of fish (36.5%) dominated the catch, followed by large catfishes (35.47%), major carps (23.64%) and featherbacks (4.39%).

Dhubri : 21.7 t of fish were landed at Dhubri during the months January, July, August and September 1990. Major carps (36.85%) dominated the catch, followed by hilsa (25.04%), miscellaneous group of fish (20.33%), large catfishes (20.33%) and featherbacks (4.75%).

Goalpara : 16.3 t of fish were landed at Goalpara landing centre during June to September 1990. Major carps (29.8%) dominated the catch, followed by hilsa (25.12%), miscellaneous group of fish (18.82%), large catfishes (14.17%), minor carps (6.86%) and featherbacks (5.16%).

Dibrugarh : 20.9 t of fish were estimated to have been landed at Dibrugarh centre from June to September 1990. Major carps (40.0%) dominated the catch, followed by miscellaneous group of fish (32.9%), large catfishes (14.4%), minor carps (10.1%) and featherbacks (2.6%).

Survey of fishing methods

It was observed that the operation of Clap net (Shangla jal) was in vogue from May 1990 to November 1990. The main catch in the net was hilsa. Other nets encountered in operation round the year were Dip net (Dheki jal), Scoop net (Thela jal), Parangi net, Chinese net and Cast net (Asra jal). The catch in these nets comprised miscellaneous fish, prawn and shrimps.

Environment impact assessment

River Brahmaputra receives effluents/sewage at two main points of the river course in Guwahati *viz.*, Bharalumukh and Saraighat. It has been estimated that the rate of effluent discharge is more at Bharalumukh (400-500 l/min) as compared to Saraighat (50-100 l/min). The water remained hard as indicated by the values of hardness (56-96 mg l^{-1}). In view of enormous water discharge in the river Brahmaputra, the effluents do not adversely affect the water quality. However, the effluents do affect the dissolved gases, especially oxygen (1.2-1.8 mg l^{-1}) and from CO_2 (2-30 mg l^{-1}). the primary productivity as indicated by gross production ranged between 6.25 & 242.0 mg C m^{-3} hr^{-1}. Net production varied from 100.0-206.25 mg C m^{-3} hr^{-1} whereas respiration ranged between 0-350 mg C m^{-3} hr^{-1}. About 50 m below the outfall areas the water regains its original water quality.

Biotic features

An average population abundance of plankton (770 u l^{-1}) was recorded in river Brahmaputra around Guwahati. In the total plankton blooms,

phytoplankters were predominantly encountered (645 u l^{-1}) over zooplankters (125 u l^{-1}) . The details in respect of five different sampling points are given below :

Average numbers of plankters

Plankters	Noonmati	Bharalumukh		Saraighat	
		OF	BOF	OF	BOF
Phytoplankton	701	743	884	378	520
Zooplankton	150	147	180	70	78
Total	**851**	**890**	**1064**	**448**	**598**

PROJECT FC/B/10

EVALUATION OF FISH COMMUNITY STRUCTURE IN THE CONTEXT OF ENVIRONMENTAL MODIFICATIONS IN RIVER YAMUNA

Personnel : D.N. Mishra, Usha Moza, Krishna Chandra, Shree Prakash (since 23.04.90), V. Kolekar (up to 30.11.90), Ramji Tiwari, Sudarshan Bandopadhyay, Suresh Singh (since 1.10.90).

Duration : 1990-91

Location : Agra (U.P.)

Catch Statistics : Fish landing data of river Yamuna were collected from commercial landings at Mathura and Etawah.

The centre-wise and month-wise landings of various fish groups are given in Table-1. The miscellaneous group (19.06%) was represented by *B. bagarius, P. pangasius, S. silondia, R. rita, C. garva, E. vacha, L. bata, Notopterus* sp., shrimps, murrels,and minor carps etc.

The fish catch statistics from other sources (ponds, reservoirs etc.) at Agra amounted to 144312.12 kg as against 220307.34 kg in 1990. The major carp showed dominance 73740.02 kg (51.09%) but was lesser than the catch of 106251.24 kg (48.23%) of previous year. The catfishes contributed to the extent of 52232.39 kg (36.20%) as compared to 89924.26 kg (4082%) in 1989-90. The miscellaneous group contributed to 18339.72 kg (12.71%) in contrast to 24131.84 kg (10.95%) in 1989-90.

Table - 1 Month wise estimated fish landings of different centres (in kg) for the year 1990-91

Landing Centres	April	May	June	July	Aug.	Sept.	Months Oct.	Nov.	Dec.	Jan	Feb.	March	Grand Total	Average %
River Yamuna														
Agra														
Indian Major														
Carps	3263.05	704.99	755.25	2176.21	510.83	713.42	871.99	1630.17	1637.73	522.63	1328.60	419.60	14334.37	25.55
Cat Fishes	4821.74	1419.89	1819.50	1512.39	2493.82	1857.80	2302.06	5512.62	3319.17	999.21	3693.37	1856.40	31507.97	55.39
Misc. Group	696.55	555.28	1371.00	1470.60	1751.30	457.49	930.78	1020.78	1333.00	273.80	652.75	330.00	10843.10	19.06
Mathura														
Indian Major														
Carps	145.50	93.00	-	-	449.50	349.00	201.50	3191.00	-	-	-	-	4429.50	28.20
Cat Fishes	2800.50	735.48	-	-	127.10	504.50	582.80	2275.00	-	203.05	-	265.60	7494.03	4 7.71
Misc. Group	870.00	170.50	-	-	-	301.00	186.00	1915.00	-	77.50	168.00	96.00	3784.00	2 4.09
Etawah														
Indian Major														
Carps	4549.50	2043.78	-	4670.15	-	-	-	948.50	-	-	607.60	922.40	13741.93	43.87
Cat Fishes	6032.46	1710.63	-	463.45	-	-	59.67	2910.00	-	-	2755.90	1024.80	14956.90	47.75
Misc. Group	330.00	671.44	-	620.00	-	-	31.00	180.00	-	-	602.00	192.00	2626.44	8.38
Agra (Other Sources)														
Indian Major														
Carps	3547.42	4421.46	2607.30	5276.13	4840.32	10477.42	3144.64	10870.90	7518.74	12200.54	5646.37	3189.60	73740.02	51.09
Cat Fishes	6402.55	3670.48	1412.10	2845.94	2128.49	3121.49	2872.15	8235.14	6190.39	5442.37	7296.09	2615.20	52232.39	36.20
Misc. Group	1255.36	1496.90	1185.00	1483.50	1101.66	1616.24	1608.90	2510.22	2390.10	1834.34	1445.50	412.00	18339.72	12.71

Spawn prospecting investigations : Spawn prospecting investigations were undertaken at Bahadurpur village in Yamuna (Agra) by employing 1/8" (Midnapur-type) shooting nets from 11.7.90 to 20.8.90. The index of quality of spawn was:

Phase	*C. catla*	*L. rohita*	*C. mrigala*	*W. attu*	minor carp
I	27.00	-	35.50	-	37.50
II	14.28	10.00	14.35	-	27.39
III	8.00	10.00	45.50	10.00	20.50

The spurts were recorded when the water level increased by 2.22, 2.89 and 3.53 m respectively from the original level. The spawn associates were shrimps, *O. cotio, Puntius sarana, P. ticto, Chela* sp., *Gudusia chapra, Notopteurs chitala, N. notopterus, Wallago attu, Mastocembelus armatus, Trichogaster* sp., *Cirrhina reba, Labeo bata, L. calbasu, A. coila, Glossogobius* sp. and *Silonia silondia.*

At Agra the total fish landings and the major carps showed a decline against the catches of 1989-90, the quantities being 92925.5 and 32434.6 kg respectively. The assessment of distribution of fry and fingerlings around Agra was undertaken in November by operating cast net/drag net at nine selected sites on river Yamuna, covering about 50 km stretch. On an average, 19-406 nos fry/fingerlings were caught per haul.

At Mathura too, there was a decline of the total catch to the extent of 40% compared to that of 1990. At Etawa, the decline was marginal (6.0%) but catfishes showed an improvement on the catches.

Water quality monitoring : The impact of industrial and city sewage wastes from Yamuna nagar to Etawah stretch was undertaken quarterly (Tejewalla, Yamuna nagar, Delhi) and monthly (Mathura, Agra and Etawah). Significant observations were recorded at various centres (season-wise and month-wise) for hydrobiological parameters. The studies indicated that summer month was worst affected followed by winter months, autumn and monsoon in almost all the centres probably due to more concentrated wastes released to the river.

The river had maximum pollution load during November to June in Delhi to Etawah stretch, less water is available at these centres due to less discharge of water from Tajewalla headworks.

It was observed that mostly acidic wastes (pH 2.18-6.27) were being discharged at Delhi whereas dyewaste and sewage waste at Mathura, Agra and Etawah indicated acidic to alkaline values (pH 6.4-8.8).

The fresh zones were devoid of free CO_2 and NH_3 except during monsoon when trace CO_2 values were recorded.

The temperature of Tajewalla stretch indicated always 5 to 6°C lesser temperature than in other centres during same months. The dissolved

oxygen at the outfalls of Najafgarh drain, Okhla drain at Delhi, Power house drain at Agra dye waste at outfalls of Mathura and Etawah indicated always lower values (Nil-5.9 mg/l) throughout the study.

The maximum values of primary productivity were recorded during winter followed by summer and autumn and least during monsoon months. The sewage-fed outfalls of Delhi, Mathura, Agra and Etawah indicated more production (gross production 67.6--210.50 mg C m^{-3} hr^{-1} and net production 46.51-149.07mg C m^{-3} hr^{-1}) than fresh zones.

The plankton samples from Tajewalla, Yamunanagar and Delhi were studied quarterly. The Tajewalla having fast current and completely unpolluted zone was represented by Bacillariophyceae 533.34 u l^{-1} during February. Whereas Yamunanagar stretch above outfall was represented by Bacillariphyceae 350 u l^{-1}. At Wazirabad (Delhi) plankton comprised mainly Bacillariophyceae 900 u l^{-1} (39.13%) and Chlorophyceae 925 u l^{-1} (40.22%).

The plankton density at Vrindavan was 7676 u l^{-1}. A marginal increase was noted at Mathura (7979 u l^{-1}) probably due to the sewage mixed waste joining the river at this stretch.

The sewage-fed stretch at Agra indicated impact of sewage and combined industrial wastes at the outfall indicating reduction in plankton population from 1639 (AOF) to 871 u l^{-1}.

The Etawah zone plankton population (1912-2150 u l^{-1}) indicated not much adverse impact of pollution.

The benthic population at Tajewalla, Yamunanagar and Wazirabad (Delhi) was 389.86, 158.76 and 1721 u m^{-2} respectively. The sewage outfall of Delhi indicated 158.86 u m^{-2} at Najafgarh outfall. Mostly molluscs dominated in Tajewalla, Yamunanagar and Wazirabad. At the sewage outfall oligochaetes dominated particularly *Tubifex tubifex.*

The macrobenthos in fresh zone of the stretch was represented by *Cauphyloma* sp., Viviparus bengalensis, *Melonia streatella, Tuberculata, Corbicula striatella, Chironomus* sp. and *Tubifex* sp.

Periphyton

Periphyton deposition at Mathura stretch was to the tune of 6635-24410 c cm^{-2}. At Agra, the periphyton population was better at Kailash (fresh zone) 27375 u cm^{-2} followed by a decline at outfall 4502 u cm^{-2}. The periphyton abundance at Etawah stretch was to the tune of 4630-7130 u cm^{-2} and 54290 u cm^{-2} at Shergarh. The highest values at latter centre may be attributed to the increase in organic load in rivers. A direct correlation between periphyton productivity and temperature was recorded.

Economics : The price structure of different species of fish caught from riverine sources and other sources (ponds, lakes, reservoirs, etc.) were recorded along with the channels retailer and consumer.

PROJECT FC/A/4

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

Personnel : Arun G. Jhingran, K.K. Vass, V.V. Sugunan, H.C. Joshi, G.K. Vinci, K. Mitra, N.N. Mazumder

Duration : Upto April, 1993

Location : Garapota and Mogra Beels in the district of 24 Parganas (N), West Bengal

During the year, work on Mogra beel was completed and apart from continuing work on Garapota another beel *viz.* Padma was taken up for investigations.

A Trophic evaluation and ecosystem analysis :

i) Morphology :

Studies on these beels revealed that different morphometric characteristics affect their thermal behaviour resulting in significant variations in biological communities. Main features are tabulated below :

Comparative Morphology of three beels, in West Bengal

Parameters	Mogra	Garapota	Padma
1 Location	Haringhata (Nadia District)	Bongaon (24-Parganas)	Bagdah 24-Parganas (North)
2 Drainage type	Perennial (closed)	Perennial (open)	Perennial (Closed)
3 Area (ha)	110	100	60
4 Max.. depth (m)	5.0	8.5	3.5
5 Mean depth (m)	1.75	3.5	1.25
6 Thermal character -istics	Isothermal round the year	Stable stratification in summer	Isothermal round the year
7 Macrophyte infestation	Heavy infestation mainly *Ceratophyllum Hydrilla*	Moderate infestation mainly *Vallisneria Ceratophyllum*	Marginal infestation mainly *Ottelia Myriophyllum*
8 Basin type	Saucer type	Saucer type	Shallow
9 Water level fluctuation	Marked	Moderate	Marked
10 Catchment	Crop fields Jute plantations	Paddy, vegetable, crop fields. Jute plantation.	Paddy & crop

ii) Chemical Monitoring

Water quality parameters, such as, alkalinity (264.8 mg l^{-1}), hardness (208.7 mg l^{-1}), chlorides (22.8 mg l^{-1}) and specific conductivity (347.22 µs cm-1) recorded the corresponding values were 83.18 mg l^{-1}, 72.1 mg l^{-1}, 18.87 mg l^{-1} and 123.7 µs cm-1 respectively. The concentrations of sediment indicate high productive potential of both the beels.

iii) Biological communities

Algal dynamics : In Garapota beel, population dynamics along the depth profile revealed, a surface water density in the range of 45-54 X 10^3 u l^{-1} which increased to a range of 61-88 X 10^3 u l^{-1} at 3 m depth zone. The algal population of Padma beel recorded a density range of 2.4 to 3.7 X 10^3 u l^{-1}, less dominance of Bacillariophyceae was a significant feature in Padma beel.

Macrophyte dynamics : In the beels investigated, submerged species viz. *Vallisneria*, *Ceratophyllum* and *Hydrilla* were dominant in Garapota and Mogra beels. On the other hand in Padma beel, recorded dominance of *Ottelia* followed by *Myriophyllum* and *Nymphoides*. Total standing crop in three beels ranged from 687 to 1634 g m^{-2} (dry wt.) with minimum in Garapota and maximum in Padma.

The macrophyte associated fauna in three beels were represented by insects, molluscs and miscellaneous group comprising oligochaetes, ostracods, annelids and arachnids.

iv) Fish and Fisheries

Main highlights regarding fishery trend in two beels is tabulated below :

Name of beel	Mean catch	Mean Energy kg d^{-1}	Estimated yield cal m^2d^{-1}	Major species kg $h^{-1}y^{-1}$	EUS intensity	Stocked fish biomass	Annual harvest (t)	Turn over ratio (t)
Garapota	128.88	120.6	368.8	IMC dominant growth of *Catla catla*	Severe	11.8	44.02	3.7
Padma	108.8	159.47	485.08	IMC dominant growth of *L. rohita*	Mild	5.5	29.02	5.3

Pesticide residue monitoring

Different concentrations for various parameters are tabulated below:

Parameter	Garapota beel	Padma beel
1 Mercury, ug g^{-1}	0.26 ± 0.07	0.03 ± 0.001
2 Copper, ug g^{-1}	8.46 ± 2.29	2.32 ± 0.63
3 Zinc, ug g^{-1}	47.93 ± 9.6	38.9 ± 6.8
4 Total DDT, ug g^{-1}	0.037 ± 0.025	BDL
5 Total HCH, ug g^{-1}	0.293 ± 0.15	0.013 ± 0.002

Monitoring of DDT and HCH residue in muscle tissues of various fish species from these beels indicated bottom feeders as highly contaminated.

Pen-culture Experiments

A split bamboo pen of 400 m^{-2} area was installed along the littoral zone of Padma beel. On the basis of available food spectrum in the beel, species mix of *L. rohita*, *C. catla*, *C. mrigala*, *H. molitrix* and *Macrobrachium rosenbergii* were stocked in the pen. In the present experiment a production range of 2760-3012 kg $ha^{-1}y^{-1}$ has been achieved by exploiting only the natural productivity of the system.

Fish disease

The epizootic ulcerative disease infestation has been much higher in the Garapota beel than in the Padma beel.

PROJECT FC/A/6

ECONOMICS OF FISHING - A CASE STUDY OF SELECTED RESERVOIR

Personnel : S. Paul, V.V. Sugunan, H.K. Sen

Duration : Upto March 1991

Location : Barrackpore

Work has been completed.

PROJECT **FC/A/7**

ECOLOGY AND FISHERIES OF FRESHWATER RESERVOIRS

Personnel : Ch. Gopalakrishnayya, A.K. Lal, D.S. Krishna Rao, P.K. Sukumaran, M. Choudhury, A.Hajra, M. Karthikeyan, M.F. Rahman (Bangalore)

V.R. Desai, Dhirendra Kumar, N.P. Srivastava, K.K. Agarwal (Raipur)

P.L.N. Rao, M.D. Pisolkar, B.K. Singh, B.L. Pandey, S.K. Srivastava (from 10.12.1990), Debasis Saha (Pune)

G.K. Bhatnagar, D.K. Kaushal, B.K. Sharma (Kangra)

Duration : 1987-1993

Location : Bangalore, Raipur, Pune, Kangra

Bangalore : Markonahalli reservoir

Morphometric features of the reservoirs : Markonahalli reservoir was created on the river Shimsha at Markonahalli village of Tumkur District of Karnataka at latitude 12°55' N and longitude 77°55'15" East. The impoundment was started in 1939 to irrigate 15000 acres of land.

Water level was maximum in April (727.16 m MSL) and minimum in February (725.946 m MSL).

Physico-chemical characteristics of soil and water : Narrow fluctuation of chemical parameters was observed primarily due to the low water level all through the year.

The difference between the surface and bottom values also was narrow influeced by the mixing of column of water due to low water level, low organic matter in the soil and poor plankton density.

Plankton and primary productivity : The mean gross primary production values during the year varied between 0.675 (December) and 0.320 g C $m^{-2}d^{-1}$ (July). The photosynthetic efficiency was in the range of -0.7176 to 15.86% and -0.7176 to 14.24%. From the values Markonahalli reservoir may be categorised as 'medium' with regards to trophic status and production efficiencies.

The total counts of plankton at the three sectors were : lotic sector, 24 to 142 u l^{-1}, intermediate sector, 11 to 166 u l^{-1} and lentic sector, 28 to 208 u l^{-1}. Monthly variation in total counts was significant. The zonal average

counts showed a predominance of zooplankton, particularly consituted by *Diatomus* spp.

Bottom biota : Bottom biota comprised *Viviparus bengalensis, Melania striatella, M. platia, Lamellidens marginalis, Corbicula peninsularis,* stonefly nymphs and a number of oligochaetes. From H it was inferred that lotic zone was more stable than the intermediate followed by the lentic zone.

Aquatic vegetation and associated fauna : Reservoir was infested with macrophytes *viz.*, Hydrilla, verticillata, Potamogeton and Cerratophylum spp. Their biomass varied sector-wise and ranged from 200-1200 g m^{-2}. Macro-invertebrates *viz., Viviparus bengalensis, Melania striatella, M. scabra, Indoplanorbis exustus, Corbicula peninsularis* amongst molluscs and members of oligochaetes and nematode were also associated. The settlement of periphyton on rocks and weeds in terms of total counts varied from 288 to 1,041 number cm^{-2}. The minimum was in July and maximum in September.

Biology :

Notopterus notopterus, Mystus cavacius, M. armatus, O. bimaculatus, C. mrigala, C. reba, L. rohita, L. calbasu and *P. dorsalis* examined for biological studies.

Yield estimation and fish population dynamics : During April 1990-March 1991, 4074 kg fish were landed from the reservoir giving an estimated average annual production of 5.56 kg ha^{-1} yr^{-1}. The Indian major carps accounted for (2278 kg; 56%) followed by catfishes (667 kg; 16%), minor carps (188 kg; 5%), air breathing fishes (141 kg; 3%) and miscellaneous fishes (800 kg; 20%).

Stocking : A total of 91,000 fingerlings of major carps (Catla; 89,000 and rohu; 2,000) were stocked during December 1990.

RAIPUR (Ravishankarsagar)

The average reservoir water level during the period under report ranged from 338.72 m (June) to 348.27 m (January) with the yearly average being 343.99 m.

The specific conductivity, total dissolved solids, pH and temperature, did not show any sectoral variation. As seen from the overall value of specific conductivity (71.0 micro mhos), the reservoir water was found to be low productive.

Plankton : The monthly average plankton population ranged from 221 u l^{-1} (September) to 4062 u l^{-1} (May). The yearly average plankton of the year under report was 1363 u l^{-1} and 0.84 ml m^{-3}.

Bottom biota : The overall benthic population of the reservoir in 1990-91 was estimated as 307 nos/m^{-2}, mainly constituted by dipteran larvae (55.6%) followed by gastropods (20.7%). The biomass was available in the entire depth range from surface to 20 m.

Aquatic vegetation and associated fauna : Due to the high water level, the macrophytes (only Hydrilla and Vallisneria) were available only from April to July and their monthly average density ranged from 561.0 to 2319.0 g m^{-2}.

Fish fauna : In addition to 41 species already reported, 5 more species were encountered, namely : *Puntius phytunio, Esomus danrica, Channa striatus, Lepidocephalus guntea* and *Noemachilus* sp.

Recruitment studies : Recruitment studies were made during July from 11.7.90 to 31.7.90 at Tuma centre in between lotic and intermediate sector, 13 km above the dam by operating spawn collection nets.

Biology of commercially important fishes : The length-weight relationship and food studies of *C. catla, L. rohita* and *C. mrigala* were conducted.

Based on the food studies, minnows were classified as follows :

Phyto- and zooplankton feeder	:	*G. chapra* (No change in preferred food was observed in the length range of 35-120 mm).
Phytoplankton feeder	:	*E. danrica, R. daniconius, A. mola, A. morar, P. sohor, P. ticto, P. ambassis* and *C. reba.*
Zooplankton feeder	:	*S. bacaila, S. phulo, D. devario, O. cotio, O. vigorsii, Clupisoma, C. nama, C. ranga* and *M. pancalus.*
Insect feeder	:	*M. cavasius, X. cancila* and *G. giuris*
Mud and phyto feeder	:	*R. corsula.*

Yield estimation

A total of 46.09 t fish was landed from the reservoir during April 1990 to February 1991. The fish yield on productive area of the reservoir (6380 ha) was calculated to be 7.2 kg ha^{-1} against 6.0 kg ha^{-1} of 1989-90 and 2.5 kg ha^{-1} of 1988-89. In 1990-91, major carps (41.5%) were followed by miscellaneous groups (31.2%) and catfish (26.2%) in the order of abundance. During 1987-88 to 199-91 major carp fishery increased from 9.3% to 41.5% with good establishment of only *C. mrigala* and the catfish population was lowered down from 44.5% to 26.2%.

Stocking of the reservoirs

Till December 1990, a total of 6.86 lakh major carp fry were stocked (catla, 45.87%, rohu, 44.03% and mrigal, 9.30%) in the reservoir. This stocking ratio gave subdued importance for mrigal as the species has already established with a good breeding record. The stocking rate is suggested to increase to 300 nos. per ha against the present rate of 100 nos ha^{-1}.

PUNE : Bhatgar reservoir

Plankton : In the lentic zone, plankton quantitatively ranged between 8493 u m^{-3} (August) to 66,01,178 u m^{-3} (June) with an average of 10,56,968 u m^{-3}. Phytoplankton was represented by Myxophyceae, Chlorophyceae, Bacillariophyceae, Desmidaceae and Dinophyceae in the order of abundance. In the intermediate zone, the average plankton quantity was 1,10,663 u m^{-3}. The plankton in lotic zone had an average of 7,10,223 u m^{-3}. Chlorophyceae dominated at this zone followed by Desmidaceae, Myxophyceae and Bacillariophyceae.

Bottom biota : Bottom biota was practically nil in the lentic and intermediate zones, while one sample from the lotic zone revealed 95 u m^{-2} exclusively of chironomid larvae.

The periphyton settlement on submerged rocks and wood ranged from 1100-90,000 u cm^{-2} (average 26,314 u cm^{-2}). The genera encountered were - *Navicula, Synedra, Spirogyra, Microspora, Gomphonama* and *Staurastrum.*

Fish fauna : During the year a few non species were recorded from the reservoir : *Gagata itchkeea, Puntius phutunio* and *Silondia sykesii.*

Recruitment and stocking : Fry (30-45 mm) of *C. fulungee, P. kolus* and *R. corsula* were collected from the intermediate zones confirming their breeding in the reservoir. A total of 1.25 lakh major carp fingerlings (catla 5%, mrigal 90% and rohu 5%) were stocked in the reservoir during 1990.

Biology of *T. khudree, C. mrigala,Rohtee vigrosii* and *O. cotio were studied.*

Yield estimation : A total of 8384 kg of fish were landed. The catch comprised *Chela* (33.4%), *C. fulungee* (23.9%), *P. kolus* (21.9%) among others. No fishing took place during June and July.

While *T. khudree* (mahseer) the once dominant species of the reservoir has been relagated to the last position, *C. catla* has shown a perceptible revival due to the stocking of 2.5 lakhs major carps fingerlings during September 1989.

KANGRA (Pong reservoir)

Water level of the reservoir during the period August-October 1990 fluctuated by 3.36 m from 420.69 m in August to 424.05 m in October.

Physico-chemical characteristics of soil and water

Soil texture indicated high percentage (62.03%) of sand in lotic zone while silt and clay was more (62.00%) in lentic zone. pH of soil ranged from 7.3 to 8.8. Available phosphorus and nitrogen varied between 2.4 to

16.0 mg /100 g and 11.48 to 15.40 mg/100 g respectively. Organic matter was low and varied from 0.48 to 0.60%.

In lotic zone the range was pH 8.0-8.2, alkalinity 106-108 ppm, D.O. 8.4-8.8 ppm, Free CO_2 2.0 ppm, phosphorus 0.12 ppm, silicate 0.018 and 0.020 ppm, water hardness 94 and 96 ppm and specific conductivity 198.4 µ mhos cm^{-1}.

In intermediate zone, the water temperature, pH, alkalinity, DO, Free CO_2, phosphate, organic matter, silicate, water hardness and specific conductivity ranged between 16.0 and 16.3°C, 7.92, 81.6, 83.6 ppm 7.92 ppm, 2.0 ppm, 2.0 ppm, 2.0 ppm, 0.060 ppm 4.08 and 4.96 ppm, 0.0188 and 0.0192 ppm, 82.4, 88.8 ppm and 169.79 and 1987.86 µ mhos cm^{-1} respectively.

Plankton and primary productivity

The average plankton population in the reservoir fluctuated from 26,347 u l^{-1} in August to reach a minimum of 1,323 u l^{-1} in the month of January. Seasonal distribution of plankton indicated three distinct peaks, the primary (26,347 u l^{-1}) in August, secondary (5,431 u l^{-1}) in November and tertiary (4,855 u l^{-1}) in February. Spatial distribution showed that blooms were comparatively rich in intermediate (4.39 ml m^{-3}) followed by lotic (3.77 ml m^{-3}) and lentic zones (3.47 ml m^{-3}). Phytoplankton constituted 97.58% of the total plankton.

The average gross and net production in March were 334.3 and 168.7 mg C m^{-3} hr^{-1} respectively. The average respiration was 198.7 mgC m^{-3} 8 hrs^{-1}.

Bottom biota

The average standing crop for whole reservoir was 286 no./3.66 g m^{-2}. The minimum was in September (138 no. m^{-2}) and the peak in winter (482 no. m^{-2}).

Aquatic vegetation and associated fauna

Periphytic communities showed the domiance of Bacillariophyceae both qualitatively as well as quantitatively (83.02-95.3%) with maximum abundance in the month of August (95.3%) and lowest in September (83.02%). Bacillariophyceae was followed by Chlorophyceae (4.7-16.90%) and Myxophyceae (1.24-6.13%).

Biology .: (of commercially important fishes) like *C. catla, L. rohita, C. mrigala, L. calbasu* and *T. putitora* also was studied.

Yield estimation and fish population dynamics

A total of 442 t of fish was landed during the period April '90 to March '91. The rate of production per hectare was estimated at 32.4 kg ha^{-1}/11 months. The fish landings were dominated by *L. rohita* (31.18%), *M. singhala* (27.45%), *T. putitora* (14.65%), *L. calbasu* 9.44%, *W. attu* (5.46%), *C. mrigala* (3.86%), and *C. catla* (1.62%).

A total of 22 fish species belonging to 18 genera and 8 families were recorded from the reservoir.

A total of 20.30 lakh common carp fingerlings were stocked in the reservoir during the year.

PROJECT FC/A/10

ECOLOGY AND FISHERIES MANAGEMENT OF A SMALL RESERVOIR IN ALIYAR BASIN

Personnel : C. Selvaraj, V.K. Murugesan, R.N. Seth, R.C. Singh

Duration : 1985-1992

Location : Coimbatore

Yield estimation and reservoir management

The reservoir yielded a total of 49618.400 kg of fish during the period (Table 1). The catch per unit effort was 11.32 kg.

Growth of Indian major carps

Out of 500 catla, 500 rohu, 650 mrigal and 600 common carp stocked in Aliyar reservoir after clipping and treating the left pelvic-fin between December 1987 and February 1988, 3 catla, 42 rohu and 280 mrigal were recovered.

Growth of exotic carps : Out of 3920 fingerlings (112.5 mm/14.0 g) of silver carp stocked in Aliyar reservoir during November-December 1989, 293 specimen were harvested.

An average growth of 2000 g in case of grass carp in the reservoir without much aquatic plants also appears to be encouraging.

Fish seed production in the farm

Maintenance of brood fish : Major carp brood fish were maintained in 2 ponds of 0.1 ha each. The brood fish were infected with *Argulus* sp.

A pesticide, Cypermethine, was effective in eradication of the ectoparasite.

Spawn production : A total of 0.81 million spawn of catla and 0.975 million of rohu were produced through hypophysation.

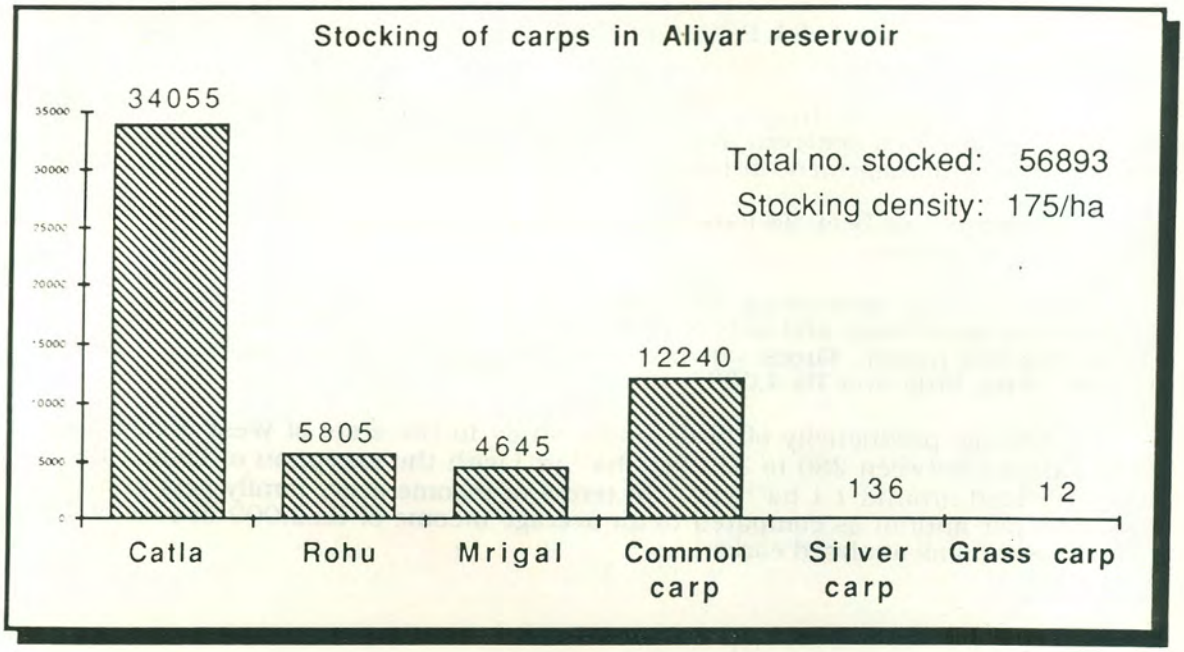
Seed rearing : The spawn produced by the centre was reared and maintained in 12 nursery ponds (0.01 ha each).

Table 1. Total fish yield of Aliyar reservoir during 1990-91 (kg)

Month	*C. catla*	*L. rohita*	*C. mrigala*	*C. carpio*	*H. molitrix*	*C. idella*	*L. fimbriatus*	*T. mossambica*	Misc.	Total
April	928.50	230.50	345.25	262.50	6.00	-	3.50	2.50	1.50	1780.25
May	1405.50	602.75	673.50	242.70	40.35	-	1.25	9.00	2.00	2976.95
June	2352.55	1454.10	2268.50	478.45	80.00	-	12.00	-	-	6645.60
July	2581.55	2735.00	1947.95	583.80	139.05	-	7.50	-	-	7994.85
August	1159.00	949.00	1842.70	291.75	19.00	-	-	-	-	4261.45
September	877.45	954.55	1274.00	387.65	107.30	0.90	-	-	-	3601.85
October	1359.10	732.85	1460.75	423.00	97.75	-	-	36.75	-	4110.20
November	1192.85	1319.60	2422.40	552.60	102.25	-	-	59.40	-	5649.10
December	714.60	1058.45	1775.60	569.30	55.45	-	-	201.70	113.75	4488.85
January'91	298.35	516.50	1192.80	370.05	43.25	-	-	56.75	22.50	2500.20
February	461.55	668.30	1079.30	202.55	12.25	4.00	-	26.25	8.50	2462.70
March	829.30	930.15	1145.95	208.00	33.00	-	-	-	-	3146.40
Total	14160.300	12151.750	17428.700	4572.350	735.550	4.900	24.250	392.350	148.250	49618.400
% Contri.	28.54	24.49	35.11	9.22	1.48	0.01	0.05	0.79	0.30	

Fish seed stocking in the reservoir

A total of 56893 fingerlings of over 100 mm in length, consisting of 34055 catla, 5805 rohu, 4645 mrigal, 12240 common carp, 136 silver carp and 12 grass carp were stocked in the reservoir. Thus, the reservoir has been stocked with a density of 175 fingerlings per hactere.



PROJECT FC/A/13

A COMPARATIVE STUDY OF PRE-HARVEST AND POST-HARVEST MANAGEMENT PRACTICES OF SELECTED BEELS OF THE COUNTRY

Personnel : S. Paul, Y.S. Yadava, H.K. Sen

Duration : Upto 1991

Location : Barrackpore

Economic indicators in respect of 3 beels in 24 Parganas of West Bengal were analysed. The interim findings are as under.

1 Bagula Beel, 24 Parganas (North), area - 90 ha, production : 27 tonnes.

As against the input costs of Rs.44,000 per annum, gross sale proceeds during the year 1980-89 amounted to Rs.5.5 lakhs. Income-wise distribution for per family amounts to Rs.5,500/-. The major cost constituent was expenditure on stocking.--But, average maintenance of crafts and gear amounted to Rs.50 per annum.

2 Raghavpur Beel, 24 Parganas (North), area - 22 ha. Production : 11 tonnes.

This beel can be treated as a large pond. But the productivity level of 800 to 1000 kg has been achieved in the previous years mainly due to heavy stocking and intensive management in terms of better retrieval.

3 Padmapukur Beel, 24 Parganas (North), area - 40 ha. Average Production : 35 tonnes per annum.

This beel is supporting 130 fishermen families. The input costs in terms of depreciation of boats and nets is very nominal. During 1988-89 a crop of about 40 tonnes was netted. Gross sale proceeds amounted to Rs.5.44 lakhs, per family income being little over Rs.4,000/- per month.

Average productivity of beels under study in the state of West Bengal has been ranging between 280 to 320 kg^{-1} ha^{-1} yr^{-1} with the exception of Padma Beel which yielded around 1 t ha^{-1} yr^{-1}. In terms of income every family gets around Rs.5,000 per annum as compared to an average income of Rs.2,000 in case of 15 beels in Assam as analysed earlier.

PROJECT **FC/A/14**

ECOLOGY AND FISHERIES MANAGEMENT OF A SMALL RESERVOIR IN GANGA BASIN (BAGHLA RESERVOIR)

Personnel : M.A. Khan, D.N. Singh, Balbir Singh, H.P. Singh, R.K. Dwivedi, R.K. Tyagi, Ram Chandra, J.P. Misra.

Duration : 1988- June 1991

Location : Allahabad

Physico-chemical parameters of water

Depthwise monthly estimation of physico-chemical parameters were estimated. Lower values of temperature, alkalinity, dissolved oxygen (except in May and June), pH (except specific conductivity) were observed in monsoon season due to the influence of rain water. The concentration of nitrate, phosphate and silicate were higher in monsoon, calcium and magnesium did not show any definite trend. Decreasing trend in the values of alkalinity, pH and

conductivity were observed from April to August and thereafter it increased again till March.

Depth-wise reduction was observed from surface in 4 or 5 m depth in respect of temperature, dissolved oxygen and pH whereas an increment was noticed depth-wise in bicarbonate and specific conductivity. Diurnal variation in physico-chemical parameters also was studied.

Thermal as well as chemical stratification were observed. Chemical parameters showed a declining trend in July, 1990.

Primary productivity

Gross and net productivity ranged between 37.5 and 308.33 mg C m^{-3} hr^{-1} and 25.0 and 225.0 mg C m^{-3} hr^{-1}. Highest gross and net production was observed in April and lowest in November. Respiration also fluctuated between 10.0 and 270.0 mg C m^{-3} hr^{-1} being lowest in October and highest in August.

Physico-chemical features of soil

Soil samples were analysed for pH, specific conductivity, total dissolved solids, organic carbon and free calcium carbonate which ranged from 6.89 to 7.61, 182.0 µ mhos cm^{-1}, 91.0 and 110.0 mg l^{-1}, 0.92 and 1.39% and 4.25 and 4.75% showing higher values in June and lower in September.

Plankton

The plankton population ranged from 71 u l^{-1} in November, 1990 to 13334 u l^{-1} in April 1990, on an average being 3075 u l^{-1} which is 1.4 fold less from last year production. Two peaks in plankton production were observed one in summer and another in winter.

Periphyton

Periphyton population ranged from 144 u cm^{-2} in October to 5415 u cm^{-2} in February, on an average being 1455 u cm^{-2}. Bacillariophyceae (56.91%) dominated over Chlorophyceae (22.88%), Myxophyceae (16.67%) and Desmidoceae (3.54%).

Aquatic macrophytes

Aquatic weeds were recorded during the months May, November, December and January in the reservoir. Associated fauna ranged from 124 m^{-2} in May to 194 u m^{-2} in November being an average of 104 u m^{-2}.

Macrobenthic fauna

The benthic fauna of the reservoir ranged between 220 (August) to 3828 u m^{-2} (April). The benthos were dominated by Oligochaeta (44.0)%, followed by insect larvae (42.4%) and molluscans (13.6%).

Pre-recruitment studies

Spawn of catfishes and minor carps were collected. Barring a few fingerlings (70 to 85 mm) of *Labeo calbasu* ·no major carps spawn were collected.

Stocking of the reservoir

Based on the primary productivity study and the proposed fish production about 70,500 fingerlings of mrigala (54%), rohu (40%) and catla (6%) were stocked in the reservoir which were produced at the reservoir site itself by the team.

Growth study

The growth study on major carps was conducted by fin clipping and tagging methods. The growth increment recorded per day varied from 1.2 g and 0.6 mm and 5.12 and 1.3 g in respect of *C. catla* and *L. rohita* by length and weight respectively.

Commercial fishing

A fish production of 50.79 qt. equivalent to 101.60 kg ha^{-1} $annum^{-1}$ was achieved during the fishing season of 1989-90. Major carps formed 55.20% followed by catfishes (24.70%) and miscellaneous fishes (20.10%).

Energy transformation through primary production

The reservoir has been assessed as moderately productive based on abiotic parameters. The potential fish yield was assessed as about 100 to 126 kg ha^{-1} $annum^{-1}$ against this 101.60 kg ha^{-1} $annum^{-1}$ were achieved.

The rate of energy transformation by phytoplankton (total) and nannoplankton were made in the reservoir using radio isotopes ^{14}C technique.

PROJECT FC/A/15

ECOLOGY AND FISHERIES MANAGEMENT OF MUKTAPUR OXBOW LAKE (*MAUN*) IN GANDAK BASIN (NORTH BIHAR)

Personnel : K.P. Srivastava, B.C. Jha, V.R. Chitranshi, P.N. Jaitley, V. Pathak, C. Lakra, M.P. Singh, S.K. Srivastava

Duration : 1988-91

Location : Patna

Problem (i) : Physico-chemical studies of water and soil (including diel cycle)

Physico-chemical characteristics of soil and water have been studied. Both the available nutrients nitrogen (584 to 810 ppm) and phosphorus (107 to 132 ppm) were very high in the soil. The rich nutrient status of the bottom soil was however not reflected in the water phase which was found to be poor in respect of both nitrate and phosphate (av. 0.238 mg l^{-1} and 0.126 mg l^{-1}) respectively.

Water quality parameters like DO, pH, CO_2, CO_3 and HCO^3 showed considerable diurnal variations, the magnitude being different in different months.

Problem (ii) : Estimation of chlorophyll content and primary productivity (nannoplankton, net plankton and macrophytes)

The chlorophyll content of phytoplankton was within the range of 2.12 to 8.50 mg m^{-3} of which 1.92 to 5.62 mg m^{-3} was contributed by nanno group. Thus, out of 5.6 mg m^{-2} (av.) chlorophyll content of phytoplankton, the contribution by nannoplankton was 3.59 that is 64% of total. Almost 70% of the primary production by phytoplankton was contributed by nannoplankton group and only 30% by the net plankton.

Problem (iii) :	Quantitative estimation of detrital load and bottom energy

The bottom organic matter deposites in the form of organic detritus was very high in the lake ranging from 168.8 g m^{-2} to 482.4 g m^{-2} (dry weight). Thus, on average the detrital load in the lake was 310.3 g m^{-2} which is equivalent to 4,65,450 cal m^{-2} day^{-1} of bottom energy.

Problem (iv) :	Qualitative and quantitative estimation of plankton

Net plankton : The average crop of plankton during the period in the lake was 911 u l^{-1} and that in pen was 1,326 u l^{-1}, contributed by 80.7 % and 75.4% by phytoplankton and zooplankton respectively.

Nannoplankton : The abundance of nannoplankton ranged between 7,118 u l^{-1} (July) to 37,166 u l^{-1} (June) with an average of 21,044. The bacteria were numerically most dominant group contributing almost 79.63 to 91.95% of the total population.

Periphyton : The periphytic population in the lake ranged between 2,488 nos. cm^{-2} to 5,712 nos. cm^{-2} (av. 3,927 nos. cm^{-2}). Bacillariophyceae was the most dominant group (67.8%) followed by Chlorophyceae (18.6%), Myxophyceae (9%).

Macrophytes : Muktapur lake was highly infested with macrophytes and among them submerged vegetation was the most dominant. The wet weight of the hydrophytes ranged between 5.6 kg m^{-2} to 14.8 kg m^{-2} with an average of 9.0 kg m^{-2}.

Flora and fauna associated with weeds : Many insects and benthic organisms were found inhabiting the macrophytic niche of the system, the important among them were molluscs. The associated flora were dominated by Bacillariophyceae followed by Chlorophyceae.

Macrobenthic fauna : The numerical abundance of benthos in the lake was an average 2,490 nos m^{-2}. Benthos was comparatively rich in the pen (1,865 to 2,871 nos m^{-2}).

Fish catch statistics : Monthwise fish landing in Muktapur lake has been presented in Table 1.

Table 1. Month-wise fish landing in Muktapur lake

Months	Total catch (t)	Major carps (kg			Cat fishes		Misc. fishes
		Mrigal	Rohu (kg)	Catla	Calbasu	*(W. attu)* (kg)	
April	0.480	42.400	267.600	45.000	-	12.600	474.400
May	1.560	32.540	425.300	38.310	-	20.250	937.700
June	0.960	48.300	302.400	52.500	-	14.400	556.800
July	0.517	25.185	162.855	27.100	2.000	7.755	292.105
August	0.167	7.100	52.605	7.400	-	3.035	96.860
September	No fishing						
October	-do-						
November	-do-						
December	-do-						
January	0.295	-	15.200	-	-	-	278.850
February	0.508	2.650	3.290	2.730	-	-	499.680
March	0.690	1.675	5.350	2.670	-	-	680.405
Grand Total	**5.327**	**159.850**	**1231.500**	**176.710**	**2.00**	**58.040**	**3816.800**
(%)		3.0	25.12	3.32	0.40	1.09	67.07

Fish culture in the lake : Culture experiment in pen (0.08 ha) was conducted with 800 nos of fingerlings comprising *C. catla* 500 nos, *L. rohita* 2 nos and *C. mrigala* 100 nos. A total of 260.1 kg of fish was harvested leaving behind an estimated stock of 40 to 50 kg.

A new pen (0.1 ha) has been constructed and installed in the lake with the aim to culture five species combination to enhance productivity.

Flow of energy in the biotop : The total energy fixed through primary production amounted to 149.68 X 10^5 cal m^{-2} yr^{-1}. Out of the available energy, fish was able to fix only 15.984 cal m^{-2} yr^{-1}. This gave a conversion efficiency of 0.107% and 0.0023% from photosynthesis and light energy to fish.

PROJECT **FC/A/16**

ECOLOGY AND FISHERIES MANAGEMENT OF BEEL IN BRAHMAPUTRA BASIN (ASSAM)

Personnel : S.N. Mehrotra, S.P. Singh, R. C. Singh, A. Sarkar M. Choudhury, D.K. Biswas

Duration : 1988-1991

Location : Siligurijan beel and Peetkati Beel,

Cage culture in Siligurijan beel : Experiments to culture fish in cages were conducted in Siligurijan beel from 15th September 1989 to June

1990. About 450 nos. of mrigal and rohu fingerlings (63-66 mm/6g) were stocked in cages.

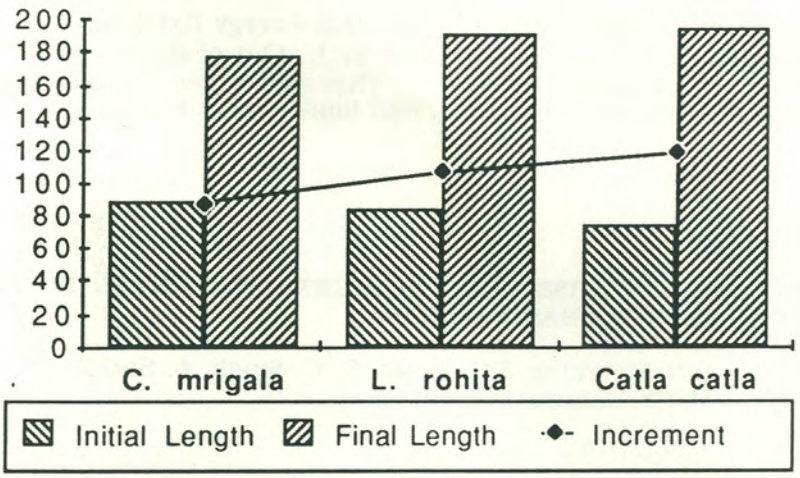
Pen culture in Peetkati beel :

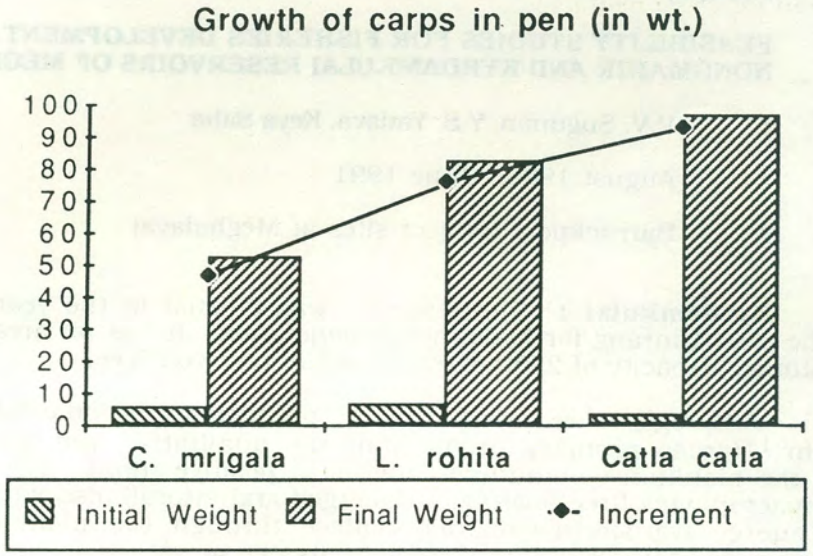
600 number of major carps fingerlings, comprising mrigal, catla and rohu in the ratio of 1:1:1 were stocked in the pen on 20th September, 1990. Pre-management of the pen area viz. manuring by raw cow-dung, addition of lime and fertilization was also done. Floating and submerged weeds were also cleared manually.

Periodical sampling of the fish stock by drag netting operation was done and the growth of fish recorded till 23rd March 1991 was as follows.

Species	Size range (mm)	Av. wt. (g)	Av. length (mm)	Increment Av. wt. (g)	Length (mm)	wt. (g)
L. rohita	64-90 (85)	7	192	83	107	76
C. catla	58-85 (75)	4	194	97	119	93
C. mrigala	74-102 (90)	6	178	53	88	47

Growth of carps in pens (in mm)





Abiotic features of the beel :

High productive capacity of beel water was evidenced by values obtained for gross production (19.5-156.75 mg C m^{-3} hr^{-1}), net production (0-125 mg C m^{-3} hr^{-1}) and respiration (25-180 mg C m^{-3} hr^{-1}).

Biotic features :

The biotic community was characterised by rich plankton population (phytoplankton : 1433 ul^{-1}) and (zooplankton : 569 ul^{-1}).

Benthic organisms were not encountered in the sediment collections.

PROJECT **FC/A/17**

FEASIBILITY STUDIES FOR FISHERIES DEVELOPMENT IN NONGMAHIR AND KYRDAMKULAI RESERVOIRS OF MEGHALAYA.

Personnel : V.V. Sugunan, Y.S. Yadava, Keya Saha

Duration : August 1990 - June 1991

Location : Barrackpore (Project sites at Meghalaya)

Kyrdemkulai : The reservoir was created in the year 1979 by damming the river Umrang for hydel power generation. It has an area of 90 ha and a live storage capacity of 2250 acre feet at full reservoir level.

Although a low rate of organic productivity is indicated @ 56.88 mg C m^{-3} hr^{-1} (gross promary production) the qualitative and quantitative richness of the plankton communities suggest a positive trend. The near-total absence of macrophytes (free floating, submerged and littoral) also indicates that the major energy transformation takes place through the plankton chain. Macrobenthos population, was thin (16-112 units per sq. m).

The recent stocking of Indian major carps in the reservoir (0.15 million approx.) is yet to reflect on the fishery.

Nongmahir : This is a pickup reservoir formed in the year 1979 by conduting the residual waters of the Kyrdemkulai turbines into a steep gorge. The environmental and water quality parameters are observed to be in the productive range though the rate of carbon synthesis at the primary producer level is rather low, estimated at 34.38 mg C m^{-3} hr^{-1} (Gross Primary Production). Out of the average density of 3790 units per l plankton : 90% is constituted by the desmids; the density of benthos was 16-96 units per sq. m.

PROJECT **BF/B/2**

STUDIES ON THE FISHERIES POTENTIAL OF ESTUARINE WETLANDS (BHERIES)

Personnel : Apurba Ghosh, Amitabha Ghosh, G.N. Saha, R.K. Das, P.K. Chakraborti, K.R. Naskar, A.C. Nandy, S.C. Thakurta, H.C. Karmakar, H.C. Joshi, N.N. Mazumder, S.K. Chatterjee, L.K. Parbat

Duration : 1986 - March,1992

Location : Barrackpore, Calcutta

Management of non-saline sewage-fed wetlands

Physico-chemical and bacteriological investigations :

Bacterial load of Kantatala wetland was always much higher than that of Minakhan due to the higher concentration of sewage effluent reaching Kantatala. Primary production at Kantatala was more than double of Minakhan bheri receiving dilute sewage. Soil characteristics also give evidence of better productivity of Kantatala soil. Transparency at Kantatala most often was near to critical values due to planktonic bloom and reducing the DO value to trace to nil at night.

Cage culture experiment :

Recently, some pen culture experiments have been conducted in a 12 ha bheri in West Bengal. After 5 months of rearing, the growth was as follows (Table 1):

Table 1 : Production of *Oreochromis* spp. and *C. carpio* in cages installed in bheries

Species	Initial wt.	Final wt.	
		Pen I	Pen II
O. mossambicus	8.4 g	127 mm/31.4 g	128 mm/32.5 g
O. niloticus	19.5 g	148 mm/65.6 g	147 mm/64.5 g
C. carpio	38.8 g	164 mm/81.0 g	169 mm/89.2 g

Wolffia sp. and Enmteromorpha as food for fishes :

Laboratory investigations were conducted in glass jars to assess the efficacy of *Wolffia* and *Enteromorpha* as food for wetland fishes using *O. mossambicus* as the test species. Wolffia can be a substitute for natural foods.

The two trials, each of one month duration, with Entermorpha did not show any encouraging result.

At Minakhan, two wetlands of varying salinity concentration were selected for studying growth rate of fishes and prawns. Two 10 sq.m. parts of the wetland No. 1 was seperated with earthen dykes and stocked with *O. mossambicus, L. parsia* and *P. monodon.* The growth rate observed was as follows :

Species	Initial wt.(g)	Wetland I (Final wt.)(g.)		Wetland II (Final wt.)(g.)	
		Chamber I	Chamber II	ChamberI	Chamber II
*O. mossambicus**	2.7	17.4	20.0		
*L. parsia**	1.7	8.0	6.3	25,000 no/ha	30,000 no./ha
*P. monodon**	0.6	9.0	8.4	12.20 g. @ 5000 no/ha	11.90 g. @1000 no/ha
*M. rosenbergii***		Nil		Nil	NIl

* @ 15,300 no./ha
** @ 2,000 no./ha

The stocking of *M. rosenbergii* excert no descernible influence on the growth of other species. Similarly raising of stocking density of *P. monodon* from 5,000 to 10,000 showed no adverse effect on the growth of the species.

Biology of Oreochromis niloticus

Investigations on different aspects of the biology of the species reared in wetlands were conducted.

Heavy metal monitoring

Heavy metal monitoring in various fishes like *O. mossambicus, O. niloticus* and *C. carpio* of sewage fed bheries revealed consistent accummulation of metals in flesh tissues. However, the mercury accummulation in flesh tissues of different tissues did not exceed the tolerance level of 0.5 mg/ g wet wt. recommended fore human consumption. In the case of *O. mossambicus* liver tissues showed significantly higher mercury level (1.78 mg/ g wet wt.).

Sub-Project : Ecology and management of estuarine bheries

During the year 1990-91, ecological studies in relation to biological productivity of bheries under three saline zones were made at places Kharibari (low saline), Malancha (medium saline) and Golabari (high saline).

Total fish and prawn production recorded in bheries were 552.6 kg, 250 kg and 290.6 kg ha^{-1} yr^{-1} in low medium and high saline bheries respectively and *P. monodon* contributed at 128.6 kg, 40.5 kg and 62.24 kg ha^{-1} yr^{-1} respectively.

Abundance of commercial fish and prawn seed in tidal ingress water of bheries was poor this year at all the collection centres. *P. monodon* was almost absent in collection barring stray occurance at Golabari. *M. brevicornis* was available only at Malancha (24 nos net^{-1} hr^{-1}) and at Golabari (60 nos net^{-1} hr^{-1}) in November 1990. While *P. styliferus* was recorded in all the centres being highest at Golabari (65 nos net^{-1} hr^{-1}) in November 1990.

Significant results were achieved in cage culture experiments in low and medium saline bheries in producing juveniles from early juveniles (14.22 mm) and adults from young ones (95-108 mm) of prawn *(P. monodon).* The early juveniles were raised by rearing post larvae in six hapas (2 x 1 x 1 m) fixed in bheri. The survival of early juvenile was recorded as 75% at 3.8-4.1 ppt salinity in low saline bheri while as 81% in high saline bheri at 17.1-21.0 ppt salinity.

Cages of size 150 x 75 x 60 cm made of split bamboo were used. Three such cages were fixed in each low and high saline bheri. In each cage 75 nos of early juvenile of *P. monodon* were released and reared for one month. The survival of juvenile prawn was recorded as 71.2% (41.55 mm/551 mg) at 3.8-5.0 ppt salinity in high saline bheri based on only natural food. Besides encouraging result were achieved in raising adult *P. monodon* at high saline bheri.

Plankton and Benthos

During the year the monthly plankton studies revealed that the plankton densities at non-saline sewage-fed wetlands and saline sewage fed wetlands averaged at 0.3 ml/50 l (i.e. , 637.54 u/l) and 0.5 ml/50 l (i.e., 1038.47 u/l).

There were differences in the average densities of benthos from saline wetlands (63.82 x 103 u/m^2) and non-saline wetland (16.48 x 103 u/m^2). The reason for such differences may be attributed to higher abundance of filamentous algae like *Enteromorpha* sp. and crustaceans harbouring the lablab matrix.

PROJECT **BF/B/3**

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

Sub-Project : **Assessment of fishery resources, biological investigations and stock recruitment studies and monitoring of ecological parameters of the estuarine system.**

Personnel : B.N. Saigal (upto July 1990), R.N. Pal, Babu Lal, A.K. Ghosh, M.K. Mukhopadhyay, H.C. Joshi, R.K. Banerjee, M.K. Das, M.M. Bagchi, R.K. Das, P. Mitra, H.C. Karmakar, S.N. Dutta, D.K. De, R.N. Dey, A.R. Paul, A.K. Roy, N.C. Mondal, S.P. Ghosh, Pintu Biswas, T. Chatterjee, Keya Saha, A.K. Banerjee, P. P. Ghosh, S.K. Chakraborty, S. Chakraborty, H.K. Routh, K.K. Das, P. Singh, Subhra Saha

Duration : 1983-95

Location : Barrackpore, Canning, Uluberia, Diamond Harbour, Digha and Frazerganj/Namkhana

Dynamics of plankton in Hooghly-Matlah estuarine system :

Zone II (industrial Zone) showed significant variations in all the values when compared with zone I (upper non-industrial zone). The low SDI and high C values indicated prevalance of pollution during monsoon and post monsoon months in zone II. Brackishwater non-industrial zone (zone III) showed normal pattern of planktonic distribution indicating negligible impact of pollution in the down stretch of the Hooghly estuary. Matlah estuary had high concentration of plankton throughout the year with peak during winter months which showed direct relationship with fin and shellfish abundance during same period in the system. Zooplankton and diatoms were the principal organisms contributing to plankton population.

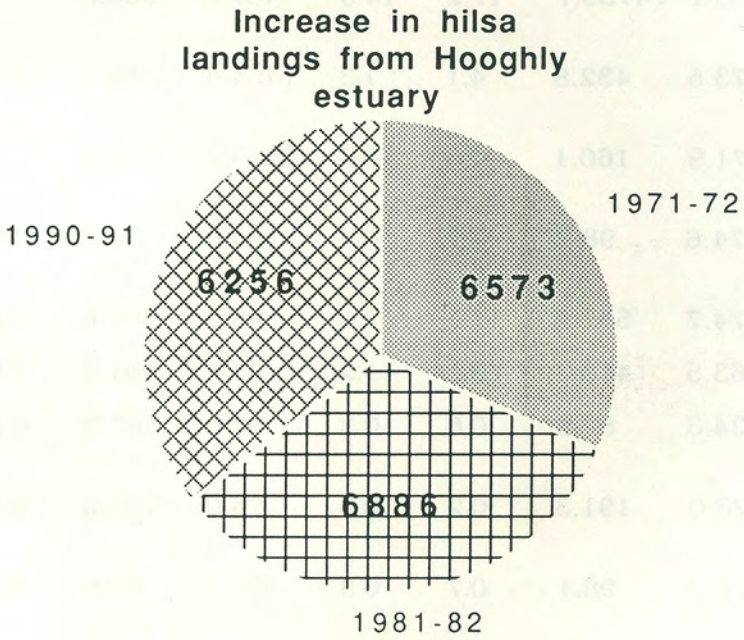
Dynamics of zoobenthos in Hooghly estuary

Zonewise studies indicated wide fluctuations in density and SDI values of benthic fauna in zone II. The dominant organisms in zone II were gastropods (*Lymnaea* sp., *Pleurocera* sp., *Indoplanorbis* sp. etc.), oligochaete worms (*Branchiura* sp.) and polychaete worms (*Neanthes* sp.). High densities of these indicator organisms and low SDI values indicated high organic deposition in industrial zone of the estuarine stretch. Zone III was proved to be almost free from pollutional impact.

Assessment of fishery resources and fish catch

Hilsa : The prime fish, hilsa, *Tenualosa ilisha*, catch was the highest recorded in the last nine years. The details are given below :

Year	Catch (in t)
1971-72	6573.3
1981-82	6886.0
1990-91	6256.5



Annual fish yield and catch structure in Hooghly estuary

The lower estuarine zone accounted for about 95.7% of the total estimated estuarine fish yield of 40981.0 t. Yield per ha increased from 41.4 kg in 1989-90 to 51.2 kg in 1990-91.

The specieswise break up constituting the dominant fishery in 1989-90 and 1990-91 are presented in Table 1.

Table - 1. Contribution of dominant fish species and prawns (in t) to the total estuarine fish catch

Name of species	Contribution to total catch		% in the total catch		Contribution to total catch*		% of Col,.6	% of Col.7
	Feb. 90-Jan.91	Feb.89-Jan.90	Feb.90-Jan.91	Feb.89-Jan.90	Feb.90-Jan.91	Feb.89-Jan.91		
1	2	3	4	5	6	7	8	9
Tenualosa ilisha	6256.5	1563.4	15.3	4.7	6256.0	1563.4	43.7	21.0
Pama pama	5235.2	3978.2	12.8	12.0	224.0	374.7	1.6	5.0
Setipinna spp.	3898.4	4379.4	9.5	13.2	165.5	322.9	1.2	4.3
Harpodon nehereus	7065.7	4735.7	17.2	14.3	437.6	528.0	3.1	7.1
Tachysurus jella	1673.5	432.8	4.1	1.3	1464.4	244.0	10.2	3.3
Stromateus cinereus	1871.9	160.1	4.6	0.5	1699.2	103.4	11.9	1.4
Polynemus paradiseus	174.6	98.2	0.4	0.3	84.8	78.2	0.6	1.0
Coilia spp.	474.7	537.2	1.1	1.6	88.3	302.6	0.6	4.1
Ilisha elongata	863.5	413.4	2.1	1.2	131.1	101.2	0.9	1.4
Sciaena biauritus	234.3	87.5	0.6	0.3	72.0	60.3	0.5	0.8
Polynemus indicus	73.0	191.3	0.2	0.6	73.0	191.3	0.5	2.6
Chirocentrus dorab	272.3	98.1	0.7	0.3	273.3	82.6	1.9	1.1
Prawns	2635.4	2670.0	6.4	8.1	845.2	760.8	5.9	10.2
Others	8417.4	9815.7	20.5	29.6	2307.4	2548.0	16.1	34.2
Total	**40981.0**	**33139.6**	**100.0**	**100.0**	**14311.9**	**7450.8**	**100.0**	
	100.0							

*Excluding winter fishery

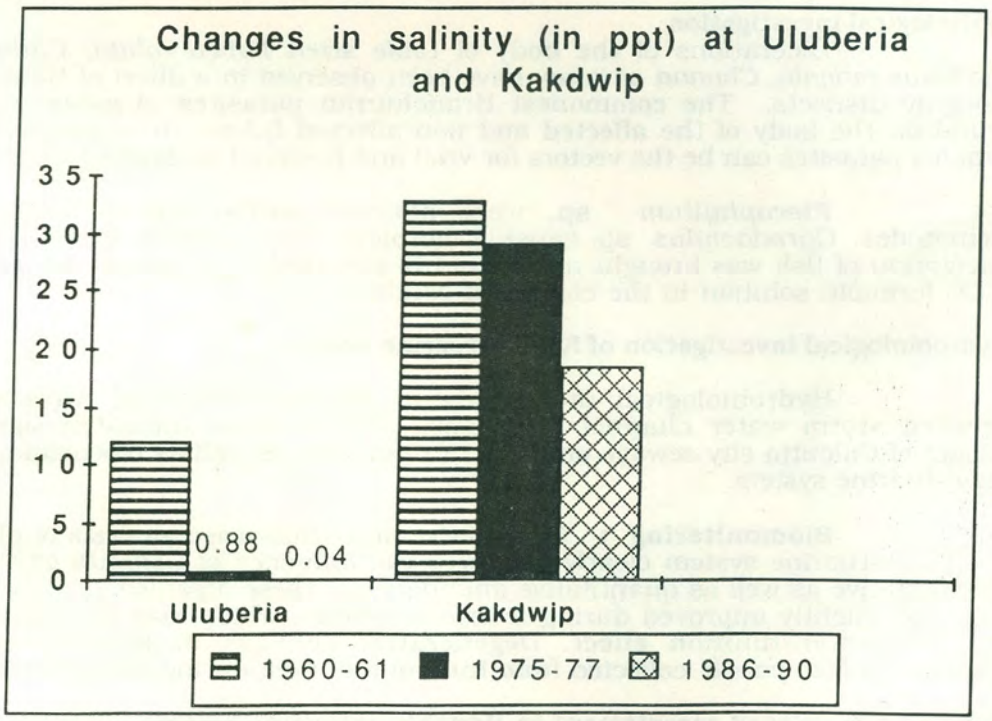
Winter migratory bagnet fishery : Total estimated winter migratory bagnet catch amounted to 26669.0 t accounting for 65% of the total estuarine catch, with an average CPUE of 198.7 kg compared to the catch of 25688.8 t with an average CPUE of 107.4 kg for the previous year.

Gearwise composition of catch : Bagnets and drift gill nets constituted the most dominant gears in the entire estuary, accounting for 97% of the total yield (bagnets 69.6%, gill nets 27.4%).

Biology and fishery : Biology and fishery of *Polynemus paradiseus* was studied.

Physico-chemical characterisation of the Hooghly estuarine water

The salinity pattern as shown in the following table clearly indicates gradual shifting of the estuarine gradient zone towards the down stretch of the estuary.



Salinity pattern in Hooghly estuary

Zone	Place	Maximum salinity (in ppt) 1960-61*	1975-77**	1986-90
II	Uluberia	12.00	0.379	0.042
III	Kakdwip	32.80	29.24	18.604

* Before Farakka discharge
** Immediately after Farakka discharge.

Energy dynamics of Hooghly-Matlah estuarine system

With the gradual decrease in freshwater dilution the concentration of half bound carbondioxide increased in Jalangi river and reached to the level of 258 X 10^{-6} g l^{-1} during November.

Pathological investigation

Ulcerations of the body of table sized *Labeo rohita, Catla catla, Cirrhinus mrigala, Channa striatus* have been observed in a Jheel of Howrah and Hooghly districts. The commonest Branchiuran parasites, *Argulus* sp. were found on the body of the affected and non-affected fishes. It is suspected that *Argulus* parasites can be the vectors for viral and bacterial pathogens of fish.

Pterophyllum sp. were affected badly due to monogenetic trematodes, *Gyrodactylus* sp. causing morbidity and mortality of the fish. The infestation of fish was brought under control effectively by dipping the fish in 1 : 5000 formalin solution in the controlled condition.

Hydrobiological investigation of Kulti estuarine system

Hydrobiological monitoring of 40 km stretch of Kulti estuary between storm water channel confluence and Kanmari indicated significant impact of Calcutta city sewage on the water qualities as well as biocommunities of the estuarine system.

Biomonitoring : Centre-wise and seasonwise analysis of plankton in Kulti estuarine system clearly indicated the influence of Calcutta city sewage on qualitative as well as quantitative abundance of these organisms. However the condition slightly improved during monsoon months which may be attributed to the freshwater dilution effect. Degenerative changes in hepatocytes were observed in *Liza parsia* collected from Kulti outfall area during summer months.

Fish and prawn seed recruitment in Hooghly estuarine system : Recruitment of estuarine fish and prawn seed was assessed at two centres of the Hooghly estuary *viz.*, Frezerganj and Sagar. The maximum availability of prawn and fish seed collected per shooting net per hour at Frezerganj was that of *Penaeus monodon* (2208). At Sagar also the maximum number was of *P. monodon.*

Water quality monitoring

The environmental monitoring campaigns in the Hooghly estuary during monsoon, winter and early summer have revealed distinct influence in the water quality of the Hooghly estuary below the confluence of the river Jalangi at Nabadwip. The chemical and biological parameters during winter and early summer showed large variations at different locations whereas during monsoon the variation was supressed due to heavy discharge in the river.

The impact of pollution was evident on the plankton population and insect population at various locations as evident from the Species Diversity Indices. SDIs for benthos also showed impact of pollution near Hajinagar.

The pulp and paper effluent at Hajinagar suppressed the microbial population at the factory side bank. The microbial population was found to be highest at Diamond Harbour.

Haematological parameters viz. RBC, WBC, Hb and Hct in the sedentry fish *Rita rita* collected from Nabadwip and Hajinagar showed distinct impact of environmental stress due to effluents from pulp and paper and other industries in the Hajinagar region. However, in the migratory fish *S. panijus* the blood parameter in the specimen collected from Hajinagar and Diamond Harbour did not show any significant difference.

Heavy metal and pesticide residue monitoring

Heavy metgals (Zn, Cu and Hg) and pesticide residue (t-DDT and t-HCH) levels in various fish and plankton collected from three locations in the Hooghly estuary could not find any violation of recommended tolerance levels for human consumption for metals and pesticides. The DDT levels were highest in the fish collected from Diamond Harbour and HCH in fishes collected from Hajinagar.

PROJECT **BF/B/8**

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

Personnel : P.K. Chakraborti, Y.S. Yadava, K.R. Naskar, R.K. Das, Babu Lal, N.N. Mazumder

Duration : 1986-1990

Location : Gosaba-Sajnakhali, Kulti and Bakkhali

During the year, investigation was continued at Sudhanyakhali (without guano) and Sajinakhali (with guano) in the core area, Durgaduani (semi core area), Gosaba (Human interferred area), Bakkhali (coastal area) and Malancha (sewage influenced area).

The floral density was estimated to be 25 t/ha while the floral height did not exceed 10 metres. Thus, the total floral biomass in the Indian Sunderbans (2,300 sq.km) is estimated to be 5.75 million tonnes.

So far 32 periphytic and phytobenthic flora have been recorded from the mangrove ecosystem.

Plankton :

The plankton densities at different sampling centres varied as follows :

	100 u/l	mg/l (dry wt.)	cc/l (settled vol.)
Sudhanyakhali	12.06-18.25	0.22-0.28	0.37-0.49
Sajinakhali	16.03-18.04	0.27-0.28	0.47-0.48
Durgaduani	12.10-14.42	0.14-0.15	0.25-0.26
Gosaba	24.39-27.89	0.35-0.36	0.61-0.86
Bakkhali	3.92-5.34	0.04-0.07	0.07-0.12
Malancha	11.08-15.13	0.15-0.23	0.26-0.39

Estimation of species diversity revealed that mangrove forest receiving both fresh and brackishwater (i.e., Malancha and Bakkhali) showed the highest diversity (d) of species. The low values of concentration of dominant species (C) and high value of eveness (J) prove less fluctuation of the ecosystem even though there are tidal exchanges in the mangrove areas.

Benthos

The benthos densities at different sampling centres varied at follows :

	1000 u/m2	mg/m2 (dry wt.)
Sudhanyakhali	0.73-0.99	1.06-1.44
Sajinakhali	3.89-4.10	5.64-5.95
Durgaduani	4.94-5.55	122.65-192.62
Gosaba	0.98-1.30	1.42-116.24
Bakkhali	0.52-0.63	116.23-116.40
Malancha	51.17-86.73	998.08-3590.32

The study of species diversity for the benthos revealed the same trend as that for the plankton.

Associated fauna

There was practically no change in the abundance of associated fauna of the phytotelmates of different sampling sites excepting the decline in *P. monodon* seeds.

Biochemical studies

Comparative study of the composition of fresh litters of the three species of *Avicennis* were conducted.

Chemical aspects

During the year, the solar energy transformation, the rate of carbon assimilation, total alkalinity, Ec and TDS of the ecosystem were studied which reveals that the maximum efficiency of energy transformation and carbon fixation are observed in the core areas.

Microbial studies

During the year three sets of samples were studied. During the first quarter the highest bacterial load was at Durgaduani and the least at Bakkhali. In the monsoon and in the post monsoon phase bacterial loads were influenced both by the nutrient rich condition of Sudhanyakhali, Sajinakhali, Durgaduani and Gosaba and the decomposed litter washing from the forest.

PROJECT **BF/B/9**

ECOLOGY AND FISHERIES OF NARMADA ESTUARINE SYSTEM WITH SPECIAL REFERENCE TO IMPOUNDMENT OF RIVER NARMADA (SARDAR SAROVAR)

Personnel : D. Nath, S.N. Singh, S.K. Sarkar, G.C. Laha, R.C. Mandi, K.S. Banerjee, C.K. Vava

Duration : 1988-1993

Location : Vadodara

Hydrological regime

Physico-chemical features were studied. The soil reaction was alkaline at all the centres (pH 8.0 to 9.1). Organic carbon content of the Narmada Estuarine system varied from 0.1 to 1.3%.

Primary production

Average Gross (187.4 mg Cm^{-3} hr^{-1}) and Net (112.5 mg Cm^{-3} hr^{-1}) production were highest at Vedgam representing the dam site stretch, the community respiration followed the similar trend.

Biological regime

The average planktonic biomass for the Narmada Estuarine System as a single entity fluctuated from 109 (Bharuch) to 345 nos. l^{-1} (Vedgam). Phytoplankton (72.73 to 95.57%) was the most prevailing fraction of this abundance. By and large zooplankton (4.43 to 27.27%) was meagerly represented and mainly consisted of copepods and rotifers.

Projecting the Narmada Estuarine Complex as a whole, the average macro-benthos abundance ranged from 388 (Bharuch) to 2342 nos. m^{-2} (Vedgam). Greater faunal diversity at freshwater extent reflected the prevailing congenial state.

Identification of Discharge points (industrial, agricultural and domestic)

Baijalpur point at Bharuch stretch was identified as the point receiving domestic and industrial effluents.

The soil was rich at Outfall as reflected by high organic carbon content (av. 1.5%), high available nitrogen (33.7 mg 100 g^{-1}) and high total nitrogen (0.16%).

Artificial fecundation of *Tenualosa ilisha*, its hatching and rearing techniques :

A new hatchery was designed which encompassed recirculation device coupled with constant aeration.

Four sets of *Tenualosa ilisha* were successfully bred during this monsoon.

Dry stripping methods was employed. Rate of fertilization varied from 36.67 to 77.08%. The water hardened embryo were subjected to hatching in the designed hatchery. The percentage of hatching was 63.46 to 72.17%; 1.938 lac of spawn was transported to Umarwada and Ukai fish farms. The spawn attained an average size of 103.5 mm in length and 5.45 g in weight after 148 days of rearing. A growth rate of 0.70 mm day^{-1} could be achieved.

Biological studies of the hilsa also was conducted.

PROJECT **BF/A/2**

FISHERIES AND BIOLOGY OF HOOGHLY HILSA, *TENUALOSA ILISHA*

Personnel : B.N. Saigal, Apurba Ghosh, M.K. Mukhopadhyay, A. Mukherjee, Amitabha Ghosh, P. Mitra, H.C. Joshi, V.K. Unnithan, D.K. De

Duration : 1986-91

Location : Estuarine Division, Barrackpore

A hatching-cum-rearing unit, designated as 'Circular grid hatchery' has been fabricated and put on trial at Farakka. Each unit of the hatchery is consisting of a plastic pool (4' dia and 3' height) with the provision of an outlet of water below 3" of its top, a revolving sprinkler and a circular grid.

Eggs are placed in the grid and a feeble circular current of water is maintained through the revolving sprinkler. The hatchlings were reared in the plastic pool for 7 days with the survival rate of 82%. The percentage of hatching is found to be of 89.5 (85-94%). The spawn were fed with finely powdered mustard oil cake and rice powder (1:1) at the rate of 2% of their body weight.

Seed raising of *Tenualosa ilisha*

Two nursery ponds of 0.1 ha each at Farakka were stocked with 7 days old spawn of *T. ilisha* and reared for 95 days with a survival rate of 29-32%. In one

of the ponds synthetic thyroxine, Eltroxin (Allenburys) was given daily in powdered form along with the feed.The stocked spawn grew to an average length/weight of 74.5 mm/4.13 gm in the eltroxin treated pond.

The first release of the reared fry of *T. ilisha* into the river system was done by the General Manager of Farakka Barrage Project.

Physiological changes of migratory hilsa

Investigations were conducted on the moisture and lipid contents of muscle and gonad of *T. ilisha* at Frazergunj, Nababgunj, Nabadwip and Farakka.

Haematological characterisation of *T. ilisha* collected from three sampling points within 400 km stretch of Hooghly Bhagirathi System between Diamond-Harbour and Farakka.

Biology

The age and growth of both male and female hilsa, *Tenualosa ilisha* were studied separately by using the length frequency method from the lower zone of Hooghly estuary. It was found that four age groups were involved in both male and female populations.

Multivariate discriminate analysis revealed that two sub-populations significantly differed on four morphometric characters viz., snout to dorsal base, clept of mouth, thickness and snout to margin of eye (F=14.8117 d.f. 4,109, D2 = 2.2706, T2 = 60.8775) exist in Hooghly.

Heavy metal monitoring

Investigations were conducted to assess the extent of heavy metal accumulation in the tissues of hilsa collected from Nababganj, Nabadwip and Farakka (Table below).

Place	Tissue	Zn	Cu	Cr	Cd	Hg
		(in µ/g wet wt. basis (mean)				
Nawabgunj	Muscle	8.16	0.86	0.7	0.33	0.006
	Ovary	33.85	4.50	nd	0.29	nd
Nabadwip	Muscle	5.12	nd	0.9	nd	0.047
	Ovary	21.42	nd	nd	nd	0.013
Farakka	Muscle	4.04	nd	nd	nd	0.035
	Ovary	14.30	nd	nd	nd	0.029

nd - not detectable

Hilsa migration studies

Experimental trials were conducted at Farakka on the use of 'Floy' tags for investigating migration and related biological changes in hilsa.

PROJECT **AN/A/9**

DEVELOPMENT OF SUITABLE DESIGN OF PENS AND CAGES FOR AUGMENTING FISH PRODUCTION IN LAKES AND RESERVOIRS

Personnel : A.B. Mukherjee

Duration : 1986-91

Location : Barrackpore

Pen enclosure

Studies showed the shore profile of the Muktapur oxbow lake has not undergone any major change over its original slope (1 : 35000) as recorded after the monsoon in the vicinity of the pen enclosure. Lateral bracings provided to the pen structure were found adequate in counter-acting thrusts of low surface waves.

Cages

Studies have been conducted on shorting and composition of reservoir bed materials with a view to developing anchorage facilities for the floating net cage to be used in the Bhatgar Reservoir.

Ecology of the Narmada estuarine system

Seven centres were earmarked for exploring the basic annual ecological events of the Narmada Estuarine System. The selection of the centres was based on the topography and the deltaic extent and these were, Gadher and Vedgam representing hilly and woody freshwater stretch, Poicha and Sisodara demarcating inclined plains freshwater stretch, Jhanor and Bharuch and Bhadbhyut forming the transitional and plain deltaic extent respectively.

Physico-chemical environment

Relevant data on physico-chemical regime of water and soil and primary production were studied.

Based on the average transparency, deltaic centres were more turbid as compared to riverine centres, thus projecting zonal demarcation.

PROJECT **AN/A/12**

IDENTIFICATION OF THE AETIOLOGICAL AGENT OF EPIZOOTIC ULCERATIVE SYNDROME IN FRESHWATER FISHES

Personnel : R.N. Pal, M.K. Das, S.P. Ghosh, S.K. Choudhury (School of Tropical Medicines), B.D. Chatterjee (School of Tropical Medicines)

Duration : July 1990 - December 1992.

Location : CICFRI, Barrackpore & School of Tropical Medicines, Calcutta.

Both gram positive and gram negative bacteria belonging to various genera and species have been isolated from fish environment and fishes affected with Epizootic Ulcerative Syndrome(EUS).

Pseudomonas aeruginosa is the solitary pathogen isolatd from the leisons of the catfishes. No Actinomycetes or acid fast bacterium could be isolated either from the leison or from the circulatory system of the affected fishes.

Studies indicated that prior to the outbreak of disease there is a drop in the alkalinity and hardness values in the affected sites within the range of 20-30 ppm and temperature values between 4 and 8°C.

PROJECT **AN/A/13**

PILOT PROJECT ON MASS REARING OF GIANT AFRICAN SNAIL, *ACHATINA FULICA*

Personnel : G.K. Vinci, V.K. Unnithan, V.V. Sugunan

Duration : June 1990 - December 1992.

Location : CICFRI, Barrackpore

A snail house is erected at Barrackpore measuring 10 m x 2 m x 0.75 m and has 10 compartments. A field snail farm of the size 10 m x 5 m is erected at Barrackpore. These two constructions are made for mass rearing of the snails so as to ascertaining proper stocking densities and rate of growth. Breeding experiments were conducted in the glass terrarium. Under demonstration of the technology, a training was conducted to three officials of the Government of Meghalaya.

PROJECT **CSS/1**

DEVELOPMENT OF INLAND FISHERIES STATISTICS

Personnel : R.A. Gupta, S. Paul, S.K. Mandal, Arati Das, Sucheta Majumder

Duration : 1985-March '94 (extended to VIII Five Year Plan)

Location : CICFRI, Barrackpore

Sample survey was carried out in the selected districts in thirteen states viz., West Bengal, Maharashtra, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, Bihar, Assam, Rajasthan, Orissa, Gujarat, Kerala, and Tripura for estimation of resource and fish yield along with the associated sampling variances. The survey was conducted following the methodology and data collection system evolved during the earlier years.

Sampling design adopted for the survey was stratified two stage cluster sampling with clusters of villages as the first stage unit of selection and ponds in the cluster as the second stage unit.

Efficiency of estimates : The size of the sample was limited to six clusters of five villages in each district for area estimation and a maximum number of five ponds from each village for estimation of fish yield.

The results of the analysis showed that co-efficient of variation for area statistics ranged from 8.6% to 49% and C.V. for catch estimates ranged from 3 to 62%.

Gain in precision due to identification : There was considerable gain in precision due to stratification in some districts, *viz.*, Bastar (65.95%), Dhar (49.05%) and Betul (36.04%) but no gain was achieved in the districts of Jabalpur and Satna in Madhya Pradesh. In West Bengal also, the gain due to stratification was negative in the districts of Nadia (-9.46%) and Bankura (-13.51%) whereas in the Coochbehar district there was no change in precision due to stratification. These results indicate that stratification in some of the districts is undesirable as far as technical aspects are concerned.

Survey for estimation of resource and catch under reservoirs, lakes and beels : Two types of approaches have been followed namely landing centre approach and fishing village approach depending upon the selection of the ultimate unit of sampling. Survey of the Coochbehar district was completed during this period and the area under beels having water area less than 20 ha were estimated at 817.4-1096.13 ha. The work in the remaining districts is in progress and the data is awaited.

The compilation of the data for the estimation of catch under rivers, streams and estuaries has been taken up for analysis.

PUBLICATIONS 1990-91

Ayyappan, S. & P.K. Sukumaran 1986
On some hydrobiological observations in Sankey Tank, Bangalore during the solar eclipse of 1980. *J. Inland Fish. Soc.,India,* **18**(1) : 52-55.

Banerjee, R.K., A.C. Nandy, H.C. Joshi & B.B. Das 1990
Impact of Calcutta metropolitan effluent on the ecology of Kulti estuary. *In* Contribution to the Fisheries of Inland Open Water Systems in India, Part 1, Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh, *Inland Fisheries Society of India, Barrackpore,* : 147-153.

Banerjee , R.K. & Babu Lal 1990
Role of soil and water in fish farming with special reference to primary production. *In* Technologies for Inland Fisheries Development. Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore : 125-131.

Banerjee, R.K., H.C. Karmakar, S.K. Chatterjee & S.K. Saha 1990
Evaluation of nutrient loss from sewage-fed fish ponds. *Environ. & Ecology,* **8**(1) : 450-453.

Bhattacharya, S.K. & R.K. Tyagi 1990
Bayesian reliability analysis based on first few observations from the two parameters exponential distribution.
IAPQR Transactions, **15**(1) : 35-43.

Bhaumik, Utpal 1990
Carp seed raising technology. *In* Technologies for Inland Fisheries Development. Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore : 37-46.

Bhaumik, Utpal, P.K. Pandit, J.G. Chatterjee & D.D. Halder 1988
The problems of exotic carp culture and suggested measures - the fish farmers' perception. *J. Inland Fish. Soc. India,* **20**(2) : 38-42.

Bhaumik, Utpal, P.K. Pandit & J.G. Chatterjee 1990
Participation of fisherwomen in inland fisheries activities - perceived problems and measures. *Environ. & Ecology,* **8**(2) : 713-716.

Chakraborti, P.K. 1990
Culture techniques of freshwater prawns. *In* Technologies for Inland Fisheries Development. Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore : 85-91.

Chatterjee, D.K. & G.N. Saha 1986
Effect of lime on fish pond soils. *J. Inland Fish. Soc. India,* **18**(1) : 41-44.

Chatterjee J.G., Tapas Kumar Das, S.R. Das 1989
Early summer breeding of *Puntius javanicus* (Blkr.) with hypophysation at 37° to 40° C in deltaic tract of Sunderbans. *J. Indian Soc. Coastal agric. Res.*, **7**(2): 133-135.

Choudhury, M. 1989
An econometric study on the socio-economic status of the fishermen community in lower Assam. *J. Inland Fish. Soc. India*, **21**(1) : 7-13.

Das, Manas, K. 1990
Integrated fish farming with poultry, duckery and livestock.*In* Technologies for Inland Fisheries Development. Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore : 59-68.

Das, R.K., M.M. Bagchi, M.K. Mukhopadhyay, B.B. Ghosh & Keya Saha 1990
Impact of paper and pulp factory effluent on the fish and their environment in Hooghly estuary. *In* Contribution to the Fisheries of Inland Open Water Systems in India, Part 1, Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh, *Inland Fisheries Society of India, Barrackpore*, : 154-158.

Dwivedi, R.K., K.P. Srivastava, N.K. Srivastava, R.K. Tyagi & Ravish Chandra 1990
Influece of certain hydrological and meteorological factors on the abundance of carp spawn in a stretch of river Yamuna near Allahabad. *In* Contribution to the Fisheries of Inland Open Water Systems in India, Part 1, Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh, *Inland Fisheries Society of India, Barrackpore*, : 135-140.

Ghosh, Apurba 1990
Culture prospects of brackishwater finfish and shellfish and their economics.*In* Technologies for Inland Fisheries Development. Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore : 111-122.

Ghosh, Apurba 1990
Rice cum fish culture and its economic feasibility. *In* Technologies for Inland Fisheries Development. Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore, : 69-84.

Ghosh Apurba & P.K. Chakraborti 1991
Recent investigation on paddy-cum-fish culture in coastal and inland waters. *In* Aquaculture Productivity. Ed. by V.R.P. Sinha & H.C. Srivastava. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi : 479-484.

Ghosh, B.B., M.K. Mukhopadhyay & M.M. Bagchi 1985
Status of zinc pollution in the Hooghly estuary and the related toxicity to fish and fish food organisms. ***In*** *Proc. National Seminar on Pollution Control & Environmental Management*, 17-19 March 1985. 194-199.

Ghosh, B.B. & M.M. Bagchi 1990
Oil pollution and its toxicity to fish, prawn and zooplankters in Hooghly estuary. *In* Contribution to the Fisheries of Inland Open Water Systems in India, Part 1, Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh, *Inland Fisheries Society of India, Barrackpore,* : 177-183.

Govind, B.V., D.S. Krishna Rao, P.K. Sukumaran & M.F. Rahman 1990
Need for management - a case study of Krishnarajasagar. *In* Contribution to the Fisheries of Inland Open Water Systems in India, Part 1, Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh, *Inland Fisheries Society of India, Barrackpore,* : 165-170.

Jha, B.C. 1990
The periphyton of Govindsagar reservoir and allied waters. Himachal Pradesh 1. Abundance and periodicity of diatoms. *In* Contribution to the Fisheries of Inland Open Water Systems in India, Part 1, Ed. by Arun G. Jhingran, V. K. Unnithan & Amitabha Ghosh, *Inland Fisheries Society of India, Barrackpore :* 122-129.

Jhingran, Arun G. 1990
Aquatic pollution with special reference to the Ganga River System. *In* Impacts of environment on animals and aquaculture. Ed. by G.K. Manna & B.B. Jana, University of Kalyani, Kalyani, 1990 : 35-43.

Jhingran, Arun G. 1990
Impact of environmental stress on freshwater fisheries resources. Keynote address delivered at the National Symposium on Environmental Pollutants & Resources of Land and Water. Marathwada Univ., Aurangabad. on 21st December, 1990.

Jhingran, Arun G 1990
Recent advances in inland fisheries development in India. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore, 1990 : 1-13.

Jhingran, Arun G. 1991
Fisheries status of Aquaculture -based open water systems in India. *In* Aquaculture Productivity. Ed. by V.R.P. Sinha & H.C. Srivastava. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi : 295-306.

Jhingran, Arun G. 1991
Water Resources development in India in the context of environmental perturbations. Presented at the Meeting on Preserve Planet Earth, Rotary International on 27.4.91. 17 p.

Jhingran, Arun G. & Apurba Ghosh 1988
Aquaculture as a potential system of sewage disposal - a case study. *J. Inland Fish. Soc. India,* **20**(2) : 1-8.

Jhingran, Arun G. & Babulal 1990
Primary production, energy fixation and fishery potential of Hooghly-Matlah Estuarine system. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh, *Inland Fisheries society of India, Barrackpore :* 130-134.

Jhingran, Arun G. & P.K. Chakraborti 1990
An approach to coastal zone management and planning in West Bengal. *Inland Fisheries Society of India & CICFRI, Barrackpore.* 53 p.

Jhingran, A.G. & V.K. Unnithan 1988
Matsya palan ke liye antarsthaliya jal vyavastha (in Hindi). No. 4 : 1-28.

Jhingran, Arun G., V.K. Unnithan ed. 1990
Reservoir fisheries in India : Proceedings of the National Workshop on Reservoir Fisheries, 3-4 January, 1990. Special Publication No. 3, Asian Fisheries Society, Indian Branch, Mangalore, 1990. 173 p.

Jhingran, Arun G., V.K. Unnithan & Amitabha Ghosh 1990
In Contributions to the Fisheries of Inland Open Water Systems in India, Part 1. *Inland Fisheries Society of India, Barrackpore,* 1990, 188 p.

Jhingran, Arun G. & V. Pathak 1988
Impact man-induced environmental modifications on productivity potential and energy dynamics of river Ganga. *J. Inland Fish. Soc. India,* **20**(2) : 43-53.

Jhingran, Arun G. & V.V. Sugunan ed. 1990
General guidelines and planning criteria for small reservoir fisheries managements. *In* Reservoir Fisheries in India : Proceedings of the National Workshop on Reservoir Fisheries, 3-4 January, 1990. Special Publication No. 3. Asian Fisheries Society, Indian Branch, Mangalore : 1-8.

Jhingran, Arun G. & V.V. Sugunan 1991
Potential for development of inland fisheries in rivers lakes and reservoirs. Paper presented at the International Seminar on Fisheries, State Bank Staff College, Hyderabad. 4 p.

Joseph, K.O., C. Selvaraj, V.K. Murugesan & P.K. Aravindakshan 1990
Observations on the effects of low electrolyte reservoir water on carp egg hatching and sruvival rate. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries Society of India, Barrackpore :* 141-146.

Joshi, H.C. 1988
DDT residues in fish in the river Hooghly. ***In*** *Proc. Sym. Pest Resid. & Env. Pollu. :* 93-96.

Joshi, H.C. 1985
Pesticide residue monitoring in the Bhagirathi Hooghly stretch of the Ganga River System. ***In*** *Proc. National Seminar on Pollution Control & Environmental Management*, 17-19 March, 1985 : 80-85.

Joshi, H.C. 1987.
Pesticide residues in some fish ponds in West Bengal. *IAWPC Tech. Annual* **14 :** 35-38.

Joshi, H.C. 1990
Pollution and its effect on inland fisheries in India. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 189-196.

Joshi, H.C. 1990
Water pollution problems in Indian reservoirs. *In* Reservoir Fisheries in India : Proceedings of the National Workshop on Reservoir Fisheries, 3-4 January 1990. Special Publication No. 3. Asian Fisheries Society, Indian Branch, Mangalore : 21-28.

Joshi, H.C., M.K. Mukhopadhyay. 1990.
Toxicity of quinalphos and endosulfan to different life-stages of tiger prawn (Penaeus monodon). *Environmental Conservation* : 266-267.

Joshi, H.C. & Sukumaran, P.K. 1991
Water pollution investigation in the river Tungabhadra near Harihar, Karnataka. *Indian J. Anim. Sci.*, **61**(2) : 230-234.

Katiha, Pradeep K. 1990
Efficiency of different fish marketing agencies. *Ind. Jour. Agril. Mktg.*, **4**(1) : 66-70.

Katiha, Pradeep K. & Ravish Chandra.
Fishing marketing efficiency : A case study of Allahabad market. *Fishing Chimes*, **10**(7) : 21-28.

Kaushal, D.K. & A.P. Tyagi 1989
Observations on the bathymetric distribution of benthos in Govindsagar reservoir, Himachal Pradesh. *J. Inland Fish. Soc. India*, **21**(1) : 37-46.

Kaushal, D.K. & A.P. Tyagi 1990
A study of the macroinvertebrates of Govindsagar reservoir in relation to fish and fisheries. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 72-79.

Khan, M.A., K.P. Srivastava, R.K. Dwivedi, D.N. Singh, R.K. Tyagi & S.N. Mehrotra 1990

Significance of ecological parameters in fisheries management of a newly impounded reservoir, Bachhra reservoir. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G . Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 100-108.

Khan, M.A., R.K. Dwivedi, S.N. Mehrotra, K.P. Srivastava, R.K. Tyagi & P.K. Katiha 1990

Stocking as a management tool in optimising fish yield from a small reservoir (Bachhra) in Ganga basin. *In* Reservoir Fisheries in India : Proceedings of the National Workshop on Reservoir Fisheries, 3-4 January 1990. Special Publication No. 3. Asian Fisheries Society, Indian Branch, Mangalore : 71-76.

Kolekar, V., & Mahadev Choudhury 1989

Some observations on the biology of *Mystus seenghala* (Sykes) from the river Brahmaputra in Assam. *J. Inland Fish. Soc. India,* **21**(1) : 47-53.

Laal, A.K. 1988

An effective treatment of diplostomiasis of black spot disease of carps. *Matsya,* No. 14 : 94-95.

Laal, A.K. 1989

Association of macroinvertebrates with macrophytes in some tropical ponds. *J. Inland Fish. Soc. India,* **21**(1) : 20-25.

Laal, A.K., S.K. Sarkar, A. Sarkar, B.L. Pandey & K.P. Singh 1990

Culture possibilities of Indian major carps in pens in sewage-fed zone of a channel of river Ganga. *J. Aqua. Trop.,* **5**(1) : 53-59.

Mandal, S.K. 1989

A path co-efficient analysis of some physico-chemical parameters in relation to *Penaeus monodon* (Fabricius culture. *J. Inland Fish. Soc. India,* **21**(1) : 30-36.

Mukherjee, A.B. 1990

Design, construction and maintenance of fish farms. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 197-202.

Mukherjee, A.B. 1990

Wave dissipating structures for protection of floating net cages in reservoirs. *In* Reservoir Fisheries in India : Proceedings of the National Workshop on Reservoir Fisheries, 3-4 January 1990. Special Publication No. 3. Asian Fisheries Society, Indian Branch, Mangalore : 33-39.

Mukherjee, Ardhendu 1990
Techniques for controlled breeding of common carp. In Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 25-28.

Mukherjee, Ashok , Goutam Mukherjee & R.K. Banerjee 1986
Physico-chemical character of Panchet reservoir in the context of industrial discharge- a preliminary study. *J. Inland Fish. Soc. India,* **18**(1) : 45-51.

Mukhopadhyay, M.K. & B.N. Saigal 1986
Distribution of *coscinodiscus grauii* and its possible use as bioindicator for demarcating salinity regime in the Hooghly estuary. *J. Inland Fish. Soc. India,* **18**(1) : 24-28.

Murugesan, V.K., C. Selvaraj & P.K. Aravindakshan 1990
Growth of major carps in Aliyar reservoir based on the recovery of marked fish. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 115-121.

Murugesan, V.K., P.K. Aravindakshan & C. Selvaraj 1988
An interesting case of tumour in *Cyprinus carpio* L. *Matsya, No.* **14** : 92-94.

Nandy, A.C., M.M. Bagchi, S.K. Mazumder & B.K. Saha 1990
Observations on the phytoplankton populations of the Hooghly estuary. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 159-164.

Naskar, K.R. & N.N. Mazumder 1990
Some fish poisonous plants from the Sunderbans mangrove ecosystem. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 184-188.

Pal, R.N. & Ajoy Kr. Ghosh 1990
Fish health protection in aquaculture operation. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 133-144.

Pandit, P.K. 1990
Bundh breeding of carps. *In* Technologies for Inland Fisheries Development. Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 29-36.

Patnaik, S. T. Ramaprabhu & K.M. Das 1988
Aquatic weed management in a fish culture tank. *J. Inland Fish soc. India, 20*(2) : 54-63.

Paul, S. 1990
Inland Fisheries - marketing and market intervention. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 203-207.

Paul, S. & V.V. Sugunan 1990
Development of reservoir fisheries areas of hopes and despair. *In* Reservoir Fisheries in India : Proceedings of the National Workshop on Reservoir Fisheries, 3-4 January 1990. Special Publication No. 3. Asian Fisheries Society, Indian Branch, Mangalore : 29-32.

Rahman, M.F. 1989
An incidence of cestode Ligula intestinalis (Linn.) in *Puntius dorsalis* (Jerdon). *J. Inland Fish. Soc. India*, **21**(1) : 62-63.

Rai, S.P. & R.C. Singh 1990
Potential of pen culture in oxbow lakes. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 97-100.

Ramakrishnaiah, M. 1990
Observations on different trophic phases in Nagarjunasagar, a tropical impoundment in Andhra Pradesh. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 80-84.

Rao, N.G.,S., M.F. Rahman & Salarjan 1991
Ichthyofauna of Vanivilas sagar Reservoir, Karnataka. *Curr. Res.*, **20 :** 15-16.

Saha, G.N. 1990
Managing wetlands - a case study of bheri fisheries in West Bengal. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 177-182.

Saha, G.N., S.K. Chatterjee & U. Bhaumik 1990
Mussoorie rock phosphate as direct fertilizer for fish pond - its efficasy as compared to single super phosphate. *Fertilizers News*, **35**(2) : 27-33.

Saigal, B.N. & M.K. Mukhopadhyay 1990
Estuarine fisheries resources of India and their conservation. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 183-188.

Selvaraj, C. & V.K. Murugesan 1990
Management techniques adopted for achieving a record fish yield from Aliyar reservoir, Tamil Nadu. *In* Reservoir Fisheries in India : Proceedings of the National Workshop on Reservoir Fisheries, 3-4 January 1990. Special Publication No. 3. Asian Fisheries Society, Indian Branch, Mangalore : 86-96.

Selvaraj, C., V.K. Murugesan & P.K. Aravindakshan 1990
Impact of stocking of advanced fingerlings on the fish yield from Aliyar reservoir. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 109-114.

Seth, R.N. , R.K. Tyagi & R.S. Panwar 1990
Toxicity of 2-Methoxy-Ethyl mercuric chloride copper sulphate and Mercuric chloride to freshwater snail *Viviparus bengalensis* (Swanson). *J. Environ. Biol. India,* **11**(3) : 263-267.

Sharma, V.K. 1990
Common carp fishery in relation to the Indian major carps and silver carp in the Govindsagar reservoir, and its impact on overall fish production of the reservoir. *In* Reservoir Fisheries in India : Proceedings of the National Workshop on Reservoir Fisheries, 3-4 January 1990. Special Publication No. 3. Asian Fisheries Society, Indian Branch, Mangalore : 82-85.

Shetty, H.P.C., M.C. Nandeesha & A.G. Jhingran 1989
Impact of exotic aquatic species in Indian waters. *In* Exotic Aquatic Organisms in Asia : Proceedings of the Workshop on Introduction of Exotic Aquatic Organisms in Asia. *Asian Fish. Soc. Special Publication 3,* Asian Fisheries Society, Manila, Philippines : 45-55.

Shree Prakash 1991
Studies on morphological variations in Ganga river prawn, *Macrobrachium choprai. J. Appl. Zool. Res.,* **2**(1).

Singh, D.N. 1989
Diel variations of certain physico-chemical parameters in McPherson lake, Allahabad. *Proc. Nat. Acad. Sci. India, B,* **59**(4) : 363-367.

Singh, D.N. 1990
Diurnal vertical migration of plankton in McPherson lake, Allahabad. *Proc. Nat. Acad. Sci.,* **6013** (2) : 141-147.

Singh, D.N. 1989
Studies on weed associated macrofauna of an ox-bow lake. *Proc. Nat. Acad. Sci. India,* **59**B (3) : 271-277.

Singh, D.N. 1990
Studies on the phytoplankton of McPherson lake, Allahabad. *Proc. Nat. Acad. Sci. India,* **60B**(3) : 237-243.

Singh, D.N. & Yadav, Y.S. 1990
Culture of airbreathing fishes in Assam. *Proc. Nat. Acad. Sci.,* **60B** (2) : 125-131.

Singh, Hardial 1989
Observations on minimum salinity tolerance and effect of sudden and gradual lowering of salinity on the survival of *Penaeus monodon* (FABR) larvae. *J. Inland Fish. Soc.*, **21**(1) : 58-61.

Singh, Hardial 1990
Seed collection and raising techniques of brackishwater fin fish and shellfish species. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 103-110.

Singh, H.P. 1990
Distribution and seasonal fluctuation of certain physico-chemical features in the Brahmaputra river. *J. Assam Sci. Soc.*, **32**(2) : 64-69.

Singh, H.P. 1990
Studies on thermal and chemical stratification of Govindsagar reservoir, Himachal Pradesh. *In* Contributions to the Fisheries of Inland Open Water Systems in India. Part 1. Ed. by Arun G. Jhingran, V.K. Unnithan & Amitabha Ghosh. *Inland Fisheries society of India, Barrackpore :* 171-176.

Singh, H.P. & S.N. Sharma 1990
Effect of herbicides on the uptake potential of nitrogen, phosphorus and potassium for aquatic weeds from farm ponds. *Proc. Nat. Acad. Sci. India*, **60B**(1) : 9-12.

Singh, H.P. & S.N. Sharma 1989
Studies on persistence of herbicides in pond water. *Proc. Nat. Acad. Sci. India*, **59B**(4) : 369-372.

Singh, S.N. 1988
Evaluation of macro-benthic community through species diversity index in Kanti Oxbow Lake, Muzaffarpur, Bihar. *J. Inland Fish. Soc. India*, **20**(2) : 30-34.

Sugunan, V.V. 1990
Reservoir fisheries management. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 155-165.

Tyagi, R.K. & S.K. Bhattacharya 1989
A note on the MVU estimation of reliability for the Maxwell failure distribution. *Estadistica*, **41**(137) : 73-79.

Tyagi, R.K. & S.K. Bhattarcharya 1990
Bayesiun approach to discrete reliability analysis. Proceedings of the Second Biennial Conference, Allahabad, Mathematical Society, Allahabad Statistics Section : 23-28.

Tyagi, R.K., & S.K. Bhattacharya 1990
Bayesian life testing and reliability estimation for exponential model. Proceedings of the Second Biennial Conference, Allahabad, Mathematical Society, Allahabad Statistics Section : 1-7.

Unnithan, V.K. & G.K. vinci 1990
Prospects of snail farming in India and its economic consideration. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 145-153.

Vass, K.K. 1990
Pen and cage culture in open waters. *In* Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 93-101.

Vinci, G.K., V.K. Unnithan & V.V. Sugunan 1990
Manual on farming, processing and marketing of giant African snail, *Achatina fulica*, CICFRI, Barrackpore & MPEDA, Calcutta, 1990. 35 p.

Vinci, G.K., V.V. Sugunan & V.K. Unnithan 1991
Farming and export potential of the snail *Achatina fulica* Bowdich. In Aquaculture Productivity Ed. by V.R.P. Sinha & H.C. Srivastava, *Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi*, 295-306.

Wishard, S.K., M.Y. Kamal & P. N. Jaitly 1986
Influence of running water condition on the breeding of Indian major carps. *J. Inland Fish. Soc. India*, **18**(1) : 34-40.

Yadava, Y.S. 1990
Fisheries of the flood plain lakes : a management perspectives. In Technologies for Inland Fisheries Development Ed. by V.V. Sugunan & Utpal Bhaumik, CICFRI, Barrackpore 1990 : 167-175.

PERSONNEL

The following scientists rendered their services to the Institute during the period April 1990 to March 1991.

Dr. Arun G. Jhingran, Director, Barrackpore

RIVERINE DIVISION

Allahabad Centre

Dr. Y. Rama Rao, Principal Scientist
Shri Ravish Chandra, -do-
Dr. S.K. Wishard, Scientist (SG)
Shri R.K. Saxena, -do-
Shri G.N. Srivastava, -do-
Dr. D.N. Singh, -do-
Shri Balbir Singh, -do-
Shri R.K. Dwivedi, -do-
Dr. M.A. Khan, -do-
Dr. H.P. Singh, -do-
Shri R.K. Tyagi, -do-
Shri P.K. Katiha, Scientist

Lalgola Centre

Shri A.R. Chaudhury, Scientist

Guwahati Centre

Shri K.P. Srivastava, Scientist (SG)
Shri S.N. Mehrotra, -do-
Shri D.K. Choudhury, -do- (upto 31.1.1991)
Dr. M. Choudhury, Scientist (Sr. Sc.)

Patna Centre

Shri S.P. Singh, Principal Scientist
Dr. B.C. Jha, Scientist (SG)
Dr. V.R. Chitranshi, -do-
Dr. V. Pathak, -do-
Shri R.N. Seth, -do-
Dr. P.N. Jaitly, Scientist

Agra Centre

Shri D.N. Mishra, Scientist (SG)
Dr. (Ms.) Usha Moza, -do-
Dr. K. Chandra, -do-
Shri Shree Prakash, -do-
Shri V. Kolekar, Scientist

LACUSTRINE DIVISION

Bangalore Centre

Shri Ch. Gopalakrishnayya, Principal Scientist
Dr. D.S. Krishna Rao, Scientist (SG)
Dr. M. Ramakrishnaiah, -do-
Dr. A.K. Laal, -do-
Shri P.K. Sukumaran, Scientist (Sr. Sc.)
Shri M. Karthikeyan, Scientist
Shri A. Hazra, Scientist

Eluru Centre

Dr. R.S. Panwar, Principal Scientist
Dr. K.V. Rao, Scientist (SG)
Dr. J.B. Rao, -do-

Coimbatore Centre

Shri C. Selvaraj, Principal Scientist
Shri V.K. Murugesan, Scientist (SG)

Pune Centre

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

Raipur Centre

Dr. V.R. Desai, Principal Scientist
Dr. D. Kumar, Scientist (SG)
Dr. N.P. Srivastava, Scientist (Sr. Sc.)

Kangra Centre

Shri G.K. Bhatnagar, Principal Scientist
Dr. D.K. Kaushal, Scientist (SG)
Dr. V.K. Sharma, Scientist (Sr. Sc.)

ESTUARINE DIVISION

Barrackpore Centre

Dr. B.N. Saigal, Principal Scientist (Head) upto 31.7.1990.
Shri R.N. Pal, Principal Scientist
Dr. M.K. Mukhopadhyay, Scientist (SG)
Dr. H.C. Joshi, -do-
Shri M.M. Bagchi, -do-
Dr. R.K. Das, -do-
Shri P.M. Mitra, -do-
Dr. M.K. Das, -do-
Dr. D.K. De, -do-
Shri A. Mukherjee, -do-
Dr. Babulal, -do-

Vadodara Centre

Dr. D. Nath, Scientist (SG)
Dr. S.N. Singh, -do-
Shri G.C. Laha, Scientist (Sr. Sc.)
Shri S.K. Sarkar, -do-

Calcutta Centre

Shri G.N. Saha, Principal Scientist
Shri A.C. Nandy, S-3
Dr. A.K. Ghosh, S-3
Dr. R.K. Banerjee, Scientist (SG)
Dr. K.R. Naskar, -do-
Shri H.C. Karmakar, -do-
Shri S.C. Thakurta, -do- (upto 31.10.1990)

Canning Centre

Shri S.N. Dutta, Scientist (SG)

BRACKISHWATER IMPOUNDMENT SECTION, Barrackpore

Shri Apurba Ghosh, Principal Scientist
Dr. Y.S. Yadava, Scientist (SG)
Dr. Amitabha Ghosh, -do-
Shri P.K. Chakraborty, -do-

OTHER CENTRES/SECTIONS AT BARRACKPORE

Inland Molluscs Section

Dr. V.V. Sugunan, Scientist (SG)
Ms. G.K. Vinci, -do-
Dr. V.K. Unnithan, -do-

Beel Fisheries Section

Dr.K. K. Vass, Principal Scientist
Dr.(Ms.) Krishna Mitra, Scientist (SG)

Extension Section

Shri U. Bhaumick, Scientist (SG)
Shri P.K. Pandit, -do-

Engineering Section

Shri A. B. Mukherjee, Principal Scientist

Economics Section

Shri S. Paul, Scientist (SG)

Central Sector Scheme for Inland Fisheries Statistics

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

Krishi Vigyan Kentra, Kakdwip

Shri J.G. Chatterjee, Scientist (SG)

Scientists & staff on Deputation/Lien

Shri M. F. Rahman, T-5, Karnataka Power Corporation Ltd., Bangalore.

Shri B.C. Bhattacharjee, Assistant, Inland Fisheries Training Centre (CIFE), Barrackpore.

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

Sr.R.A.

Shri S. N. Sar

T-7

Dr. A.K. Chattopadhyaya

T-6

Shri J. Ghosh
Shri S.K. Sadhukhan
Ms. Mira Sen

T-5

Shri Ramchandra
Shri A.K. Roy
Shri P.S.C. Bose
Shri R.N. De
Shri R.C. Singh
Shri A.R. Mazumder
Ms. Anjali De
Shri P.K. Ghosh
Shri S.K. Das
Shri N.K. Srivastava,
Shri K.S. Rao
Shri T.S. Rama Raju
Shri R.C. Satapati
Shri K.K. Agarwal
Shri R.C. Mandy
Shri Sanjoy Bhowmick
Md. T.K. Syed Shakul Hameed
Shri R.R. Mukherjee

T-4

Shri A.R. Paul
Shri K.S. Banerjee
Shri D.N. Srivastava
Shri B.D. Saroj
Shri Alok Sarkar
Shri N.N. Mazumdar
Shri S.P. Ghosh
Shri N.C. Mondal
Shri H.K. Sen
Shri P. Dasgupta
Shri Sukumar Saha
Ms. Dipti Manna
Shri C.N. Mukherjee
Ms. Satnam Kaur
Shri Ladu Ram Mahabhar

T-II-3

Shri J.P. Mishra
Shri H. Chaklader
Shri Amiya Kr. Banerjee
Shri Fatik Manna
Shri Ramji Tiwari
Shri Camil Lakra
Shri M.P. Singh
Shri S.K. Srivastava
Shri D.K. Biswas
Shri T. Chatterjee
Shri Pintu Biswas
Shri B.K. Biswas
Shri H.C. Banik
Ms. Keya Saha
Ms. Arati Das
Ms. K. Sucheta Majumder
Shri B.B. Das
Shri Swapan Kr. Chatterjee
Shri Sushil Kumar

T-I-3

Shri D. Sanfui
Shri A.K. Banerjee
Shri Donald Singh
Shri M.M. Das
Shri S.N. Sadhukhan
Shri Swapan Chatterjee
Shri K.P. Singh
Shri R.K. Halder
Shri T.P. Ghosh
Shri C.R. Das
Shri A.K. Majumder

T-2

Shri D. Chatterjee
Ms. Rina Basak
Shri B.N. Das
Shri P. Rajani
Shri Bhai Lal
Shri A. Mitra
Shri C.K. Vava
Ms. Abhijita Sengupta
Shri G.N. Burman (up to 31.8.1990)

T-I

Shri Prahlad Singh
Shri L.K. Parbat
Shri D. Saha
Shri S. Bandopadhyay
Shri C.G. Rao
Shri S. Kottaiah
Shri Atanu Das
Shri H.L. Biswas
Shri S.N. Chakki
Shri A.K. Barui
Shri Hiralal Biswas
Shri K.K. Das
Shri H.K. Routh
Ms. Shuvra Das
Shri S.K. Chakraborty
Shri N.K. Saha
Shri Rajesh Kumar Sah
Shri Sakshi Gopal Biswas
Shri S.G. Biswas
Shri Ashis Roy Chowdhury

Auxiliary

Shri P.R. Rao, Hindi Translator
Shri Swapan Kr. Das, Time Keeper
Shri G.N. Burman, Mike Operator
Shri S.K. Biswas, Carpenter
Shri S.K. Dev, Plumber
Shri K.L. Chakraborty, Sr. Gestetner Operator
Shri J.L. Bose, Sr. Gestetner Operator
Shri S.C. Bhowmick, Sr. Gestetner Operator
Shri Mool Chand Raikwar, Sr. Gestetner Operator
Shri M.C. Raikwar, Sr. Gestetnar Operator
Shri D. Bergyoary, Driver
Shri K. Ganesan, Driver
Shri K.L. Das, Driver
Shri Kanchan Datta, Driver
Shri U.K. Chatterjee, Driver
Shri R.L. Balmiki, Driver
Shri S. Bahadur, Driver
Shri Badal Lal Singh, Driver
Shri V.G. Dhindore, Driver
Shri N.C. Biswas, Driver
Shri K.R. Deb, Driver
Shri Kishan Deo, Driver
Shri Ranjit Singh, Driver
Shri M.C. Paul, Driver
Shri Virendra Kumar, Driver
Shri Ram Prasad, Driver
Shri Sunder Singh, Driver
Shri Arun Kumar Mondal, Driver
Shri Subhendu Mondal, Boat Driver
Shri R.M. Roy (Retd. & Expired)
Shri Saradindu Chakraborty, Sstsnh
Shri A.K. Goswami, Driver
Shri P. Ramalingeswara Rao, Driver
Shri Suklal Bairagi, Pump Man

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

Senior Administrative Officer

(Vacant)

Accounts Officer

Shri J.R. Verma

Administrative Officer

(Vacant)

Assistant Administrative Officer

Shri A.K. Sengupta
Shri B.C. Dutta

P.A. to Director

Shri G. Lahiri

Senior Stenographer

Shri R.C. Srivastava

Superintendent

Shri M.R. Roy
Shri N.K. Sarkar
Shri N.H. Baidya (upto 30.6.1990)
Shri T.P. Das
Shri S. Dasgupta
Shri Ranjit Kr. Ghosh (A & A)
Shri Mahesh Prasad (KVK)

Assistant

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

Stenographer

Shri U.K. Ghosh
Shri T.K. Roy
Shri S. Bhattacharjee

Senior Clerk

Shri T.K. Sreedharan
Shri L.P. Mishra
Shri Baij Nath
Shri Keshab Prasad
Shri H.K. Nath
Shri J.N. Banerjee
Shri S.K. Sarkar
Shri D.N. Baidya
Shri S.R. Halder
Shri H.L. Sarkar
Shri B.B. Mukherjee
Shri B.C. Mazumdar
Shri S. Bhowmick
Shri M.K. Das
Shri D.K. De Sarkar
Shri A.B. Biswas
Shri Samir Kr. Roy
Shri S.B. Roy
Shri H.B. Sutar
Shri T.K. Mazumder
Shri Kalu Singh
Shri S.S. Sinha
Shri Surendra Kumar
Shri M.L. Biswas
Ms. Sikha Mazumder
Shri Biswanasth Sah
Shri P. Lahiri

Junior Stenographer

Ms. G. Vinoda Lakshmi
Ms. Jolly Saha

Junior Clerk

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

Shri Brahmapal Balmiki
Shri S. Karmakar
Shri Sukumar Sarkar
Shri A.K. Dey
Shri M.K. Joardar
Shri S.K. Ghosh
Shri A. D. Sinde

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

Supporting Grade IV

Shri R.L. Raikwar
Shri J.M. Kujur
Shri H.B. Lama
Shri Antiram Das
Shri H.K. Das
Shri T.K. Biswas
Shri Sunil Kr. Das
Shri M.S. Burman
Shri Mewa Lal
Shri H.K. Pramanick
Shri Nar Bahadur
Shri Sitaram Balmiki
Shri A.M. Patra
Shri B. Prakash
Shri D.D. Poudel

Supporting Grade III

Shri J.N. Biswas
Shri S.C. Balmiki
Shri P. Sayalu
Shri S.P. Yadav
Shri B.N. Mondal
Shri R.N. Tar
Shri Laluram Balmiki
Shri B.B. Das
Shri Balaram Bhanja
Shri S.N. Burman
Shri G.C. Mondal
Shri Jungli
Shri Jugal Kishore
Shri S.K. Boral
Shri Tek Bahadur
Shri H.S. Burman
Shri S.S. Burman
Shri Munshi Ram Balmiki
Shri L. Samulu
Shri Bhim Bahadur
Shri K.L. Balmiki
Shri N.L. Das
Shri H.K. Burman
Shri Ram Sunder
Shri J. Khalko
Shri C.P. Singh

Supporting Grade II

Shri Munnilal Mallah
Shri Maha Singh
Shri Dukhharan Sahani
Shri Laxmi Ram
Shri Suraj Bahadur
Shri B.N. Mondal
Shri Rajendra Ram
Shri A. Sahani
Shri C.P. Singh
Shri K.D. Raju
Shri P. Seshanna
Shri P.C. Bez
Shri D.C. Das
Shri B.C. Das
Shri B. Hazarika
Shri P.C. Kachari
Shri A.L. Yadav
Shri Parameswar
Shri S. Mahendra
Shri M.L. Saha
Shri J. Mukhia
Shri A.K. Biswas
Shri Khemchand Balmiki
Shri L.K. Halder
Shri A.C. Ghosh
Shri J.N. Mallah
Shri Gulab Shaw
Shri Subrahmani
Shri M. Mahadeva
Shri K. Ningigowda
Shri S.T. Gavate
Shri S. Mahendran
Shri V. Mariappan
Shri A. Ramaswamy
Shri M.V. Krishnan
Shri K. Kalianan
Shri Ram Prasad
Shri Karam Raj
Shri Satyendra Burman
Shri Lalta Prasad
Shri Sita
Shri Rajdhari Mallah

Shri Sukchand Biswas
Shri Bideshi Lal
Shri B. Pugalendhi
Shri Om Prakash
Shri M.P. Bind
Shri A. Gangaiah
Shri K. Bahadur
Shri A. Biswas
Shri R. Palaneswami
Shri K.K. Dhir
Shri A. Murugesan
Shri S.S. Bondre
Shri B.N. Krishnappa
Shri Gunadhar Dhibar,(Ad-hoc)

Supporting Grade I

Shri Lakshmi Ram
Md. Yusuf Dar
Shri Suresh Kumar
Shri Umesh Chowdhury
Shri Kuldeep Singh
Ms. Bimla Devi
Shri Kawalpati Ram
Shri Mahadev Panika
Shri N. Rajak
Shri Suresh Rajak
Shri R.U. Muchi
Shri A. Kistaiah
Shri U. Satyanarayana
Shri S. Jaan
Shri P. Atchaiah
Shri S. Kalita
Shri N. Deka
Shri Khagen Ch. Das
Shri Bhabalu Boro
Shri Jai Ram Prasad
Ms. Godhuli Mondal
Ms. Mina Rani Bahadur
Ms. Mina Biswas
Ms. B. Balmiki
Shri K.C. Malakar
Shri H.P. Bhanja
Shri T. Ghosh
Shri Sankar Bose
Shri Muktipada Das
Shri Kharban Kumar
Shri Man Bahadur
Shri S.L. Bairagi
Shri Bhaskar Sardar
Shri Pasupati Ghosh
Shri Jagdish Balmiki
Shri S. Banerjee
Shri Sibu Lal Das
Shri S.C. Sadhukhan
Shri Dipak Chakraborty
Shri Biswanath Bose
Shri Ananta Kr. Bhanja
Shri Rabi Kr. Sardar
Shri Lal Bahadur
Shri Dilip Kr. Das
Ms. B. Sakuntala
Shri Mohan Lal Sarkar
Ms. Hemlata Halder
Shri Balkishen Balmiki
Shri S.N. Nan
Shri Mahendra Balmiki
Shri Ullas Naik
Ms. Rupali Chatterjee
Shri Ashok Kr. Dey
Shri Ganesh Ch. Paramanick
Shri Iswarram Balmiki
Ms. Anjali Dutta
Shri Bharat Kr. Halder
Shri Anil Ch. Das
Shri S. Guin
Shri P. Singh
Shri D. Singh
Shri Atiullah
Shri Sitla Prasad
Ms. Kamal Devi
Shri M. Anjanappa
Shri G.J. Roundale
Shri M.S. Bhoi
Shri T.H. Ghume
Shri K. Subbaiya
Shri R. Nagraj
Shri S. Govindarajan
Shri K. Subramahnaiyan
Shri Gopal Chand
Ms. Kalosasi Mondal
Shri G. Lal
Shri Sree Nath
Shri A.C. Biswas
Shri R.D. Chaudhury
Sk. Monsur Ali
Shri S.K. Chakraborty
Shri Prasidh Sahani
Shri Amar Nath Prasad
Shri Umashankar Ram
Shri P.C. Paramanick
Shri Prakash Ch. Paramanick
Shri N.K. Das
Shri Joydev Patra
Shri A. Bhattacharjee
Shri K. Kumar
Ms. Dharamaya
Shri M. Mutta
Shri Basudev Gharami

Shri T.K. Gayen
Shri B.P. Samanta
Shri B.P. Mishra
Shri R.P. Halder
Shri N.T. Dolui
Shri Gour Gharami
Shri M.C. Gharanu
Shri C. Muniappa
Shri T.K. Halder
Shri Ganesh Chandra Burman

Shri Ranjit Kumar Roy
Shri M.C. Das
Shri P.N. Rao
Shri Sitaram Nisad
Shri M. Pannappa
Shri Appa Rao
Shri K. Mohanan
Shri Bablu Mondal
Sk. Abdullah
Shri M. Nobi
Ms. Sibani Roy

PROMOTIONS

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

Name	Designation	Promoted to	With effect from
Shri A.C. Nandy	S-2	S-3	1.1.1986
Dr.A.K. Ghosh	S-2	S-3	1.1.1986
Dr. N.P. Srivastava	S-1	S-2	1.1.1986
Shri B.K. Singh	S-1	S-2	1.1.1986
Shri P.K. Sukumaran	S-1	S-2	1.1.1986
Dr. V.K. Sharma	S-1	S-2	1.1.1986
Shri S.K. Sarkar	S-1	S-2	1.1.1986
Shri G.C. Laha	S-1	S-2	1.1.1986
Dr. M. Choudhuri	S-1	S-2	1.1.1986
Shri K.L. Shah (retired)		(2 increments)	
Shri A.R. Choudhury		(3 increments)	
Shri B. C. Datta	Superintendent	Asst. Adm. Officer	2.7.1990
Shri T.P. Das	Assistant	Superintendent	17.8.1990
Shri S. Dasgupta	-do-	-do- (Ad-hoc)	22.5.1990
Shri Mahesh Prasad	-do-	-do- (Ad-hoc)	17.8.1990
Shri Ranjit Kr. Ghosh	Senior Clerk	-do- (A&A) (Ad-hoc)	17.8.1990
Shri N.K. Mitra	Senior Clerk	Assistant	25.4.1990
Shri S.K. Kar	-do-	-do- (Ad-hoc)	25.4.1990
Shri J.C. Patra	-do-	-do- (Ad-hoc)	22.5.1990
Shri M. Kachhap	-do-	-do-	17.8.1990
Shri Surendra Kumar	Junior Clerk	Senior Clerk	25.4.1990
Shri M.L. Biswas	-do-	-do-	17.8.1990
Ms. Sikha Majumder	-do-	-do- (Ad-hoc)	22.5.1990
Shri B.N. Sah	-do-	-do-	17.8.1990
Shri P. Lahiri	-do-	-do- (Ad-hoc)	17.8.1990
Shri D.D. Paudal	SSG-III	SSG-IV	17.8.1990
Shri C.P. Singh	SSG-II	SSG-III	17.8.1990
Shri P.C. Kachari	-do-	-do-	6.12.1990
Shri B.N. Krishnappa	SSG-I	SSG-II	17.8.1990
Shri S.S. Bondre	-do-	-do-	6.7.1990
Shri Gunadhar Dhibar	-do-	-do- (Ad-hoc)	6.12.1990
Ms. Mira Sen	T-6	T-7	1.7.1989
Shri Alok Sarkar	T-4	T-5	1.1.1988
Shri Sukumar Saha	-do-	-do-	1.7.1988
Shri A.R. Paul	-do-	-do-	1.7.1990
Shri H.K. Sen	-do-	-do-	1.7.1990
Shri S.P. Ghosh	-do-	-do-	1.7.1990
Shri B.D. Saroj	-do-	-do-	1.7.1990
Shri D.N. Srivastava	-do-	-do-	1.7.1990
Shri N.N. Majumder	-do-	-do-	1.7.1990
Shri N.C. Mondal	-do-	-do-	1.7.1990
Shri K.S. Banerjee	-do-	-do-	1.7.1990
Shri S.K. Deb	-do-	-do-	1.7.1989

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

Name	Designation	Merit increments	With effect from
Shri S.K. Sadhukhan	T-6	Three	1.7.1989
Shri R.C. Singh	T-5	One	1.1.1990
Shri Gautam Pathak	T-5	Two	1.1.1990
Shri P.K. Ghosh	T-5	One	1.1.1990
Shri S.K. Das	T-5	One	1.1.1990
Ms. Dipti Sett	T-4	One	1.7.1989
Shri A.K. Banerjee	T-I-3	Three	1.7.1990
Shri K.L. Das	T-I-3	Two	1.1.1990

Retirement during the period

Name	Designation	Date of Retirement
Dr. B.N. Saigal	Principal Scientist	31.7.1990
Shri D.K. Choudhury	Scientist (SG)	31.1.1991
Shri S.C. Thakurta	Scientist (SG)	31.10.1990
Shri A.K. Sengupta	Asst. Adm. Officer	31.3.1991
Shri N.H. Baidya	Superintendent (KVK)	30.6.1990
Shri G.N. Burman	T-2	31.8.1990

Appointments

Following appointments were made during the period

Name	Designation	Place of posting	Date of appointment
Shri R.R. Mukherjee	T-5	Bangalore	18..5.1990
Ms. Abhijita Sengupta	T-2	Calcutta	27.8.1990
Shri Ashis Roy Chowdhury	T-1	Patna	27.8.1990
Shri N. Appa Rao	SSG-I	Bangalore	3.4.1990
Shri K. Mohanan	-do-	-do-	3.4.1990
Shri M. Pannappa	-do-	-do-	30.3.1990
Shri Bablu Mondal	-do-	Kangra	1.8.1990
Sk. Abdullah	-do-	-do-	1.8.1990
Shri M. Mari	-do-	Bangalore	23.11.1990
Ms. Sibani Roy	-do-	Barrackpore	21.2.1991
Shri P. Ramalingeswara Rao	Driver (Aux.)	Eluru	10.9.1990
Shri Suklal Bairagi	Pump Man (Aux.) 24.12.1990 (Ad-hoc)		Barrackpore

Transfers

The following members of CICFRI were transferred during the period April 1990 to March 1991.

Name	Designation	From	To
Shri G.K. Bhatnagar	Principal Scientist	Bilaspur	Kangra
Dr. D.K. Kausal	Scientist (SG)	-do-	-do-
Dr. V.K. Sharma	Scientist	-do-	-do-
Dr. K.R. Naskar	Scientist (SG)	Barrackpore	Calcutta
Shri K.P. Srivastava	-do-	Patna	Guwahati
Dr. M. Choudhury	-do-	Bangalore	Guwahati
Shri S.C. Karmakar	-do-	Barrackpore	Calcutta
Shri S.P. Singh	Principal Scientist	Guwahati	Patna
Dr. M. Ramakrishniah	Scientist (SG)	Eluru	Bangalore
Shri R.N. Seth	-do-	Coimbatore	Patna
Dr. A.K. Ghosh	Principal Scientist	Barrackpore	Calcutta
Shri Ambika Lal	Junior Clerk	Allahabad	Bangalore
Shri Moloy Joardar	-do-	Barrackpore	Calcutta
Shri Sushil Kumar	T-II-3	Bilaspur	Kangra
Shri O.M. Prakash	SSG-II	-do-	-do-
Shri Kuldip Singh	SSG-II	-do-	-do-
Shri Sitala Prasad	SSG-I	-do-	-do-
Ms. Kamala Devi	-do-	-do-	-do-
Shri Gangaiah	SSG-II	Eluru	Dumpagadopa (under Eluru)
Shri A. Kistaiah	SSG-I	Dumpagadopa	Eluru
Shri Suresh Singh	T-II-3	IFOT, Lucknow	CIFRI, Agra
Shri Satya Prakash	SSG-II	-do-	-do-
Shri S.K. Srivastava	T-II-3	Patna	Pune
Shri P. Rajani	T-2	Bangalore	Patna
Shri A. K. Goswami	Driver	KVK, Kakdwip	Barrackpore
Shri Swapan Kr. Gayen	SSG-I	Lalgola	Calcutta
Shri K.R. Deb	T-II-3	Barrackpore	Calcutta
Shri Amoy Barui	T-1	Barrackpore	Calcutta
Shri A.M. Patra	SSG-IV	Barrackpore	Calcutta
Shri K.P. Singh	T-I-3	Canning	Farakka
Shri B.N. Mondal	SSG-III	-do-	-do-
Shri Ranji Tewari	T-II-3	Agra	Allahabad
Shri Iswar Ram Balmiki	SSG-I	Barrackpore	Calcutta
Shri Arunava Mitra	T-2	-do-	-do-
Ms. Rina Naiya	T-2	-do-	-do-

वार्षिक रिपोर्ट 1990–91
केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान (मा.कृ.अनु.प.) बैरकपुर : पश्चिम बंगाल

संक्षिप्त इतिहास

भारत सरकार ने सन् 1943 में अपने एक ज्ञापन में देश की मात्स्यकी स्त्रोतों के विकास हेतु एक केन्द्रीय विभाग की स्थापना पर विशेष बल दिया था । तत्पश्चात् कृषि वानिकी तथा मात्स्यकी से संबंधित केन्द्रीय सरकार नीति-समिति की मात्स्यकी उप-समिति ने इस विषय का पृष्ठाकंन किया था । इसके आधार पर 17 मार्च सन् 1947 में भारत सरकार के खाद्य व कृषि मंत्रालय के अधीन कलकत्ता में केन्द्रीय अंतर्स्थलीय मात्स्यकी अनुसंधान केन्द्र की स्थापना हुई। एक अन्तरिम योजना के रूप में प्रवर्तित यह अब अंतर्स्थलीय मात्स्यकी क्षेत्र में एक प्रमुख अनुसंधान संस्थान बन गया है । यह केन्द्र सन् 1959 में एक अनुसंधान संस्थान का पूर्ण रूप ग्रहण कर बैरकपुर स्थित अपने निजी भवन में स्थानांतरित हो गया । सन् 1967 से यह संस्थान भारतीय कृषि अनुसंधान परिषद (आइ.सी.ए.आर.) के प्रशासनिक प्रबंध में है । इस संस्थान का मुख्य उद्देश्य देश के मात्स्यकी स्त्रोतों के उचित मूल्यांकन हेतु अन्वेषण करना तथा इनके संरक्षण और समुचित उपयोग के लिए उपयुक्त पद्धतियों को विकसित करना है । उक्त उद्देश्य की पूर्ति के दौरान इस संस्थान ने अपने अनुसंधानात्मक प्रयासों द्वारा विभिन्न प्रकार के जल-स्त्रोतों जैसेः नदी, ज्वारनदमुख, सरोवर, तालाब, जलाशय और चापझील के पर्यावरण तथा उत्पादन क्रियाशीलताओं को सुलझाने का प्रयास किया है । इन अध्ययनों द्वारा विभिन्न प्रकार के वातावरण में जलीय पारिस्थितिक तंत्र की जटिल पोषी संरचना तथा प्रकार्यों को सुलझाया गया है। संस्थान के अधिदेश में उचित परिवर्तन कर देश के प्रग्रहण मात्स्यकी स्त्रोतों पर विशेष ध्यान दिया गया तथा 1.4.87 से संस्थान का नामकरण केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान किया गया । पुनर्प्रतिष्ठित के.अ.प्र.मा.अनु.संस्थान को उन उन्मुक्त जल क्षेत्रों में अनुसंधान कार्य करने का दायित्व सौंपा गया है जहाँ मात्स्यकी प्रबंध प्रणाली पर्यावरणीय अनुमापन तथा संरक्षण से संबद्ध है ।

अधिदेश

प्राकृतिक एवं मनुष्य द्वारा निर्मित अंतर्स्थलीय जल-स्त्रोतों में संग्रहण, उचित समुपयोजन एवं संरक्षण द्वारा मछली उत्पादन में वृद्धि के लिए अनुसंधान करने हेतु इस संस्थान की स्थापना की गई है ।

संगठन

उक्त उद्देश्यों की प्राप्ति हेतु संस्थान के अनुसंधान कार्य को देश के मुख्य मात्स्यकी स्त्रोतों के अनुरूप तीन प्रभागों के अंतर्गत रखा गया है । नदीय प्रभाग अपने इलाहाबाद स्थित मुख्यालय से देश के नदीय मात्स्यकी स्त्रोतों की समग्रबंध पद्धतियों को विकसित करने के लिए, नदीय-पर्यावरण के संरक्षण में आवश्यक ध्यान देते हुए कार्य कर रहा है । गंगा, यमुना, ब्रह्मपुत्र और नर्मदा नदियाँ इस प्रभाग की मुख्य अनुसंधान परियोजनाओं के अंतर्गत आती हैं । सरोवरीय प्रभाग का मुख्यालय बैंगलूर में है तथा इसके केन्द्र तमिलनाडु, आन्ध्रप्रदेश, उत्तर प्रदेश, मध्य प्रदेश, हिमाचल प्रदेश और महाराष्ट्र में हैं । इसके अन्वेषणों का लक्ष्य बड़े तालाबों, सरोवरों और जलाशयों में मत्स्य उत्पादन बढ़ाने हेतु प्रबंध प्रणालियों को विकसित करना है । बैरकपुर स्थित ज्वारनदमुखी प्रभाग पूरे हुगली-मातलाह ज्वारनदमुखी तंत्र और नर्मदा ज्वारनदमुखी क्षेत्र में विभिन्न अनुसंधान योजनाओं का संचालन कर रहा है । औद्योगिक केन्द्रों के बहिस्त्राव तथा कृषीय और नगरीय अपरद्द पदार्थों के प्रवाह के कारण हुगली ज्वारनदमुखी क्षेत्र को गंगा नदीय तंत्र के अत्यधिक प्रदूषित क्षेत्रों में एक माना जा रहा है । ज्वारनदमुखी प्रभाग ने इस प्रदूषित क्षेत्र में उल्लेखनीय कार्य किया है । ज्वारनदमुखी मछलियों में महत्वपूर्ण मछली हिल्सा पर गहन अनुसंधान कार्य चल रहा है । यह संस्थान पश्चिम बंगाल और असम की बीलों और गन्डक बेसिन की चापझीलों पर भी अनुसंधानात्मक कार्य कर रहा है । इनके अतिरिक्त विवृत्त जल क्षेत्रों में केज तथा पेन कल्चर, अंतर्स्थलीय घोंघों की पारिस्थितिकी एवं उत्पादन प्रक्रिया, हाइड्रालिक संरचनाओं से मत्स्य पारगमन के अभियात्रिक पहलुओं तथा मात्स्यकी के आर्थिक व सांख्यिकी विषयों पर भी अनुसंधान कार्य हो रहा है । इस संस्थान के अनुसंधान कार्य को 20 अनुसंधान परियोजनाओं तथा एक केन्द्रीय सेक्टर योजना में विभाजित किया गया है ।

मुख्य उपलब्धियाँ

हिल्सा पलायन संबंधी अध्ययन

ज्वारनदमुखी प्रभाग द्वारा हाल ही में किए गए अध्ययनों से फरक्का बाँध के पार हिल्सा मछलियाँ ऊर्ध्व प्रवाह की ओर पलायन करने के संकेत मिले हैं । मानसून ऋतु के दौरान प्राप्त हिल्सा मछलियों के बच्चों का परिमाण 15 से 35 कि. ग्रा. प्रति दिन आंका गया है । इन किशोर अवस्थावाली मछलियों की लम्बाई 65-218 मि.मी. व परिमाण 1.96 से 98.50 ग्रा. के बीच रही । इस उपज दर व परिमाण की विभिन्नता से हिल्सा मछलियों की प्रजनन काल में ऊर्ध्व प्रवाह की ओर पलायन की सम्भावना की पुष्टि होती है । यह पलायन मानसून के बाढ़ जल की रिहाई के साथ होता है ।

हिल्सा मछलियों का कृत्रिम निषेचन

फरक्का में इस वर्ष भी हिल्सा मछलियाँ, *तेन्युलोसा ईलिशा* की कृत्रिम निषेचन व संवर्धन का कार्य जारी रखा गया है । इस कार्य से निम्नलिखित विषयों पर प्रकाश डाला गया है।

1. हैचरी के नए मॉडल का निर्माण करना
2. विशेष रूप से तैयार किए गए हिल्सा नर्सरी में जीरों का संवर्धन करना
3. हिल्सा जीरों की अतिजीविता में थाइरोक्जाइन की भूमिका के पुष्ठिकरण की दिशा में अनुकूल संकेत ।

हिल्सा अंड निषेचन हैचरी की नई रूप रेखा

हैचरी : इस वर्ष फरक्का में हिल्सा प्रजनन काल के दौरान एक सुवाह्य निषेचन व संवर्धन युनिट की रूप रेखा तैयार कर स्थापित की गई । इस नए युनिट को सरक्युलर ग्रिड हैचरी नाम दिया गया । यह हैचरी एक वृत्ताकार प्लासटिक पूल (4'व्यास एवं 3' ऊँचाई) से बनी है, जिसमें घूमनेवाला छिडकाव यंत्र पानी का नियंत्रण करता है । इस ढाँचे के निचले भाग में 1.8 मि.मी. जाल एवं अन्य भाग में 2 मि.मी. वाली जाल लगी होती है ।

प्रचालन : हैचरी के प्रचालन हेतु प्लासटिक पूल के भीतरी भाग में मारकिन कपड़े का ह्रपा लगाया जाता है । छिड़काव यंत्र को प्लासटिक पूल की निछली सतह पर रखा जाता है एवं इस यंत्र को ऊपर बने एक प्लासटिक पूल से पाइप द्वारा जोड़ा जाता है । प्लासटिक पूल में पानी भरने के बाद, पानी की सतह से 6 इंच नीचे वृत्ताकार ढ़ाँचा रखा जाता है । इस प्रकार के प्रत्येक युनिट में डेढ़ लाख अंडों की क्षमता होती है । अंडों को ढांचे में रखकर नीचे लगे छिड़काव यंत्र की सहायता से मन्द गति से जल प्रवाह को संचालित किया जाता है । जल का औसतन तापमान 28 डिग्री से.ग्रे. होने पर 18 से 21 घंटों में अंडों का प्रस्फुटन हो जाता है एवं डिम्बक ढाँचे से निकलकर प्लासटिक पूल में पहुँच जाते हैं । तत्पश्चात अंडों के खोल आदि के साथ ढाँचे को प्लासटिक पूल से निकाल लिया जाता है ।

हिल्सा जीरों की अतिजीविता पर थाइरोक्जाइन का प्रभाव

हिल्सा डिंभकों की अतिजीविता पर थाइरोक्जाइन के प्रभाव के मूल्यांकन हेतु प्राथमिक तौर पर प्रयोग किया गया । दो दिन आयुवाली 500 हिल्सा जीरों को संग्रहित कर सिन्थटिक थाइरोक्जाइन इलट्रोक्जिन (एलेनबरिज) 0.2 पीपीबी प्रतिदिन की दर से उपचार किया गया । इलट्रोक्जिन चूर्ण को आहार (सरसों की खली एवं चावल के चूर्ण 1:1 अनुपात में) के साथ मिलाकर दिया गया । इस प्रकार के 15 दिनों के उपचार से जीरों को अधिक सक्रियता एवं 92% अतिजीविता दर प्राप्त हुई है जबकि साधारण परिस्थितियों में यह अतिजीविता दर 84% होती है ।

कोल्लेरु झील में व्रणकारी रोग संलक्षण

कोल्लेरु झील से इस महामारी वणकारी रोग के संलक्षणों के संकेत मिले हैं । विभिन्न प्रजातियों की मछलियाँ इस महामारी रोग से प्रभावित हुई हैं । मेजर कार्प मछलियाँ अधिक प्रभावित नही हुई हैं किन्तु अन्य व्यवसायिक प्रजातियाँ जैसे *चन्ना स्ट्रियेटस, चन्ना पंकटेटस* और *पुनटियस सराना* (80 से 90% क्षति) अत्यधिक प्रभावित हुई हैं । यह रोग संक्रमण झील के उत्तरी, पूर्व, मध्य तथा दक्षिण-पूर्वी क्षेत्रों तक ही सीमित है ।

तमिलनाड में व्रणकारी रोग

तमिलनाड से भी मछलियों की इस भंयकर व्रणकारी रोग की सूचना मिली है । चेंगलपेट, तान्जावूर और ट्रिची जिले तथा पूण्डी जलाशय, कविलपथागई झील और सेक्काडू झील इस रोग से प्रभावित हैं । तमिलनाड में विशेषकर बड़े जल क्षेत्र ही इस रोग से प्रभावित हैं । *चन्ना, मिस्टस, मास्टोसेम्बिलस, पुनटियस* प्रजातियाँ एवं *सी. आइडेल्ला* अत्यधिक प्रभावित हुई हैं जबकि भारतीय मेजर कार्प मछलियों में रोग का प्रभाव सीमित था । कुल मिलाकर रोग ग्रसित मछलियों का परिमाण 15 से 30% ऑका गया है । इस संदर्भ में विस्तृत जानकारी हेतु बैरकपुर स्थित मत्स्य रोग विज्ञान प्रयोगशाला में सूक्ष्मजीवी तथा पर्यावरणीय तत्वों पर कार्य किया जा रहा है ।

भारत में महामारी व्रणकारी रोग की वर्तमान स्थिति

18 जनवरी 1991 को भारत सरकार की कृषि व सहकारिता मंत्रालय द्वारा नई दिल्ली में, इस रोग के उद्भव एवं फैलाव तथा रोग नियंत्रण के लिए अपनाए जा रहे उपायों की समीक्षा हेतु एक बैठक का आयोजन किया गया था । केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान ने इस बैठक में रोग की वर्तमान स्थिति पर एक रिपोर्ट प्रस्तुत की और सभा सदस्यों को उपचारात्मक उपायों से अवगत कराया।

गंगा नदी में हिल्सा मत्स्य बीजों की कृत्रिम आपूर्ति

के.अ.प्र.मा.अनु.संस्थान ने गंगा नदी में *तेन्युलोसा ईलिशा* मत्स्य बीजों की आपूर्ति हेतु एक योजना आरम्भ की है । इस कार्यक्रम का शुभारम्भ दिनांक 23 फरवरी 1991 को श्री बी. बी. घोष, महाप्रबंधक, फरक्का बाँध परियोजना द्वारा किया गया था । इस अवसर पर श्री यू. बाला, अधीक्षक अभियंता, फरक्का बांध परियोजना भी उपस्थित थे । के.अ.प्र.मा.अनु.संस्थान की अभिलाषित कार्यक्रम के शुरुआत के रूप में 170 हिल्सा पोनों को बाँध के ऊपरी क्षेत्र में संग्रहित किया गया । संग्रहण कार्यक्रम को नियमित रूप से चलाने के लिए संस्थान ने फरक्का में एक हैचरी का निर्माण कार्य आरम्भ किया है ताकि हिल्सा पोनों का बड़े पैमाने पर उत्पादन किया जा सके । गंगा नदी में संग्रहित पोनों को फरक्का में ही 0.1 क्षेत्रफल वाले दो नर्सरी तालाबों में संवर्धित किया गया था । 95 दिनों के संवर्धन काल में ये जीरें 74.5 मि.मी./4.13 ग्रा. के हो गए थे ।

महत्वपूर्ण घटनाएँ

उप-प्रधानमंत्री द्वारा नई प्रयोगशाला भवन का शिलान्यास

माननीय उप-प्रधानमंत्री श्री देवीलाल जी दिनांक 31 मई 1990 को केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान के इलाहाबाद केन्द्र का विशेष संदर्शन कर एक तीन तलीय भवन का शिलान्यास किए हैं। इस आधुनिक प्रयोगशाला के निर्माण में 46 लाख रूपयों की लागत आएगी एवं इसके निर्माण से संस्थान की अकांक्षा पूर्ण होगी। उप-प्रधानमंत्री जी इस अनुसंधान केन्द्र में दो घंटों से अधिक समय तक रहे एवं डॉ. पी.वी. देहद्राय, उप-महानिदेशक (मात्स्यकी), डॉ. अरुण झिंगरन, निदेशक, के.अ.प्र.मा.अनु.सं. से संस्थान के विभिन्न कार्यों पर विचार विमर्श किए। इस अवसर पर अनेक मछुआरों ने उप-प्रधानमंत्री जी से मिलकर उन्हें अपनी समस्याओं से अवगत कराया।

इससे पूर्व, नई प्रयोगशाला भवन के शिलान्यास करते हुए माननीय उप-प्रधानमंत्री जी ने वैज्ञानिकों से अपील की कि वे उन समस्याओं पर ध्यान दें जिनका ग्रामीण समाज की आर्थिक उन्नति से सम्बंध हो। उन्होंने कहा कि देश की कुल G.N.P. का एक बड़ा भाग अनुसंधान कार्य पर खर्च किया जाता है। अतः वैज्ञानिकों का यह कर्त्तव्य है कि वे इस ओर ध्यान दें कि अनुसंधान कार्य पर खर्च की गई राशी से गरीब व दलित वर्गों को कितनी राहत मिलती है। उन्होंने संतोष व्यक्त किया कि पिछले दशकों में देश की अंतर्स्थलीय मात्स्यकी क्षेत्र में छः गुणा वृद्धि हुई है जबकि इस दौरान विश्व मत्स्य उत्पादन में मात्र चार गुणा वृद्धि हुई है।

श्री जनेश्वर मिश्र, माननीय संचार राज्य मंत्री जी ने समारोह की अध्यक्षता की एवं श्रीमती शुभदा मिश्र, उत्तर प्रदेश ग्रामीण विकास मंत्री समारोह की मुख्य अतिथि रहीं। श्रीमती मिश्र ने उत्तर प्रदेश के मुख्य मंत्री श्री मुलायम सिंह यादव द्वारा भेजे गए संदेश को सभा सदस्यों तक पहुँचाया। श्रीमती मिश्र ने अंतर्स्थलीय मात्स्यकी क्षेत्र को ग्रामीण समाज की उन्नति में महत्वपूर्ण बताया जिसमें करीब 17 लाख रोजगार पाते हैं। अतः इस क्षेत्र के तकनीकी विकास से समाज के एक बड़े भाग के जीवन स्तर में उन्नति हो सकती है। उन्होंने उल्लेख किया कि सभी जलीय क्षेत्रों की उत्पादन में वृद्धि होना चाहिए जिससे इस शताब्दी के अंत तक 125 लाख टन मत्स्य प्रति वर्ष की माँग की पूर्ति की जा सके।

इस अवसर पर श्री मिश्र ने वैज्ञानिकों को बधाई दी एवं आग्रह किया कि वे मछुआरों से सम्पर्क बनाए रखें, अंततः वे ही प्रयोगशालाओं में किए जा रहे अनुसंधान कार्य का लाभ प्राप्त करनेवाले हैं। उन्होंने आशा व्यक्त की कि अनुसंधान कार्य की दिशा गरीब मछुआरों की उन्नति की ओर होगी। उन्होंने यह भी आशा व्यक्त की कि यह नई प्रयोगशाला नदियों, जलाशयों, झीलों व जवारनदमुखों में मत्स्य उत्पादन की वृद्धि में सहायक होगी।

इस समारोह में अनेक गणमान्य व्यक्ति जैसे विश्वविद्यालयों के उपकुलपति एवं केन्द्र व राज्य सरकार के अनेक उच्च अधिकारियों ने भाग लिया।

विशेष बैठकें

स्टाफ रिसर्च कौंसिल की बैठक

संस्थान की स्टाफ रिसर्च कौंसिल की वार्षिक बैठक 18-20 अप्रैल 1990 के दौरान डॉ. अरुण झिंगरन, निदेशक की अध्यक्षता में बैरकपुर में सम्पन्न हुई । डॉ. पी. वी. देहद्राय, उप-महानिदेशक (मात्स्यकी) एवं डॉ. एम. वाई. कमाल, सहायक-महानिदेशक (मात्स्यकी) भारतीय अनुसंधान कृषि अनुसंधान परिषद का प्रतिनिधित्व कर रहे थे । बैठक में संस्थान द्वारा संचालित 20 अनुसंधान परियोजनाओं में हुई प्रगति की समीक्षा की गई । प्रत्येक परियोजना का मूल्यांकन पूर्व निर्धारित अनुसंधानात्मक लक्ष्यों के आधार पर किया गया । वर्ष 1990-91 के लिए कुल 21 परियोजनाओं के संचालन का निश्चय किया गया ।

गंगा नदीय परितंत्र में मात्स्यकी की पुनर्स्थापना हेतु तकनीकी व वैधानिक उप-समितियों की बैठकें

के.अं.प्र.मा.अनु.संस्थान द्वारा गंगा नदीय तंत्र में जैव विविधता में उन्नति तथा पारिस्थितिक प्रत्यानयन क्षेत्र में दिए गए योगदान तथा प्रस्तावित नदीय बेसिन प्रबंध में संस्थान की भूमिका को ध्यान में रखते हुए डॉ. अरुण झिंगरन, निदेशक की अध्यक्षता में पारिस्थितिक प्रत्यानयन एवं मात्स्यकी की तकनीकी व वैधानिक पहलुओं पर दो उपसमितियों का गठन किया गया । इन समितियों की बैठकें के.अं.प्र.मा.अनु.सं., बैरकपुर में दिनांक 10-11 जुलाई 1990 को सम्पन्न हुई ।

तकनीकी उप-समिति : तकनीकी उप-समिति ने गंगा नदी में व्यवसायिक मत्स्य उपज में आई कमी के कारणों की जानकारी प्राप्त की एवं मात्स्यकी स्त्रोतों के संरक्षण हेतु प्रजनन, मत्स्य रोग निवारण आदि विषयों पर अनेक सुझाव दिए ।

वैधानिक उप-समिति : इस उप-समिति ने पर्यावरण संरक्षण एवं मात्स्यकी से संबंधित वर्तमान विनियमों की समीक्षा की । बैठक में नदीय पर्यावरण, मात्स्यकी और वैधानिक सहायता विषय पर चर्चा हुई । समिति ने सिफारिश की कि मात्स्यकी को राज्य के अधिकार क्षेत्र से निकाल दिया जाए ताकि केन्द्रीय सरकार देश के किसी भी भाग के लिए नियम बना सके । उप-समिति ने उत्तर प्रदेश, बिहार और पं. बंगाल द्वारा मात्स्यकी क्षेत्र के लिए बनाए गए नियमों को प्रभावकारी बनाने की सिफारिश की ।

गंगा परिशुद्धिकरण योजना की **तकनीकी व वैधानिक उप-समितियों** की दूसरी बैठक दि. 18 जनवरी 1991 को बैरकपुर में सम्पन्न हुई। डॉ. अरुण झिंगरन, निदेशक, के.अं.प्र.मा.अनु.सं. तथा दोनों उप-समितियों के अध्यक्षों ने बैठक को सम्बोधित किया । बैठक में दोनों उप-समितियों द्वारा की गई प्रगति की समीक्षा की गई ।

के.अं.प्र.मा.अनु.संस्थान की प्रबंध समिति

डॉ. अरुण झिंगरन की अध्यक्षता में संस्थान की प्रबंध समिति की चौथी बैठक दि. 12 जुलाई 1990 को सम्पन्न हुई । समिति के सदस्यों के रुप में डॉ. एम. वाई. कमाल, सहायक-महानिदेशक, भा.कृ.अनु.प.

तथा श्री डी.के. श्रीवास्तव, निदेशक (वित्त), भा.कृ.अनु.प. ने भाग लिया । समिति ने अनुसंधान कार्यक्रमों पर पूर्ण संतोष व्यक्त किया एवं वर्ष 1990-91 हेतु अनुसंधान कार्यक्रमों का अनुमोदन किया ।

गंगा परिशुद्धिकरण योजना की अनुमापन समिति

डॉ. अरुण झिंगरन, निदेशक, के.अं.प्र.मा.अनु.सं. ने दि. 25 जुलाई 1990 को योजना भवन, नई दिल्ली में आयोजित गंगा परिशुद्धिकरण योजना की अनुमापन समिति की तेरहवीं बैठक में भाग लिया जिसमें गंगा परिशुद्धिकरण योजना की प्रगति की समीक्षा की गई । समिति ने इस संस्थान द्वारा पिछले कुछ दशकों में नदीय पर्यावरण में मत्स्य निवास की विविधताओं के अनुमापन पर किए गए कार्य की प्रशंसा की । संस्थान द्वारा संग्रहित आँकडों को गंगा नदीय पर्यावरण की एकमात्र बृहत सूचना स्त्रोत के रुप में अनुमोदित किया । यह संस्थान गंगा परिशुद्धिकरण योजना के सभी कार्यक्रमों में गंगा तथा अन्य नदीय तंत्रों की जैविक उत्पादकता, जैविक अनुमापन एवं पारिस्थितिक पुनर्रुद्धार की दिशा में सक्रिय योगदान दे रहा है ।

जैविक अनुमापन पर भारत व डच वैज्ञानिकों की बैठक

डॉ. अरुण झिंगरन, निदेशक ने 4-5 मार्च 1991 के दौरान 'जैविक अनुमापन-विकास के मानदण्ड' विषय पर जवाहरलाल नेहरु विश्वविद्यालय, नई दिल्ली में हुई बैठक में भाग लिया । इस बैठक में जल की गुणवत्ता प्रबन्ध पर उपलब्ध आँकडों की समीक्षा की तथा जैविक तत्वों के उपयोग से जल की गुणवत्ता की वृद्धि के मानदण्डों के निर्धारण पर विचार विमर्श किया गया । जल की गुणवत्ता प्रबन्ध के विभिन्न पहलुओं पर भी चर्चा हुई । डॉ. झिंगरन ने इस अवसर पर 'फिश इन रिलेशन टू वाटर क्वालिटी' नामक समीक्षात्मक लेख भी प्रस्तुत किया ।

नर्मदा परियोजना पर विश्व बैंक की बैठक

डॉ. एस. एन. सिंह, के.अ.प्र.मा.अनु.संस्थान के वदोदरा स्थित अनुसंधान केन्द्र के व. वैज्ञानिक ने 4, 13 व 14 फरवरी 1991 के दौरान पर्यावरण संरक्षण पर विश्व बैंक की बैठक में भाग लिया । इस बैठक में मत्स्य आयुक्त कार्यालय, गाँधीनगर, गुजरात द्वारा प्रस्तुत तीसरी परिवर्तित कार्य योजना में प्रस्तावित पर्यावरण परिरक्षण के विभिन्न प्रस्तावों की समीक्षा की गई ।

नर्मदा नियंत्रण प्राधिकरण की पर्यावरणीय उप-समिति की ग्यारहवीं बैठक

नर्मदा नियंत्रण प्राधिकरण की पर्यावरणीय उप-समिति की ग्यारहवीं बैठक 1 मई 1991 को दिल्ली में, श्री रंजीत सिंह, सचिव, पर्यावरण विभाग की अध्यक्षता में सम्पन्न हुई । के.अ.प्र.मा.अनु.संस्थान के दो वरिष्ठ वैज्ञानिक श्री पी.के.चक्रवर्ती तथा डॉ. एस.एन. सिंह इस बैठक में भाग लिए । इस उप-समिति ने कार्यसूची के अन्य मदों के साथ के.अ.प्र.मा.अनु.संस्थान द्वारा नर्मदा तट के मछुआरों की सामाजिक स्थितियों पर तैयार की गई रिपोर्ट के मसौदे पर भी विचार किया । यह रिपोर्ट विश्व बैंक की आर्थिक सहायता से संस्थान की परामर्शक सेवाओं के अंतर्गत तैयार की गई है । उप-समिति द्वारा यह सुझाव दिया गया है कि बाँध निर्माण के बाद मात्स्यकी की पुनरुद्धार हेतु एक कार्य योजना तैयार की जाए ।

हिन्दी सप्ताह

संस्थान में 14-20 सितम्बर 1990 के दौरान हिन्दी सप्ताह का आयोजन किया गया था । सप्ताह भर के इस हिन्दी कार्यान्वयन कार्यक्रम में 17 सितम्बर को एक सभा का आयोजन किया गया । इस अवसर पर डॉ. अरुण झिंगरन, संस्थान के निदेशक ने संस्थान द्वारा सरकारी कामकाज में तथा विभिन्न प्रकाशनों में हिन्दी के प्रयोग में की गई प्रगति का उल्लेख किए हैं । डॉ. झिंगरन ने संस्थान के कुछ कर्मचारियों को बधाई दी जिन्हें हिन्दी में कार्यसाधक ज्ञान हेतु आवश्यक परीक्षाओं में सफलता प्राप्त हुई एवं इस सफलता हेतु अग्रिम वेतन वृद्धि भी प्राप्त हुई । डॉ. झिंगरन, निदेशक और श्री सुरेन्द्र पाल, कार्यालय प्रमुख ने हिन्दी को राष्ट्रीय एकता भावना विकसित करने का महत्वपूर्ण साधन बताया ।

श्री एस. एन. झा, उप-निदेशक, हिन्दी कार्यान्वयन योजना (पूर्वी क्षेत्र) ने देश के लिए एक संपर्क भाषा की आवश्यकता पर बल दिया । उन्होंने हिन्दी को समृद्ध बनाने में सभी प्रादेशिक भाषाओं के योगदान का स्वागत किया ।

डॉ. हेमचन्द्र जोशी, व.वैज्ञानिक व संस्थान के हिन्दी कार्यान्वयन कक्ष के प्रभारी ने हिन्दी सप्ताह के महत्व का उल्लेख किया और डॉ. वी. वी. सुगुणन्, व.वैज्ञानिक ने दोहराया की अहिन्दी भाषी क्षेत्रों के लोगों को हिन्दी का कार्यसाधक ज्ञान प्राप्ति एवं राष्ट्र भाषा का प्रयोग करना चाहिए ।

सहयोग

संस्थान ने वर्ष 1990-91 के दौरान अनेक राष्ट्रीय तथा अंतर्राष्ट्रीय सहयोगिक अनुसंधान कार्य और प्रशिक्षण कार्यक्रमों में भाग लिया ।

राष्ट्रीय

'अलियार बेसिन के छोटे जलाशयों की मात्स्यकी तथा पारिस्थितिकी' परियोजना के कार्य में केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान को तमिलनाडु सरकार ने फार्म तथा वाहन सुविधाएँ उपलब्ध कराकर अपना सक्रिय सहयोग दिया ।

इस संस्थान ने हिमाचल प्रदेश सरकार तथा अरुणाचल प्रदेश सरकार को प्रग्रहण मात्स्यकी एवं मत्स्य पालन हेतु प्राथमिकता प्राप्त जल क्षेत्रों को रेखांकित करने में सहयोग दिया । कुछ नई परियोजनाओं का भी प्रस्ताव किया जहाँ भारतीय कृषि अनुसंधान परिषद एवं संबंधित राज्य सरकार आपसी सहयोग कर सकें ।

संस्थान द्वारा ऑल इंडिया इंस्टिट्यूट ऑफ हाइजिन एवं पब्लिक हेल्थ तथा स्कूल ऑफ ट्रोपिकल मेडिसिन, कलकत्ता के सहयोग से अलवणीय जल क्षेत्रों के (विदेशी तथा देशी प्रजातियों की) मछलियों में व्रणकारी रोग संलक्षणों के कारक तत्वों के अन्वेषण हेतु एक संयुक्त परियोजना प्रारम्भ की गई ।

इनके अतिरिक्त केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान ने विभिन्न राज्य सरकारों तथा मात्स्यकी विकास में संलग्न अभिकरणों को अपनी परामर्शक सेवाओं द्वारा सहयोग दिया ।

केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान सस्थान द्वारा उपलब्ध की गई परामर्शक सेवाएँ

मछलियों में व्रणकारी संलक्षण रोग का अनुमापन

महाराष्ट्र में व्रणकारी संलक्षण मत्स्य रोग : व्रणकारी संलक्षण मत्स्य रोग पर ग्यारह देशों की अंतराष्ट्रीय परियोजना के एक सहयोगी के रूप में के.अ.प्र.मा.अनु.संस्थान निरंतर इस भयानक रोग के विस्तार का अनुमापन कर रहा है । दिसम्बर 1990 में इस रोग का विस्तार प्रथम बार महाराष्ट्र में भी देखा गया । अब तक उत्तर-पूर्व राज्य, पं.बंगाल, उडीसा, बिहार, उत्तर प्रदेश, मध्य प्रदेश, तमिलनाडु और कर्नाटक राज्य ही इस रोग से प्रभावित हुए थे । संस्थान के वैज्ञानिक महाराष्ट्र राज्य में प्रभावित मछलियों का परीक्षण किए जिससे यह देखा गया कि रोगाणुओं पर चूना और पोटाशियम परमैंगनेट का उपयोग लाभदायक है । इस क्षेत्र में प्रभावित मछलियाँ जैसे *चन्ना पंकटेटस*, *एनाबास टेस्टूडिनियस* का परीक्षण किया गया ताकि इनसे विषाक्त तथा बैक्टीरिया रोगाणुओं को निकाला जा सकें । मेमालियन सेल-लाइन से किसी भी प्रकार की विषाक्त रोगाणु नही पाए गए किन्तु इन मछलियों में बैक्टीरिया रोगाणु जैसे *क्लेबसियेल्ला* तथा *पिसोडोमोनस* पाए गए । इन रोगग्रस्त मछलियों पर जैव रसायनिक तथा सीरम संबंधी परीक्षण किए जा रहें हैं ताकि रोगाणुओं को स्पीजीज स्तर तक पहचाना जा सके ।

जलाशय मात्स्यकी की सम्भाव्यता का अध्ययन

संस्थान ने मेघालय के नोंगमाहिर व कीरडमकुलाय जलाशयों में मात्स्यकी के विकास की सम्भाव्यता के अध्ययन हेतु उत्तर पूर्वी परिषद के साथ कार्य आरम्भ किया और जून 1991 तक अध्ययन समाप्त होने की आशा है ।

अंतराष्ट्रीय

केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान ने नेटवर्क ऑफ एक्वाकल्चर सेन्टर्स इन एशिया (नाका) को उनकी क्षेत्रीय अनुसंधान परियोजना 'पर्यावरण नियंत्रण और मछलियों में व्रणकारी संलक्षण' में सक्रिय सहयोग दिया । इस परियोजना में अन्य 11 देशों के साथ भारत स्थित केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान भी शामिल है ।

मत्स्य रोगों पर सहयोगिक परियोजना

के.अ.प्र.मा.अनु.संस्थान तथा स्टरलिंग विश्वविद्यालय, ब्रिटेन के आपसी सहयोग से मत्स्य परजीवियों पर एक अनुसंधान परियोजना का प्रस्ताव है । इस संदर्भ में स्टरलिंग विश्वविद्यालय के प्रतिनिधि डॉ. आर. वूटेन एवं डॉ. सी.सोमरविल्ले दिनांक 27.3.91 से 31.3.91 के दौरान संस्थान का दौरा किए हैं । इस दौरान उन्होंने निदेशक तथा मत्स्य रोग-विज्ञान अनुभाग के वैज्ञानिकों के साथ चर्चा की । इस सहयोगिक परियोजना का मुख्य उद्देश्य भारतीय विवृत्त जल क्षेत्रों में परजीवीकरण के प्रभाव का अध्ययन करना है । ब्रिटिश वैज्ञानिकों ने कलकत्ता के समीप कुछ लवणीय जल के कृत्रिम झीलों का निरीक्षण कर पं.बंगाल राज्य मत्स्य विकास निगम

के स्वामित्ववाले 'गोबाला' एवं 'नलबन' झीलों का चयन किया । इन झीलों में *अरगुलस* तथा अन्य मत्स्य परजीवियों की बहुलता है ।

प्रौद्योगिकी हस्तांतरण

घोंघा पालन का प्रशिक्षण

संस्थान ने मिजोरम के तीन मत्स्य अधिकारियों के लिए दि. 16.9.1990 से 22.9.1990 तक की अवधि में घोंघा पालन प्रशिक्षण कार्यक्रम का आयोजन किया । प्रशिक्षण कार्यक्रम में घोंघा संग्रहण, प्रजनन, निषेचन तथा टरेरियम में घोंघा पालन की विविध पहलुओं से संबंधित व्याख्यान, क्षेत्रीय दौरे आदि सम्मिलित किए गए । विभिन्न प्रकार के पालन विधियों में घोंघा संवर्धन, प्रजनन, निषेचन आदि पहलुओं को दर्शाया गया । पाठ्यक्रम में फार्म की रूपरेखा, टरेरियम, स्नैल हाउस, क्षेत्रीय स्नैल फार्म का निर्माण तथा प्रबन्ध आदि का समावेश किया गया। घोघों के संसाधन व पैकिंग तकनीकों को भी दर्शाया गया है ।

सुन्दरवन के कृषकों द्वारा प्रौद्योगिकी का अभिग्रहण

पं.बंगाल राज्य के दक्षिण 24 परगना जिले के 10 गावों के 160 परिवारों का सर्वेक्षण किया गया । इस अध्ययन से ज्ञात होता है कि 63% कृषक सीमान्तस्तर के तथा 34% छोटे स्तर के हैं । प्रौद्योगिकी अभिग्रहण का अधिकतम प्रतिशत (58.4%) मध्यम वर्ग से संबंधित हैं। धान, मछली और झींगों का उत्पादन क्रमशः 2501-3500 कि.ग्रा. प्रति हे., 401-500 कि.ग्रा.प्रति हे. होता जबकि परम्परागत पद्धति से धान उत्पादन मात्र 1400-2000 कि.ग्रा. प्रति हे. होता है । संसाधनों की कमी, अपर्याप्त सिंचाई सुविधाएँ तथा सहायता व विस्तार कार्यक्रमों के अभाव, सामाजिक बुराईयाँ आदि कुछ अवरोध हैं ।

सुन्दरवन में मत्स्य बीज संग्रहण का आर्थिक मूल्यांकन

नामखाना कुलपी क्षेत्र के कुल 314 मत्स्य बीज संग्रहकों से साक्षात्कार किया गया ताकि उनकी सामाजिक व आर्थिक स्थिति तथा फिनफिश एवं शेलफिश बीज संग्रहण से प्राप्त पारीश्रमिकी का मूल्यांकन किया जा सके । ये मत्स्य बीज संग्रहक 14 से 62 वर्ष के आयुवाले हैं तथा इनमें से 65.3% अनुसूचित जाति के हैं । इस समूह में 25% पुरुष एवं 25% अशिक्षित हैं। इनमें से 79.6% लोगों का मुख्य रोजगार बीज संग्रहण कार्य ही है । बीज संग्रहण का व्यस्ततम काल जनवरी से सितम्बर तक होता है, इस दौरान कुल बीज संग्रहण का 90% बीज संग्रहित कर लिया जाता है । औसतन प्रत्येक व्यक्ति प्रतिदिन 4 घण्टा कार्य करता है और दो प्रकार के जालों का प्रयोग करता है । संग्रहित बीजों में से बड़े झींगों के बीजों को अलग कर लिया जाता एवं शेष अन्य प्रजातियों के मत्स्य बीजों को फेंक दिया जाता है, परिमाणस्वरुप लगभग 18000 लाख बीजों की हानि प्रति वर्ष होती है । व्यस्ततम काल में प्रति व्यक्ति की आय 801-1000 रु. प्रति माह होती है।

विस्तार कार्य

विगत वर्षों की तरह इस वर्ष भी संस्थान ने अपने सलाहकार कार्य- विस्तार व्याख्यान, प्रशिक्षणार्थियों व किसानों हेतु प्रदर्शनों के आयोजन आदि किए । विद्यार्थियों व प्रशिक्षणार्थियों के 24 दल, 99 मत्स्य पालक एवं अनेक संदर्शक इन कार्यक्रमों से लाभान्वित हुए ।

प्रशिक्षण कार्यक्रम

वर्ष 1990-91 के दौरान छोटी अवधि के 11 प्रशिक्षण कार्यक्रमों का आयोजन किया गया । इन कार्यक्रमों से लगभग 373 मत्स्य पालक व मछुआरें, विस्तार कार्य के 44 अधिकारीगण लाभान्वित हुए ।

बैंक अधिकारियों को 'अंतर्स्थलीय मात्स्यकी विकास' का प्रशिक्षण

5-12 सितम्बर 1990 के दौरान बैंक ऑफ बरोडा के वरिष्ठ अधिकारियों हेतु 'अंतर्स्थलीय मात्स्यकी विकास' विषय पर एक आठ दिवसीय प्रशिक्षण पाठ्यक्रम का आयोजन किया गया था । अंतर्स्थलीय मात्स्यकी विकास के क्षेत्र में बैंकों की भूमिका को बहुत समय पहले ही स्वीकारा गया है । बैंक अधिकारियों के लिए अंतर्स्थलीय मात्स्यकी में पूंजी निवेश के लिए आवश्यक प्रतिभूतियों, जमानत व समान्तर संपत्ति आदि का निर्धारण करना कठिन कार्य है। के.अ.प्र.मा.अनु.संस्थान का यह प्रयत्न रहा कि प्रशिक्षण पाठ्यक्रम के माध्यम से बैंक अधिकारियों को अंतर्स्थलीय मात्स्यकी तकनीकों से अवगत कराया जाए ।

यह प्रशिक्षण कार्यक्रम बैंक के वरिष्ठ अधिकारियों के लिए ही आयोजित किया गया और प्रशिक्षण का मुख्य उद्देश्य इन्हें विभिन्न प्रकार के मात्स्यकी पारितंत्रों तथा इनके प्रबन्ध प्रणालियों की अच्छी जानकारी उपलब्ध कराना था। इससे बैंक अधिकारियों को मात्स्यकी परियोजनाओं में पूंजी निवेश करने में सुविधा हो ।

इस कार्यक्रम का उद्घाटन प्रो. डी.के. दासगुप्त, उप-कुलपति, विधानचन्द्र कृषि विश्वविद्यालय द्वारा दि.5.9.90 को बैरकपुर में किया गया । इस समारोह में बैंक ऑफ बडौदा के उप-महाप्रबन्धक श्री डी.के. मुखोपाध्याय, अहमदाबाद स्थित स्टाफ ट्रेनिंग कालेज के संकाय सदस्य वी.बी.त्रिवेदी भी उपस्थित थे । प्रशिक्षण की संतोषजनक समाप्ति पर, सभी 25 प्रशिक्षणार्थियों को दि. 12.9.90 को आयोजित समापन समारोह में प्रमाण पत्र भी दिए गए हैं । समापन सत्र की अध्यक्षता श्री ए.बी. दासगुप्त, सदस्य, पं.बंगाल राज्य योजना सलाहकार बोर्ड, ने की जिन्होंने प्रशिक्षणार्थियों को प्रमाण पत्र व 'टेक्नोलजीज फर इन्लैंड फिशरीज डवलपमेंट' नामक पुस्तक भी वितरित की ।

बाबा साहेब डॉ. अम्बेदकर की जन्म शताब्दी समारोह

बैंगलूर

बैंगलूर के जलाशय प्रभाग में कर्नाटक मत्स्य निदेशालय तथा अंतर्स्थलीय मात्स्यकी विकास निगम, कर्नाटक एवं अन्य संगठनों के सहयोग से डॉ. बी.आर.अम्बेदकर जन्म शताब्दी समारोह के संस्मारक में एक 'मत्स्य पालक दिवस' का आयोजन किया गया । इसमें अनेक मत्स्य पालक एवं मछुओं की सहकारी समितियों

के सदस्यों ने भाग लिया । इस अवसर पर मारकोनाहल्लि जलाशय में भारतीय मेजर कार्प, कतला व रोहु की 2000 अंगुलिकाओं को संग्रहित किया गया ।

पं.बंगाल

सुन्दरवन के पिछड़े क्षेत्र में एक मत्स्य पालक दिवस, किसान मेला आदि का आयोजन किया गया । 700 से अधिक मत्स्य पालकों ने इन कार्यक्रमों में भाग लिया । चार्ट व पोस्टरों के माध्यम से मत्स्य पालन की दिशा में हुई आधुनिक प्रगति से इन मत्स्य पालकों को अवगत कराया गया ।

कृषि में महिलाएँ

दक्षिण 24 परगना जिले के निश्चिन्तपुर नामक स्थान पर 'कृषि में महिलाएँ' दिवस का आयोजन किया गया । लगभग 500 महिलाओं ने इसमें भाग लिया । संस्थान के वैज्ञानिकों के अलावा राज्य सरकार के अधिकारीगण एवं समाज सेवकों ने सक्रिय रूप से विभिन्न चर्चाओं में भाग लिया । इस आयोजन में भाग लेनेवालों को जाल बुनना, ऊन की बुनाई, अचार व जाम बनाना और धान रोपाई की पद्धति आदि का प्रदर्शन किया गया ।

मत्स्य पालक दिवस

वर्ष 1990-91 के दौरान संस्थान ने 532 उद्यमियों के हित के लिए छः मत्स्य पालक दिवसों के आयोजन में भाग लिया ।

प्रदर्शनियाँ/फिल्म शो

संस्थान ने इलाहाबाद, नैहाटी, पातिपुकुर एवं नई दिल्ली में आयोजित चार प्रर्दशनियों में भाग लिया । इसके अतिरिक्त तीन अन्य प्रदर्शनियों के लिए प्रदर्शन सामग्री उपलब्ध करायी । इस वर्ष के दौरान लगभग 150 फिल्म प्रदर्शनियों का भी आयोजन किया गया ।

संस्थान के कार्य कलापों को विभिन्न अवसरों पर दूरदर्शन, प्रसार माध्यम व प्रकाशनों द्वारा दर्शाने की व्यवस्था की गई ।

कृषि विज्ञान केन्द्र

कृषि विज्ञान केन्द्र, काकद्वीप को 1 अगस्त 1989 से के.अ.प्र.मा.अनु.संस्थान के प्रशासनिक नियंत्रण में हस्तांतरित किया गया । इस वर्ष के दौरान कृषि विज्ञान केन्द्र द्वारा आयोजित प्रर्दशनियाँ एवं विस्तार कार्य मुख्यतः 1) मात्स्यकी 2) फसल उत्पादन 3) बागवानी तथा 4) गृह विज्ञान क्षेत्र से संबन्धित है।

मत्स्य बीज उत्पादन, कार्प पालन, आलवणीय जल क्षेत्रों में फिन फिश एवं शेल फिश पालन, एकीकृत पालन, मत्स्य रोग नियंत्रण आदि विषयों पर विशेष ध्यान दिया गया ।

फसल उत्पादन क्षेत्र में धान, सूरजमुखी, सरसों, मृदा प्रबन्ध तथा पौधा संरक्षण प्रणाली आदि महत्वपूर्ण रहे हैं ।

बागवानी कार्यक्रम के अंतर्गत मिर्च, आम तथा अन्य सब्जियों की खेती पद्धति का प्रदर्शन किया गया है ।

गृह विज्ञान क्षेत्र में फलों का परिरक्षण, फलों से जाम, जेली व अचार बनाना, सिलाई कार्य, कुर्सियों की बुनाई, शिशु रक्षा, स्वास्थ्य, प्रौढ़ शिक्षा आदि विषयों पर ध्यान दिया गया है ।

इस वर्ष के दौरान कृषि विज्ञान केन्द्र द्वारा 98 अल्प अवधि के प्रशिक्षण कार्यक्रमों का आयोजन किया गया ।

विषय	प्रशिक्षण कार्यक्रमों की संख्या		कुल प्रशिक्षणार्थी
	संस्थान परिसर में	संस्थान परिसर से बाहर	
मात्स्यकी	6	15	
फसल उत्पादन	4	16	
बागवानी	6	18	
गृह विज्ञान	7	26	
कुल	23	75	2505

इन प्रशिक्षण कार्यक्रमों के आयोजन से पूर्व एक क्षेत्र-विशेष तथा वहाँ के स्थानीय परिवारों का सर्वेक्षण किया गया ताकि उनके आवश्यकतानुसार कार्यक्रम की रूपरेखा तैयार की जा सकें। इन कार्यक्रमों के अलावा कृषि विज्ञान केन्द्र के अधिकारियों द्वारा विभिन्न अवसरों पर उपरोक्त विषयों पर 27 व्याख्यान दिए गए हैं ।

तिलहन बीज उत्पादन कार्यक्रम के अंतर्गत 160 किसानों को 10 हे. क्षेत्र के लिए आवश्यक सरसों के बीज वितरित किए गए जिससे 800 से 1500 कि.ग्रा. प्रति हे. की उपज दर प्राप्त हुई । 65 किसानों को सूरजमुखी बीज भी वितरित किए गए ।

कृषि विज्ञान केन्द्र ने चार विशेष कार्यक्रमों को दूरदर्शन कलकत्ता के माध्यम से प्रस्तुत किया और दो प्रदर्शनियों में भी भाग लिया । कुल 574 परिवारों का सर्वेक्षण किया गया ताकि उनकी सामाजिक व आर्थिक स्थिति एवं धान व मत्स्य पालन प्रविधि अपनाने की प्रवृत्ति की जानकारी प्राप्त की जा सके ।

प्रयोगशाला से भूमि की ओर

भारतीय कृषि अनुसंधान परिषद के प्रयोगशाला से भूमि की ओर कार्यक्रम दक्षिण 24 परगना जिले के निश्चिन्तपुर, काकद्वीप, नारायणपुर और नंदाभंगा ग्रामों के 100 कृषक परिवारों में कार्यान्वित किया गया । कार्यक्रम के पाँचवीं दशा के तीसरे वर्ष में मत्स्य पालन एवं फसल उत्पादन के विभिन्न तकनीकों के प्रसार से उपज दर में महत्वपूर्ण प्रगति हुई जो दुगनी से भी अधिक है । विभिन्न उत्पादनों में प्राप्त उपज दर निम्नलिखित हैं–

क्रम सं	फसल का नाम	परम्परागत पद्धति में औसतन उपज दर क्विंटल प्रति हे.	प्रौद्योगिकी हस्तांतरण के बाद उपज दर क्विंटल प्रति हे.
1.	खरीफ धान	10.0	41.0
2.	बोरो धान	25.0	47.0
3.	सूखा मिर्च	7.5	22.0
4.	पहाड़ी मिर्च	–	100.0
5.	आलू	30.0	120.0
6.	तरबूज	250.0	536.0
7.	मत्स्य बीज उत्पादन	–	150 लाख जीरें 10 लाख पोना 5 लाख अगुलिकाएँ
8.	मिश्रित मत्स्य पालन	8.0	33.0
9.	आलवणीय जल क्षेत्रों में मत्स्य और झींगा उत्पादन	1.50	8.5
10.	छत्रक (प्लिरोटस स्पी.)	–	250 ग्रा./वर्गफीट

पुस्तकालय व प्रलेखन सेवाएँ

केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान के पुस्तकालय ने इस वर्ष 112 पुस्तकों, 63 विविध प्रकाशनों एवं 8 पुनर्मुद्रित वैज्ञानिक लेखों का संकलन किया तथा 34 विदेशी एवं 63 भारतीय वैज्ञानिक पत्रिकाओं की प्राप्ति हेतु संपर्क बनाया । पुस्तकालय में 6425 पुस्तकें, 4124 पुनर्मुद्रित वैज्ञानिक लेख, 753 मानचित्र तथा 2837 विविध प्रकाशनों का संग्रहण है । पुस्तकालय ने पुस्तक विनिमय हेतु प्रमुख राष्ट्रीय तथा अंतराष्ट्रीय सूचना केन्द्रों के साथ 8 नए संबंध स्थापित किये ।

यह पुस्तकालय अनेक अनुसंधान संगठनों, विश्वविद्यालयों, उद्यमियों और मत्स्य पालकों को संस्थान के निजी प्रकाशन निःशुल्क भेजता रहा ताकि वे मात्स्यकी क्षेत्र में हुई अनुसंधान की जानकारी प्राप्त कर सकें । 146 अन्तर-पुस्तकालय ऋण के रूप में अन्य पुस्तकालयों को भी भेजी गई । इस वर्ष के दौरान पुस्तकालय के लिए 412371 रुपये खर्च किए गए ।

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

तकनीकी रिपोर्ट

संस्थान की अनुसंधानात्मक प्रगति से संबंधित 30 से भी अधिक तकनीकी रिपोर्टों का संकलन किया गया । संस्थान के वैज्ञानिकों के अनुसंधानात्मक लेखों को विभिन्न वैज्ञानिक पत्रिकाओं में प्रकाशित करने से पूर्व उनका संवीक्षण किया गया । विभिन्न समस्याओं और प्रश्नों का जवाब भी अनुभाग के वैज्ञानिकों द्वारा प्रस्तुत किया गया । इस अनुभाग ने संस्थान के वैज्ञानिकों द्वारा सेमिनार, संगोष्ठि, सम्मेलन आदि में भाग लेने से संबंधित कार्यों का भी पर्यवेक्षण किया । अनुसंधान परियोजनाओं की वार्षिक प्रगति रिपोर्ट तथा संस्थान के वैज्ञानिकों के योगदान से संबंधित सूचनाओं को प्राथमिक परियोजना फाइल तथा वैज्ञानिकों की व्यक्तिगत फाइलों में संग्रहित किया गया । आर.पी.एफ. (रिसर्च प्रोजेक्ट फाइल), अनुसंधानात्मक सक्रियता के लक्ष्य (एक्टिविटी माइलस्टोन) तथा मासिक, तिमाही एवं वार्षिक रिपोर्टों के माध्यम से अनुसंधान प्रगति की देख रेख, इस अनुभाग का एक महत्वपूर्ण दायित्व है ।

प्रकाशन

निम्नलिखित विभागीय प्रकाशनों को वर्ष अप्रैल 1990 से मार्च 1991 के दौरान प्रकाशित किया गया ।

1. वार्षिक रिपोर्ट 1989-90

2. 'टेक्नोलजीज फर इन्लैंड फिशरीज डवलपमेंट' पुस्तक—डॉ. वी. वी. सुगुणन् एवं श्री उत्पल भौमिक द्वारा संपादित ।

3. मैनुअल ऑन फार्मिंग, प्रोसेसिंग एण्ड मार्केटिंग ऑफ जैंट आफ्रिकन स्नैल *एकाटिना फुलिका*—श्रीमती जी. के. विन्सी, डॉ. वी. के. उन्नीत्तान एवं डॉ. वी. वी. सुगुणन् तथा MPEDA द्वारा संपादित ।

4. इंडियन फिशरीज एब्सट्रैक्ट
   खण्ड 25 (3), 1986
   खण्ड 26 (1-3), 1987
   खण्ड 27 (2), 1988
   खण्ड 28 (1), 1989

5. समाचार पत्रिका (न्यूज लेटर)

APPENDIX -I

Ministry /Department/Office of the Central Inland Capture Fisheries Research Institute (I.C.A.R.), Barrackpore, West Bengal. Statement showing the total number of I.C.A.R. servants and the number of Scheduled Castes and Scheduled Tribes among them as on 31st March ,1991.

Group/Class	Permanent/ Temporary	Total no. of	Scheduled castes	Percentage of total employee	Scheduled tribes employees	Percentage of total employees	Remarks
Gr. A(Cl. I) Permanent - (i) Other than lowest rung of Cl.I (ii) Lowest rung of Cl.I total							
Temporary - (i) Other than lowest rung of Cl.I (ii) Lowest rung of Cl. I		1	-	-	-	-	-
Gr. B(Cl. II)	Permanent	14	1	7.14%	-	-	
	Temporary	4	2	50%	1	25%	
Gr.C (Cl.III)	Permanent	168	36	21.43%	4	2.38%	
	Temporary	26	6	23.07%	2	7.70%	
Gr.D (Cl. IV) Excluding sweepers	Permanent	141	49	34.75%	6	4.26%	
	Temporary	33	10	3.3%	7	6.06%	
Gr. D (Cl. IV) sweepers	Permanent	11	8	72.73%	-	-	
	Temporary	1	1	100%	-		-

APPENDIX - II

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

Address List of Research/Survey Centres

		Telegramme/Telephone/ Telex
1	**Central Inland Capture Fisheries Research Institute** Barrackpore-743 101 WestBengal	**FISHSEARCH** BARRACKPORE/ **(033) 56-1190** **56-1191** **021 8552 CIFI IN**
2	**Allahabad Research Centre** Central Inland Capture Fisheries Research Institute 24, Pannalal Road Allahabad-211002, Uttar Pradesh	**FISHSEARCH** ALLAHABAD-2/ **(0532) 600531**
3	**Bangalore Research Centre** Central Inland Capture Fisheries Research Institute No.22 (Old No.1031-C & D), 80 ft, Road, 1st Main, IV Block, Rajainagar, Bangalore - 560 010	**FISHSEARCH** BANGALORE-560010/ **(0812) 357213**
4	**Central Inland Capture Fisheries Research Centre,** Ujjain, Tika Nather, Zamanabad Road, Kangra-176 001, Himachal Pradesh.	**CENTRALFISHERIES** KANGRA-176 001 HIMACHAL PRADESH
5	**Calcutta Research Centre** Central Inland Capture Fisheries Research Institute M.S.O. Building (2nd Floor, 'C' Block) DF Block, Salt Lake, Calcutta - 700 064	**(033) 379444**

Research/Survey Centres	Telegram/Telephone
6 Canning Survey Centre Central Inland Capture Fisheries Research Institute R.N. Tagore Road, Canning - 743 329, West Bengal	
7 Diamond Harbour Survey Centre Central Inland Capture Fisheries Research Institute House of Bidhu Bhushan Bhuiya, New Madhavpur, P.O. Diamond Harbour, 24 Parganas (South), West Bengal	
8 Digha Survey Centre Central Inland Capture Fisheries Research Institute Digha, Midnapur Dist., West Bengal	
9 Kolleru Lake Research Centre Central Inland Capture Fisheries Research Institute 24-B/10-53 Panugantivari House & Street, P.O. RAMACHANDRARAO PET, ELURU - 534 002, West Godavari District, Andhra Pradesh	**FISHSEARCH** ELURU - 534 002/ **(08812) 22520**
10 Vadodara Research Centre Central Inland Capture Fisheries Research Institute Gaikwad Building (Opposite Bhimnath Mahadev Temple), Sayajiganj, Vadodara - 390 005	**(0265) 334329**
11 Guwahati Research Centre Central Inland Capture Fisheries Research Institute Natun Sarania, Guwahati - 781 003, Assam	**(0361) 31717**

Research/Survey Centres	Telegram/Telephone
12 Agra Research Centre Central Inland Capture Fisheries Research Institute Bhagawatisadan, First Floor, 47, Heerabagh Colony, Dayal Bagh Road, Agra-282 005	
13 Lalgola Survey Centre Central Inland Capture Fisheries Research Institute Lalgola-742 148, Dist. Murshidabad, West Bengal	
14 Patna Research Centre Central Inland Fisheries Research Institute,m 1st Floor, Shambey House, Kankarbagh, Patna - 800 020, Bihar	**(0612) 51894**
15 Pune Research Centre Central Inland Capture Fisheries Research Institute Flat No.6, Indraprasta House Society, Godital-Hadapsar P.O., Pune - 411 028 Maharastra	**(0212) 672401**
16 Raidighi Survey Centre, Central Inland Capture Fisheries Research Institute, Raidighi, 24 Parganas (South), West Bengal	
17 Raipur Research Centre Central Inland Capture Fisheries Research Institute 326, 'Ashirwad', Shankar Nagar, Near Bottle House, Raipur - 492 007, Madhya Pradesh	**(0771) 424312**

Research/Survey Centres	Telegram/Telephone
18 Uluberia Survey Centre Central Inland Capture Fisheries Research Institute Uluberia, Dist. Howrah, West Bengal	
19 Coimbatore Research Centre Central Inland Capture Fisheries Research Institute 15/3, Bharathi Park Road, 7th Cross, Saibaba Colony P.O., Coimbatore - 641 011	
20 Krishi Vigyan Kendra Central Inland Capture Fisheries Research Institute Kakdwip, 24 Parganas (South), West Bengal	**(031732) 572**

APPENDIX III

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

ORGANIZATION CHART, 1990-91