



Central Inland Capture Fisheries Research Institute • Barrackpore



ANNUAL REPORT

1991-92

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I.C.A.R.

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. Vincl
V.K. Unnithan
M.K. Das

Assisted by :

Anjali De
H. Chaklader

LASER Composing :

H. Chaklader

Hindi Translation :

P.R. Rao

LASER Composing (Hindi) :

Md. Quasim

Printing :

Md. Quasim

Cover design :

A.R. Majumder

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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 CIFRI was later modified giving added emphasis on capture fisheries resources of the country and the Institute was rechristened as CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE with effect from 1.4.1987. Under the changed set up, the CIFRI is entrusted with the responsibility to conduct research on open water bodies where the fisheries

management norms are closely associated with environmental monitoring and conservation.

MANDATE

The mandate has the following functions:

- (i) To study fish population dynamics of exploitable inland water bodies such as rivers, lakes, reservoirs, beels, canals, estuaries, lagoons, etc. exceeding 10 ha in water spread;
- (ii) To evolve management systems for optimising fish production from such water bodies;
- (iii) To investigate causes/effects and remedies of riverine, estuarine and lacustrine pollution and provide research support for conservation of such resources;
- (iv) To study impact of river valley projects on the fisheries of the basins concerned and evolve strategies for their management; and
- (v) To conduct training and extension education programmes and to provide institutional consultancy services.

ORGANISATION

In order to achieve the above mandate, the research at CIFRI has been organised under three Divisions, corresponding to the major fishery resources of the country. The *Riverine Division*, with its headquarters at Allahabad, strives to develop systems for effective management of the vast riverine fisheries resources of the country with adequate emphasis on the conservation of riverine environment. The research projects under the Division cover the rivers Ganga, Yamuna, Brahmaputra and Narmada.

The *Lacustrine Division* has its headquarters at Bangalore with centres in Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Himachal Pradesh and Maharashtra. The investigations being carried out at the Division aim at developing management norms for optimising fish yield from large tanks, lakes, and reservoirs.

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 fish of Indian estuaries is being subjected to intensive research.

The Institute also conducts investigations on oxbow lakes of West Bengal, Assam and Gandak basin (*mauns*). 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

FEASIBILITY STUDY FOR RESERVOIR FISHERIES IN NORTH EASTERN REGION

On a consultancy assignment from the North Eastern Council Secretariat, Shillong, the Institute made *Feasibility Studies for Fisheries Development* in respect of *Nongmahir and Kyrdekulai reservoirs* in Meghalaya. The project comprised an intensive, one-year campaign to survey the two reservoirs, during which the major environmental variables relevant to productivity were thoroughly investigated. Based on the rate of primary productivity of the two lakes, fish production potential for the lakes was determined. Final Report of the project has been communicated to the NEC. These reports provide a complete manual for fish yield optimisation from Nongmahir and Kyrdekulai reservoirs. The management norms prescribed for the two lakes are equally applicable to other reservoirs in the country, sharing common morpho-edaphic features.

DESIGN OF PENS AND CAGES

PEN DESIGN FOR BEELS : Based on an engineering survey, a design for pen enclosure suitable to the *beel* ecosystem in Gandak basin was finalised. The design is based on a semi-rigid structure covering a wide area of 1500 m². A small nursery unit of 120 m² was also given shape. The pens are rectangular in form with symmetrical round corners to facilitate the even fixing of the net. Bamboos of different diameters and sizes were selected to constitute the main construction material for the pen, the advantages being their easy availability, low cost, low dead weight and reasonable strength to withstand external forces.

The selected site had a gentle shore gradient varying between 1 : 3000 and 1 : 3500. The fine grained sediment had a high initial porosity and considerable change in volume due to drying or superimposed load and had an average density of 1.5 g cm⁻³. The rainfall, vegetation cover of the terrace and the soil loss were also taken into consideration in site selection and design of the pen.

ANCHORAGE ARRANGEMENTS FOR A SINGLE CAGE UNIT : Analytical design of a suspended anchor for a floating cage (10 x 6 x 2.5 m) to offer stability against rocking or heel has been developed. The weight is suspended from the centre of the cage base. The tension in the anchor rope puts an additional downward force on the body enabling it to displace a larger volume of water. A rectangular metal frame is fitted to the base of the cage and the net is firmly tied with the frame to prevent the lateral displacement or the current-induced drift of the net. This ensures that the net is well-spread within the cage.

HILSA BREEDING IN MATLAH ESTUARINE SYSTEM - A FIRST-TIME REPORT

Fry of the Indian shad, *Tenualosa ilisha*, were collected from the bag net catches of the Matlah estuary near Canning at about 100 km upstream from the seaface. One bag net collection during the low tide on 19th September 1991 contained fry of the size group of 19-23 mm. So far, the breeding of the species in West Bengal was reported to be restricted to the Bhagirathi-Hooghly riverine systems. The present observation is indicative of the species' breeding in the Matla estuary also.

SURVEY OF HIRAKUD RESERVOIR

A study team of scientists from the Institute visited the Hirakud reservoir in Orissa to conduct a short-term survey of the fishery potential of the reservoir. The study covered an appraisal of water and soil quality parameters of the reservoir and the parameters relating to fish productivity. In addition, the team prepared an inventory of fishing effort and the socio-economic status of the fishermen. A comprehensive report containing the measures for the fisheries development of the water body has been submitted to the Government of India.

STATUS APPRAISAL ON FISHERIES IN RIVER BRAHMAPUTRA

A report on the present status of fisheries in Brahmaputra was prepared and submitted to the Ministry of Agriculture and Cooperation, Govt. of India. The report contains an analysis of the massive database created by the CIFRI over the years. It highlights the production dynamics of the river system in context of the prevailing abiotic and biotic parameters and identifies the factors that contributed to the decline of fisheries in the river.

HIGHER PRODUCTION FROM ESTUARINE WETLANDS THROUGH PEN CULTURE

Experimental pen culture operations in the marginal area of a large *bheri* in West Bengal resulted a yield rate of 5 150 kg ha⁻¹ yr⁻¹, indicating the possibility of introducing pen culture to augment fish yield from *bheries*. Fish yield from *bheries* is often low due to poor recovery rate. The large size of most *bheries* is an impediment in adopting intensive management of fisheries in *bheries*. Pen culture of fishes and prawns can overcome this problem to a great extent since the stock is kept confined within the plan area.

Experiments were taken up in Kantatala *bheri*, a sewage-fed wetland near Calcutta metropolis with three species combination involving *Oreochromis*

mossambicus, *O. niloticus* and *Cyprinus carpio* at a stocking density of 40,000 ha⁻¹ and species mix of 2 : 1 : 1. The experiment corroborated the efficacy of the duckweed, *Wolffia*, as a major component of artificial feed. *O. nilotica* registered a growth of 158 in 90 days.

Collaborative Project on Fish Diseases

The Institute has recently completed the first stage of a project on fish parasites in brackishwater impoundments. The six months' study encompassed parameters like infestation rate, host specificity and host preference in respect of the ectoparasitic crustaceans, especially *Argulus* sp. The study has brought to light interesting facts on the host-parasite relationship in such ecosystems. Preliminary results indicate that the parasite exhibits a definite preference for bottom dwelling fishes and the intensity of the infestation has a relation to different life stages of the host. The project has generated valuable data on the biological traits of the parasites and hosts, which can go a long way in developing management norms for containing the parasite problems in wetland ecosystems. The study was undertaken as a collaborative research project on fish parasites with the Institute of Aquaculture, Sterling University, U.K.

ENVIRONMENTAL MONITORING IN GANGA ABOVE FARAKKA

Environmental monitoring in the river Ganga by the Institute was extended to the stretch upstream of Farakka during this year. The water quality index (100) indicated favourable environment for fisheries just upstream of Farakka barrage. The residue levels of DDT and its metabolites in wet muscle tissues of fish *Rita rita*, a resident species were analysed and found to be below the detection level. In the water samples, the accumulation levels of DDT (7.42 µg g⁻¹), DDE (46.82 µg g⁻¹), DDD (31.28 µg g⁻¹) and Σ -HCH (4.42 µg g⁻¹) were recorded. Sediment samples showed only traces of HCH and DDT residues. None of the parameters exceeded the safe limit for fisheries.

ENVIRONMENTAL IMPACT ASSESSMENT OF RIVER GANGA

Under the EIA programme in the river Ganga, the pesticide residue level in water, sediments and tissues is being monitored by the Institute on a regular basis. Highest accumulation of BMC (60.8 ppb) and DDT (32.12 ppb) in *Labeo calbasu* was recorded from the river Kali at Kanauj, followed by BMC (28.2 ppb) in river Jalangi at Nabadwip. In the river Ganga at Farakka and in the Jalangi at Nabadwip, incidences of DDT (20.34 ppb) and BMC (24.2 ppb) accumulation were observed in the same test fish. On an average, DDT and BMC accumulation

levels in water were 0.0013 - 0.007 ppb and 0.008 - 0.026 ppb in the river Ganga and its tributaries.

MONITORING OF HEAVY METALS IN HOOGHLY ESTUARY

The Institute continued to monitor the heavy metal concentration in the estuarine waters. Accumulation of heavy metals like Zinc ($0.05 \mu\text{g l}^{-1}$), Copper ($0.01 \mu\text{g l}^{-1}$), Chromium (below detection level) and Mercury (below detection level), in water phase did not show any sign of alarm. Water quality indices at Farakka, Nabadwip and Diamond Harbour did not fall below 100, showing favourable environmental conditions for fisheries.

IN SITU TOXICITY TESTS FOR INDUSTRIAL EFFLUENTS : *In situ* toxicity tests were conducted in the Hooghly estuary for evaluating ultimate toxicity of pulp and paper mill effluents. Aluminium cages (60 x 50 x 45 cm) lined with nylon mesh were used for the study. The impact of change in composition of effluents due to variation in proportion of discharge from different units of the factor was remarkably reflected by the response of the fishes in the *in situ* tests. Medium lethal tolerance time (LT_{50}) for pulp and paper mill effluents has been provisionally estimated.

SURVEY ON EUS OUTBREAK IN TAMIL NADU AND KERALA

TAMIL NADU : A survey conducted in Tamil Nadu by the Institute in 1991 indicated that Epizootic Ulcerative Syndrome in fishes has spread to several districts of Tamil Nadu. The disease seriously affected the standing crop of fishes in Udumalpet, Chingalpet, Thanjavur and Trichy districts mostly afflicting the fishes of large water bodies. The overall percentage of infestation in the affected areas is estimated at 15--30%. The large size of the water body gave limited scope for adopting remedial measures. Fisheries managers were advised to subject the fingerlings to prophylactic treatment before stocking.

KERALA : In Kerala, the districts affected were Kottayam, Alappuzha and Wynad. Fishes in canals adjacent to paddy fields, part of backwaters, Pookot lake and Banasurasagar reservoir were affected. The percentage of infection in fish populations was within the range of 10-20%. Short-term and long-term measures to contain the disease were suggested. Dr. M. K. Das Senoir Scientist representing the Institute had several interactions with ministers, state officials, scientists and mass media to remove all unwanted apprehensions about the disease.

Investigations on microbiological and the environmental parameters relevant to the disease have been taken up in a large way at the Fish Pathology Laboratory at Barrackpore, as a part of the seven nations collaborative investigations on the disease.

HIGHER YIELD UNDER LAB TO LAND PROGRAMME

A substantial rise in the yield of crops was demonstrated at the farm plots under the supervision of the Krishi Vigyan Kendra of the Institute at Kakdwip. Over four times increase was observed in case of kharif rice, potato and fish over the yield under the traditional methods. The yield of dry chilli was three times high and production of boro rice and watermelon almost doubled from unit area. The programme, being implemented by the Institute in this backward area of West Bengal, has given a new impetus to the modernisation of agricultural practice prevailing in the area. Under the multi-disciplinary approach of KVK, induced breeding of Indian and exotic carps, brackishwater aquaculture, mushroom cultivation, home science, veterinary programmes, etc. are also given adequate stress. Women's participation in development programmes is a priority consideration.

SURVEY ON FINFISH AND SHELLFISH SEED DESTRUCTION IN HOOGHLY ESTUARY

A forty km stretch of Hooghly river from Kulpi to Namkhana was surveyed for the destruction of finfish and shellfish seed. As the first part of the two stage random sampling, a list of 3140 seed collectors from 10 villages were prepared and 340 of them were interviewed. Based on the study, the estimated annual destruction of fish and shellfish seed by the seed collectors in their effort to segregate prawn seed was estimated at 181.4 million.

IMPORTANT EVENTS

Workshop-cum-Training on Biomonitoring in the River Ganga

A five day Workshop-cum-Training Course on Biomonitoring in the River Ganga was organised jointly by the CIFRI, the Ganga Project Directorate and the Thames Water International, U.K., during 3-7 June, 1991 at Barrackpore. The main objective of the Workshop was to evolve a uniform methodology for biomonitoring investigations to be followed by various agencies/organisations engaged in pollution studies. It also provided an opportunity to upgrade the skills and to facilitate exchange of views among the technical personnel belonging to Central and State Pollution Control Boards, Research Institutes, State Governments, the Central Water Commission and the Ganga Project Directorate.

The programme was inaugurated by Dr. J. J. Ghosh, Retired Professor, Dept. of Biochemistry, Calcutta University on 3rd June 1991. Dr Nilay Chowdhury, Professor and Head, Dept. of Civil Engineering, Jadavpur University, delivered the key-note address. The function was presided over by Ms. Nandita Chatterjee, Regional Director, Ganga Project Directorate, Calcutta. Dr. Mike Andrews, an authority on biomonitoring of streams, was among the resource personnel who imparted theoretical and practical training to the participants.

The technical sessions considered many important aspects like environmental constraints in fisheries management and ecotoxicology in the Indian context. Recent advances in EIA methodology for aquatic ecosystems, application of bioindicators in water quality monitoring and restoration programmes were highlighted. Field demonstrations were conducted in the rivers Ganga and Hooghly in Allahabad and Calcutta respectively.

Certificates were distributed to the participants by Dr. P. Das, Director, National Bureau of Fish Genetic Resources, during the valedictory function organised at Allahabad on 7th June 1991.

HINDI WEEK

In compliance with the Official Language Implementation Policy of the Indian Union, as a part of the Hindi Week (14-20 September, 1991) a meeting was organised at the Institute.

MEETINGS

Staff Research Council Meeting held on 23rd and 24th April 1991

Management Committee meeting held on 25th April 1991

Technical Cooperation among Developing Countries (TCDC) in Agricultural sector, held at New Delhi from 7-11 October 1991.

COLLABORATION

The Institute collaborated with a number of national and international agencies during 1991-92 for research and training activities.

NATIONAL

The Institute continued to receive active support from the Government of Tamil Nadu and the Tamil Nadu Fisheries Corporation Ltd., in the execution of the projects on reservoir fisheries at Aliyar and Tirumurthy.

The Institute, in collaboration with the Governments of Himachal Pradesh and Arunachal Pradesh, delineated the priority areas for the development of the coldwater regions of the states. 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 at Calcutta, launched a joint project for the identification of aetiological agent of Epizootic Ulcerative Disease Syndrome in exotic and indigenous freshwater fishes.

CIFRI is engaged in assisting different State Governments and Agencies associated with the fishery development through its consultancy services.

CONSULTANCY SERVICES BY CIFRI

Sociological Survey of the Fishing Families of the Narmada : The Institute completed a sociological survey of the fishermen community in the Narmada basin under a consultancy assignment with the Narmada Control Authority (NCA). The survey covered 1312 km riverine stretches covering 17 districts in the states of Madhya Pradesh, Gujarat and Maharashtra. The report on the demographic profile of fishermen in the Narmada basin and the craft and gear used in the area was submitted to the NCA. This document has an exhaustive coverage on the ethnic and socio-economic and educational status of fishermen, and their attitude towards a change in their traditional vocation in the event of a necessity arising from the Narmada basin development programme. The study addresses to many vital questions in the context of the rehabilitation programmes under the Narmada Plan.

Feasibility Study for Reservoir Fisheries : The Institute was engaged by the North-Eastern Council (NEC) to prepare feasibility studies for fisheries development for Nongmahir and Kyrdamkulai reservoirs at Meghalaya. A feasibility report was submitted to NEC after probing into the morpho-edaphic features, biotic characteristics and productive potential of the reservoirs in different seasons.

INTERNATIONAL

Collaborative Project on Fish Diseases : CIFRI actively collaborated with eleven countries in the Network of Aquaculture Centres in Asia (NACA) in their Regional Research Project on Environmental Monitoring and Ulcerative Syndrome in Fish.

Workshop on biomonitoring : Workshop and Training on Biomonitoring in River Ganga sponsored by Ganga Project Directorate/Thames Water International, U.K. from 3rd June 1991 to 7th June 1991 at CIFRI, Barrackpore and Allahabad

TCDC Programming Exercise

The Institute actively participated in the Technical Cooperation among Developing Countries (TCDC). Meeting held at New Delhi from 7-11 October 1991. The exercise was organised jointly by UNDP, FAO and the Ministry of Agriculture, Govt. of India. Representatives from more than 32 countries participated in the deliberations. Many developing countries found our activities very interesting and expressed willingness to cooperate in joint ventures. The areas identified were reservoir fisheries, ecological investigations, hilsa and EIA. Dr. V.V. Sugunan, Senior Scientist represented CIFRI in the meeting.

MANPOWER DEVELOPMENT

Training Abroad

Dr. Y. S. Yadava, Senior Scientist received training in investigations on ENERGY DYNAMICS OF AQUATIC ECOSYSTEM at University of Edinburgh, U. K. from 2nd April 1991 to 29th September 1991 .

Dr. Krishna Chandra, Senior Scientist was deputed under AIDAB/Colombo Plan Programme to undergo a training course on ENVIRONMENT MANAGEMENT at Griffith University, Brisbane, Queensland, Australia. The course commenced from 14th February 1992 and ended on 25th December 1992.

Training Inland

Dr. V.V. Sugunan, Senior Scientist attended a training course on **METHODOLOGY AND MAINTENANCE OF MANAGEMENT INFORMATION SYSTEMS** conducted by NAARM, Hyderabad held from 3-15 September 1991.

Dr. Balbir Singh, Senior Scientist participated two and half months training programme on the **USE OF ISOTOPES AND RADIATIONS IN AGRICULTURE** organised by IARI, New Delhi from 18th February 1991 to 3rd May 1991.

Shri R.K. Das, Senior Scientist underwent four weeks training in **IDENTIFICATION OF MICROORGANISMS, SPECIALLY BACTERIA**, in the Institute of Microbial Technology, Chandigarh from 8th November 1991 to 4th December 1991.

Shri P.K. Chakraborty, Senior Scientist attended the course on **OCEAN SCIENCE AND TECHNOLOGY** held at Jadavpur University, Calcutta from 12th to 31st August 1991 and also participated a workshop on **MONITORING AND EVALUATION OF AGRICULTURAL RESEARCH PROJECTS** held at NAARM, Hyderabad, from 22nd-24th October 1991.

Dr. H.C. Joshi, Senior Scientist attended the XIIIth short term course on **USE OF COMPUTER IN AGRICULTURAL RESEARCH** organised by Indian Agricultural Statistics Research Institute, New Delhi from 18th to 30th September 1991.

Shri Utpal Bhaumik, Scientist (S.G.), participated in the workshop on **MEANINGFUL LEARNING AS A COMMUNICATION PROCESS** held at NAARM, Hyderabad from 9th to 12th July 1991.

Dr. D. Nath, Senior Scientist attended a training course on **HANDLING AND USE OF RADIOISOTOPES (C-14) FOR DETERMINATION OF PRIMARY PRODUCTION OF AQUATIC ECOSYSTEM** at Board of Radiation and Isotope Technology (BRIT), Trombay, Bombay from 17th to 28th February 1992.

Shri J.G. Chatterjee, Senior Scientist attended the training course on **TRAINING OF TRAINERS** organised by NAARM, Hyderabad, from 15th to 26th October 1991.

Mrs. S. Kaur, T-4 received training in **MUSHROOM CULTIVATION** at Indian Institute of Horticultural research, Hesaraghatta (Bangalore) from 12.6.1991 to 21.6.1991.

Shri C. N. Mukherjee, T-4 attended a training course on **INTEGRATED PEST MANAGEMENT OF HORTICULTURAL CROPS** with effect from 4.7.1991 to 24.7.1991 at I. I. H. R., Hesaraghatta.

Mrs. D. Sett, T-4 and Mrs. S. Kaur, T-4 participated in the training course on **APPROPRIATE AGRICULTURAL AND HOME SCIENCE TECHNOLOGY FOR FARM WOMEN** held at Avinashilingam Trainers' Training Centre, Coimbatore from 11.11.1991 to 4.12.1991.

Shri S.K. Sadhukhan, T-6 had training in TROPICAL VEGETABLE PRODUCTION TECHNOLOGY held at T.T.C. of I. I. H. R., Hessaraghatta (Bangalore) with effect from 4.12.1991 to 24.12.1991.

Seven scientists of the Institute were exposed to the current trends in biomonitoring of aquatic systems through a WORKSHOP AND TRAINING ON BIOMONITORING IN RIVER GANGA sponsored by Ganga Project Directorate/Thames Water International, U.K. from 3rd June 1991 to 7th June 1991 at CICFRI, Barrackpore and Allahabad. Besides three scientists acted as Faculty Member for the course.

HONOURS, AWARDS, ETC

Shri B. K. Singh, Scientist (Sr.Scale) has been awarded the degree of DOCTOR OF PHILOSOPHY in Zoology, by the Marathwada University, Aurangabad for his thesis **Some biological aspects of the silver carp, *Hypophthalmichthys molitrix* (Valenciennes)** from Government Fish Seed Farm, at Hadapsar, Pune (Maharashtra).

Shri B. L. Pandey, Senior Scientist qualified for the degree of DOCTOR OF PHILOSOPHY in the Magadh University, Bodh-Gaya (Bihar) for his thesis entitled **Studies on fishery biology and socio-economic aspect of fishermen of river Padma.**

Shri P. K. Pandit, Senior Scientist obtained the degree of DOCTOR OF PHILOSOPHY from the University of Calcutta for his thesis entitled **Experiments on some aspects of fish culture technology under rural condition in West Bengal.**

Shri K. P. Srivastava, Senior Scientist has been nominated as a Member of the Academic Council of the Assam Agricultural University, Jorhat for a period of two years with effect from 22nd July 1992.

TRANSFER OF TECHNOLOGY

EXTENSION AND NATION-BUILDING ACTIVITIES

The Institute's extension activities are extended by the Extension wing at the Headquarters and the Krishi Vigyan Kendra at Kakdwip. Other centres of the Institute also participate in the technology transfer activities.

RESEARCH/SURVEY : A forty km stretch of Hooghly river from Kulpi to Namkhana was surveyed for assessing the damage caused to the fish and prawn populations due to collection of finfish and shellfish seed. A list of 3140 seed collectors were prepared and 340 of them were interviewed. The estimated seed destruction was to the tune of 181.4 million in their effort to segregate prawn seed.

TRAINING : Six short-term need-based training courses were organised in which 100 extension officials and farm journalists participated.

EXHIBITION : The Institute participated in three exhibitions one each at Calcutta, Chota Jagulia and Barrackpore.

WOMEN'S DAY : A women's day was organised at Namkhana on 4.12.1991 in which 250 women participated. Technologies in fisheries, horticulture and home science were demonstrated to them.

Women's days were organised at Rajnagar, Srinathgram and Nischintapur villages in which a total of 330 women participated. The highlights of the Days were demonstrations on a variety of topics including home science, fisheries, and horticulture. The farm women actively participated in the discussions.

FISH FARMER'S DAY : Fish Farmer's Day were organised at village Nandabhanga on 11 March 1992 and at Nischintapur village on 12 March 1992, where 65 and 90 interested farmers respectively participated.

DEMONSTRATION IN OIL SEEDS AND PULSES PRODUCTION : First line demonstrations in mustard and sunflower cultivation was undertaken in 20 ha area involving 200 farmers. Another 250 farmers were given demonstration in the improved cultivation of mung and arhar.

TRAINING PROGRAMME : Training programme on Inland Fisheries Development for the Extension Functionaries of Action Aid was organised by the Extension Section of the Institute from 16 to 25 July 1991.

OTHER ACTIVITIES : Twenty three batches comprising 597 students, fifteen officials, and 61 fish farmers who visited Barrackpore were briefed of the Institute's activities and the advancements in fisheries science. Literature on fisheries were supplied to 38 officials and entrepreneurs. Thirty four lectures were delivered by the Extension Scientists on various occasions.

A feasibility study on the development of fisheries at Tapan Block, West Dinajpur District, West Bengal was conducted by the extension unit and the final report was submitted to the Tagore Society of Rural Development, Calcutta.

KRISHI VIGYAN KENDRA

The KVK of the Institute at Kakdwip conducted several training programmes, covering a variety of disciplines like fishery, crop production, horticulture, home science and animal science. The courses were designed according to the local need, and focussed mainly on the poor farmers of the area.

A total of 28 on-campus and 106 off-campus training programmes were organised during the years. The details of the programmes are given below :

Discipline/ Subject	On-campus		Off-campus	
	No. of courses	No. of Participants	No. of courses	No. of Participants
Fishery	8	75	18	717
Crop production	3	29	25	672
Horticulture	7	70	24	646
Home Science	9	90	34	599
Animal Science	1	10	4	104
Total :	28	274	105	2738

Suggestions/advice were given to 2114 farmers, women and entrepreneurs on various disciplines of above subjects. A total of 775 farm families were covered under a survey to assess their involvement in fishery, crop production, horticulture, home science and animal science. Fourteen lectures were delivered by the KVK staff addressing a variety of audiences ranging from farmers to officials.

LAB TO LAND PROGRAMME

The Vth phase of the Lab to Land Programme continued at the Institute covering 200 farm families of South 24 Parganas District. While the Extension unit at Barrackpore concentrated on fish farming with 100 families as beneficiaries, the KVK at Kakdwip spread the activity to a variety of crops. A substantial hike from the yield under traditional methods was obtained in all varieties of crops.

The farmers under the supervision of the extension scientists produced 150 million carp spawn, 1.0 million fry and 0.05 million fingerlings for stocking in their farm. The average production of freshwater carp in Lab to Land ponds was 3300 kg ha⁻¹yr⁻¹ and the brackishwater fish and prawn was to the tune of 850 kg ha⁻¹yr⁻¹. The first year of VIth phase is in progress at Namkhana-Kakdwip area of West Bengal involving 100 farm families.

LIBRARY & DOCUMENTATION SERVICE

The CIFRI is the main source of information for a variety of users including researchers, university professors, officials, students and entrepreneurs. The library added 124 books, 333 reprints of the scientific

papers, 58 miscellaneous publications and 180 maps to its collection and subscribed 28 foreign and 64 Indian journals. The Library has now a total holding of 6549 books, 4190 reprints, 933 maps and 2881 miscellaneous publications. Twenty one 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 inland 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.1.121 million.

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 13 technical reports on the progress of research activities of the Institute were compiled. Research publications of CIFRI scientists were scrutinised before publication in various journals. Technical queries regarding the activities of the Institute from various quarters of the country and abroad were attended to by the section. 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 contribution made by individual scientists are being 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 1991 to March 1992.

- 1 **Annual Report** for the year 1990-91.
- 2 Deputation report - Second Asian Fisheries workshop Haugzhou Peoples Republic of China, 15-19 October 1990 by Arun G. Jhingran.
- 3 A Report on sociological survey of the fishing families of the Narmada river (Consultancy report submitted to the Narmada Control Authority)

- 4 *Anterdestiya Matsya Chas Unnatikalpe Prasikshan* (Training for Inland Fish culture in Bengali system). Edited by U. Bhowmik and P. K. Pandit.
- 5 Prospect of developing farming system and trade of the giant African snail *Achatina fulica* in the Andaman and Nicobar Islands - A survey report by V.K. Unnithan.
- 6 Performance of Tilapia in Indian waters and its possible impact on the nature ichthyofauna by Arun G. Jhingran (Presented at the Workshop on Tilapia in the capture and culture based fisheries in the Indo-Pacific Region, 5th IPFC Working Party and of Experts on Inland Fisheries, Bogor, 27-29 June, 1991).
- 7 Development potential and constraints of Inland Fisheries Management in India by Arun G. Jhingran. (Presented at 5th IPFC Working Party of Experts on Inland Fisheries, Bogor, 24-26 June, 1991).
- 8 Course material on openwater fishery resource assessment and management (prepared for trainees under FAO sponsored training during November 6- December 2, 1991).
- 9 Proceedings of the Workshop cum Training on Biomonitoring in the river Ganga. Edited by Apurba Ghosh, K. K. Vass and H.C. Joshi for course held at CIFRI during June 3-7, 1991.
- 10 Development of Fisheries in Tapan Block, West Dinajpur, West Bengal -A feasibility study. By Utpal Bhowmick, G.N. Saha, M.K. Mukhopadhyay, M.M. Bagchi & P.K. Pandit.
- 11 Indian Fisheries Abstracts -
Vols. 25 (1) 1986 26 (4) 1987 27 (1) 1988 28 (3) 1989 29 (2) 1990.

CONFERENCES, SYMPOSIA, ETC.

The following important Meetings/Workshops, etc. were organised by the Institute during April 1991 to March 1992.

Workshop-cum-Training on Biomonitoring in the River Ganga was organised by CIFRI in collaboration with Ganga Project Directorate and Thames Water International, U.K. from 3-7 June 1991 at Barrackpore and Allahabad. The main objective of the workshop was to evolve a uniform methodology for biomonitoring studies to be carried out by the participating Institutes, Universities allotted projects on biomonitoring. At Barrackpore, theoretical

lectures were delivered by guest lecturers like Dr. Mike Andrews, Dr. Arun G. Jhingran, Dr. Niloy Choudhuri, Dr. S.K. Konar and Dr. P.N. Viswanathan, Dr. K.K. Vass and Dr. H.C. Joshi covering various aspects of biomonitoring investigations. The course was inaugurated by Dr. J.J. Ghosh, Head (Retd.), Biochemistry Dept., Calcutta University. Mrs. Nandita Chatterjee, IAS, Regional Director, GPD presided over the function. The welcome address was delivered by Dr. Arun G. Jhingran and Keynote address by Dr. Niloy Choudhuri, Prof & Head, Civil Engineering Dept., Jadavpur University. The training programme was concluded at Allahabad and the Valedictory address was delivered by Dr. P. Das, Director, NBFG, Allahabad.

Training on Inland Fisheries Development for the Extension Functionaries of Action Aid from 16-25 July 1991 at CICFRI, Barrackpore.

Apart from the above, the scientists of the Institute participated/presented/submitted papers in the Fifth International Symposium on the **Ecology of Regulated Streams** organised at Flathead Lake Biological Station, University of Montana, Polson, Montana 59860, USA, from 3rd to 7th September 1991; National workshop on **Low energy fishing** organised by CIFT, Kochi, sponsored by MPEDA, NBARD, SCIC Co. etc. , on 8th & 9th August 1991; Rotary International District Meet on **Preserve Planet Earth** on 27th April 1991 at Ice Skating Rink, Calcutta; National symposium on **Farming System for Sustained Productivity in Humid Tropics** conducted by Andaman Science Association, C/o CARI, Port Blair on 16th & 17th December 1991; Workshop on **Conservation of Mahseer Resources in India** at Lonawala by Tata Electric Company, from 9th to 11th August 1991; National Workshop on **Kolleru Environmental Information System** on 4th & 5th October 1991 at Hyderabad; International Conference on **Land Water Interactions** at New Delhi from 8th to 14th December 1991; XXIII Annual convention Indian Society Agric. Chemists and Symposium on **Pollution and Stressed** held at Agriculture Institute Engineering and Rural Technology, Allahabad on 27th & 28th September 1991; National seminar on **Conservation and Management of Mangrove Ecosystem with Special Reference to Sunderbans** held at BCKVV, Mohanpur from 6th to 8th December, 1991; and National Fishworkers' Forum, New Delhi - **Training for Fishermen Youths** at Indian Social Institute, Bangalore, from 18th to 27th November 1991.

A total of 38 papers were presented by the scientists of the Institute in the above mentioned seminars/workshops/meetings, etc.

VISITORS

A large number of distinguished personalities including national leaders visited the Institute's Headquarters and its different centres during 1991-92. This include **Shri K.C. Lanka**, Hon'ble Minister of State, DARE, ICAR, New Delhi

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

Ahluwalia, S.S. (Dr.), Director (IC), Ministry of Agriculture, New Delhi

Bhaduri, J.N. (Dr.), IFS, Chief Conservator of Forest and Director, Sunderbans Biosphere Reserve, West Bengal.

Bhatt, R.C. (Mr.), Officer-on-Special Duty, Narmada Planning Group, Gandhinagar

Blinkhorn, A. Thomas (Mr.), Principal Project Officer, Environment, The World Bank, USA

Bose Dilip Kumar (Dr.), Secretary, Dept. of Science and Technology, Govt. of West Bengal.

Boyd, Clavde E. (Dr.), Dept. of Fisheries and Allied Aquaculture, Auburn University, Alabama-36849, USA

Char, N.V.V. (Mr.), Secretary, Sardar Sarovar Construction Advisory Committee, Ministry of Water Resources, Govt. of India, Vadodara

Dehadrai, P.V. (Dr.), Deputy Director General, Indian Council of Agricultural Research, New Delhi

Gamble, Don (Dr.), Chief of Staff, World Bank Independent Review Mission

Jeyabaskaran, Y. (Mr.), General Manager, Tamil Nadu Fisheries Development Corporation Ltd., Tamil Nadu

Kadrekar, S.B. (Dr.), Vice-Chancellor, Kankan Krishi Vidyapeth, Dapoli, Maharashtra State.

Keulikora, P. (Mrs.), USSR Institute of Irrigation Fisheries (Agricultural Academy, Moscow.

Kozlov, B. (Dr.), USSR Institute of Irrigation Fisheries (Agricultural Academy, Moscow.

Krishnan, P. (Mr.), General Manager, Tamil Nadu Fisheries Development Corporation Ltd, Tamil Nadu

Kutty, M.N. (Dr.), FAO/UNDP from Bangladesh

Mahajan, K.K. (Dr.), Director (Rtd.), Dept. of Environment, New Delhi

- Meena, R.L. (IAS) (Mr.), Commissioner of Fisheries, Govt. of Gujarat
- Nuruzaman, A.K.M. (Mr.), Member-Director (Fisheries), Bangladesh Agricultural Research Council (BARC), Dhaka, Bangladesh
- Purnalingam, R. (IAS) (Mr.), Commissioner of Fisheries/Chairman, Tamil Nadu Fisheries Development Corporation Ltd., Tamil Nadu
- Rwoollen (Dr.), University of Stirling, U.K.
- Rynjah, L. (Dr.), Commissioner of Fisheries, Govt. of Assam, Dispur, Assam
- Sarkar, Asoke (Mr.), Aquaculture Extension Project, Mymensingh, Bangladesh
- Sly, Peter (Dr.), Director, Science Programme, The Rawson Academy of Aquatic Science, Ontario, Canada
- Sommerville, C. (Dr.), Institute of Aquaculture, Stirling, U.K.
- Srivastava, V.S. (Dr.), National Academy of Sciences, Allahabad
- Tyagi, R.P.S. (Dr.), Member, ASRB, New Delhi
- Vozojibliev, B. (Mr.), USSR Institute of Irrigation Fisheries (Agricultural Academy, Moscow.
- Wahab, M.A. (Dr.), Associate Professor, Dept. of Fishery Biology & Limnology, Bangladesh
- Wooten, R. (Dr.), Institute of Aquaculture, University of Stirling, U.K.
- Zweig Ronald (Dr.), World Bank Expert

FINANCE

For the year 1991-92 (Rs. in lakhs)			
	B.E. 1991-92 (Rs.) -----	RE. 1991-92 (Rs.) -----	Actual Expenditure 1991-92 (Rs.) -----
Plan :	85.00	85.00	87.97
Non-Plan :	250.00	255.00	255.00
Total :	335.00	340.00	342.00

PROGRESS OF RESEARCH

CENTRE-WISE LIST OF ONGOING PROJECTS 1991-92

BARRACKPORE	:	FC/A/11 BF/B/2 BF/B/11 AN/A/12 AN/A/15	FC/A/4 BF/B/3 BF/A/2 AN/A/13 CSS/1	FC/A/13 BF/B/8 AN/A/9 AN/A/14
AGRA	:	FC/B/10	FC/B/11	AN/A/15
ALLAHABAD	:	FC/B/7 FC/A/18	FC/B/11	AN/A/14
BANGALORE	:	FC/A/7 AN/A/15	AN/A/9	AN/A/14
CALCUTTA	:	BF/B/10	FC/B/11	
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	AN/A/15
KANGRA	:	FC/A/7		
LALGOLA	:	FC/B/7		
PATNA	:	FC/B/7	FC/B/11	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	AN/A/15	
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 (upto 21.12.91), J.B. Rao, T.S. Rama Raju, K.S. Rao, P.S.C. Bose
Duration	:	1986-1991 (extended to March 1992)
Location	:	Eluru, Andhra Pradesh

Catch statistics and species composition

The fish and prawn production exploited from Kolleru lake during the period March 1991 to February 1992 was estimated at 3,529 tonnes showing an increase by 7.2% over that of the preceding year. The per hectare yield during the year was estimated to be 261 kg.

During the year 1991-92, the live fish dominated the fishery with 1674.8 t, (47.5%) followed by prawns 1318.9 t (37.9%) and carps 260.5 t (6.8%).

Plankton, benthos and macrovegetation

Plankton volume was recorded upto 0.1 ml^{-1} . The peak abundance was observed during the summer months with marked domination by phytoplankton (76.0 to 99.8%). Density of invertebrates ranged between 13 and 663 um^{-2} , the peak values recorded during June to August.

The estimated biomass of macrophytes in Kolleru lake ranged between 8.0 kg and 14.0 kg m^{-2} with an average of 8.2 kg m^{-2} .

Routine physico-chemical parameters of water and soil were recorded as in previous years.

The primary productivity ranged between 45.03 to $62.49 \text{ mg Cm}^{-3}\text{hr}^{-1}$.

Biological studies :

Biological investigations were conducted on 920 specimens of *M. gulio* collected from the three landing centres viz., Eluru, Akivedu and Bhimavaram for examining their food and feeding habits, maturity, and fecundity.

Recruitment to the fishery occur during the months of June and September and the higher average weight during July is attributed to the mature condition of the majority of the fish. The maximum size of the fish, so far recorded, was 270 mm and 246 g. The minimum size of the mature female was observed to be 80 mm and 6 g. The breeding season for this species was observed to be from May to August and maximum number of spent females were encountered in the month of August. The fecundity of 41 specimens was studied and it was found to vary between 4864 and 54582.

Pollution studies

A study was undertaken on the quantum of effluents being released into the lake and its environment by various industries and other sources which are causing some adverse impact on the fishery of lake. All these effluents were observed to adversely affect the lake fishery, mainly in its recruitment phase either directly in the brackishwater recruitment zone in the estuary or the freshwater recruitment zone in the lake itself. In addition, the deltaic canal systems of Godavari and Krishna rivers were also reported to be affected.

Bioassay studies

The LC₅₀ values of distillery effluent for different periods of exposure (24 hr, 48 hr, 72 hr and 92 hr) with respect to late fry of *C. mrigala* were estimated to be 5.2%, 3.75%, 3.10% and 2.79% by volume respectively.

Studies were also conducted with the same distillery effluent, using chironomid larvae as test organism. 100% mortality in 5% dilution of the effluent within 24 hr exposure period was observed.

The studies on pesticide residues in sediments of Kolleru lake indicated that the concentration of BHC was more in Gudivakalanka area (25.62 ppb) and less towards Sringavarappadu region (5.6 ppb). However, the total DDT residues was detected to be more in Sringavarappadu region (25.4 ppb), as compared to Gudivakalanka region (9.3 ppb).

Fish diseases

The ichthyofauna of Kolleru was affected by the Epizootic Ulcerative Syndrome during the winter months of 1990-91 and 1991-92. The fish species affected were - Severely affected *Channa striatus*, *C. punctatus*, *P. sarana* and barbels and minnows (80-90%), moderately affected *Macrornathus aculeatus*, *Mastocembalus armatus* and *M. pancalus*, *Nandus nandus*, *G. giuris*, upto 50%), *E. suratensis* (Marginally effected, upto 25%), *H. fossilis*, *C. batrachus*, *C. mrigala* and *L. rohita* (least effected, less than 10%).

PROJECT **FC/B/7**

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

Personnel : Y. Rama Rao, Ravish Chandra, S.P. Singh,
 G.K. Bhatnagar, S.K. Wishard, S.N. Mehrotra,
 H.P. Singh, D.N. Singh, R.K. Saxena, M.A. Khan,
 Balbir Singh, G. N. Srivastava, R.N. S Seth, R.K. Dwivedi,
 R.K. Tyagi, V. Pathak, B.C. Jha, P.N. Jaitly, A.R. Chaudhuri,
 N.K. Srivastava, D.N. Srivastava, Ram Chandra, B.D. Saroj,
 L.R. Mahavar, J.P. Misra, M.P. Singh, Ramji Tiwari,
 P. Rajani,

Duration : 1986-1992

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

Population structure, Breeding biology and Recruitment of *T. ilisha*

A total of 970.62 kg of hilsa was estimated to have landed during April 1991 to March 1992. Of this 785.98 kg was from Sadiapur and 194.64 kg from Daraganj. The fishery of hilsa which maintained a steady trend of revival during 1984-87 showed decline from 1988, but registered a sudden rise during 91-92 with a raise of nearly 60% over that of last year. The catch was recorded during all the three peak months of September, October and November and continued till March 92 though meagrely.

An analysis of landings revealed that IInd size group (1008 nos.) dominated the catch followed by IIIrd (435 nos.), Ist (175 nos.) and IVth (4 nos.)

Patna

The total estimated catch of hilsa during the period was 52.4 kg mainly comprising specimen in the size group I (40.4%), II (40.4%) and juveniles (17.3%). The catch increased considerably from 13.7 kg of 1990-91. During 1986-91, the annual landings of hilsa was within the range of 2.7 kg (1987) to 111.8 kg (1988) with the dominance of size groups I and II..

Spawning of hilsa around Allahabad/Patna

The breeding of hilsa in the stretch between Allahabad and Varanasi commenced from September. A total of 325 young larvae and post larvae were collected against 449 recorded during the preceding year. Yolke larvae (20 nos.) were recorded at Sindhouraghat near Chunar during September. Till 1st fortnight of October, only yolke larvae were recorded at all the centres and the

second half was restricted to post larvae at all the centres. Maximum no. of larvae/post larvae collected during the peak month of October was 114 (Vindhychal) followed by 87 (Sirsasghat), 65 (Ramnagar), 41 (Sindhouraghat) and 2 (Madhuka).

Collection of yolked larvae in the first fortnight of November at Ramnagar indicated that breeding continued till middle of November. The intensity of breeding of hilsa, this year, was almost similar to that of the preceding year. The potential stretch was confined between Sirsaghat and Varanasi. The Madhuka centre which recorded maximum number of larvae and post larvae during 1987, 89 and 90 recorded only two larvae this year.

Young fingerlings of hilsa ranging between 130-160 mm belonging to 1990 stock were reported in the catches during April and May both at Sadiapur fish assembly centres as well as various points of fishing in river Yamuna along with stray specimens of hilsa of 1st size group.

The two centres observed around Patna did not show any record of hilsa spawn.

Estimation of biological and population parameters of commercially important fish species

During 1991-92, the species-wise landings at Sadiapur, Daraganj, Patna and Lalgola centres were as follows :

Quantitative and qualitative composition of commercial fishery in selected stretches of river Ganga

SPECIES	Centres			
	Sadiapur	Daraganj	Patna*	Lalgola
<i>C. mrigala</i>	2.40	0.32	0.32	0.70
<i>C. catla</i>	2.26	0.05	0.76	1.10
<i>L. rohita</i>	1.61	0.05	0.47	0.81
<i>L. calbasu</i>	7.68	0.55	0.33	0.94
Major carps total	13.95	0.97	1.88	3.55
<i>M. aor</i>	9.52	0.94	2.73	5.22
<i>M. seenghala</i>	7.98	3.16	2.86	1.94
<i>W. attu</i>	1.53	0.08	0.73	5.12
Large sized catfishes total	19.03	4.18	6.32	12.28
<i>H. ilisha</i>	0.79	0.18	0.05	7.11
Others	50.57	20.61	19.13	45.52
TOTAL	84.34	25.94	27.38	68.46

(in t)

*April-February

At Sadiapur, the fishery of major carps did not reveal significant change over the past. The increase in landings during the year was contributed by economically less important species such as *Chela* spp., *Setipinna phasa*, *Gudusia nanmima* and *G. chapra*. Large sized catfishes, specifically, *Mystus seenghala* registered a decline of 20.6%. Daraganj market landings exhibited an increase of 25.0% over the corresponding period of preceeding year. The increase was almost for all the species, excepting *Rita rita*, *C. garua* and *Eutropichthys vacha*. These registered a decline of 23.2% during the year.

At Patna the total landings exhibited a decline of 34.1% over the year 1990-91 contributed by almost all the species.

The production rate at the stretches feeding Allahabad market were computed at 23.97 kg ha⁻¹ (major carps, 3.24 kg ha⁻¹; catfish 5.05 kg ha⁻¹; others 15.47 kg ha⁻¹). As compared to the fishery of the yester years, there was a drastic decline in 91-92 (total 46.81 kg ha⁻¹, major carps 21.25 kg ha⁻¹, catfish 10.71 kg ha⁻¹, others 10.60 kg ha⁻¹).

During 91-92, the total fish landings at Patna was 29.98 t, 27.8% less than that of 90-91. The decline in the catches may be attributed to decrease in the landings of major carps (43.5%), major catfishes (44.3%) and miscellaneous species (15.2%). Miscellaneous species dominated in the catches (67.9%) followed by major catfishes (24.8%) and major carps (6.3%), Prawns (0.8%) and hilsa (0.2%). Among the various species, *C. garua* was the most dominant (15.0%) followed by *E. vacha* (11.0%), *M. aor* (9.1%), *M. seenghala* (8.6%), *B. bagarius* (4.0%), *M. chitala* (2.9%), *C. catla* (2.5%), *W. attu* (2.4%) and *R. rita* (2.0%).

At Lalgola, the landings showed a decrease of 10.4%, the worst affected species being *H. ilisha*. The landings of hilsa registered a decline of 58.4% over the last year. The landings of large sized catfishes showed an increase of 33.5%, constituted mainly by *W. attu*. Large sized prawns increased to 6.26 t from 4.95 t of 1990-91.

Juvenile fishery

During the current year, landings of fry and fingerlings of major carps were almost negligible at Allahabad fish markets. The apprehension is that juveniles were completely prevented from entering into the main rivers and caught from floodplains for aquaculture. In the long run, it may further adversely affect the major carp fishery in the Ganges. At Patna, the juvenile fishery of major carps was estimated at 40.5 kg as compared to 131.2 kg of 1990-91.

Stock structure

The frequency occurrence of I yr. group was much higher in case of mrigal, rohu and *M. aor* as compared to 1990-91. For catla, the contribution by I yr. group came down to 26.9% from 70.6% of 1990-91. In case of hilsa, the contribution by II yr. group was much higher (62.2%) as compared to 42.8% of previous year. *C. mrigala* and *L. calbasu* were dominated by smaller size groups (I, II & III), *C. catla* by III, IV & VI and *L. rohita* by II, III and IV. The landings

of major catfishes *M. aor*, *M. seenghala* and *W. attu* were dominated by smaller size groups I, II & III.

During six years of observations from 1986 at Patna, the larger size groups of *C. catla* and *L. rohita*, medium size groups of *C. mrigala* and *L. calbasu* and smaller size group of catfishes formed major the component of landings.

At Allahabad and Patna, the catch/boat/day for different years in kg was estimated as follows :

Centre	Gill Net	Drag Net	Hook & Line	Traps
Allahabad				
Buximodha (Yamuna)	3.92	26.77	2.07	-
Lavain (Ganga)	4.83	10.91	3.35	-
Patna				
Mahendraghat	8.70	14.20	5.80	-
Ghaghat	5.10	16.80	5.20	5.00

Compared to 1990-91, the CPUE was higher at Allahabad. This year, the operation of scoop nets, which used to be the principal gear during monsoon, was not observed.

Breeding and recruitment of selected commercial and non commercial fishes

Investigations were carried out on the river Yamuna and Madhauka centre, where 3 floods and 5 spawning spurts were encountered during the season. Only 2160 ml spawn could be collected, against 14 567 ml in the previous year. The 1st flood contributed maximum spawn (36.3%), followed by 2nd (35.2%) and 3rd (25.5%). There was greater abundance of desirable spawn in the second flood (56.2%) followed by 3rd (42.23%) and 1st (41.0%), the average being 46.5%. Among the desirable ones, the most abundant was rohu (18.3%), followed by mrigal (16.5%), catla (8.6%) and calbasu (1.2%). At Jhusi centre on the river Ganga, a total of 330 ml spawn were collected from three low floods. The maximum of 63.3% was obtained in the third flood. Seasonal indices of quality and quantity were estimated to 26.0% (rohu 13.5%, mrigal 10.0% and calbasu 2.5%) and 110 ml respectively.

At Patna, a record of 2100 ml (10.5 lakhs) of spawn was collected comprising major carps (39.1%) followed by minor carps (35.0%) and others (25.9%). The indices of quality spawn was 47% dominated by *L. rohita*. Water temperature, current velocity and turbidity were in the range of 30.0 to 32.5°C, 0.9 to 2.4 km hr⁻¹ and 360 to 750 ppm respectively.

Estimation of Fry and Fingerlings

Estimation of fry and fingerlings of major carps was done by operating drag nets in the cut-off waters. The availability of fingerlings in river Ganga

(Bamrauli area) was 66 ha^{-1} by number and 14.4 kg ha^{-1} by weight. In river Yamuna (Birbal Ka Purba), the values were 69 ha^{-1} by number and 9.25 kg ha^{-1} by weight.

Impact of environmental changes on the biotic communities

Ecology of deep pools : Physico-chemical characteristics of water and soil, plankton and benthic communities were studied in Kare Centre (River Ganga) and Buximodha (River Yamuna).

Fishery of the deep pools : Maximum catch (1120.50 kg) from Kare pool was recorded in the month of November followed by March (592.9 kg). The total catch was 2551.76 kg, consisting of catfishes (70.3%), major carps (6.5%) and miscellaneous fishes (22.6%). Among catfishes *Rita rita* and *Clupesoma garua* were prominent. The landings from Buximodha deep pool was estimated at 780.7 kg of which 27.4% was landed in November and 42.8% in May-June. Catfish contributed 59.0% of the catch followed by miscellaneous fishery (28.2%), major carps (10.4%) and hilsa (1.9%).

Dragnet, gillnet and hook and line were the gear operated in the pools. Gillnet brought ashore 66.5% of the catch, followed by dragnet (24.9%) and hook and line (8.6%).

ENVIRONMENTAL IMPACT ASSESSMENT

Physico-chemical and biological characterisation of rivers Ganga and Yamuna at selected stretches was continued during the year. In Ganga three industrial zones at Kanpur, two sewage polluted and two non polluted zones at Allahabad and two sewage polluted zones at Varanasi were investigated. Two sewage polluted zones were studied in the river Yamuna. The details are given below.

River Ganga

Physico-chemical features of river water : The zones studied and the range of values of various parameters are given in Table 1. The values of pH, conductivity, bicarbonates and nutrients were much lower at Bhagwatghat compared to the values observed during 1990-91. Similar trend was observed at tannery waste disposal zone. At this site, the fluctuations were mainly dependent on the quantum of effluents discharged to the rivers. At Jajmau, there was a substantial improvement in water quality compared to previous years.

Sewage pollution and its impact was monitored in terms of DO, bicarbonates, and nitrates at Mehduarighat, Mavaiya, Nagwa and Rajghat at Varanasi.

The water quality of Ganga at Patna did not show any remarkable impact of the industrial effluents at Dighabata and sewage effluents at Rajapur.

River Yamuna

River Yamuna was investigated at Kakrahaghat receiving city waste and Sujawan, a nonpolluted zone. Low values of transparency, pH and dissolved oxygen

Table - (FC/B/7)

Table 1 : Physico-chemical characteristics at selected zones in river Ganga

	Industrial zone				Sewage zone				Industry & sewage zone		Polluted zone	
	Bahagwatghat		Tennery		Jajman		Mehduarighat		Mavalva		Fatchpurghat	Mavalva
	AOF	OF	AOF	OF	AOF	OF	AOF	OF	AOF	OF		
Temperature (°C)	29.5	30.0	29.5	30.0	-	-	18.5	31.5	19.5	33.0	19.0-31.0	20.0-33.0
Transparency (cm)	42.0	11.0	40.0	9.0	3.50	2.80	42.0	10.0	96.0	7.0	10-55	11.5-35.0
pH	7.34	6.94	7.1	6.6	7.3	6.7	7.9	6.4	7.64	6.25	6.98-7.88	6.8-7.7
Free carbondioxide (mg l ⁻¹)	Nil	3.0	Nil	2.0	Nil	10.0	Nil	15.0	Nil	32.0	Nil-1.0	Nil-5.0
Bicarbonate (mg l ⁻¹)	120.0	110.0	112.0	104.0	180.0	100.0	70.0	422.0	100.0	410.0	76.0-226.0	100.0-218.0
Dissolved oxygen (mg l ⁻¹)	7.20	3.36	5.28	0.32	Nil	7.2	9.28	1.76	10.72	0.16	6.7-10.9	4.64-11.2
Total Diss. Salts (mg l ⁻¹)	132.0	159.0	133.0	560.0	132.0	334.0	93.0	367.0	122.0	533.0	94.0-262.0	118.0-307.0
Nitrates (mg l ⁻¹)	0.25	0.81	0.35	0.88	0.34	0.74	0.20	0.52	0.21	0.59	0.20-0.24	0.19-0.24
Phosphates (mg l ⁻¹)	0.24	0.72	0.31	0.82	0.32	0.82	0.21	0.49	0.20	0.58	0.21-0.24	0.20-0.23
Silicates (mg l ⁻¹)	6.9	8.6	7.0	8.7	7.2	8.6	6.6	8.0	6.6	8.4	6.6-7.0	6.7-7.0
Sp. Cond. (μ mhos cm ⁻¹)	261.0	315.0	111.0	266.0	259.0	663.0	188.0	733.0	242.0	1063.0	187.0-522.0	234.0-609.0

were observed at the outfall region in Kakrahaghat. Specific conductivity as high as $806.0 \mu\text{mhos cm}^{-1}$ and TDS value as high as 404 mg l^{-1} were observed at this zone. The impact of the effluent discharge on the ecosystem was less this year based on the values of physicochemical features of the water.

Primary productivity investigations

Levels of primary productivity were measured in June 1991 at Bhagwatghat and Jajmau areas of Ganga at Kanpur. The rivers at Bhagwatghat receives textile industry effluents and Jajmau receives sewage effluents. Three stations at Allahabad and two stations at Varanasi also were investigated in river Ganga. The river Yamuna was studied at Kakrahaghat and Sujawan in Allahabad. The productivity levels, COD and BOD levels at these stations are listed (table 2).

Heavy metal concentrations

The soil, water and benthos were analysed from river Ganga at Kanpur (tannery and Jajmau), Allahabad (Bhagwatghat, Mehduarighat, Mavaia), Varanasi (Nagawa, Rajghat) and Patna (Dighabati, Rajapur) and the Yamuna at Allahabad (Kakrahaghat) in June 1991. The range of values were as in table 3).

Table 3 : Concentration of heavy metals at selected centres in river Ganga and Yamuna during June 1991

	<u>Zinc</u>	<u>Arsenic</u>	<u>Chromium</u>
Water ($\mu\text{g l}^{-1}$)	11.2-44.2	7.4-29.6	nil-3.6
Soil ($\mu\text{g l}^{-1}$)	30.2-84/4	9.4-20.2	8.4-15.8
Benthos ($\mu\text{g l}^{-1}$)	11.8-17.6	1.2-2.8	1.8-3.4

Biotic communities : A total of eleven sites were investigated for the biotic communities comprising industrial pollution zone, sewage polluted zone and freshwater zone. The range of counts for the plankton and benthos at these sites are given in table 4.

Plankton population in all sewage polluted zones were significantly higher. At Kanpur, the pollution load was indicated by the species like *Spirulina*, *Microcystis*, *Brachionus*, *Zoogloea ramigera*, *Sphaerotilus* sp. and *Leptotherix* sp. A peak in plankton production ($54676 \mu\text{ l}^{-1}$) dominated by *Oscillatoria* sp. was noticed at sewage polluted Mehdaurighat at Allahabad in September 1991. *Spirulina*, *Melosira*, *Euglena*, and the bacterium. *Zoogloea ramigera* were other indicator species at this region.

The benthic population was seriously affected at the outfall zone of tannery effluents at Kanpur. Substantially higher population of benthos was observed at all

Table (FC/B/7)

Table 2 : Level of primary productivity, respiration, COD and BOD in river Ganga

Stations	Season	Gross productivity (mg C m ⁻³ hr ⁻¹)	Net productivity (mg C m ⁻³ hr ⁻¹)	Respiration (mg C m ⁻³ hr ⁻¹)	COD (mg l ⁻¹)	BOD (mg l ⁻¹)
Bhagwatghat	June 91	225.0-437.5	37.5-312.5	105.0-150.0	3.4-77.0	5.0-81.8
Jajmau		No production below outfall				
Fatehpurghat	91-92	37.5-362.5	12.5-190.0	30.0-275.0		
Mehdaurighat	Monthly	38.9-179.1	25.0-142.8	6.7-145.7	3.2-40.5	3.0-38.5
Manahya	studies	37.5-300.0	12.5-200.0	30.0-165.0		
Kakrahaghat		28.5-218.7	14.3-193.7	10.0-150.0	3.2-32.3	3.0-38.4
Sujawan		37.5-150.0	12.5-125.0			
Nagwa	June 91 & Jan. 92	75.0 (AOF)	50.0 (BOF)	-	4.0-38.4	3.0-74.2
Rajghat	AOF	75.0-112.5	25.0	-	4.0-81.2	
	BOF	No productivity				

AOF = Above Outfall area BOF = Below outfall area

Fatehpurghat at Allahabad recorded all time high values of productivity influenced by the leaching of organic manure from the cultivated areas in catchment of all the centres. The BOD and COD were highest in Kanpur at the effluent releasing sites from tanneries.

Table : (FC/B/7)

Table 4 : Plankton and benthos at selected polluted and non-polluted zones of river Ganga and Yamuna

		Plankton (no. l ⁻¹)			Benthos (no. m ⁻²)		
		AOF	OF	BOF	AOF	OF	BOF
A. Industrial effluent zones							
Bhagwatghat	Kanpur	2250	600	400	484	220	308
Tannery	Kanpur	950	350	400	440	Nil	8580
Mavaiya	Allahabad	817	699	483	138	651	1976
B. Sewage zones							
Jajmau	Kanpur	4300	3400	4100	5580	7260	4136
Mehdaurighat	Allahabad	1297	5933	1150	145	1924	1044
Kakrahaghat	Allahabad (Yamuna)	715	609	450	-	-	-
Nagwahat	Varanasi	251	893	475	130	748	156
Rajghat	Varanasi	1925	3491	2385	288	88	1978
C. Non-polluted zones							
Fatehpurghat	Allahabad		947			488	
Manaiya	Allahabad		377			173	

AOF - Above outfall area OF - Outfall area BOF - Below outfall area

sewage receiving points than those of unpolluted zones. Chironomids constituted 62.0 to 88.7% of benthic population in sewage zones.

At various places around Patna the average plankton concentration ranged between 1112 and 2415 μl^{-1} , the highest being at Fatuha and lowest at Dighabata. Bacillariophyceae (67.77% to 82.18%) regulated the community structure of plankton as a whole. An inverse correlation was evident between the diatoms and sewage fungus. Blue greens, protozoans and rotifers found increasing marginally with the mixing of city sewage. Similarly green algae and copepods exhibited sign of recovery after the ingress of Gandak and Punpun waters. Significantly, the *Melosira varians* and sewage fungus *Zooglia remigera* have assumed a perennial status; indicating mild pollution throughout the year and the entire stretch around Patna.

The average benthos population ranged from 2304 to 2827 μm^{-2} at Rajapur and 260 to 391 μm^{-2} at Dighabata. The quantitative abundance of benthic population showed considerable increase in the outfall region in both the places. Remarkable qualitative changes were observed in the three zones. Among the two tributaries, Punpun was comparatively richer in benthos population (2565 μm^{-2}) than Gandak (152 μm^{-2}). Considerable qualitative difference was noted in the abundance of various groups with gastropods dominating in Punpun and oligochaetes and dipteran larvae in the Gandak (48.6 and 22.8%).

Diurnal variations : Diurnal variations in the water quality parameters like temperature, pH, DO, alkalinity conductivity and total dissolved solids were carried out in March 1992 at Allahabad in rivers Ganga and Yamuna above and below the confluence.

Diversity index : Based on the values of the diversity index (\bar{H}) in respect of phytoplankton, zooplankton and macrobenthos the whole stretch of river at Kanpur was found to be under pollution stress. The diversity index varied between 0.95-2.07; 0.0-0.69 and 0.0-1.34 in case of phytoplankton, zooplankton and macrobenthos respectively. Similar observations were made at Allahabad stretch also where the values fluctuated between 0 and 1.89, 0 and 1.75, 0 and 1.96 in respect of phytoplankton, zooplankton and macrobenthos respectively. These values at Varanasi varied between 0 and 1.23; 0 and 1.01 and 0.0 and 0.64.

On the basis of diversity index with respect to macrobenthos, which is supposed to be best indicator of pollution, the Rajghat (Varanasi) is the most polluted spot followed by Kanpur (Tannery). Allahabad is having pollution of a mild nature. The trend did not differ from that of last year, but a further deterioration of the ecosystem at Varanasi was recorded.

FC/B/9

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

Personnel : K.P. Srivastava, S.N. Mehrotra (till 30.9.1991),
M. Choudhury, R.C. Singh, A. Sarkar, D.K. Biswas
(till 7.10.1991), B.K. Biswas.

Duration : October 1985-March 1994

Location : Guwahati

Catch statistics : A total of 214.6-220.4 t till March 1992 of riverine fish has been estimated to have landed at Uzanbazar fish landing centre, Guwahati, during April, 1991 to February, 1992 showing thereby an increase of 8.60% in the total catch at the centre compared to previous year. The catch was dominated by minor carps (28.84%) comprising *L. gonius*, *C. reba*, *L. bata*, carp minnows, etc., followed by miscellaneous group of fish (23.08%), Indian major carps (17.86%), selected cat fish viz., *M. aor*, *M. seenghala* and *W. attu* (12.83%), feather backs (10.75%) and *T. ilisha* (6.63%). *L. calbasu*, *L. bata*, *W. attu* and *M. chitala* were dominant forms in their respective groups.

Hilsa was available in the river stretch during two sessions viz., April-June and September to November. A good number of fully mature milting and oozing specimens were encountered during the first season, suggesting the breeding of this species during this period.

Hydrology : Physico-chemical, hydrological and hydrobiological observations and collections were made at three selected centres viz. Noonmati, Saraighat and Bharalumukh points of the river Brahmaputra. There was no remarkable variation at Noonmati (clear water zone) and Saraighat (the discharge point of petroleum refinery effluent site) except the values of dissolved oxygen, total dissolved solids, nitrate and phosphate.

Plankton : Average plankton population at Noonmati and Saraighat centres of River Brahmaputra were estimated at 168 and 174 u/l respectively. It is of interest to note that at Bharalumukh site the plankton concentration was appreciable (357 and 353 u/l) at the outfall and below the outfall regions. Dominance of diatoms (36.90%) at Noonmati and green alga (48.28%) at Saraighat was noteworthy. The picture at Bharalumukh point indicated that while at the outfall point, Chlorophyceae was dominant, the diatoms have been encountered in abundance at the point below the outfall.

Macrobenthic fauna : At Noonmati and Saraighat sites of River Brahmaputra, negligible benthic organisms except gastropods cell were encountered, possibly due to very swift current of the river bed. At Bharalumukh site, chironomid larvae, gastropods and a few oligochaetes were available, the concentration of the former being higher than the latter.

PROJECT **FC/B/10**

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

Personnel : D.N. Mishra, Shree Prakash, Usha Moza, Krishna
 Chandra, Suresh Singh, Sudarshan Bandopadhyay

Duration : 1990-92

Location : Agra (U.P.)

Pollution investigation : Dak patthar was selected as an unpolluted zone in river Yamuna to compare the water quality with the polluted zone downstream. At this stretch, Pontasahib was identified as landing centre to investigate the composition of commercial fishery. Below this stretch, the river is interrupted with several hydel projects and further down, the river receives effluents from industries, refinery and domestic sources. The river is reduced to polluted pools between Tajewala to Etawa during most part of the year. The characterisation of the sewage discharged to the river at Agra, Etawa, Okhla (Delhi) and Najabgharh (Delhi) and the industrial effluents at Yamunanagar and Mathura was continued during the year.

Commercial fishery : The total landings from river Yamuna (Mathura-Etawa stretch) was estimated at 110.8 t comprising large catfishes (53.8%), major carps (26.42%) and miscellaneous fish (19.78%). The landings at Agra was 64.35 t, Mathura 12.32 t and Etawa, 34.11 t. Major carps contributed 10.9-31.3% at these centres.

Labeo calbasu (49.7-58.9%), *L. rohita* (23.11%), *Cirrhina mrigala* (22.8-50.6%) and *Catla catla* (4.4%) constituted the major carps while *Mystus seenghala* (65.25-73.25%), *M. aor* (3.76%) and *Wallago attu* (31.0%) formed the large catfishes. *Bagarius bagarius*, *Pangasius pangasius*, *Silonia silondia*, *Rita rita*, *Pupesoma garua*, *Eutropiichthyes vacha* and *Labeo bata* constituted the miscellaneous fishery (17.95%).

Spawn prospecting : Due to scarce monsoon, breeding of major carp was negligible. The spawn collected (6.15 ml per net per hr) was dominated by *Chela* spp. and *Puntius* spp. 1162 ml of spawn were handed over to the State Department.

Environmental monitoring

The observations were made at Tajewala, Yamunanagar, Delhi, Mathura and Etawa. Absence of flood and monsoon adversely affected the river water quality. The parameters recorded are given below :

Table : Values of physico-chemical parameters in Yamuna during 1991-92

Parameters	Tajewala (upstream)	Zones Wasirabad (Delhi)	Vrindavan (Mathura)	
			AOF	OF
pH	6.8-7.2	7.7-9.4	6.7-9.1	6.75-8.94
Sp. conductivity (μ mhos cm^{-1})	225-305	256-986	416-1292	1026-8310
BOD (mg l^{-1})	1.5-4.0	6.9-11.5		
Alkalinity (mg l^{-1})	25-116	171-348	196-346	185-346
Carbondioxide (mg l^{-1})	Nil	0.5-3.5 (monsoon only)		
Ammonia (mg l^{-1})	Nil	Nil		
Primary productivity ($\text{mg Cm}^{-3}\text{hr}^{-1}$)	31.36-75.56 (net production)	69.1-256.5 (gross production)		77.7-152.1

Biota

The macrophytes spread intermittantly had maximum biomass (400 g m^{-2}) at Delhi and minimum ($19.5\text{-}55.0 \text{ g m}^{-2}$) at Shergarh. A direct correlation between *Eichhornia* mass and gross organic load was noticed at Delhi and Agra.

The plankton in the river had a population of $226\text{-}2597 \text{ ul}^{-1}$. The dominating forms were *Phormidium*, *Microcystis*, *Merismopedia*, *Pediastrum*, *Scenedesmus*, *Synedra*, *Navicula* and *Melosira*. The regular presence and occasional bloom of *Phormidium* species indicated the organic pollution load at Agra. The sewage-mixed zone had occasional blooms of *Synedra* and *Navicula*. The phytoplankton had 61.9-93.4% share in the total plankton counts. *Brachionus*, *Ceriodaphnia* and nauplii had higher representation among rotifers and crustaceans. The outfall region at Mathura receiving textile industry wastes had lowest concentration of zooplankton. The plankton volume fluctuated between 0.01 and 22.0 cc ml^{-1} , mostly governed by zooplankters. The SDI calculated were Vrindavan 3.63, Mathura 2.9, Mathura oil refinery 2.82, Agra 1.84, Etawa 1.22, and Shergarh 2.48.

The benthic communities had a higher representation of Diptera (31.8-52.9%) followed by oligochaetes and molluscs.

The dominance of *Chironomus tentipformis*, *Limnodrilus* sp., *Tubifex tubifex* and occasional presence of *Cypris* sp. at Mathura and Etawah show high organic load in the system. However at oil refinery, AOF Agra and Shergarh, low organic pollution is indicated by the high percentage of molluscs like *Melania striatella*, *Lymnae* and *Viviparus bengalensis* respectively. The community pattern changes with the change in pollutional load and nature of pollution corroborated by the presence of *Cypris* sp. (90%) along Mathura and Etawa during summers, and presence of *Macrobrachium lammerti* during October at Mathura-Agra after monsoons, and presence of *Physa* sp. at the refinery stretch.

Diatom contributed maximum (70.0%) to the periphyton population. Above outfall regions showed a higher percentage of green algae, 9.86% at Mathura, 4.99% at Shergarh and 16.37% at Etawa. The maximum quantity of blue green algae (40.0%) were noticed at the outfall region at Agra. The species diversity index was maximum at Shergarh (4.06) and minimum at Agra (2.64).

Bioassay experiments

Impact of industrial waste (Mathura oil refinery) and mixed waste (sewage + tannery) were studied under laboratory conditions on fries and yearlings of common carp (*C. carpio*) by conducting bio-assay experiments with renewal technique. After 96 hours exposure no lethal effect by oil refinery waste was recorded, Lc50 (96 hr) was observed at 25% dilution for the mixed wastes.

Histological observations showed no hypertrophy with refinery waste but mixed wastes did show club shaped gill lamellae with expanded lumen, widened blood capillaries, sometimes bulging out of coelom indicating depleted oxygen condition of the medium. Longitudinal splitting of muscles have also been recorded in fishes kept in mixed waste.

The yearlings (90-95 g, 170-180 mm) exposed to oil refinery waste for 30 days did not indicate any adverse effect of the waste.

PROJECT FC/B/11

**ASSESSMENT OF ECODEGRADATION AND
CHARACTERISATION OF BIOLOGICAL AND CHEMICAL
RELATIONSHIPS IN THE RIVER GANGA AND ITS
TRIBUTARIES**

Personnel : Barrackpore Centre :
K.K. Vass, H.C. Joshi, M.K. Mukhopadhyay, M.M. Bagchi,
K. Mitra, Keya Saha, A.K. Banerjee (upto Nov.91),
D. K. Biswas (from 1.12.91)
Calcutta Centre : A.C. Nandy, R.K. Banerjee, H.C. Karmakar
Allahabad Centre : H.P. Singh, Balbir Singh, S.K. Wishard
Patna Centre : B.C. Jha, V. Pathak, P.N. Jaitly
Agra Centre : U. Moza, K. Chandra

Duration : April 1991-March 1996

Location : Environmental Monitoring Section, Barrackpore, Estuarine
Research Centre, Calcutta, Riverine Division, Allahabad,
CIFRI Research Centre, Patna, CIFRI Research Centre, Agra

Two environmental monitoring campaigns were organised during summer (June-July) and winter (December-February) in river Ganga at Kannauj (U.P.), Hajipur (Bihar) and Farakka, Nabadwip and Diamond Harbour (West Bengal). Similar campaigns were also made in the rivers Kali at Kannauj, Ghagra at Faizabad, Yamuna at Allahabad, Gandak at Sonapur, Jalangi at Nabadwip, and Damodar in the downstream at Durgapur.

Water quality

Water quality indices at different locations in the main Ganga and its tributaries did not indicate any alarming change in environmental conditions with respect to fisheries. The slight deterioration in water quality (WQI - 90, low DO - 4.96 mg l⁻¹, high BOD - 6.8 mg l⁻¹ and high COD - 7.8 mg l⁻¹) in river Yamuna during summers is a natural feature as the discharge in the river decrease without any reduction in pollution load.

WQI (Horten, 1965) of less than 100 was observed only at Yamuna at Allahabad (WQI - 90) and Damodar at Amta (WQI - 95).

The diversity indices for planktonic and benthic population at different locations always figured greater than 1, indicating by and large, a healthy environment for aquatic life. The planktonic populations have shown the impact of mixing of Kali waters in the main Ganga at Kannauj where the SDI in the Ganga below confluence with Kali has declined to 2.283 from 3.209 at a point above the confluence.

Biological parameters

Plankton : Plankton density was moderately high in Kali (1170-2021 u l⁻¹) and Gandak (1325-1638 u l⁻¹). In Yamuna the plankton density was relatively lower (250-500 u l⁻¹) while the lowest plankton density was recorded

in Ghagra ($100-275 \text{ u l}^{-1}$). Dominance of Bacillariophyceae (*Melosira* sp., *Synedra* sp., *Fragilaria* sp., *Navicula* sp.) characterised the plankton population in the upper stretch of the Ganga except in river Kali where Xanthophyceae bloom was predominant during summer. The plankton density was extremely low ($170-194 \text{ u l}^{-1}$) at Farakka and Diamond Harbour. *Phormidium*, *Brachionus* and *Coscinodiscus* dominated among the plankton at this stretch.

Benthos : Rich benthic fauna was observed in river Gandak (1207 u m^{-2}) but poor in rivers Kali (130 u m^{-2}) and Yamuna (209 u m^{-2}) and moderate in Ganga between Farakka and Diamond Harbour ($264-464 \text{ u m}^{-2}$). Benthic population was significantly high (1809 u m^{-2}) in the river Ganga below the confluence with river Gandak and low below the confluence with the river Kali in the main Ganga.

Insect population : Insect population was monitored in two locations in the main Ganga at Farakka and Nabadwip. Diversity index was lowest (1.69) at Nabadwip during summer and the highest at Farakka (3.278) during winter. The fauna was dominated by hemipterans.

Macrophytes : River Kali at Kannauj was found to be heavily infested with *Polygonum amphibium* and *Vallisneria spiralis* especially in summer. On the contrary, the river Ganga was completely devoid of aquatic vegetation at the confluences with Kali at Kannauj.

Fish health monitoring

The analysis of blood from *Rita rita* of river Kali at Kannauj showed poor RBC, Hb and HCT counts, while the best values were recorded in the river Ganga at Kannauj. Fish from other locations did not show any significant deviations in blood parameters. The histopathological examination of liver and kidney of fish *Rita rita* collected from Farakka and Nabadwip did not show any signs of toxicological stress.

Table : Haematological parameters (average values) of *Rita rita* in the Ganga River System

River	Sampling station	No./Size (mm)	Haematological parameters			
			RBC (million/cc)	WBC (1000/cc)	Hb(%)	HCT (%)
Ganga	Kannauj	4 (90-330)	4.20	14.2	6.2	54.4
	Farakka	12 (185-364)	4.61	11.17	9.28	42.7
	Nabadwip	10 (100-215)	4.27	6.3	7.74	30.78
Kali	Kannauj	5 (65-270)	1.23	5.64	3.08	24.6
Gandak	Sonepur	11 (95-160)	2.39	5.42	4.38	26.5

Heavy metal and pesticide residues : Heavy metal and pesticide residues were analysed in water, sediment and fish samples collected from different locations in the main Ganga and its tributaries. Zinc recorded $1.6-25.0 \mu\text{g g}^{-1}$ (in wet muscle), copper $0.3-2.9 \mu\text{g g}^{-1}$, cadmium below detection level to $0.76 \mu\text{g g}^{-1}$ and mercury below detection level to $0.56 \mu\text{g g}^{-1}$. There was wide variation of values in fishes collected from even same locations. *Labeo calbasu* and *Mystus gulio* had the highest levels of concentration among the four species studied from four locations of Ganga and Kali rivers.

In water, variations in the t-DDT was to the extent of $1.3-7.62 \text{ ng l}^{-1}$, the highest value was recorded from Yamuna at Allahabad ranged from 8.8 to 26.3 ng l^{-1} . In sediment, t-DDT levels varied from 1.63 to 20.34 ng l^{-1} , higher values obtained from Farakka and Nabadwip. Among fishes, the range of values for -HCH, -DDT and -HCH were $1.7-12.8$, $3.2-32.1$ and $3.8-60.8 \text{ mg l}^{-1}$, the highest values recorded from Kali river at Kannauj. Four species were studied for the pesticide content in their muscles.

The tributaries in the upper reaches of the river Ganga showed dominance of catfish and low diversity of fish as compared to the main river in its lower stretch between Farakka and Diamond Harbour. The decline in diversity was not in conformity with the physicochemical quality of water, soil and other biological parameters such as plankton and benthos as observed in this study.

PROJECT FC/A/4

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

Personnel : K.K. Vass, V.V. Sugunan, H.C. Joshi,
G.K. Vinci, K. Mitra

Duration : Upto April, 1993

Location : 2 beels each in Coochbehar, Murshidabad, Nadia, Hooghly
and 24-Parganas (North) in the State of West Bengal

Trophic Assessment

Morphology : Ten beels were selected in five districts viz., Coochbehar, Murshidabad, Nadia, Hooghly, and 24-Parganas (North) to have a rapid trophic evaluation during two sampling campaigns in winter and summer.

Chemical Spectrum Monitoring

Water and soil : Water quality analysis in 10 beels in 5 districts of West Bengal showed marked variation. Maximum variation was discernible in total

alkalinity (58-256.5 mg l⁻¹), Sp. conductivity (146.6-1189 μ mhos cm⁻¹), and chlorides (17.3-52 mg l⁻¹). The pH of water was mostly around 8 in beels of 24-Parganas, Hooghly, Nadia and Murshidabad districts while it ranged between 7.6 to 7.8 in Coochbehar District.

Soil : Soils in all the beels have shown slightly alkaline pH (7.0-7.6) except in Bhandardaha beel (6.7). Most of the beels showed rich organic carbon ranging from 0.3-2.31 which may be attributed to deposition of decayed macrophytes at the bottom. Soil type is loamy except in Gopalpur and Baloon beels where soil has more sand.

Primary Production and Chlorophyll

The beels indicate good productive potential, the carbon fixation in different beels range from 4.044 mg C m³h⁻¹ in Kol to 33.50 mg C m³h⁻¹ in Bhandardaha. The plankton biomass was maximum in Cooch Behar beels showing moderate production level. The production levels indicate that beels are at moderate to highly eutrophic state.

Biological Communities

Plankton : Analysis of plankton indicated differences in distribution pattern in various beels.

The trend indicate that beels in Murshidabad and Nadia are highly eutrophic since they favour more of Cyanophyceae population. On the other hand higher percentage of Chlorophyceae in Coochbehar and 24-Parganas places them in moderately eutrophic category. Another significant observation is low zooplankton population in Murshidabad beels, this may be ascribed to deeper and large beels selected in this district. Analysis of plankton density, diversity indices reveals that Hooghly beels are poor in plankton population while one beel each in Coochbehar and Murshidabad recorded maximum density 1441 u l⁻¹ and 922 u l⁻¹, respectively. Species diversities indices does not depict any adverse environmental impact.

Benthic population

All the beels were evaluated with regard to zoobenthic biomass and diversity indices.

The data collected reveals that Nadia district beels to be rich in benthic population (594 to 1261 u m⁻²) while beels in Murshidabad registered lower densities (166 to 412 u m⁻²). On the whole benthos is rich in all ecosystems.

Macrophyte dynamics

Data indicates that macrophyte standing crop was minimum in the beels of Coochbehar but maximum in Gopalpur beel located in 24-Parganas district. The dominance of *Ceratophyllum* and *Hydrilla* in many beels is indicative of rich organic load in the system. Among the associated fauna, beels are dominated by gastropods followed by insects.

Fish and Fisheries

Most of the beels are not managed properly. Species composition reveals that beels are mostly dominated by catfishes and other important varieties. Beels in 24-Parganas are well managed recording a production range of 424-520 kg/ha/yr. On the other hand less than 150 kg/ha/yr is recorded in other beels.

Pesticide Residue Monitoring

Pesticide residue analysis of soil, water and fish have been carried out. The most frequently used pesticide was endosulfan. Both isomers of endosulfan (-), DDT and its metabolites and HCH isomers (-r, B-&8) were detected in water samples. In soils the concentration of various pesticides was below detection level. In three beels viz., Baloon, Kol and Bhanderdaha the murels (*Channa marulius*) showed DDT residues upto 200 ppb, and endosulfan upto 28 ppb.

PROJECT **FC/A/7**

**ECOLOGY AND FISHERIES OF FRESHWATER
RESERVOIRS**

Personnel : Ch. Gopalakrishnayya, M. Ramakrishnlah, A.K. Lal,
D.S. Krishna Rao, P.K. Sukumaran, A.Hajra (upto 30.1.92),
M. Karthikeyan,

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

P.L.N. Rao, M.D. Pisolkar, B.K. Singh, B.L. Pandey, (Pune)

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

Duration : 1987-1994

Location : Bangalore, Raipur, Pune, Kangra

Bangalore : Markonahalli reservoir

Meteorological observations

The reservoir registered low water level during May (725.21 m) followed by an increase of 1.7 m in June. The level was more or less maintained upto September with a sharp increase during October-November and highest water level occurring in December (730.86 m). Other observations like temperature and physico-chemical parameters also were conducted.

Primary productivity and plankton

The average gross primary production during this period was 85 mg C m⁻² h⁻¹ which indicates that the reservoir is medium productive. The standing crop of plankton varied from 0.1 ml (120 u l⁻¹ September) to 2.1 ml l⁻¹ (4248 u l⁻¹ December).

Zooplankton formed the major segment of plankton during both the pulses. Among zooplankton copepods contributed to the bulk followed by cladocera and rotifera.

Major component of phytoplankton was Dinophyceae (*Ceratium* sp.) contributing about 82.0% followed by diatoms 9.80%, green algae 7.94% and blue green algae 0.89%.

Significant features of plankton of Markonahalli reservoir are the dominance of Dinophyceae and poor occurrence of blue green algae in phytoplankton.

Periphyton

The volume of periphyton from the reservoir varied from 0.1 to 1.35 ml m⁻². The maxima and minima were observed in lotic (monsoon) and intermediate sector (monsoon) respectively. The mean number of periphyton ranged from 722 (summer) to 2,908 cm⁻² (monsoon) in the intermediate sector.

Bottom biota

Population of benthic macro-invertebrates were poor. Annual variations in the bottom biotal species ranged from 2-9 (9-285 no/m²), amongst them molluscs were dominant. H were lesser 1.36, 1.96 in the lentic and intermediate sectors respectively and more, i.e. 2.4 in the lotic sector.

Aquatic vegetation and associated fauna and flora

Reservoir was infested with macrophytes viz. *Hydrilla verticillata*, *Potamogeton pectinatus* and *Ceratophyllum* spp., their biomass varied sector wise and ranged from 200-1200 g m⁻². Bacillariophycean algae viz., *Nitzschia* spp., *Mastogloia* spp., *Merismopedia*, *Gomphonema* spp., *Navicula* spp., *Cyclotella* spp. and *Synedra* spp. were found associated with macrophytes. A large number of *Indoplanorbis exustus* and other young ones of molluscs, oligochaetes and may fly nymphs were found attached to macrophytes.

Fish fauna

Twenty five species belonging to 9 families have been recorded, so far, from the reservoir.

Breeding and recruitment

The inflow during July and August, the two critical months for carp breeding, was meagre which seems to have affected the breeding and recruitment of carps. In the dragnet collections the most dominant species was *G. affinis petruelis* followed by *O. clupeoides*, and *C. atpar*.

Biology of fishes

L. rohita, *L. calbasu*, *Cirrhinus mrigala*, *C. reba*, *Mystus cavasius*, *Mastocembelus armatus*, *Glossogobius giuris*, *Puntius dorsalis*, and *Notopterus notopterus* were examined for their food habits and other biological studies.

Yield estimation

The fish catch from Markonahalli reservoir during the period was estimated at 5,201 kg as against 4,074 kg of previous year showing an increase of 28%. Major carps accounted for 2,488 kg (48%) followed by cat fishes 622 kg (12%), common carp 573 kg (11%), murrels 520 kg (10%), minor carp 160 kg (3%) and miscellaneous fishes 834 kg (16%). *L. rohita* contributed 22.42% followed by *C. catla* 19.80%, *C. carpio* 11.02% and *N. notopterus* 9.50%.

The stocking of catla and rohu during December 1990 started appearing in the catches during 1992. The yield per hectare is calculated to be 7.1 kg as against 5.56 kg of previous year.

Stocking

The present yield is rather low at 7 kg/ha for want of stocking of prime carps. In the absence of natural recruitment, stocking is a must to enhance the yield.

RAIPUR (Ravishankarsagar)

Meteorological observations

The reservoir had maximum level in April (347.09 m) and it declined marginally till June (346.57 m) but suddenly increased in July (347.06). The average water levels during the year was higher than previous years.

Fish yield, fishing effort and catch composition

During the period April 1991 to March 1992 fish catch of 53.0 t landed from the reservoir (317 days) with the operation of 1,29,552 nets, against 50.0 t of fish caught during the corresponding period of 1990-91 (220 days). Thus with 77% of increased fishing effort of 1991-92, the total catch increased by 3 t. Catch/ha (kg) on productive area of the reservoir (6380 ha) was calculated to be 8.3 kg/ha/yr, against 7.8 kg/ha/yr. of previous year. The overall fish composition of the reservoir was mainly represented by catfish (52.23%) followed by major carps (23.22%) and miscellaneous group (21.09%). Species-wise *M. aor* contributed 33.36%, *M. seenghala* 14.42%, *C. mrigala* 12.08%, *C. catla* 8.87%, *W. attu* 4.45%, *L. rohita* 2.07% and *L. calbasu* 3.46%.

Plankton

The monthly average plankton number ranged from 577 u/l (May) to 3,763 u/l (July). The yearly average plankton population was 1,620 u/l and 0.88 ml/m³ against 1,363 and 0.84 ml/m³ of previous year showing improvement. The plankton was found to be more or less uniformly distributed in three sectors. The overall quality was mainly represented by zooplankton (80.2%) followed by phytoplankton (19.8%) with greater occurrence of *Microcystis* in September which was not observed earlier in two years.

Benthos

Macro benthos : The overall population of macrobenthos in 1991-92 was 553 u/m² against 307 u/m² of preceding year. The monthly average numbers ranged from 254 u/m² (June) to 845 u/m² (December). The benthic population was mainly constituted by dipteran larvae (52.6%), followed by gastropods (30.6%), caddisworms (13.7%), bivalves (2.6%) and oligochates (0.5%). The depthwise data of macro-benthos were further analysed with regard to contour water level of the reservoir.

Micro-benthic (Periphyton) : The average monthly count of periphyton ranged from 23 to 1463 units/cm². The community was mainly represented by Bacillariophyceae (66.7-99.1%) followed by Chlorophyceae (0.86-24.98%) and Myxophyceae (2.5-17.5%).

Macrophytes

It is interesting to observe that macrophytes occurred abundantly (3200.0 to 11,500.0 g/m²) throughout the reservoir all the year round. *Hydrilla* and *Vallisneria* were the most dominating plants in this year also but the occurrence of *Chara* for the first time was noteworthy.

Pre-recruitment study of fish

Observations were made from 11.7.1991 to 9.8.1991 operating 1-2 spawn collection trial nets every day for 6 hours along South bank of river Mahanadi. The first egg spurt was recorded on 18.7.1991 which yielded 20,000 eggs with 2 nets in 4 1/2 hours. A few hundred eggs of *C. catla* were again collected on 31.7.1991.

Biology of commercial fishes

The relative condition studies were conducted on *C. catla*, *L. rohita*, *C. mrigala* and *L. calbasu* and fecundity studies were done on the four species *L. gonius*, *O. bimaculatus*, *M. aor*, and *M. cavasius*.

The minnows in this reservoir constituted 23 species with dominance of *G. chapra* (49.7%).

Occurrence of *Barilius barilia* (Ham.) and *Mystus bleekeri* (Day) updated the total number of species recorded from the reservoir to 48.

PUNE : Bhatgar reservoir (Maharashtra)

Physico-chemical parameters

Routine analysis of physico-chemical parameters of water and soil were conducted which did not show any significant variation.

Primary production

Gross production ranged from 62.5 mg C/m³/hr to 83.33 mg C/m³/hr.

Plankton

Phytoplankton accounted for approximately 85% in all the sectors and represented by Desmidiaceae, Chlorophyceae, Bacillariophyceae and Myxophyceae. Significant occurrence of desmids indicate oligotrophic condition of the water body.

Periphyton

The density estimated ranged from 1 lakh to 8.8 lakh u/cm².

Fish yield and species composition

Total fish landings were estimated at 2.83 t and much of it was contributed mostly by uneconomic species. Major carps together contributed only 2.21%.

The poor fish yield in Bhatgar is due to poor stocking, coupled with poor growth rate of major carps and lack of natural breeding and recruitment.

Stocking

About 1.5 lakh fingerlings of major carps were released into the reservoir during the year.

KANGRA (Pong reservoir)

Meteorological observation

The annual rainfall was 1,521.9 mm with 69.88% of it occurring during July-September indicating that the reservoir catchment had a greater influence of the South-West monsoon.

Chemical monitoring

The various physico-chemical parameters of water were recorded from the lotic, intermediate and lentic zones which did not show any significant variation.

The chemical stratification was observed in depth profile (upto 30 m depth) in the month of October in respect of the following parameters : pH 8.2 (S), 7.6 (30 m); D.O. 9.2 (S), 8.4 (30 m); specific conductivity, 144.67 (S), 173.61 (30 m) micro-mhos. The biogenic chemical stratification reflects the productive character of the reservoir.

Primary production

The gross and net primary carbon production varied between 10.41 and 55.55 mg/C/m³/hr and 17.35 and 54.68 mg/C/m³/hr. The respiration recorded between 15.62 and 93.75 mg/C/m³/hr respectively. The average annual gross production was estimated as 33.74 mg/C/m³/hr.

Plankton

The average plankton population indicated that their maximum abundance was in Intermediate zone (2689 u/l), followed by lotic (2000 u/l) and lentic (1248 u/l) zones.

Seasonal distribution of plankton indicated three distinct peaks; the primary (84,373 u/l) in October, secondary (1,04,462 u/l) in July and tertiary (6,040 u/l) in January. The first two pulses were mainly represented by *Synedra* whereas the tertiary pulse was by *Rhizoclonium*. Spatial distribution showed that biomass was comparatively rich in intermediate (2.34 ml/m^3) followed by lotic (1.44 ml/m^3) and lentic (1.29 ml/m^3) zones.

The average plankton for whole of the reservoir was estimated at 12,128 u/l with biomass of 1.62 ml/m^3 . This indicated an increase in the population compared to that of 5,970 u/l, of the year 1990-91.

Plankton population indicated the eutrophic tendency of Pong reservoir with the presence of dinoflagellates comprising *Peridinium incospicuum*, eutrophic diatoms represented by *Synedra ulna* and blue green algae *Microcystis*.

Macrobenthos

The average standing crop of macrobenthos for whole of the reservoir was estimated at 513 u/3.71 g/m^2 . This indicated an increase in the population compared to that of 286 u/m^2 during the year 1990-91.

Qualitatively, oligochaetes (*Brachiura*, *Limnodrilus*, *Tubifex*, *Nais*), dipterans (*Chironomus*, *Chaoborus*, *Ceratopogon*), Molluscs (*Lymnea*, *Gyraulus*, *Sphaerium*, *Piscidium*) and ephemeropterans (*Ephemera*) constituted the fauna of the reservoir. Dipteran larvae dominated in lotic zone.

Bathymetric distribution of macro fauna showed the greater congregation of fauna at contour level 397 m in lentic, 399 m in intermediate and 407 and 409 m in lotic.

Periphyton

Periphytic communities recorded an average of $1,758 \text{ no./cm}^2$ with dominance of Bacillariophyceae forming 89.56% followed by Chlorophyceae 8.17% and Myxophyceae 2.27%.

Fish fauna

31 fish species have been recorded from the reservoir.

Spawn survey was conducted in the main river Beas at Dehra (Lotic zone) which appeared as the potential breeding grounds of fishes. Developing eggs were collected in spurts with a maximum rate of 2000 ml/hr/net.

Biological studies viz. food habits, age and growth, length frequency distribution were conducted on the fishes *M. seenghala*, *T. putitora*, *W. attu*, *C. carpio*, *L. rohita*, *L. calbasu*, *C. mrigala*, *S. plagiostomus*, *P. sarana*, *C. catla*.

Yield estimation

During April 1991 to March 1992 a total of 486 tonnes of fish (with guts removed) were recorded from the reservoir giving an yield of 35.6 kg/ha/yr after giving 10% weightage for spoilage. Thus, the fish yield increased by 10.8% over the previous year. *M. seenghala* formed 33.65% of the total catch followed by

Labeo rohita (30.99%), *Tor putitora* (12.31%), *Labeo calbasu* (10.10%), *Wallago attu* (4.18%), *Cirrhinus mrigala* (2.93%) and *Catla catla* (2.50%). The remarkable feature is that *M. senghala* replaced *L. rohita* as the dominant species during this year.

Reservoir management

A total of 5,00,000 fingerlings of major carps and 3,35,000 fingerlings of mirror carp have been stocked in the reservoir so far in this year as per the data supplied by the Assistant Director of Fisheries, Pong Dam. The rate of stocking has been computed to be 56 fingerlings ha⁻¹ year⁻¹.

PROJECT FC/A/10

ECOLOGY AND FISHERIES MANAGEMENT OF A SMALL RESERVOIR IN ALIYAR BASIN

Personnel : C. Selvaraj, V.K. Murugesan, V.K. Unnithan
(from 16.10.91)

Duration : Aliyar basin 1985-1992
Thirumoorthy 1991-96

Location : Coimbatore/Aliyar nagar/Thirumoorthy nagar

Fish seed stocking in the reservoir

A total of 97604 (@ 300/ha) fingerlings consisting of *C. catla* (50%), *L. rohita* (20%), *C. mrigala* (15%) and *C. carpio* (15%) were stocked in the reservoir.

Population dynamics and growth rate of fish

Out of 500 rohu and 650 mrigal fingerlings stocked in Aliyar reservoir after fin-clipping during December 1987 and February 1988, 2 rohu of weight 1.9 and 2.4 kg, and 96 mrigal with weight ranging from 1.3 to 2.9 kg were recovered. Similarly, out of 3920 silver carp fingerlings stocked during November-December 1989, 101 specimens in the weight range 1.0 to 10.5 kg were recovered.

Fish yield and reservoir management

A total of 40.04 t of fish was harvested giving an yield of 142.1 kg/ha/annum as against 153.14 kg of previous year. The catch per unit of effort ranged from 4.87 kg to 22.02 kg, with an average of 10.74 kg. *C. catla* contributed the bulk (34.29%) followed by *C. mrigala* (31.05%), *L. rohita*

(22.99%), *C. carpio* (7.60%), *H. molitrix* (1.27%) and *C. idella* (0.01%). Thus, the miscellaneous fishes including *O. mossambicus* (1.5%) formed 2.79% of the total yield. *L. rohita* dominated the catch by number, followed by *C. mrigala*, *C. catla* and *C. carpio*.

Appearance of EUS in the reservoir

Fishes in Aliyar reservoir suffered due to Epizootic Ulcerative Syndrome during December 1991 causing heavy mortality of miscellaneous fishes. The mortality was maximum in *Puntius filamentosus* followed by *Mystus malabaricus*, *P. carnaticus*, *Ompok bimaculatus*, *O. malabaricus*, *P. sarana*, *Eetroplus maculatus*, *Mastocembelus armatus*, *Glossogobius giuris*, *Xenentodon cancila* and *Chana marulius*. Among major carps a good number of *Cirrhinus mrigala* and a few specimens of *C. catla* and *C. carpio* were affected by the disease. However, the disease subsided naturally within two months.

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 December 1992
Location : Barrackpore

Production performance of beels, particularly, in the State of West Bengal (Raghavpur, Padmapukur and Bagula) did not register any appreciable improvement in productivity as it was stagnating round 300 kg/ha/yr.

Achievement of optimum yield rates and sustainable development of beels in West Bengal necessitate a judicious combination of stocking (density, size, species combination etc.) and harvesting. This is in contrast to large open beels in the Brahmaputra basin which call for a strategy of maintaining the deeper central portion for capture fisheries and utilisation of the margins for aquaculture purposes.

It is felt that data in respect of some more beels will be worthwhile so as to have an integrated view of the beel resources.

PROJECT**FC/A/15****ECOLOGY AND FISHERIES MANAGEMENT OF
MUKTAPUR OXBOW LAKE (MAUN) IN GANDAK BASIN
(NORTH BIHAR)**

Project wound up due to the drying up of the maun.

PROJECT**FC/A/16****ECOLOGY AND FISHERIES MANAGEMENT OF BEEL IN
BRAHMAPUTRA BASIN (ASSAM)**

- Personnel** : S.N. Mehrotra (till 30.9.1991), K.P. Srivastava,
M. Choudhury, R. C. Singh, A. Sarkar, D.K. Biswas
(till 7.10.1991), B.K. Biswas
- Duration** : 1988-1994
- Location** : Peetkati Beel, Hajo, Dist. Kamrup, Assam

Environmental monitoring

Physico-chemical and hydrological observations and collections were made in the Peetkati beel. The pH of the beel water remained acidic almost throughout the year ranging between 6.2 and 6.4 and tilted towards alkaline side only from January 1992 onwards, the reason for which may be attributed to liming treatment of the water in different phases.

Plankton : Average plankton population of the water area in the beel was estimated at 1,769 u/l the phyto and zooplankton contributing on an average 75.29% and 24.71% respectively.

On an average, the phytoplankters dominated over zooplankters but the picture during the months of September and December, 1991 is different as the zooplankters had outnumbered the phytoplankters in these months.

Penculture experiment : The pen, covering an area of 0.1 ha, was stocked with 1,706 nos. fingerlings of *C. catla*, *L. rohita*, *C. mrigala* and *P. javanicus* of average weight ranging from 4-23 g. Regular environmental monitoring and feeding was done upto November 1991. EUS outbreak started during this period resulting in considerable loss of the fish stock, though remedial measure were undertaken.

PROJECT **FC/A/18**

**PRODUCTION DYNAMICS AND FISHERIES DEVELOPMENT IN A
SMALL RESERVOIR IN M.P.**

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

Duration : July 1991 - June 1995

Location : Allahabad

A small reservoir Naktara near Maihar in M.P. was taken up by the Institute in 1991 for enhancement in its fish production. It is about 6 km away from the Poundi Hatchery Complex. The submerged area at FTL is about 90.58 ha and 18.5 ha at LSL. The command area is about 13.86 sq km. The reservoir was taken from M.P. State Govt. for a lease value of Rs.5726/- per year.

Physico-chemical features of soil :

The soil samples collected from deeper zone (Nalha) of Naktara Reservoir was alkaline (pH 7.83), where free calcium carbonate contributed 3.5% of the composition. Organic carbon was 0.64%, Sp. conductivity was 142.0 u mhos/cm and TDS was 71.0 mg l⁻¹. But the soil samples collected from other parts of the reservoir consisted mostly gravel with an organic carbon content of 0.30% indicating poor productivity potential.

Physico-chemical features of water :

The free carbon dioxide was absent both the seasons. The cooler climate prevailed in November resulted in comparatively higher DO values during November. The nutrient status was of a new order indicating lower production potential of the reservoir.

Diurnal variations in water qualities indicated that the temperature was highest in November (21.6°C) at 1400 hrs and lowest (19.0°C) at 0600 hrs. The highest transparency (102 cm) was recorded at 1400 hrs. DO had at variation from 8.0 (mg l⁻¹) at 0600 hrs to 8.96 (mg l⁻¹) at 1800 hrs. Carbondioxide was recorded only during night hrs (1.0-2.0 (mg l⁻¹)). There was not much variations in case of pH, specific conductivity, TDS and bicarbonate alkalinity. But in March the specific conductivity reduced from 157.0 u mhos cm⁻¹ (1400 hrs) to 118.0 u mhos cm⁻¹ (0200 hrs). Free CO₂ was absent at surface and was recorded at 2 m depth. Water temperature and DO showed similar trend as in the case of November/December.

Thermal and Chemical Stratification

Depthwise water column was studied in March. Sudden fall of 2.0°C from 1 m (25.0°C) to 2 m (23.0°C) in water temperature was observed. DO reduced from 8.48 to 7.36, specific conductivity from 142 to 136 u mhos cm⁻¹ and pH

from 7.34 to 7.14 indicating that the reservoir is thermally and chemically stratified.

Plankton

Plankton collections were made from surface, 1 m and 3 m depths. Zooplankton (79.78%) population outnumbered the phytoplankton (20.22%). Surface recorded 17.57% of the total plankton population while samples from 1 m and 3 m depths recorded 34.07% and 48.36% respectively. The diurnal studies did not reflect much variation.

Bottom Biota

The bottom biota varied from Nil (November) to 1032 $u\ m^{-2}$ in (July) and represented by Oligochaeta, 42.6%, chironomid, 29.5%, Polychaeta, 16.4%; Culicoides, Dixidae and Trichoptera, 3.3% each, followed by bivalves 1.6%.

Periphyton

A sample of periphyton was taken from the stones submerged in the reservoir.

The examination of the sample revealed that it consisted of Navicula, Diatoma and Gyrosigma among the Bacillariophyceae (80%) followed by Oscillatoria (10%) of Myxophyceae and Oedogonium (10%) of the Chlorophyceae.

Primary Productivity

Primary productivity was measured by conventional method using 'light and dark' bottle technique in situ. Gross and net production fluctuated between 80.0 and 140.0 $mg\ C\ m^{-3}hr^{-1}$ and 37.5 and 100.0 $mg\ C\ m^{-3}hr^{-1}$ respectively. Annual average of gross production was 98.75 $mg\ C\ m^{-3}hr^{-1}$ whereas net average was 60.0 $mg\ C\ m^{-3}hr^{-1}$. Respiration was found to be 46.5 $mg\ C\ m^{-3}hr^{-1}$.

Rearing of Seed

One lakh fry (average size 22 mm) procured from State Govt. were reared in two nurseries. The average growth after a rearing period of 45 days was 52, 51 and 100 mm in case of *C. mrigala*, *L. rohita* and *C. catla* respectively.

Stocking of Reservoir

During November, about 55,000 fingerlings of mrigal, rohu and catla in the size range of 100-150 mm were stocked in the reservoir in the ratio of 5:4:1. About 210 fingerlings (size range 110-185 mm) were tagged with internal anchor tags and steamer tags. The growth rate in 110 days was estimated at 1.4 and 1.5 mm per day for *C. mrigala* and *L. rohita* respectively.

Recruitment Studies

Breeding of major carp was observed on 24.7.91 at northern side of the reservoir. Eggs were collected and reared upto fry stage. Fry of average size 40 mm of *C. mrigala* were collected from the reservoir in the month of August.

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, H.C. Joshi, H.C. Karmakar,
N.N. Mazumder

Duration : 1986 - March, 1992

Location : Barrackpore, Calcutta

Ecological Investigations

Investigations on the ecological variations in sewage-fed wetlands at Kantatala (freshwater) and Minakhan (saline) were continued. The plankton density was 0.4-2.4 ml 50 l⁻¹ and 0.35 and 2.7 ml 50 l⁻¹ at these place. The benthos also demonstrated fluctuations in numerical abundance of different species. Representation of phytoforms was highest during midnight while zooforms during mid-day in the benthos.

The sparse aquatic vegetation was represented by *Eichhornia* sp., *Enhydra* sp., *Colocasia* sp., *Spirodella* sp. and *Lemna* sp. in freshwater wetlands and *Enteromorpha tubulosa* and *Panicum* sp. as dominant forms in saline sewage-fed wetlands.

Values on physico-chemical parameters at both these wetlands are given in Table 1.

Table 1: Values of physico-chemical parameters at Kantatala and Minakhan wetlands

Parameters	Wetlands	
	Kantatala (freshwater)	Minakhan (saline)
Dissolved oxygen (mg l ⁻¹)	7.6-9.0	6.4-8.0
Salinity (ppt)	Tr.-0.52	1.5-5.8
Transparency (cm)	9.5-11.5	16.0
Gross primary productivity (mg C m ⁻³ hr ⁻¹)	380	1800

Penculture in wetlands : The experiments in bamboo pens in sewage-fed wetland at Kantatala was concluded in June 91. The yield rate was 5150 kg ha⁻¹. The details of the experiments are given in Table 2.

Table 2 : Growth of fish in pens at Kantatala wetland

Species	Initial weight (g)	Pen I	Pen II
<i>Oreochromis mossambicus</i>	8.43	63.08	66.45
<i>O. niloticus</i>	19.48	177.45	182.12
<i>Cyprinus carpio</i>	38.80	191.00	198.25

Stocking density : 40000 nos. ha⁻¹. Ratio : 2 : 1 : 1.

Period of rearing : 9 months.

Average production rate : 5150.60 kg ha⁻¹

Wolffia as feed for tilapia : Efficacy of *Wolffia* sp. as food for *O. niloticus* and *O. mossambicus* was tested in laboratory. *O. mossambicus* of 33 mm/624 mg size grew to 48 mm/2.868 g in 30 days, while the control fishes fed with plankton grew to 51mm/2.411 g. Larger specimens (62 mm initial size) had better growth with *Wolffia* compared to control. *O. niloticus* of 91 mm/15.066 g grew to 110 mm/19.042 g in 30 days while the plankton fed control registered a growth of 107 mm/18.210 g.

Salinity tolerance of tilapia : Both *O. mossambicus* and *O. niloticus* were found to tolerate salinity levels upto 30 ppt. *O. mossambicus* however, can tolerate 38 ppt if transferred gradually to higher salinities.

Biology of *Oreochromis* spp. : was worked out.

The length-weight relationship of *O. mossambicus* in the wetlands was worked out to be $\text{Log } W = -4.6821 + 2.3336 \text{ Log } L$.

The number of eggs per individual female varied between 200 and 1280 in *O. mossambicus* and between 380 and 1920 in *O. niloticus* at Kantatala wetland.

Heavy metal levels in the tissues of fishes

Metal concentration in fishes from wetlands was studied. *O. niloticus* showed relatively higher accumulation of copper, cadmium and mercury in the muscle tissues. The mercury level in *O. niloticus* marginally exceeded WHO prescribed safe level of 0.5 ppm $\mu\text{g g}^{-1}$.

PROJECT**BF/B/3****ECOLOGY AND PRODUCTION BIOLOGY OF HOOGHLY-MATLAH AND KULTI ESTUARINE SYSTEMS**

- Personnel** : Apurba Ghosh, M.K. Mukhopadhyay, D.K. De, H.C. Joshi, M.M. Bagchi, P. Mitra, H.C. Karmakar, S.N. Dutta (upto July 1991)
- Duration** : 1983-95
- Location** : Barrackpore, Canning, Uluberia, Diamond Harbour, Digha and Frazerganj/Namkhana

Salinity distribution pattern in Hooghly-Matlah estuarine system was investigated and accordingly, freshwater tidal gradient and marine zones were demarcated on the basis of the prevailing salinity regime.

Biological productivity and fish yield in different zones of the Hooghly-Matlah estuarine system were estimated. The freshwater tidal zone (Zone I) was comparatively less productive (fish yield 703.4 t) than the euryhaline zones (Zones II & III; (fish yield 12,510.1 t). In zone I, 47 freshwater species, mainly catfish (*M. aor*, *W. attu*, *M. vittatus*, *M. tengara*, *R. rita*, *C. garua*, *E. vacha*), Carps (*C. catla*, *L. calbasu*, *C. mrigala*, *L. bata*, *C. reba*) and minnows constituted 80-85% of the annual yield. Zone II, i.e., the transitional zone, harboured only 8-10 species while zone III covering high saline and adjoining coastal areas had fisheries comprising 28-30 euryhaline and marine species.

Pama pama, one of the species, which exhibits an increasing trend in yield from the estuary, was studied for food and feeding habit. Examination of 106 specimens indicated variations in food preference at different life stages of the species. The fingerlings (50-90 mm) are zooplanktophagous. Young ones between 100 and 150 mm prefer small prawn, crab larvae and worms, while the adults (above 180 mm) fed mainly on prawn.

With the increase in fishing effort, the hilsa (*T. ilisha*) catch reached to the level of 3568.5 t this year. This is the highest record of the last two decades.

Year-round monitoring of seed abundance at five centres on Hooghly estuary, one on Matlah estuary and one on Rupnarayan tributary indicated no significant change in the availability of the seed of commercially important estuarine species of finfish and shelfishes as compared to the previous year. The lower zone of the estuary remained both quantitatively as well as qualitatively richest in fish and prawn seed where *P. monodon* (332 nos h^{-1}), *P. indicus* (474 nos h^{-1}), *Liza parsia* (338 nos h^{-1}) could be hauled out by shooting net operation.

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,
N.N. Mazumder**Duration** : 1986-1993**Location** : Gosaba-Sajnakhali, Kult and Bakkhali

Investigations were continued at Sudhanyakhal (without guano) and Sajnakhali (with guano) in the core area Durgaduania (semi-core area), Gosaba (human interferred area), Bakkhali (coastal area) and Malancha (sewage influenced area).

Studies during the year were concentrated on periphytic and phytobenthic flora in relation to various niches within the ecosystem. So far 41 such flora could be detected and identified from the mangals. Most of these periphytic communities exhibit location specificity in abundance and occurrence.

The major features of the plankton population of the high saline area including core and semi-core regions are that the distribution of zooplankters other than crustaceans and rotifers is insignificant and the density of filamentous algae and diatom is quite high. The diatom density at Bokkhali region has poor soil quality and the plankton in general are dependent on the nutrients released from the decomposed mangrove. Low plankton density was observed at these places.

Benthos : Benthos from core and semi core areas did not contain rotifers. It was absent at Gosaba also during October to March. Except April to June, molluscs were also scarce in core areas. But in semi core area (Durgaduani) there was sizeable population of molluscs. Contrary to core areas, molluscan fauna declined at Gosaba during April to September and were abundant during October to March. The maximum abundance of molluscs was at Malancha due to the manurial effect of the sewage effluent.

Seasonal variation in the density of plankton and benthos was studied at all the six centres and the characteristics of species distribution were delineated.

Associated Fauna : Fauna abundance associated with the mangroves, specially for those available in the phytotelmates were ascertained and compared with those of previous years. There was no significant difference except during 1990-91. The decline in the *P. monodon* seed abundance is still persisting thereby suggesting that the stability of the ecosystem has not been regained. However, considerable recovery for *P. monodon* seed abundance was observed at Bakkhali, the site closer to the prawn breeding grounds.

Quarter-wise relative abundance indices revealed that molluscan fauna were more abundant in the core areas except April-June. This time they were more at Malancha. Malancha exhibited maximum concentration of fish fry except during October-December when they were mainly available at Gosaba. Prawn juveniles were more at core and semi-core areas and moved a little upstream during January-March. Crabs, polychaetes, etc. were more abundant at Sudhanyakhali during July to March.

Physico-chemical investigation : Physico-chemical characteristics during different seasons were studied at all the six selected sites. During winter when salinity assumed modal values, the transparency values for the six sites were 6, 56, 61, 59, 66 and 26.5 cm respectively. During rainy season the pH and salinity declined but for nitrogen and phosphate increased. The salinity level at Malancha was found reduced by the influence of sewage effluents. Salinity variation for all the sites taken together was from 2.0 to 24.0 during the year.

Microbial studies : Density of heterotrophic, phosphate solubilizing and aerobic nitrogen-fixing bacteria varied considerably with the seasons. The six selected centres were investigated for the bacterial load during summer, rainy season and winter.

PROJECT

BF/B/9

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

Personnel : D. Nath (upto 11.12.91), S.N. Singh, S.K. Sarkar, G.C. Laha, R.C. Mandi, K.S. Banerjee (upto 7.3.92), C.K. Vava

Duration : 1988-1993

Location : Vadodara

Hydrological regime

Transparency varied from 2.0 to 143.0 cm for the system as a whole. Dissolved oxygen was fairly abundant at all the centres which fluctuated from 4.0 to 10.8 mg l⁻¹. Lower deltaic region had higher free CO₂ content as compared to riverine one. pH of water drifted from 8.0 to 8.6 during this period. Based on the total alkalinity, the system may be categorised as "Productive".

Soil

Soil was alkaline at all the centres. Soil texture varied from stretch to stretch and also within the stretch being clay loam at Mahegam and Bhadbhut while at

Bharuch it was loam to clay loam. Jhanor and Vedgam had sandy loam to clay loam; the other fresh water centres had sandy to loamy sand or loamy texture.

Primary Production

No particular trend could be discerned except that the gross production was high at Poicha followed by Mahegam and this varied from 25.0 to 220.84 mg C m⁻³ hr⁻¹. Net production which fluctuated from 8.3 to 183.3 mg C m⁻³ hr⁻¹ was recorded high at Mahegam followed by Sisodara.

Biological Regime

The average planktonic abundance for the Narmada Estuarine Complex fluctuated from 102 (Sisodara) to 381 nos. l⁻¹ (Mahegam). Phytoplankton (53.67 to 95.63%) was the mainstay of this abundance except at Mahegam.

The average macrobenthos abundance varied from 510 (Bhadbhut) to 2874 nos. m⁻² (Jhanor). Mollusca at Bhadbhut (48.44%), Oligochaeta/polychaeta at Bharuch (61.79%), Jhanor (89.63%) and Vedgam (45.63%), and Diptera at Sisodara (59.25%), Poicha (69.79%) and Gadher (55.60%) were the major macrofaunal elements constituting the bulk of this abundance.

Identification of discharge points (industrial, agricultural and domestic)

Baijalpur point and Shakurpura point were identified as stress points.

Baijalpur : At the confluence (OF), poor dissolved oxygen (av. 3.5 mg l⁻¹), low transparency (av. 17.8 cm), high total alkalinity (av. 249.3 mg l⁻¹), high free CO₂ (av. 18.8 mg l⁻¹), high specific conductivity (av. 1596.0 μ mhos cm⁻¹), high T.D.S. (av. 800.0 mg l⁻¹). Studies here reflected the setting-in of the organic enrichment process. This was further substantiated by high values of BOD₅ (av. 24.7 mg l⁻¹) and high DOM (av. 11.9 mg l⁻¹).

The soil was also observed to be rich as reflected by higher availability of organic carbon, high available nitrogen and high total nitrogen. This further corroborated the above inference.

Planktonic biomass was also high which was conspicuously composed of blue-green, and the greater incidence of bacterium *Zoogloea ramigera* (11.52%) which is an established bio-indicator of water contaminated with sewage and industrial wastes.

Macro-benthic population (av. 1729 nos. m⁻²), mainly constituted of Oligochaeta/polychaeta (70.73%) coupled with the incidence of developmental stages of *Tipula* sp. and *Psychoda* sp. further confirmed the organic enrichment at confluence.

Shakarpura point : Poor dissolved oxygen, high free CO₂, very high dissolved organic matter and extremely high BOD₅ were the important attributes at outfall which confirmed stress condition at this point.

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

Four sets of *Tenualosa ilisha* were successfully bred. Dry stripping method was employed. Rate of fertilization varied from 15.04 to 94.32%. The percentage of hatching was 63.0 to 80.95. The 2.7 lakh of spawn obtained from first two sets were stocked in pond No.4 of the Ukai Fish Farm on 15.8.1991.

Biological studies of *Tenualosa ilisha*

The length-weight relationship for male (length range : 330 to 495 mm and weight range : 305 to 960 g) and female (length range : 400 to 560 mm and weight range : 780 to 2100 g) specimens have been computed.

The gut analysis of hilsa young ones varying in length from 65 to 108 mm and 2.035 to 10.3 g in weight revealed that these subsisted fairly high on diatoms.

PROJECT

BF/B/10

INVESTIGATIONS ON PRODUCTION DYNAMICS OF SALINE BHERIES IN RELATION TO THEIR FISHERIES DEVELOPMENT

Personnel : G.N.Saha, A.K. Ghosh, A.C. Nandy, R.K. Banerjee, H.C. Karmakar, K.R. Naskar, S.K. Chatterjee, B.B. Das, A. Mitra, Abhijita Sengupta, L.K. Parbat, Amoy Barui, D. Saha

Duration : April 1991 to March 1995

Location : Calcutta (Bheries taken up at Kharibari in North 24-Parganas and Malancha and Basanti in South 24-Parganas)

Three bheries have been taken up one each at Kharibari (Low saline zone), Malancha (medium saline zone) and Basanti (high saline zone). Their ecological variations of hydrobiological parameters in relation to fish and prawn production were studied. In the bheri at Malancha two bamboo pens of 100 m size have been made and put under operation for monoculture of *P. monodon* (with and without feed) with a stocking density of 50,000/ha, while in the high saline bheri at Basanti two identical portions measuring 0.047 ha have been partitioned out with earthen

dykes having hume pipe connection with the mother bheri and *P. monodon* have been stocked at the same rate for similar study.

Soil and water quality

Soil : The medium and high saline bheries exhibited wide variation in soil reaction. Available nitrogen ranged from 10.7 to 18.3 mg 100 g⁻¹ soil, phosphate (4.8 to 12.5 mg 100 g⁻¹) soil and organic carbon (0.39 to 0.78%).

Water : The low saline bheri with salinity range 0.1-0.82 ppt showed variation in alkalinity (60-180 ppm). Primary productivity ranged from 80.0 to 140.2 mg C m⁻³hr⁻¹. The medium saline bheri with salinity 15.05 ppt maintained high levels of phosphate (0.9 to 1.21 mg l⁻¹) and ammonia (1.4 to 1.6 mg l⁻¹) whereas the high saline bheri with salinity range 16.2 to 20.8 ppt recorded primary productivity range of 10.41 to 31.26 mg C m⁻³hr⁻¹.

Biological production

Plankton : The net plankton density greatly varied in the three saline bheries. The volume ranged from trace to 0.8 cc, trace to 2.5 cc and trace to 0.2 cc in 50 litres in low, medium and high saline bheries respectively. The plankton concentration ranged from 25 u/l to 130 u/l, 55 u/l to 1145 u/l and 35 u/l to 260 u/l in the low, medium and high saline bheries respectively, the minimum being 25 u/l in low during August 1991 and the maximum 1145 u/l in medium during January 1992. In all the bheries under study blue green algae formed the bulk of the population.

Benthos

Benthic algae : The benthic algal composition varied considerably from month to month but the greatest variety was observed at medium saline bheries at Malancha. The concentration of benthic algae varied from 2-10 cc m⁻² to 3-45 cc m⁻² and 2 to 30cc m⁻² in low-medium and high saline areas respectively. In low saline bheries where algal production is very low and there was practically no growth from July-November 1991 and very little from December 1991-February 1992. The minimum growth was in July 1991 (10 cc m⁻²) and the dominating species being *Oscillatoria tenuis*.

Macrozoobenthos : The abundance of benthic macrofauna varied from 20-65 nos m⁻² l⁻¹, 3-235 nos m⁻² l⁻¹ and 5-220 nos m⁻² l⁻¹ in low-medium and high saline bheries respectively. The density of tanaisids (95 nos m⁻² l⁻¹) was highest in medium saline area in July 91 while Gammarus - tanaisids - amphipods and polychaets were the dominants in medium saline bheri. In high saline bheries polychaets dominated the population.

Macrophytes of different saline zones and estimation of the biomass produced

The Malancha area is devoid of any mangrove flora except halophytic herbaceous flora like *Ruppia maritima*, *Panicum* sp. along with the macro algae *Enteromorpha tubulosa*. The bio-mass obtained from 1 m² area on dry weight basis were *Ruppia maritima* 0.175 kg, *Panicum* sp. 0.275 kg, *Enteromorpha tubulosa* 0.120 kg.

In the high saline zone infestation of *Avicennia marina*, *A. alba*, *Sonneratia apetala* and the halophytic herbs *Acanthus ilicifolius* was recorded.

Gross output of the bheries under study

The low saline bheri at Kharibari measuring 1.49 ha had a gross output of 1575 kg of fish and prawn i.e. 1057.05 kg ha⁻¹yr⁻¹ of which *P. monodon* was 155 kg (104.03 kg ha⁻¹) other prawn 120 kg and Indian major carp 1000 kg. The bheri in the medium saline zone measuring 9.33 ha had a total harvest of 5058 kg (546.49 kg ha⁻¹yr⁻¹) *P. monodon* constituted 1120 kg of the total catch which worked out to be 120.043 kg ha⁻¹yr⁻¹.

Parasitic infections of prawn

Parasitic infection in penaeid prawns due to fungus pathogens was recorded. The fungus was cultivated in the laboratory and was inoculated to the disease free prawns and has been identified as *Saprolegnia* sp. Laboratory study revealed that a salinity range 2.6 to 3.2 ppt, and an increase in calcium concentration in the host water body might increase the fungal attack.

PROJECT

BF/B/11

INVESTIGATION ON DISEASES OF FISHES INHABITING ESTUARIES AND ESTUARINE IMPOUNDMENTS

Personnel : R.N. Pal, A.K. Ghosh, R.K. Das, M.K. Das, S.P. Ghosh

Duration : July 1991 to March 1995

Location : Barrackpore

Investigation on EUS outbreak for the first time in Tamil Nadu in the districts of Chengalpet, Thanjavur and Trichy was conducted during April 1991. The

outbreak occurred in Pondi Reservoir, Kovidpathagai lake and Sekkadu lake during the month of December 1990. The affected species were mostly murels and *Puntius* sp.

Investigation on EUS outbreak was conducted in Chilka lake of Orissa during May 1991. EUS outbreak occurred during November/December 1990 and gradually subsided from January 1991. Brackishwater fish species affected by EUS were *Mugil cephalus*, *M. subviridis*, *M. bornensis*, *Etroplus suratensis* and *Protosus canius*. The freshwater species observed were *Channa* sp., *Notopterus* sp. and *Heteropneustes* sp.

Investigation on EUS outbreak was conducted in Kerala, during August/September 1991. The disease started from August. The areas affected were canals, adjacent paddy fields, backwater fringes and lakes. Fish species affected were *Channa* sp., *Mastocembelus* sp., *Barbus* sp., *Mystus* sp., *Glossogobius* sp., *Heteropneustes* sp., *Clarius* sp., *Etroplus* sp., *Mugil* sp.. The low alkalinity and hardness associated normally with acidic soils seem to be very conducive for outbreak of EUS.

Monitoring of the disease EUS in different states of India was done from the responses of the questionnaire developed by CICFRI. The data collected revealed that Rajasthan also got affected by EUS from this year. From the reported data from different affected states lime @ 200-300 kg ha⁻¹ is giving encouraging results in containing the disease.

About 210 estuarine fishes were examined for the study of the parasite fauna. The fishes *L. parsia*, *L. calcarifer*, *L. tade*, *M. gulio* and *G. giuris* were investigated in the bheris as well as in the estuarine system.

Histopathological studies conducted on *Ergasilus* infestation in the gills of *L. parsia* reveal partial destruction of the efferent vessel of the filament especially in the distal part of the filament. Destruction of the encapsulating tissue also occur.

Investigation on bacterial pathogens conducted in the bheries and estuarine system at Canning and Minakhan areas revealed the bacterial load to range from 2.48×10^3 /ml- 5.32×10^4 /ml at salinity ranging from 6.8-22.4 ppt. The bacterial species identified through biochemical tests from such environments are : (i) *Bacillus coagulans*, (ii) *Escherichia coli*, (iii) *Pseudomona putida*, (iv) *Enterobacter* sp., (v) *Aeromonas* sp.

35 permanent slides of different parasites and affected tissues have been prepared for identification of the parasites upto species level and for studying histopathological manifestations of disease encountered from the different fishes.

PROJECT **BF/A/2**

**FISHERIES AND BIOLOGY OF HOOGHLY HILSA,
*TENUALOSA ILISHA***

Personnel : Apurba Ghosh, G.N. Saha (from 1.2.92), M.K. Mukhopadhyay, A. Mukherjee, Amitabha Ghosh, P. Mitra, H.C. Joshi, V.K. Unnithan, D.K. De, M.M. Bagchi, N.N. Majumder

Duration : 1986-92

Location : Estuarine Division, Barrackpore

Barring the bumper catch in 71-72, 81-82 and 90-91 the catch of hilsa, *Tenualosa ilisha* during 1991-92 was the highest recorded during the last two decades. Hilsa was the major component of the estuarine fishery contributing 3568.5 t being 25.7% of the total catch while the coastal zone (lower estuary) itself contributed 87.51% of the total hilsa catch.

HILSA FISHERIES AROUND FARAKKA

Collection of landing data has been initiated from June, 1991. Analysis of the data for the consecutive seven months depicts that the estimated monthly catch was the highest (3505.50 kg) in the month of September followed by 2373 kg in the month of October coinciding with the peak breeding period of the fish.

Recruitment of Hilsa seed

Based on the collection of early larvae and fry of hilsa in the Hooghly estuary, effort was made to delineate the spawning grounds and to determine the spawning season and location of spawning grounds. Recruitment of hilsa seed (spawn and fry) was assessed at nine centres viz., Sagar, Frazerganj, Kulpi, Diamond Harbour, Nurpur, Uluberia, Kolaghat, Nawabganj and Medgachi covering a stretch of 220 km.

It is evident from the present study that the species spawns in the entire freshwater zone and as well as a less saline zone around Nurpur, Diamond Harbour and Kulpi centres.

Age and growth of adult hilsa

The age and growth of both male and female hilsa, *Tenualosa ilisha* were studied separately by using the length frequency method.

Maturity and Fecundity

The attainment of first maturity in hilsa from the estuary occurs at about 340 mm length. Different maturity stages have been determined.

The number of ova produced by a female was found to range from 3,73,848 to 8,21,298 in species ranging in total length and weight from 345 to 490 mm and from 520 to 1400 g respectively.

Migratory changes in hilsa

Investigations on the lipid and moisture content of *T. ilisha* from different places were continued.

Histological investigations on the kidney of hilsa collected from Nababgunj and Farakka have been initiated to study the adaptive responses and changes in the histology of the kidney during the migration of hilsa from sea water to freshwater or vice-versa.

Food and feeding habits of hilsa was studied.

Nature of thyroid follicles of hilsa

The histological pattern of thyroid follicles of *Tenualosa ilisha* depicts five stages of activities which are recognised to be as quiescent, non-secretory, secretory, active secretory and stage of collapse or atrophied.

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 :

Design and construction of a flexible net enclosure measuring 30 m x 50 m has been completed based on detailed engineering and water area survey at the Muktapur ox-bow lake. The net pen has been installed by the side of the existing

pen. The main supports consisting of 15 cm dia bamboo poles spaced at 1 m apart, have been driven 60 cm deep into the firm lake bed. The bamboo mattings spanning on main frames have been fixed with the posts keeping the bottom line 60 cm into the bed soil. Since the bed configuration of the lake is almost flat, the bottom insertion of the matting has helped in counteracting the wind thrusts and wind driven currents action and thus keep the pen wall adequately strong and stable.

The various pen enclosure components designed on the considerations of wind thrust stress have been found to be safe against the other external forces.

Net Fouling

Experiments have been conducted to assess the physical strength and properties of the netting twines effected by primary exposure factors viz., wind velocity, temperature, solar radiation, rainfall, etc. and due to secondary exposure factors viz., dust, algae or plant organisms.

Results showed no damage of the material by water borne organisms. However, the netting material and cordage were severely fouled with the settling of plant organisms on 60% of surface area after 4 months of immersion. The tensile strength of wet nylon twine 1.2 mm dry dia (sp. gr. 0.98) has been found to be 50 kg which is almost close to its original strength.

Cage

On the request of Fisheries Department, Government of Karnataka design of a battery of six floating net cages with common V-line floatation systems has been furnished. The moorings consist of 100 kg c.c. block sinkers suspended 2.4 m deep into the reservoir. A common catwalk provides access for management and operational facilities.

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, B.D. Chatterjee, S.N. Sanyal
(School of Tropical Medicines)

Duration : July 1990 - December 1992.

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

During period under report different gram positive and gram negative bacteria belonging to various genera have been isolated from the fishes affected by

EUS. They are - *Citrobacter intermedius* isolated from *Channa* sp., *Micrococcus lutea* isolated from *Channa* sp., *Staphylococcus* sp. isolated from *Channa* sp., *Citrobacter freundii* isolated from *Channa* sp., and *NAG vibrio* isolated from *Channa* sp.

The bacteria isolated were injected into healthy *Channa* sp., manifestation of the disease did not occur within 72 hr. though localised ulcers were produced.

PROJECT

AN/A/13

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

Personnel : G.K. Vinci, V.K. Unnithan (up to 15.10.91), V.V. Sugunan
Duration : June 1990 - December 1992.
Location : CICFRI, Barrackpore

Mass rearing of snails was done in the field snail farm. The produce was supplied to the exporters Bay Islands Escargots, New Delhi in the month of August for sample consignments to various countries. The young ones were supplied to a farmer for his farm in Diamond-Harbour, the first commercial snail farm in West Bengal.

Demonstration of processing was conducted at the processing plant of the G.A. Randerian Ltd, Calcutta. The technicians at the processing centre were trained to handle snail products. The cartons were finalised after trying different models. The selected carton was made up of 320 GSM duplex board in the size 11" length X 6 3/4" width X 2" height with wax coating. Each carton accommodated 2 kg meat.

Following a suggestion from Malaysia, a review was done on the processing procedure to enhance the quantity of edible portion for export. This has revealed that the exportable portion could be as high as 50% including the ovary and the adductor muscle instead of the earlier reported 15%.

A survey was conducted in Port Blair during September 1991 to investigate in to the possibility of establishing a snail trade from the Andaman & Nicobar Islands. The report was submitted to the Government authorities and some private entrepreneurs.

PROJECT

AN/A/14

**DEVELOPING A MODEL COMPUTERISED INFORMATION
SYSTEM SUPPORTING INLAND FISHERIES RESEARCH**

The project was not initiated, since dropped.

PROJECT

AN/A/15

**STOCK ASSESSMENT AND DYNAMICS OF FISH POPULATIONS
IN MAJOR INLAND WATER SYSTEMS**

Personnel : R.A. Gupta, P. Mitra, S.K. Mondal, H.C. Karmakar, R.K. Tyagi,
M. Kartikeyan, M. Chaudhury, S. Majumder

Duration : June 1990 - December 1992.

Location : CICFRI, Barrackpore

Investigations on stock dynamics and fisheries assessment of the Ganga and the Hooghly estuarine ecosystem were conducted. Catch records were utilised to estimate parameters such as mortality rate (Z) and exploitation rates (F). The total mortality rate in case of *L. calbasu* was the highest (1.2 yr^{-1}) followed by *C. mrigala* (1.09), *C. catla* (1.01) and *L. rohita* (0.74). The exploitation rate (F/Z) for these species were estimated at 0.71, 0.68, 0.75 and 0.59 respectively. Stock assessment based on Cohort analysis method estimated the MSY level at 3.59 t for *C. catla*, 7.97 t for *C. mrigala*, 33.58 t for *L. calbasu* and 3.59 t for *L. rohita*.

The results show that the present effort level is optimum for *C. mrigala*, it can be increased for *C. catla* and *L. rohita* and should be reduced for *L. calbasu* in order to approach yield near to MSY level.

Fishing fluctuations of *T. ilisha* in the estuarine waters of West Bengal based on catch and effort revealed very moderate fluctuations in CPUE indicating that the catches have not shown a decline in abundance in the recent past. However, the surplus production models could not be employed to estimate the sustainable yields due to wider scatter of points with no definite trend.

PROJECT CSS/1

**DEVELOPMENT OF INLAND FISHERIES
STATISTICS**

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

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

Location : CICFRI, Barrackpore

During the period under report, resource and catch assessment surveys were undertaken in the selected districts of fourteen states presently participating under this project. Stratified two stage cluster sampling was continued for selection of ultimate sampling unit. Estimates of area, and catch were derived along with their sampling errors. The sampling error estimates for these estimates varied from 24.2% to 31.57%, indicating that the estimates are reasonable good and sampling design provides reliable assesment of the total resources.

Survey work has also been initiated during this year for other resources like rivers and streams, and reservoirs. The sampling methodology suggested earlier were recommended for ultimate selection of sample and one of the two methods based on landing centre/fishing village approach were adopted depending on the administrative and technical feasibility.

Assessment survey for beels in some selected districts of West Bengal was also continued on the basis of total enumeration.

The total area under beels has also been computed on complete enumeration basis. The area of beels in the districts of Murshidabad, North 24 Parganas and Coochbehar of West Bengal is 4,002 ha, 1,566 ha and 1,913 ha respectively. The catch per hectare in Murshidabad and North 24 Parganas has been estimated at 34.45 kg and 397.72 kg respectively. The higher rate of catch in North 24 Parganas is an indication of better management practices in the district.

PUBLICATIONS 1991-92

- Babulal (1990). Impact of Farakka barrage on the hydrological changes and productivity potential of Hooghly estuary. *J. Inland Fish. Soc. India*, 22 (1-2) : 38-42.
- Babulal, Utpal Bhaumik & P.K. Pandit (1990). Studies of the rate of ^{14}C assimilation, efficiency of energy transformation and chlorophyll concentration in relation to limnochemical parameters in some rural ponds of West Bengal. In *Recent Trends in Limnology*. Ed. V.P. Agrawala & P. Das. To-day & Tomorrow's Printers & Publishers. New Delhi : 233-243.
- Bandyopadhyay, A.K., C.R. Biswas, G.N. Chattopadhyay, Apurba Ghosh & P.K. Chakraborti (1990). Brackishwater aquaculture for better land utilization of monocropped coastal areas. *J. Inland Fish. Soc., India*, 22 (1&2) : 22-25.
- Banerjee, Ranjit Kumar (1992). Machh chase jal O matir bhumika(in Bengali). (the role of water and soil in fish culture) In *Antardesiya matsya chas unnotikalpe prasikhyan*. 2 day Training -cum-Interaction Programme with Farm Journalist, 28.1.92 to 29.1.92 at CICFRI, Barrackpore, 80-87.
- Banerjee, R.K., S.K. Saha, P.R. Sen & K.V. Srinivasan (1989). Ecological studies on town refuse in the context of environmental pollution abatement and fish production. *J. Inland Fish. Soc., India*, 21 (2) : 25-30.
- Bhaumik, Utpal (1991). Macher chara utpadan (in Bengali) (fish seed production). In *Antardesiya matsya chas unnotikalpe prasikhyan*, 21-25.
- Bhaumik, Utpal, B.K. Banerjee & P. Das (1989). Raising carp seed along with paddy. *J. Inland Fish. Soc., India*, 21(2) : 49-51.
- Bhaumik, Utpal, J.G. Chatterjee & S.K. Mondal (1989). Acceptance of exotic carps in aquaculture by fish farmers of West Bengal. *J. Inland Fish Soc., India*, 21(2) : 37-40.
- Bhaumik, Utpal, P.K. Pandit & J.G. Chatterjee (1991). Impact of epizootic ulcerative syndrome on the fish yield consumption and trade in West Bengal. *J. Inland Fish. Soc., India*, 23 (1) : 45-51.

- Chakraborty, Prasanta Kumar (1992). Mithe jaler chingri chas (in Bengali) (prawn culture in freshwater). In Antardesiya matsya chas unnotikalpe prasikhyan, (2 day Training-cum-Interaction Programme with Farm Journalists, 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 46-51.
- Chakraborty, Prasanta Kumar (1992). Hooghly Mohanar Maach O Tar Utpadane Farakka bandher probhab (in Bengali) (Fishes of the Hooghly estuary and the effect of Farakka barrage on their production). In Antardesiya matsya chas unnotikalpe prasikhyan (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 95-98.
- Chandra, Ravish, R.K. Saxena & R.K. Tyagi (1990). *Hilsa ilisha* (Ham.) of Ganga - its glory and downfall - A retrospect. In recent trends in Limnology. Ed. V.P. Agrawala & P. Das. Today & Tomorrow's Printers and Publishers, New Delhi : 365-378.
- Chandra, Ravish, Y.S. Yadava, V. Kolekar, M. Choudhury (1990). A checklist of fishes from Dighali beel, district Kamrup, Assam. *J. Inland Fish. Soc., India*, 22 (1-2) : 92-95.
- Chandra, Ravish, Y.S. Yadava, V. Kolekar, M. Choudhury (1991). On the introduction of common carp *Cyprinus carpio* (Linn.) in Dighali beel, Assam. *J. Inland Fish. Soc., India*, : 23(1) : 80-81.
- Chatterjee, Joygovinda (1991). Deshi O bideshi macher pranodita prajanan (in Bengali). (Induced breeding of Indian and exotic fishes). In Antardesiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 9-14.
- Chattopadhyay, A.K., J.G. Chatterjee, S.R. Das & D. Sanfui (1990). Studies on the estuarine resources management through agroforestry. *J. Inland Fish. Soc. India*, 22 (1-2) : 75-79.
- Choudhury, M., R. Chandra, V. Kolekar (1990). Observations on some biological aspects and fishery of *Hilsa ilisha* (Ham.) of river Brahmaputra. *J. Inland Fish. Soc., India*, 22 (1-2) : 66-74.
- Das, Manas Kumar (1992). Griha Palita pakhi/pasu O macher ekatrita chas (in Bengali) (duck-cum pig cum fish culture). In Antardesiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 29-36.
- Das, M.K., D.P. Halder & S.K. Mondal (1989). Macroecological studies on protozoan diseases of carps in tropical intensive fish culture ponds in India. *Environ. & Ecol.*, 7(1) : 1-9.

- Das, R.K. & P.V. Dehadrai (1986). Soil water interaction and nutrient turnover in a weed infested swamp. *J. Inland Fish. Soc. India*, 18 (2) : 13-19.
- De, Dilip Kumar (1992). Ilish maach O tar chaser sambhabana (in Bengali) (Hilsa fish and its culture). In Antardeshiya matsya chas unnotikalpe prasikhyan (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 80-87.
- De, D.K. & N.C. Datta (1990). Age growth, length-weight relationship and relating condition in Hilsa, *Tenualosa ilisha* (Ham.) from the Hooghly estuarine system. *Indian J. Fish*, 37(3) : 199-209.
- D.K. De & N.C. Datta (1990). Studies on certain aspects of the morpho-histology of Indian shad Hilsa, *Tenualosa ilisha* (Ham.) in relation to food and feeding Rabits. *Indian J. Fish*, 37(3) : 189-198.
- De, D.K. & B.N. Saigal (1989). Spawning of Hilsa *Tenualosa ilisha* (Ham.) in the Hooghly estuary. *J. Inland Fish. soc., India*, 21(2) : 46-48.
- De, D.K. & P.R. Sen (1988). Observations on the embryonic and early larval development of Indian shad *Tenualosa ilisha* (Ham.). *J. Inland Fish. Soc. India*, 18 (2) : 1-12.
- Desai, V.R. & N.P. Shrivastava (1990). Studies on age, growth and gear selectivity of *Cirrhinus mrigala* (Ham.) from Rihand Reservoir, Uttar Pradesh. *Indian J. Fish*, 37(4) : 305-311.
- Dwivedi, R.K., S.J. Karamchandani & H.C. Joshi (1986). Limnology and productivity of Kulgarhi reservoir, Madhya Pradesh. *J. Inland Fish. Soc., India*, 18(2) : 65-70.
- Ghosh, A.K., R.N. Pal, M. Ramakrishnaiah, K. Subba Rao & M.B.R. Murty (1990). Fish health problems in Kolleru lake, Andhra Pradesh. *J. Inland Fish. Soc., India*, 22(1-2) : 90-91.
- Ghosh, Amitabha (1992). Dhaner sathe macher chas (in Bengali) (Paddy-cum-fish culture). In Antardeshiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 37-41.
- Ghosh, Apurba (1992). Antardeshiya maach utpadan padhatir ogragati (in Bengali). (Progress and development of inland fish culture). In Antardeshiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 1-8.

- Ghosh, Apurba, P.K. Chakrabarti, K.R. Naskar, G.N. Chattopadhyay, D. Nath & M.L. Bhowmik (1990). Ecology and faunal association of intertidal mangrove habitats in the Hooghly-Matlah estuarine system. *J. Inland Fish. soc., India*, 22 (1-2) : 31-37.
- Ghosh, B.B., M.K. Mukhopadhyay & M.M. Bagchi (1990). Status of organic pollution in the Mathabhanga-Churni river system, West Bengal. *J. Inland Fish. Soc., India*, 22 (1-2) : 16-21.
- Gopala Krishnayya, Ch. & A.K. Laal (1990). Eutrophication, its causes and consequences with particular reference to Kolleru lake. *In* Recent trends in limnology. Ed. V.P. Agrawal & P. Das, Today & Tomorrow's Printers and Publishers. New Delhi : 145-149.
- Gupta, R.A., S.K. Mandal & S. Paul (1991). Methodology for collection and estimation of inland fisheries statistics in India. *Bull. Cent. Inland Fish. Res. Inst., Barrackpore*, No. 358 : 64 p.
- Jhingran, Arun G. (1991). Development potential and constraints of Inland Fisheries Management in India. Fifth IPFC Working Party of Experts on Inland Fisheries, Bogor 24-26 June, 1991 : 21 p.
- Jhingran, Arun G. (1991). Fisheries development in rivers, lakes and reservoirs. *Fishing Chimes*, 11(1) : 41-49.
- Jhingran, Arun G. (1991). Performance of Tilapia in Indian waters and its possible impact on the nature ichthyofauna. *Workshop on Tilapia in the capture and culture-based fisheries in the Indo-Pacific Region*. (Fifth IPFC Working Party of Experts on Inland Fishes in Bogor, 27-29 June, 1991 : 23 p.
- Joshi, C.B. & R.C. Joshi (1988). Artificial propagation of brown trout *Salmo trutta* Fario (Linn.) at Kaldhyani Hatchery, Uttar Pradesh. *J. Inland Fish. Soc., India*, 18(2) : 83-86.
- Kaushal, D.K. & Y. Rama Rao (1990). Observations on the breeding of major carps in Govindsagar reservoir, Himachal Pradesh. *J. Inland Fish. soc., India*, 22(1-2) : 96-97.
- Khan, M.A. (1990). Significance of limnology in the management of man-made lakes. *In* Recent trends in Limnology. Ed. V.P. Agrawala & P. Das. Today & Tomorrow's Printers and Publishers, New Delhi : 151-164.

- Mitra, Krishna (1992). Paschimi Bangay Bil Sampad, tar utpadan O unnayan (in Bengali). Beels of West Bengal and its productin and development. In Antardeshiya matsya chas, unnotikalpe prasikhyan (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 88-89.
- Mukherjee, Ardhendu (1991). Misra maach chas (in Bengali) (composite fish culture). In Antardeshiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 26-28.
- Nath, D. (1986). Ecological trasition in a strongly acidic pond influenced by flood. *J. Inland Fish. Soc. India*, 18 (2) : 76-78.
- Pal, Radhanath (1991). Maach chase macher swastha rakshai mul katha. (the main object of fish culture is to grow healthy fish). In Antardeshiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 68-74.
- Pal, R.N. & A.K. Ghosh (1990). Water management strategies for health monitoring. In *Ecosegregation in Parasitocoenoses*. Ed. by Sandeep K. Malhotra, Allahabad University, of Allahabad, 1990.
- Pal, R.N., Hardial Singh, R.K. Chakraborty (1991). Preliminary observations on the champed tails of prawn. *J. Inland Fish. Soc., India*, 23 (1) : 75-77.
- Pandit, Piyush Kanti (1992). Badhe pona macher prajanan (in Bengali). Breeding of major carps in bundhs. In Antardeshiya matsya chas unnotikalpe prasikhyan (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 18-20.
- Pandit, Piyush Kanti (1991). Jiol macher chas (in Bengali) (air-breathing fish culture). In Antardeshiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 42-45.
- Pathak, V. (1990). A comparative study of energy dynamics of open and closed beels in Ganga and Brahmaputra basins. *J. Inland Fish. Soc. India*, 22(1&2) : 26-30.
- Raghavan, S.L., N.G.S. Rao, & M.F. Rahman (1986). Hydrobiological investigations in two perennial ponds of Anekal Taluk, Karnataka. *J. Inland Fish. Soc., India*, 18 (2) : 52-59.
- Rahman, M.F., S.L. Raghavan, P.K. sukumaran, S. Ayyappan (1989). A freak digestive system in *Cirrhinus mrigala* (Ham.). *J. Inland Fish. Soc., India*, 21(2) : 52-53.

- Rao, J. Bhimasena & S.J. Karamchandani (1986). On the spawning Biology of *Ompok bimaculatus* (Bloch) from Kulgarhi Reservoir of Madhya Pradesh. *J. Inland Fish. Soc., India*, 18 (2) : 40-47.
- Rao, N.G.S., M.F. Rahman, Salarjan (1991). Ichthyofauna of Vanivilas sagar reservoir, Karnataka. *Curr. Res.*, 20 (1) : 15-16.
- Roy, A.K., Apurba Ghosh & B.K. Saha. Estimation of some species of fish population from pond by fin clipping and comparative effecacies of three estimators. *Environ & Ecol.*, 7(2) : 398-403.
- Saha, Ganendra Nath (1992). Production of fish from bheries of West Bengal. (Paschimbanger bheri theke maach utpadan (in Bengali)). In Antardesiya matsya chas unnotikealpe prasikhyan (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 90-94.
- Saha, S.B., M.J. Bhagat & V. Pathak (1990). Ecological changes and its impact on fish yield of Kulia beel in Ganga Basin. *J. Inland Fish. Soc. India*, 22(1&2) : 7-11.
- Saha, Sukumar (1991). American ruir niyantrita prajanan padhati (in Bengali) (artificial breeding of common carp). In Antardeshiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 15-20.
- Saxena, R.K., M.A. Khan & B.D. Saroj (1986). Efficacy of selected feed formulations for fingerlings of carp *Cirrhinus mrigala*. *J. Inland Fish. Soc., India*, 18 (2) : 34-39.
- Sen, P.R., D.K. De & D. Nath (1990). Experiments on artificial propogation of Hilsa *Tenualosa ilisha* (Ham.). *Indian J. Fish.*, 37 (2) : 159-162.
- Singh, Balbir (1990). Limnology of a tropical pond with reference to fisheries. In Recent trends in Limnology. Ed. V.P. Agrawala & P. Das. Today & Tomorrwo's Printers and Publishers, New Delhi : 419-426.
- Singh, B.K., M.D. Pisolkar, P.L.N. Rao (1991). A note on abnormal specimen of silver carp *Hypophthalmichthys molitrix* (Val.) from Hadapsar fish farm, Pune (Maharashtra). *J. Inland Fish. Soc. India*, 23 (1) : 78-79.
- Singh, B.K., P.L.N. Rao & D.D. Patil (1986). A note on seed production of Indian major carps through hypophysation at Hadapsar Fish Seed Farm, Pune, Maharashtra. *J. Inland Fish. Soc. India*, 18 (2) : 73-75.

- Sugunan, V.V. (1991). Changes in the phytoplankton species diversity indices due to artificial impoindment in river Krishna at Nagarjuna Sagar. *J. Inland Fish. soc. India*, 23(1): 64-74.
- Sugunan, V. V. (1992). Samuk chas (in Bengali) (snail farming). In Antardeshiya matsya chas unnotikalpe prasikhyan, (2-day training cum interaction programme with Farm Journalists 28.1.92 to 29.1.92 at CICFRI, Barrackpore : 75-79.
- Sugunan, V.V. & V. Pathak (1986). Temporal and spatial distribution of periphyton in Nagarjunasagar reservoir, Andhra Pradesh (India) and a new method for periphyton collection from Indian reservoirs. *J. Inland Fish. Soc. India*, 18 (2) : 20-33.
- Vass, K.K. (1990). Thermal behaviour of Indian lakes. In Recent Trends in Limnology. Ed. V.P. Agrawala & P. Das. Today & Tomorrow's Printers and Publishers, New Delhi : 323-338.
- Vass, K.K. & R.K. Langer (1990). Changes in primary production and trophic status of Kashmir oxbow-lake, Consequent to man-made modification in the environment. *J. Inland Fish. Soc. India*, 22(1-2) : 43-51.

PERSONNEL

The following scientists rendered their services to the Institute during the period April 1991 to March 1992.

Dr. Arun G. Jhingran, Director,
Barrackpore (upto 16.8.91)

Shri Apurba Ghosh, Director
(upto 31.1.92)

Dr. Y. Rama Rao, Director
(upto 31.7.92)

RIVERINE DIVISION

Allahabad Centre

Shri Ravish Chandra, Pr. Scientist
Shri S.P. Singh, -do-
Shri S.K. Wishard, Scientist (S.G.)
Shri S.N. Mehrotra, -do-
Dr. H.P. Singh, Sr. Scientist
Dr. D.N. Singh, -do-
Dr. Balbir Singh, -do-
Dr. M.A. Khan, -do-
Shri R.N. Seth, Scientist (S.G.)
Shri R.K. Dwivedi, -do-
Dr. R.K. Tyagi, Sr. Scientist
Shri R.K. Saxena, Scientist (S.G.)
Shri G.N. Srivastava, -do-
Shri R.N. Seth, -do-
Shri P.K. Katiha, Scientist

Guwahati Centre

Shri K.P. Srivastava, Scientist (S.G.)
Dr. M. Choudhury, Scientist (Sr. Sc.)

Patna Centre

Dr. G.K. Bhatnagar, Pr. Scientist
Dr. B.C. Jha, Sr. Scientist
Dr. V. Pathak, -do-
Dr. P.N. Jaitly, Scientist

Agra Centre

Dr. R.S. Panwar, Pr. Scientist
Shri D.N. Mishra, Scientist (S.G.)
Dr. Shree Prakash, Sr. Scientist
Dr. (Ms.) Usha Moza, -do-
Dr. K. Chandra, -do-
Shri V. Kolekar, Scientist

LACUSTRINE DIVISION

Bangalore Centre

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

Eluru Centre

Shri K.V. Rao, Scientist (S.G.)
Shri J.B. Rao, -do-

Coimbatore Centre

Shri C. Selvaraj, Pr. Scientist
Shri V.K. Murugesan, Scientist (S.G.)
Dr. V.K. Unnithan, Sr. Scientist
(from 16.10.91)

Pune Centre

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

Raipur Centre

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

Kangra Centre

Dr. D.K. Kaushal, Sr. Scientist
 Dr. V.R. Chitranshi, -do-
 Dr. V.K. Sharma, Scientist (Sr. Sc.)

ESTUARINE DIVISION**Barrackpore Centre**

Shri R.N. Pal, Pr. Scientist (upto 31.8.91)
 Shri G.N. Saha, Pr. Scientist
 Dr. M.K. Mukhopadhyay, Sr. Scientist
 Dr. H.C. Joshi, -do-
 Shri M.M. Bagchi, Scientist (S.G.)
 Dr. R.K. Das, Sr. Scientist
 Shri P.M. Mitra, Scientist (S.G.)
 Dr. M.K. Das, Sr. Scientist
 Dr. D.K. De, -do-
 Shri A. Mukherjee, -do-
 Shri A. Hazra, Scientist

Vadodara Centre

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

Farakka Centre

Shri A.R. Chaudhury, Scientist

Calcutta Centre

Shri A.C. Nandy, Scientist (S.G.)
 Dr. A.K. Ghosh, Sr. Scientist
 Dr. R.K. Banerjee, -do-
 Dr. K.R. Naskar, -do-
 Shri H.C. Karmakar, Scientist (S.G.)

Canning Centre

Shri S.N. Dutta, Scientist (S.G.)
 (upto 31.3.1991)
 Dr. D. Nath, Sr. Scientist

BRACKISHWATER IMPOUNDMENT SECTION, Barrackpore

Shri Apurba Ghosh, Pr. Scientist
 (upto 31.1.92)
 Dr. Y.S. Yadava, Sr. Scientist
 Dr. Amitabha Ghosh, -do-
 Shri P.K. Chakraborty, Scientist
 (S.G.)

OTHER CENTRES/SECTIONS AT BARRACKPORE**Inland Molluscs Section**

Dr. V.V. Sugunan, Sr. Scientist
 Ms. G.K. Vinci, Scientist (S.G.)

Beel Fisheries Section

Dr.K. K. Vass, Pr. Scientist
 Dr.(Ms.) Krishna Mitra, Sr. Scientist

Extension Section

Shri U. Bhaumik, Scientist (S.G.)
 Dr. P.K. Pandit, Sr. Scientist

Engineering Section

Shri A. B. Mukherjee, Pr. Scientist

Economics Section

Shri S. Paul, Scientist (S.G.)

Central Sector Scheme for Inland Fisheries Statistics

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

Krishi Vigyan Kendra, Kakdwip

Shri J.G. Chatterjee, Sr. Scientist

Scientists & staff on Deputation/Lien

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

Shri U.K. Ghosh, Senior Stenographer on lien for 2 years from the afternoon of 25th February 1992 at Income-Tax Appellate Tribunal, Calcutta.

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

Sr.R.A.

Shri S. N. Sar (upto 31.3.92)

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. S.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
Dr. Alokendu Das Roy

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. K. Sucheta Majumder
Shri B.B. Das
Shri Swapan Kr. Chatterjee
Shri Sushil Kumar

T-I-3

Shri D. Sanfui
Shri A.K. Banerjee (upto 30.11.91)
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
 Shri R.M. Roy (upto 31.12.91)

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. Kottalah
 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
 Shri Radhesyam Halder

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 (upto 31.1.1992)

Superintendent

Shri M.R. Roy
 Shri N.K. Sarkar
 Shri T.P. Das
 Shri S. Dasgupta
 Shri Ranjit Kr. Ghosh (A & A)
 Shri Mahesh Prasad (KVK) (upto 30.4.91)

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. Baldya
 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 Brahmopal Balmiki
 Shri S. Karmakar
 Shri Sukumar Sarkar
 Shri A.K. Dey
 Shri M.K. Joardar
 Shri S.K. Ghosh
 Shri A. D. Sinde
 Smt. S. Sumithra Devi
 Shri Santosh Sarkar
 Shri Rajesh Khandelwal
 Shri C.D. Parmer

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 Jugul 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 Munnalal 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. Kallanan
 Shri Ram Prasad
 Shri Karam Raj
 Shri Satyendra Burman
 Shri Lalita Prasad
 Shri Sita
 Shri Rajdhari Mallah
 Shri Sukchand Biswas
 Shri Bideshi Lal
 Shri B. Pugalendhi
 Shri Om Prakash
 Shri M.P. Bind
 Shri A. Gangaiyah
 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. Kistaiyah
 Shri U. Satyanarayana
 Shri S. Jaan
 Shri P. Atchalaiah
 Shri S. Kalita
 Shri N. Dekka
 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. Balragi
 Shri Bhaskar Sardar
 Shri Pasupati Ghosh
 Shri Jagdish Balmiki
 Shri S. Banerjee
 Shri Sibulal 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 Attullah
 Shri Sitla Prasad
 Ms. Kamal Devi
 Shri M. Anjanappa
 Shri G.J. Roundale
 Shri M.S. Bhoi
 Shri T.H. Ghume
 Shri K. Subbatya
 Shri R. Nagraj
 Shri S. Govindarajan
 Shri K. Subramahniyan
 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 R. Rajendran

Smt. Suvra Chakraborty

Shri P. Sampathn

Shri Kamlesh Kumar

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. Nobl

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
Smt. Mira Sen	T-6	T-7	1.7.1989
Shri M.R. Roy	Superintendent	Asstt. Adm. Officer	16.4.1991
Shri S. Dasgupta	Assistant	Superintendent (Ad-hoc)	2.4.1991
Shri L.P. Misra	Senior Clerk	Assistant (Ad-hoc)	16.4.1991
Shri U.K. Ghogh	Stenographer	Senior Stenographer	22.2.1992
Shri T.K. Roy	Stenographer	-do- (Ad-hoc)	22.2.1992
Shri Mahesh Prasad	Assistant	Superintendent	16.4.1991
Shri S.K. Kar	Senior Clerk	Assistant	-do-
Smt. Sikha Majumder	Junior Clerk	Senior Clerk	-do-
Shri P.K. Dutta	Junior Clerk	-do-	-do-
Shri P. Lahiri	-do-	-do-	-do-
Shri B.K. Das	-do-	-do-	-do-
Shri Gunadhar Dhibar	SSG-I	SSG-II	8.8.1991

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

Retirement during the period

Name	Designation	Date of Retirement
Dr. A.G. Jhingran	Director	16 August 1991
Shri Apurba Ghosh	Principal Scientist	31st January 1992
Shri R.N. Pal	Principal Scientist	31st August 1991
Shri S.N. Sar	Research Assistant	31st March 1992
Shri A.K. Banerjee	T-I-3	30th November 1991
Shri R.M. Roy	T-I-3	31st December 1991
Shri Mahesh Prasad	Superintendent	30th April 1991
Shri R.C. Srivastava	Senior Stenographer	31st January 1992

Appointments

Following appointments were made during the period

Name	Designation	Place of posting	Date of appointment
Shri R. Rajendran	SSG-I	Coimbatore	20.5.1991
Shri Suklal Baitragi	Pumpman (Aux.)	Barrackpore	5.9.1991
Shri Radhesyam Halder	T-1	Farakka	18.9.1991
Smt. S. sumithra Devi	Junior Clerk	Bangalore	19.9.1991
Smt. Suvra Chakraborty	SSG-I	Barrackpore	14.10.1991
Shri Santosh Sarkar	Junior Clerk	Farakka	21.9.1991
Shri P. Sampathn	SSG-I	Bangalore	9.10.1991
Shri Kamlesh Kumar	SSG-I	Agra	2.11.1991
Shri Rajesh Khandelwal	Junior Clerk	Agra	3.12.1991
Dr. Y. Rama Rao	Director	Barrackpore	31.1.1992 (A.N)
Shri C.D. Parmer	Junior Clerk	Vadodara	25.1.1992
Dr. Alokendu Das Roy	T-4	KVK, Kakdwip	22.1.1992

Transfers

The following members of CICFRI were transferred during the period April 1991 to March 1992.

Name	Designation	From	To
Dr. Y. Rama Rao	Principal Scientist	Allahabad	Barrackpore
Shri S.P. Singh	-do-	Patna	Allahabad
Shri G.N. Saha	-do-	Calcutta	Barrackpore
Dr. G.K. Bhatnagar	-do-	Kangra	Patna
Dr. R.S. Panwar	-do-	Eluru	Agra
Dr. M.A. Khan	Scientist (S.G.)	Allahabad	Guwahati
Dr. V.R. Chitransi	-do-	Patna	Kangra
Shri S.N. Mehrotra	-do-	Guwahati	Allahabad
Dr. V.K. Unnithan	-do-	Barrackpore	Coimbatore
Shri R.N. Seth	-do-	Patna	Allahabad
Dr. D. Nath	-do-	Vadodara	Canning
Shri A.R. Choudhury	Scientist	Lalgola	Farakka
Shri Anshuman Hajra	-do-	Bangalore	Barrackpore
Shri Ramji Tewari	T-II-3	Agra	Allahabad
Shri D.K. Biswas	-do-	Guwahati	Barrackpore

Shri H.C. Banik	-do	Raipur	Lalgola
Shri Suresh Singh	-do	CIFE, Bombay	Agra (Inter-Institutional Transfer)
Shri K.P. Singh	T-I-3	Farakka	Raipur
Shri Sanjoy Bhowmick	T-5	Allahabad	Uluberia
		Uluberia	Barrackpore
Shri K.S. Banerjee	-do-	Vadodara	Farakka
Shri P.S.C. Bose	-do-	Bangalore	Markonahali
		Markonahali	Reservoir site
			Eluru
Shri M. Anjanappa	SSG-I	Bangalore	centre
			Markonahali
			Reservoir site
Shri C. Muniappa	-do-	-do-	-do-
Shri Tarun Kanti Halder	-do-	Vadodara	Farakka
Shri Sibulal Das	-do-	Barrackpore	Farakka
Shri Bablu Mondal	-do-	Kangra	Kakdwip
Shri Anil Chandra Das	-do-	Lalgola	Barrackpore
Smt. Sandhya Majumder	Assistant	Barrackpore	Calcutta
Shri C.N. Shahi	Junior Clerk	Barrackpore	Patna
Shri M.K. Joarder	-do-	Calcutta	Barrackpore
Shri S.K. Tikadar	-do-	Barrackpore	KVK, Kakdwip
Shri B. Pugalendi	SSG-II	Coimbatore	Pune
Shri K. Kaliannan	-do-	Aliyar Nagar	Thirumoorthy
			Nagar
Shri A. Ramaswamy	-do-	-do-	-do-
Shri V. Mariappan	-do-	-do-	-do-
Shri P. palaniswamy	-do-	-do-	-do-
Shri S. Mahendran	-do-	-do-	-do-
Shri Shatendra Burman	-do-	Allahabad	Farakka
Shri Ashis Roy Chowdhury	T-1	Patna	Barrackpore
Shri Debasis Saha	-do-	Pune	Calcutta
Shri S. Bandopadhyay	-do-	Agra	Barrackpore
Shri P. Rajani	T-2	Patna	Allahabad
Shri Subhendu Mondal	Boat Driver	Eluru	Canning

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वार्षिक रिपोर्ट 1991-92

केन्द्रीय अंतर्स्थलीय प्रग्रहण मात्स्यकी अनुसंधान संस्थान (भा. कृ. अनु. प.) : बैरकपुर : प. बंगाल

सक्षिप्त इतिहास

भारत सरकार ने सन् 1943 में अपने एक जापन में देश के मात्स्यकी स्त्रोतों के विकास हेतु एक केन्द्रीय विभाग की स्थापना पर विशेष बल दिया था। तत्पश्चात् कृषि वानिकी तथा मात्स्यकी से संबंधित केन्द्रीय सरकार नीती-समिति की मात्स्यकी उप-समिति ने इस विषय का पृष्ठांकन किया था। इसके आधार पर 17 मार्च सन् 1947 में भारत सरकार के खादय तथा कृषि मंत्रालय के अधीन कलकत्ता में केन्द्रीय अंतर्स्थलीय मात्स्यकी अनुसंधान केन्द्र की स्थापना औपचारिक रूप में हुई। एक अन्तरिम योजना के रूप में प्रवर्तित यह अब अंतर्स्थलीय मात्स्यकी क्षेत्र में एक प्रमुख अनुसंधान संस्थान बन गया। यह केन्द्र सन् 1959 में एक अनुसंधान संस्थान का रूप ग्रहण कर बैरकपुर स्थित अपने निजी भवन में स्थानान्तरित हो गया। सन् 1967 से यह संस्थान भारतीय कृषि अनुसंधान परिषद् (आई. सी. ए. आर.) के प्रशासनिक प्रबन्ध 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 जैसे- नदी, सरोवर, तालाब, जलाशय और चापझील के पर्यावरण तथा उत्पादन-क्रियाशीलताओं को सुलझाने का प्रयास किया है। इन अध्ययनों द्वारा भिन्न-भिन्न प्रकार के वातावरण में जलीय पारिस्थितिक तंत्र की जटिल पोषी संरचना तथा प्रकार्यों को सुलझाया गया है। संस्थान के अधिदेश में किंचित 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। पुनर्प्रीतिष्ठित के. अं. प्र. मा. अनु. सं. 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

संस्थान के अधिदेश में निम्नलिखित कार्य हैं:-

1. 10 हे. से अधिक क्षेत्र वाले जलीय स्त्रोत जैसे:- नदी, ताल, जलाशय, बील, नहर, ज्वारनदमुख, लैगून आदि में मत्स्य संख्या गतिकी का अध्ययन।
2. उक्त प्रकार के जलीय स्त्रोतों में मत्स्य उत्पादन में वृद्धि करने हेतु प्रबन्ध प्रणालियों को विकसित करना।

3. नदीय, सरोवरीय तथा ज्वारनदमुखी स्त्रोतों में प्रदूषण के कारक तत्व, इसका प्रभाव तथा निवारण उपाय सम्बन्धी अन्वेषण ।
4. नदीय बेसिन की मात्स्यकी पर घाटी परियोजनाओं के प्रभाव का अध्ययन एवं प्रबन्ध प्रणालियों को विकसित करना, एवं
5. प्रशिक्षण एवं विस्तार शिक्षा कार्यक्रमों का आयोजन एवं परामर्शक सेवाएँ उपलब्ध कराना ।

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 सम-प्रबन्ध 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 परियोजना के अंतर्गत आती हैं । सरोवरीय प्रभाग का मुख्यालय बंगलोर में तथा इसके केन्द्र तमिलनाडु, आन्ध्र प्रदेश, उत्तर प्रदेश, मध्य प्रदेश, हिमाचल प्रदेश और महाराष्ट्र में स्थित हैं । इसके अन्वेषणों का लक्ष्य बड़े तालाबों, सरोवरों और जलाशयों में मत्स्य उत्पादन बढ़ाने हेतु प्रबन्ध पद्धतियों 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 कन्दों के बहिस्त्राव तथा कृषि और नगरीय अपरद पदार्थों के प्रवाह के कारण हुगली ज्वारनदमुखी क्षेत्र को गंगा नदीय तंत्र के अत्यधिक प्रदूषित क्षेत्र हो गया है । इस प्रदूषित क्षेत्र में इस प्रभाग ने 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 विवृत जल क्षेत्रों में केज तथा पेन कलचर, अंतर्स्थलीय घोंघों की पारिस्थितिकी एवं उत्पादन प्रक्रिया, हाइड्रोलिक संरचनाओं से मत्स्य पारगमन के अभियांत्रिक पहलुओं तथा मात्स्यकी के आर्थिक और सांख्यिक 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 । इन अनुसंधान परियोजनाओं का संचालन बैरकपुर स्थित मुख्यालय, 12 अनुसंधान केन्द्र, 6 सर्वेक्षण केन्द्र एवं 1 कृषि विज्ञान केन्द्र, जो 11 प्रदेशों में स्थित हैं, द्वारा किया जाता है ।

मुख्य उपलब्धियाँ

उत्तर-पूर्वी क्षेत्र में जलाशय मात्स्यकी की सम्भावनाएँ

उत्तर-पूर्वी परिषद् सचिवालय द्वारा परिचालित एक परामर्शक कार्यक्रम के अंतर्गत मेघालय के नोंगमाहिर व किरदमकुलाई जलाशयों में मत्स्य विकास की सम्भावनाओं का अध्ययन किया गया है । यह गहन अध्ययन पूरे एक वर्ष तक किया गया, जिसके दौरान उत्पादकता से संबंधित सभी प्रकार के पर्यावरणीय परिवर्तनों का समुचित अध्ययन किया गया । इन दोनों जलाशयों के प्राथमिक उत्पादकता स्तर के आधार पर मत्स्य उत्पादन क्षमता का निर्धारण

किया गया। इस अध्ययन की अंतिम रिपोर्ट उत्तर-पूर्वी परिषद् को भेज दी गयी है। इस रिपोर्ट में नौगमाहिर व किरदमकुलाई जलाशयों में मत्स्य उत्पादन को अधिकतम स्तर तक बढ़ाने के सभी सम्भावित उपायों का उल्लेख किया गया है। इन जलाशयों के लिए निर्धारित प्रबन्ध प्रणालियाँ देश के उन सभी जलाशयों में परिचालित की जा सकती हैं जिनकी संरचना व मृदीय गुणवत्ता इन दो जलाशयों के समान हैं।

पेन व पिंजरों की रूपरेखा

बीलों के लिए पेन की रूपरेखा

एक अभियांत्रिक सर्वेक्षण के आधार पर गंडक बेसिन के बील परितंत्रों के लिए उपयुक्त पेन की रूपरेखा का निर्धारण किया गया। यह रूपरेखा अर्ध-कठोर संरचना पर आधारित है जो 1500 वर्ग मी. की विशाल क्षेत्र में फैली होती है। 120 वर्ग मी. वाले एक नर्सरी की रूपरेखा का भी निर्धारण किया गया है। ये पेन का आकार समकोणीय तथा चारों कोण गोल बने होते हैं ताकि जाल समान रूप से लगाया जा सके। पेन के निर्माण के लिए मुख्य रूप से विभिन्न आमाप के व्यासवाले बाँसों को चुना गया क्योंकि ये सस्ते एवं आसानी से प्राप्त किए जा सकते हैं तथा ये बाहरी आवेगों का सामना कर सकते हैं।

चयनित स्थान की प्रवणता 1:300 तथा 1:3500 के अनुपात के मध्य थी। तलछठों के महीन दानों में उच्च प्राथमिक सूक्ष्मरंध्रता तथा सूखापन या उपरिवर्ती भार के कारण परिमाण में भारी परिवर्तन और औसत घनत्व 1.5 ग्रा. प्रति घन से. मी. थी। पेन की रूपरेखा निर्धारण एवं स्थान के चयन में वर्षपात, वनस्पतियों तथा मृदा ह्रास को ध्यान में रखा गया।

केज यूनिट की लंगर व्यवस्थाएँ

केज (10 X 6 X 2.5 मी.) को तैरते हुए रखने के लिए लंगर व्यवस्था की रूपरेखा तैयार की गई, जो दोलन आदि से भी अस्थिर नहीं होती। केज के मध्य भाग से एक भारी वस्तु को एक रस्सी की सहायता से झुलाया जाता है। इससे जल के एक बड़े परिमाण का विस्थापन होता है। एक समकोणीय लोहे के फ्रेम केज के अधस्तल में लगाया जाता है, जिसमें जाल को बाँधा जाता है ताकि यह विस्थापित न हो जाय इस प्रक्रिया से केज में जाल को अच्छी तरह बिछाया जा सकता है।

मातलह ज्वारनदमुखी परितंत्र में हिल्सा प्रजनन - एक प्राथमिक रिपोर्ट

समुद्रमुख से 100 कि. मी. ऊर्ध्वप्रवाह क्षेत्र में केनिंग के निकट मातलह ज्वारनदमुख के बेगेनेट मत्स्य स्थलन से तेनुलिसा इलिसा के फ्राई एकत्रित किया गया। 19 दिसम्बर 1991 को भाटा के समय बेगेनेट मत्स्यन से प्राप्त फ्राई का आमाप 19-23 मि. मी. पाया गया। अब तक पश्चिम बंगाल राज्य में हिल्सा का प्रजनन केवल भागिरथी-हुगली नदीय परितंत्र तक ही सीमित माना जाता था। वर्तमान अध्ययनों से संकेत मिलते हैं कि इस प्रजाती का प्रजनन मातलह ज्वारनदमुख में भी होता है।

हीराकुंड जलाशय का सर्वेक्षण

उड़ीसा में स्थित हीराकुंड जलाशय की मत्स्य उत्पादन क्षमता के अध्ययन हेतु संस्थान के वैज्ञानिकों ने इस जलाशय का अल्प-अवधिक सर्वेक्षण किया। सर्वेक्षण के दौरान जल व मिट्टी की गुणवत्ता तथा मत्स्य उत्पादन क्षमता से संबंधित गुणों का अध्ययन किया गया। इसके अतिरिक्त वैज्ञानिकों ने मत्स्यन के विभिन्न प्रयास तथा मछुआरों की सामाजिक व आर्थिक स्थितियों का भी अध्ययन किया। इस जलाशय में मत्स्य-उत्पादन के विकास के लिए आवश्यक सुझावों से संबंधित एक विस्तृत रिपोर्ट भारत सरकार को प्रस्तुत किया गया।

ब्रह्मपुत्र नदी की मात्स्यकी स्तर का मूल्यांकन

ब्रह्मपुत्र नदीय मात्स्यकी की वर्तमान स्थिति से संबंधित एक रिपोर्ट तैयार कर भारत सरकार के कृषि व सहकारिता मंत्रालय को प्रस्तुत की गई। इस रिपोर्ट में क. अ. म. अ. स. द्वारा वर्षों से एकत्रित आधारभूत आँकड़ों का विश्लेषण प्रस्तुत किया गया। नदीय तंत्र में उपलब्ध जैव व अजैव कारक के आधार पर उत्पादन गतिकी पर प्रकाश डाला गया तथा नदी में मछलियों के ह्रास के मुख्य कारणों का भी उल्लेख किया गया।

ज्वारनदमुखी आर्द्र क्षेत्रों में पेन-पालन प्रणाली द्वारा अत्यधिक उत्पादन

एक बड़े भेरी (एक प्रकार का आर्द्र क्षेत्र) के सीमान्त क्षेत्र में पेन-पालन प्रणाली के प्रायोगिक परीक्षण से 5150 कि. ग्रा. प्रति हे. प्रति वर्ष का मत्स्य उत्पादन प्राप्त किया गया, जिससे भेरी में मत्स्य उत्पादन की वृद्धि के लिए पेन-पालन प्रणाली अपनाने के लिए प्रोत्साहन मिलता है। भेरी में मात्स्यकी गहन प्रबंध प्रणाली के लिए इसका विशाल आकार एक बाधा है। पेन-पालन प्रणाली अपनाये जाने पर यह बाधा उत्पन्न नहीं होती क्योंकि मछलियाँ एक सीमित क्षेत्र में ही रह जाती हैं।

कलकत्ता के समीप मलजल से पोषित कान्तातला भेरी में तीन प्रजातियों जैसे— ओरियोक्रोमिस्मोजमविकस, ओ. निलोटीकस तथा साइप्रिनस कारपियो का मिश्रित पालन किया गया। संग्रहण दर 40,000 प्रति हे. तथा प्रजातियों का अनुपात क्रमशः 2:1:1 रखा गया। इस प्रयोग में कृत्रिम खाद्य के अंश के रूप में इक्वीड वोलफिकिया की महत्ता की पुष्टि होती है। 90 दिनों में ओ. निलोटीका का विकास 158 ग्राम पाया गया।

मत्स्य रोगों पर सहयोगिक परियोजना

संस्थान ने हाल ही में 'लवणीय जल इम्पाउंडमेन्ट में मत्स्य परजीवी' परियोजना का प्रथम चरण कार्य समाप्त किया है। छः महीनों के इस अध्ययन में ग्रसन दर, परपोषी की प्रत्येकता, क्रसटेशियन विशेषकर अरगुलस प्रजाती के संदर्भ में परपोषी अधिमान्यता आदि विषयों को सम्मिलित किया गया। इस अध्ययन से इन परितंत्रों में परपोषियों एवं परजीवियों के संबंध में रोचक तथ्य स्पष्ट हुए हैं। प्राथमिक परिणामों से स्पष्ट होता है

कि परजीवियों का अधःस्तल में निवास करनेवाले मछलियों के प्रति विशेष वरीयता होती है और ग्रसन दर का परपोषियों के विभिन्न अवस्थाओं से संबंध होता है। इस परियोजना में परजीवियों एवं परपोषियों के जैविक विशेषताओं से संबंधित आँकड़ों का संकलन हुआ है, जिनकी सहायता से आर्द्र क्षेत्र के परितंत्रों में परजीवियों के नियंत्रण हेतु प्रणालियों को विकसित किया जा सकता है। यह अध्ययन इन्स्टिट्यूट ऑफ एक्वाकल्चर, स्टेरलिंग विश्वविद्यालय, ब्रिटेन के साथ सहयोगिक परियोजना के रूप में सम्पन्न हुआ।

गंगा नदी के फरक्का के ऊपरी क्षेत्र में पर्यावरणीय अनुमापन

संस्थान ने इस वर्ष अपने पर्यावरणीय अनुमापन संबंधी अध्ययनों को फरक्का के उच्च प्रवाह क्षेत्र तक विस्तृत किया। फरक्का बाँध के निकट उच्च प्रवाह क्षेत्र में जलीय गुणवत्ता सूचकांक (100) मात्स्यकी के लिए अनुकूल पर्यावरण सूचित किया है। इस क्षेत्र में पाए जानेवाली मछली रीता रीता के ऊतकों में एकत्रित डीडीटी तथा इसके मेटाबोलाइटों का विश्लेषण किए जाने पर एकत्रित मात्रा संसूचन स्तर से भी कम पाया गया। जलीय विश्लेषण में डीडीटी की मात्रा 7.42 माप्रा प्रति लीटर, डीडीटी 46.82 माप्रा प्रति लीटर, डीडीडी 31.28 माप्रा प्रति लीटर तथा Y-HCH 4.42 माप्रा प्रति लीटर पाया गया। तलछट नमूनों में HCH तथा डीडीटी के अवशेष पाए गए हैं। इनमें से कोई भी घटक मछलियों के निर्धारित सीमाओं को नहीं लांघती है।

गंगा नदी में पर्यावरणीय प्रभाव का मूल्यांकन

गंगा नदी में पर्यावरणीय प्रभाव मूल्यांकन कार्यक्रम के अंतर्गत यह संस्थान जल, तलछट तथा ऊतकों में कीटनाशक अवशिष्टों की उपस्थिति का निरंतर अध्ययन कर रही है। लेबियो कालबसु मछलियों में अधिकतम एकत्रित मात्रा बी एम सी (60.8 पीपीबी) तथा डीडीटी (32.12 पीपीबी) कन्नौज के निकट काली नदी में तथा बीएमसी (28.2 पीपीबी) नाबाद्वीप के निकट जलंगी नदी में देखा गया।

फरक्का के निकट गंगा नदी में तथा नाबाद्वीप के जलंगी नदी में इस परीक्षण मछली में डीडीटी (20.34 पीपीबी) और बीएमसी (24.2 पीपीबी) की उपस्थिति पायी गई। गंगा तथा इसके उप-नदियों में डीडीटी तथा बीएमसी का औसतन एकत्रीकरण 0.0013-0.007 पीपीबी और 0.00-0.026 पीपीबी है।

हुगली ज्वारनदमुख में भारी-धातुओं का अनुमापन

संस्थान इस वर्ष भी ज्वारनदमुखी जल क्षेत्रों में भारी-धातुओं की सांद्रता का अनुमापन करती रही। भारी धातुओं की उपस्थिति जिंक (0.05 माप्रा प्रति लीटर), कॉपर (0.01 माप्रा प्रति लीटर), क्रोमियम (संसूचक स्तर से कम) तथा मरक्युरी (संसूचक स्तर से कम) किसी प्रकार के संकट की सूचना नहीं देती। फरक्का, नाबाद्वीप तथा डायमंड हारबार क्षेत्रों में जलीय गुणवत्ता सूचकांक 100 से कम नहीं हुई, जिससे मात्स्यकी के लिए अनुकूल पर्यावरणीय स्थितियों की संकेत मिलती है।

औद्योगिक अपरदद का स्वस्थाने विष परीक्षण

लुगदी व कागज कारखानों के अपरददों की विषाक्तता निर्धारण हेतु हुगली ज्वारनदमुख में स्वस्थाने विष परीक्षण किया गया। इस अध्ययन हेतु नाइलन जाली एलुमिनियम पिंजरो (60 X 50 X 45 से. मी.) का उपयोग किया गया। कारखानों के विविध एककों द्वारा अपरददों के विसर्जन अनुपात की विभिन्नता के कारण अपरदद के घटकों में हुए परिवर्तन का प्रभाव मछलियों की स्वस्थाने विष परीक्षण में स्पष्ट देखी गई।

तमिलनाडु व केरल में महामारी व्रणकारी संलक्षण रोग के प्रादुर्भाव

तमिलनाडु:- सन् 1991 के दौरान संस्थान द्वारा तमिलनाडु में किये गए एक सर्वेक्षण से ज्ञात होता है कि तमिलनाडु के अनेक जिलों में मछलियों का यह व्रणकारी रोग फैल चुकी है। यह रोग उदुमलपेट, चेंगलपेट, ताजांउर तथा ट्रिची जिलों के बड़े जलीय क्षेत्रों की मत्स्य उपज को अत्यधिक प्रभावित किया है। प्रभावित जल क्षेत्रों में कुल उत्पीड़न दर 15-30 प्रतिशत है। जल क्षेत्रों की विशालता उपचारात्मक कार्य को सीमित कर दी है। मत्स्य प्रबंधकों को सुझाव दिया गया कि संग्रहण से पूर्व अंगुलिकाओं को रोग निरोधक उपचार दिया जाए।

केरल:- केरल के कोट्टायम, अल्लापुजा तथा व्यानाड जिले इस रोग से प्रभावित हुए हैं। धान के खेतों के निकट के नहरों, पशुजल के कुछ क्षेत्र, पूकोट लेक तथा बानासुरासागर जलाशय की मछलियाँ प्रभावित हुई हैं। मछलियों में इस रोग का संक्रामण 10-20 प्रतिशत रही है। इस रोग के निवारण हेतु अल्प-कालिक व दीर्घ-कालिक उपायों का सुझाव दिया गया। संस्थान के प्रतिनिधि के रूप में डॉ. एम. के. दास, वरिष्ठ वैज्ञानिक अवाधित अशंकाओं को दूर करने के लिए मन्त्रियों, राज्य के अधिकारियों, वैज्ञानिकों तथा मीडिया के लोग से वार्ता की।

संस्थान के मत्स्य रोग-विज्ञान प्रयोगशाला, बैरकपुर में इस रोग से संबंधित सूक्ष्मजीवियों तथा पर्यावरणीय तत्वों का अध्ययन सात देशों के सहयोगिक अन्वेषण के अंतर्गत किया जा रहा है।

प्रयोगशाला से भूमि की ओर कार्यक्रम के अंतर्गत उच्चतर उपज

संस्थान के कृषि विज्ञान केन्द्र, काकद्वीप के पर्यवेक्षण में खेतों की उपज में उल्लेखनीय वृद्धि की गई है। परम्परागत पद्धतियों से प्राप्त उपज की तुलना में खरीफ फसल, आलू तथा मछलियों की उपज में चार गुणा वृद्धि पाई गई। सुखे मिर्च की उपज में तीन गुणा वृद्धि तथा बोरो धान व तरबूज की उपज दुगुनी हो गई। संस्थान द्वारा ५० बंगाल राज्य के इस पिछड़े क्षेत्र के कृषि प्रणालियों को आधुनिक बना रही है। कृषि विज्ञान केन्द्र का बहु-विषयक होने के कारण भारतीय व विदेशी कृषि मछलियों का प्रेरित प्रजनन, लवणीय जल-कृषि, छत्रक उत्पादन, गृह विज्ञान, पशु-पालन कार्यक्रमों पर भी विशेष ध्यान दिया जा रहा है। इन विकास कार्यक्रमों में स्त्रियों को सम्मिलित करने की प्राथमिकता दी जाती है।

हुगली ज्वारनदमुख में फिनफिश व शेलफिश के बीजों का विनाश पर एक सर्वेक्षण

हुगली नदी के लगभग 40 कि. मी. लम्बे क्षेत्र का कुलपी से नामखाना तक के क्षेत्र में फिनफिश व शेलफिश के बीजों का विनाश के अध्ययन हेतु सर्वेक्षण किया गया। दो चरणीय सर्वेक्षण के प्रथम चरण के तहत 10 गाँवों में निवसित 3140 बीज संग्रहकों की सूची तैयार की गई, जिनमें से 340 लोगों से साक्षात्कार किया गया। इस अध्ययन के आधार पर इन बीज संग्रहकों द्वारा चिंगड़ी मछलियों के बीजों को छानने के प्रयास में लगभग 181.4 मिलियन मत्स्य बीजों का विनाश होना आकलित किया गया।

गंगा नदी में जैवअनुमापन पर कार्यशाला व प्रशिक्षण कार्यक्रम

गंगा नदी में जैवअनुमापन विषय पर के.अ.म.अनु.स., गंगा परियोजना निदेशालय एवं ब्रिटेन स्थित थेम्स वाटर इंटरनेशनल द्वारा संयुक्त रूप से बैरकपुर में 3-7 जुलाई 1991 के दौरान एक कार्यशाला व प्रशिक्षण कार्यक्रम का आयोजन किया गया। इस कार्यशाला का मुख्य उद्देश्य जैवअनुमापन अन्वेषणों हेतु एक मानक प्रणाली को विकसित करना, जिसे प्रदूषण अध्ययन में लगे विभिन्न अभिकरणों व संस्थाओं द्वारा अपनाया जा सके। इस कार्यशाला के अंतर्गत केन्द्र व राज्य प्रदूषण नियंत्रण बोर्ड, अनुसंधान संस्थानों, राज्य सरकारों, केन्द्रीय जल आयोग और गंगा परियोजना निदेशालय के अधिकारियों को अपनी तकनीकी क्षमता में वृद्धि करने तथा आपसी विचार-विमर्श करने का अवसर प्रदान किया गया।

इस कार्यक्रम का उद्घाटन कलकत्ता विश्वविद्यालय के जैव-रासायनिक विभाग से सेवानिवृत्त प्रोफेसर डॉ. जे. जे. घोष द्वारा किया गया। डॉ. निलाय चौधरी, सिविल अभियांत्रिकी विभाग के अध्यक्ष एवं प्रोफेसर द्वारा मूलभूत अभिभाषण प्रस्तुत किया गया। कार्यक्रम की अध्यक्षता गंगा परियोजना निदेशालय के क्षेत्रीय निदेशक श्रीमती नन्दिता चटर्जी ने की। डॉ. माइक एनड्यू, जल-प्रवाहों में जैवअनुमापन विशेषज्ञ, ने प्रशिक्षार्थियों को प्रशिक्षण दिया।

तकनीकी सत्रों में अनेक महत्वपूर्ण पहलुओं पर विचार किया गया जैसे भारतीय संदर्भ में मत्स्य प्रबन्ध में पर्यावरणीय अवरोध, पारिस्थितिक विष-विज्ञान आदि। कार्यक्रम में जलीय परितंत्रों की पर्यावरणीय प्रभाव के मूल्यांकन में हुए आधुनिकीकरण, जलीय गुणवत्ता अनुमापन एवं पुनर्संग्रहण कार्य में जैव-सूचकों के उपयोग आदि विषयों पर विशेष प्रकाश डाला गया। इलाहाबाद और कलकत्ता में क्रमशः गंगा तथा हुगली नदियों में क्षेत्रीय निदर्शनों का आयोजन किया गया।

इलाहाबाद में दिनांक 7 जुलाई 1991 को सम्पन्न हुई दीक्षान्त समारोह में डॉ. पी. दास, निदेशक राष्ट्रीय मत्स्य आनुवंशिक संसाधन ब्यूरो, ने प्रशिक्षणार्थियों को प्रमाण पत्र प्रदान किया।

सहयोग

संस्थान ने वर्ष 1991-92 के दौरान अनुसंधान तथा प्रशिक्षण क्षेत्र में अनेक राष्ट्रीय व अंतर्राष्ट्रीय अभिकरणों के साथ सहयोग किया ।

राष्ट्रीय

अलियार तथा तिरुमूर्ति जलाशयों में मात्स्यकी परियोजनाओं को सम्पन्न करने में संस्थान ने तमिलनाडु राज्य सरकार एवं तमिलनाडु फ़िशरीज कापोरेशन लिमिटेड से निरंतर सक्रिय सहयोग प्राप्त करती रही ।

संस्थान ने हिमाचल प्रदेश एवं अरुणाचल प्रदेश सरकारों को इन शीतल प्रदेशों के विकास में प्राथमिकता प्राप्त कार्यों को रेखांकित करने में सहयोग दिया । कुछ नए परियोजनाओं का प्रस्ताव किया गया जिनमें राज्य सरकार एवं भारतीय कृषि अनुसंधान परिषद् सहयोग कर सकें ।

संस्थान ने आल इन्डिया इन्सटिट्यूट ऑफ हाइजिन एण्ड पब्लिक हेल्थ तथा स्कूल ऑफ ट्रोपिकल मेडिसिन कलकत्ता के सहयोग से अलवणीय जल क्षेत्रों की विदेशी व स्वदेशी प्रजातियों की मछलियों में जंतुमारी व्रणकारी संलक्षण रोग के कारक तत्वों के अन्वेषण हेतु एक संयुक्त परियोजना आरम्भ किया ।

के. अ. म. अ. सं. अपनी परामर्शक सेवाओं द्वारा मात्स्यकी विकास कार्य में लगे अनेक अभिकरणों तथा राज्य सरकारों को सहयोग देती रही ।

के. अ. म. अ. सं. की परामर्शक सेवाएँ

नर्मदा क्षेत्र के मछुओं की सामाजिक स्थितियों का सर्वेक्षण

नर्मदा नियंत्रण प्राधिकरण द्वारा प्रदत्त एक परामर्शक कार्य के अंतर्गत संस्थान ने नर्मदा बेसिन के मछुआरों की सामाजिक स्थितियों का अध्ययन किया । इस कार्य के अंतर्गत 1312 कि. मी. नदीय क्षेत्र जिसमें मध्य प्रदेश, गुजरात और महाराष्ट्र राज्यों के कुल 17 जिलों का सर्वेक्षण किया गया । नर्मदा नियंत्रण प्राधिकरण को नर्मदा बेसिन के मछुआरों की जनसांख्यिकीय रूपरेखा एवं इस क्षेत्र में उपयोग किए जाने वाली मत्स्यनयान तथा मत्स्य संभार सम्बन्धी रिपोर्ट प्रस्तुत की गई । इस रिपोर्ट में मछुआरों की जातीय, सामाजिक व आर्थिक एवं शैक्षिक स्तर, तथा यदि नर्मदा बेसिन विकास कार्यक्रम के कारण अपने परम्परागत व्यवसाय में परिवर्तन लाना पड़े तो इनकी इच्छा, आदि का विस्तृत विवरण दिया गया । इस अध्ययन में नर्मदा योजना के तहत विभिन्न पुनर्वास कार्यक्रमों के संदर्भ में अनेक महत्वपूर्ण प्रश्नों पर भी विचार किया गया ।

जलाशय मात्स्यकी की सम्भावनाओं का अध्ययन

इस संस्थान को उत्तर-पूर्वी परिषद् द्वारा मेघालय के नोंगमहिर एवं किरदमकुलाइ जलाशयों में मात्स्यकी के विकास की सम्भावनाओं के अध्ययन करने हेतु नियुक्त किया गया। विभिन्न ऋतुओं में इन जलाशयों की संरचना, मृदीय गुणवत्ता, जैविक अभिलक्षण तथा उत्पादन क्षमता का अध्ययन कर उत्तर-पूर्वी परिषद् को एक आशाजनक रिपोर्ट प्रस्तुत की गई।

अंतर्राष्ट्रीय

मत्स्य रोगों पर सहयोगिक परियोजना : के. अ. म. अ. संस्थान ने नेटवर्क ऑफ एक्वाकल्चर सेंटर्स इन एशिया द्वारा पर्यावरणीय अनुमापन एवं मत्स्य व्रणकारी संलक्षण पर ग्यारह देशों में चलाये जानेवाली क्षेत्रीय अनुसंधान परियोजना में सक्रिय सहयोग दिया।

जैव अनुमापन पर कार्यशाला : संस्थान के बैरकपुर तथा इलाहाबाद केन्द्रों में गंगा परियोजना निदेशालय एवं थेम्स वाटर इंटरनेशनल, ब्रिटेन द्वारा प्रवर्तित 'गंगा नदी में जैविक-अनुमापन' पर 3 से 7 जुलाई 1991 के दौरान एक कार्यशाला व प्रशिक्षण कार्यक्रम का आयोजन किया गया।

प्रौद्योगिकी हस्तांतरण

विस्तार और राष्ट्र निर्माण कार्य

संस्थान का प्रसार कार्यक्रम मुख्यालय में विस्तार अनुभाग एवं काकदीप में कृषि विज्ञान केन्द्र ने सम्पन्न किया। संस्थान के अन्य अनुसंधान केन्द्र भी प्रौद्योगिकी हस्तांतरण कार्य में भाग लिया।

अनुसंधान/सर्वेक्षण : पखमीन एवं कवचमीन के बीजों के संग्रहण से मत्स्य व झींगों को हो रही क्षति का मूल्यांकन हेतु हुगली नदी का 40 कि. मी. क्षेत्र में कुलपी से नामखाना तक के क्षेत्र का सर्वेक्षण किया गया। सर्वेक्षण के अंतर्गत 3140 बीज संग्रहकों की सूची तैयार की गई एवं 340 लोगों से साक्षात्कार किया गया। सर्वेक्षण से यह आंका गया है कि झींगा बीजों को छांटने के प्रयास में लगभग 181.4 मिलियन मत्स्य बीजों का नाश होता है।

प्रशिक्षण : छः अल्प-कालिक प्रशिक्षण कार्यक्रमों का आयोजन किया गया जिनमें 100 विस्तार अधिकारी एवं खेती से संबंधित पत्रकार शामिल हुए।

प्रदर्शन : संस्थान ने कुल तीन प्रदर्शनियों में भाग लिया जिनका आयोजन कलकत्ता, छोटा जागुलिया एवं बैरकपुर में हुआ था।

महिला दिवस : दिनांक 4.12.1991 को नामखाना में एक महिला दिवस का आयोजन किया गया, जिसमें 250 महिलाओं ने भाग लिया । मात्स्यकी, बागवानी और गृह विज्ञान संबंधी तकनीकों का निदर्शन किया गया ।

मत्स्य-पालक दिवस : मत्स्य पालक दिवस का 11 मार्च 1992 के नन्दाभंगा गाँव में तथा 12 मार्च 1992 को निश्चिन्तापुर में आयोजन किया गया जिनमें क्रमशः 65 और 90 इच्छुक मत्स्य-पालक भाग लिए हैं ।

तिलहन एवं दलहन उत्पादन प्रदर्शनी : प्रथमिक तौर पर 200 किसानों को सम्मिलित कर 20 हेक्टर क्षेत्र में सरसों तथा सूरजमुखी पालन का प्रदर्शन किया गया । अन्य 250 किसानों के समक्ष अरहड़ तथा मूँग के फसल की आधुनिक प्रणाली का निरूपण किया गया ।

प्रशिक्षण कार्यक्रम : संस्थान में 16 से 25 जुलाई 1991 के दौरान विस्तार अधिकारियों के लिए 'अंतर्स्थलीय मात्स्यकी विकास' पर एक प्रशिक्षण कार्यक्रम का आयोजन किया गया ।

अन्य कार्य कलाप : बैरकपुर कार्यालय में आये 23 दलों को, जिनमें 597 छात्र, 15 अधिकारी तथा 61 मत्स्यपालक शामिल हैं, संस्थान के कार्य तथा मात्स्यकी विज्ञान में हुई प्रगति से अवगत कराया गया । 38 अधिकारियों व उद्यमियों को मात्स्यकी से संबंधित साहित्य की आपूर्ति की गई । विस्तार वैज्ञानिकों द्वारा विभिन्न अवसरों पर 34 व्याख्यान दिए गए ।

संस्थान के विस्तार एकक द्वारा पश्चिम बंगाल के पश्चिम दिनाजपुर जिले के तपन मण्डल में मात्स्यकी विकास की सम्भावनाओं का अध्ययन किया गया और तत्संबंधी रिपोर्ट कलकत्ता के टैगोर सोसाइटी ऑफ रूरल डेवलपमेंट को सौंप दी गई ।

कृषि विज्ञान केन्द्र

संस्थान का काकदीप स्थित कृषि विज्ञान केन्द्र विभिन्न विषयों पर अनेक प्रशिक्षण कार्यक्रमों का आयोजन किया जैसे:- मात्स्यकी, फसल उत्पादन, बागवानी, गृह-विज्ञान तथा पशु-विज्ञान । प्रशिक्षण कार्यक्रमों का आयोजन स्थानीय आवश्यकताओं के अनुसार विशेषकर क्षेत्र के गरीब किसानों को ध्यान में रखकर किया गया । इस वर्ष के दौरान कुल 28 केन्द्र परिसर में तथा 106 प्रशिक्षण कार्यक्रम अन्य स्थानों पर आयोजित किया गया । कार्यक्रमों का विवरण निम्नलिखित है:-

विषय	केन्द्र परिसर में		अन्य स्थानों पर	
	कार्यक्रम की संख्या	प्रशिक्षणार्थियों की संख्या	कार्यक्रमों की संख्या	प्रशिक्षणार्थियों की संख्या
मात्स्यकी	8	75	18	717
फसल उत्पादन	3	29	25	672
बागवानी	7	70	24	646
गृह-विज्ञान	9	90	34	599
पशु-विज्ञान	1	10	4	104
कुल	28	274	105	2738

उपर्युक्त विषयों से संबंधित अनेक प्रश्नों के समाधान, सुझाव आदि 2114 किसानों, महिलाओं, उद्यमियों को दिया गया । मात्स्यकी, फसल उत्पादन, बागवानी, गृह विज्ञान और पशु-पालन कार्यों में किसान परिवारों के योगदान का मूल्यांकन हेतु 775 किसान परिवारों का सर्वेक्षण किया गया । किसानों से लेकर अधिकारियों तक के विभिन्न स्तर के लोगों के लिए केन्द्र के अधिकारियों द्वारा 14 व्याख्यान दिए गए ।

प्रयोगशाला से भूमि की ओर कार्यक्रम

संस्थान द्वारा प्रयोगशाला से भूमि की ओर कार्यक्रम का पंचम चरण जारी रखा गया जिसमें दक्षिण 24 परगना जिले के 200 किसान परिवारों को सम्मिलित किया गया । बैरकपुर स्थित विस्तार एकक 100 किसान परिवारों को लेकर मत्स्य-पालन कार्य करता रहा जबकि काकदीप स्थित कृषि विज्ञान केन्द्र अनेक प्रकार के फसल उत्पादन पर कार्य किया । सभी प्रकार के फसल उत्पादन कार्य से उपज दर में परम्परागत पद्धतियों की तुलना में उल्लेखनीय वृद्धि हुई ।

विस्तार वैज्ञानिकों के पर्यवेक्षण में मत्स्य-पालक 150 मिलियन कार्प जीरों, 1 मिलियन पोना एवं 0.05 मिलियन अंगुलिकाओं को अपने फार्म में संग्रहण करने हेतु उत्पादन किया। प्रयोगशाला से भूमि की ओर कार्यक्रम के अंतर्गत अलवणीय क्षेत्र के कार्प मछलियों का उत्पादन 3300 कि. ग्रा. प्रति हे. प्रति वर्ष तथा लवणीय जल क्षेत्र के मछलियों व झींगों की उपज 850 कि. ग्रा. प्रति हे. प्रति वर्ष प्राप्त किया गया। इस कार्यक्रम के छठवे चरण के अंतर्गत पश्चिम बंगाल के काकद्वीप क्षेत्र में नामखाना स्थान पर कार्य चल रहा है जिसमें 100 किसान परिवारों को सम्मिलित किया गया।

पुस्तकालय व प्रलेखन सेवाएँ

के. अ. म. अ. संस्थान का पुस्तकालय अनुसंधानकर्त्ताओं, विश्वविद्यालयों के प्रोफेसरों, अधिकारियों, विद्यार्थियों और उद्यमियों के लिए आवश्यक सूचनाओं के लिए मुख्य स्रोत है। इस वर्ष के दौरान पुस्तकालय ने अपने साहित्य भंडार में 124 पुस्तकों, वैज्ञानिक लेखों का 333 पुनर्मुद्रित प्रतियाँ, 58 विविध प्रकार के प्रकाशन तथा 180 मानचित्रों की वृद्धि के साथ ही 64 स्वदेशी जर्नल तथा 28 विदेशी जर्नलों के लिए सम्पर्क बनाया। इस समय पुस्तकालय में कुल 6549 पुस्तक, 4190 वैज्ञानिक लेखों की पुनर्मुद्रित प्रतियाँ, 933 मानचित्र तथा 2881 विविध प्रकार के प्रकाशनों का भंडार है। इस वर्ष के दौरान 21 राष्ट्रीय और अंतर्राष्ट्रीय संस्थाओं के साथ विनिमय सम्बन्ध स्थापित किया गया।

पुस्तकालय इस वर्ष भी विभागीय प्रकाशनों को विभिन्न अनुसंधान संगठनों, विश्वविद्यालयों, उद्यमियों तथा मत्स्य-पालकों को निःशुल्क भेजता रहा ताकि वे अंतर्स्थलीय मात्स्यकी अनुसंधान की प्रगति की जानकारी प्राप्त कर सकें। 146 पुस्तकें अन्तर-पुस्तकालय ऋण के रूप में अन्य पुस्तकालयों को भी भेजी गईं। इस वर्ष के दौरान पुस्तकालय के लिए खर्च की गई राशि रु. 11,21,000 थी।

इस अनुभाग में फोटोग्राफी तथा रेप्रोग्राफी सेवाओं के लिए एक सक्रिय एकक बना है। संस्थान के वैज्ञानिकों के अतिरिक्त विभिन्न अनुसंधान संस्थानों और विश्वविद्यालयों को फोटोग्राफ्स, पुनर्मुद्रित लेख तथा फोटोकॉपियाँ निःशुल्क दी गईं। इस अनुभाग ने एक साइक्लोस्टाइलिंग और जिल्दसाज एकक को भी संस्थान के विभिन्न अनुभाग के सेवार्थ कायम रखा।

तकनीकी रिपोर्ट

संस्थान के अनुसंधानात्मक प्रगति से संबंधित 13 से भी अधिक तकनीकी रिपोर्टों का संकलन किया गया। संस्थान के वैज्ञानिकों के अनुसंधानात्मक लेखों को विभिन्न वैज्ञानिक पत्रिकाओं में प्रकाशित करने के पूर्व उनका संवीक्षण किया गया। समस्याओं और प्रश्नों का जवाब भी अनुभाग के वैज्ञानिकों द्वारा प्रस्तुत किया गया। इस अनुभाग ने संस्थान के वैज्ञानिकों द्वारा सेमिनार, संगोष्ठी, 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 निजी फाइलों में संग्रहित किया गया। आर. पी. एफ. (रिसर्च प्रोजेक्ट फाइल), अनुसंधानात्मक सक्रियता के लक्ष्य (एक्टिविटी माइलस्टोन) तथा मासिक, तिमाही एवं वार्षिक रिपोर्ट के माध्यम से अनुसंधान प्रगति की देख-रेख, इस अनुभाग का एक महत्वपूर्ण दायित्व है।

प्रकाशन

निम्नलिखित विभागीय प्रकाशनों को वर्ष अप्रैल 1991 से मार्च 1992 के दौरान प्रकाशित किया गया।

1. वार्षिक रिपोर्ट 1990-91
2. चीन गणतन्त्र में 15-19 अक्टूबर 1990 के दौरान सम्पन्न द्वितीय एशियन फिशरीज वर्कशाप पर डॉ. अरुण झिंगरण की प्रतिनियुक्ति रिपोर्ट।
3. नर्मदा नदी के मछुओं से संबंधित सामाजिक सर्वेक्षण का रिपोर्ट- (नर्मदा नियंत्रण प्राधिकरण को प्रेषित परामर्शक सेवा रिपोर्ट)।

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, 1992.

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		69	4	5.88%			
(ii) Lowest rung of Cl.I total		14	1	7.04%			
Temporary -							
(i) Other than lowest rung of Cl.I							
(ii) Lowest rung of Cl. I		1	-	-	-	-	-
Gr. B(Cl. II)							
Permanent		32	7	21.88%	-	-	
Temporary		4	2	50%	1	25%	
Gr.C (Cl.III)							
Permanent		140	32	22.86%	4	2.86%	
Temporary		34	8	23.53%	2	5.88%	
Gr.D (Cl. IV)							
Permanent		158	44	27.85%	6	3.80%	
Excluding sweepers	Temporary	28	9	32.14%	3	10.71%	
Gr. D (Cl. IV)							
Permanent		15	10	66.67%	-	-	
sweepers	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/
1	Central Inland Capture Fisheries Research Institute Barrackpore-743 101	FISHSEARCH (033) 56-1190 56-1191 021 8552 CIFI IN (Telex)
2	Allahabad Research Centre Central Inland Capture Fisheries Research Institute 24, Pannalal Road Allahabad-211002, Uttar Pradesh	FISHSEARCH (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 (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 Bhutya,
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
- 10 **Vadodara Research Centre**
Central Inland Capture Fisheries Research Institute
Gaikwad Building
(Opposite Bhimnath Mahadev Temple),
Sayajiganj,
Vadodara - 390 005
- 11 **Guwahati Research Centre**
Central Inland Capture Fisheries Research Institute
Natun Sarania,
Guwahati - 781 003,
Assam

FISHSEARCH
ELURU - 534 002/
(08812) 22520

(0265) 334329

(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** (0612) 51894
Central Inland Fisheries Research Institute,m
1st Floor, Shambey House,
Kankarbagh,
Patna - 800 020, Bihar
- 15 **Pune Research Centre** (0212) 672401
Central Inland Capture Fisheries Research Institute
Flat No.6, Indraprasta House Society,
Godital-Hadapsar P.O.,
Pune - 411 028
Maharastra
- 16 **Raidighi Survey Centre,**
Central Inland Capture Fisheries Research Institute,
Raidighi, 24 Parganas (South),
West Bengal
- 17 **Raipur Research Centre** (0771) 424312
Central Inland Capture Fisheries Research Institute
326, 'Ashirwad',
Shankar Nagar, Near Bottle House,
Raipur - 492 007,
Madhya Pradesh

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
No. 68, Rajunaidu Road,
Tatabad,
Coimbatore - 641 012 Tamil Nadu
- 20 **Krishi Vigyan Kendra**
Central Inland Capture Fisheries Research Institute
Kakdwip,
24 Parganas (South),
West Bengal

**FISHSEARCH
COIMBATORE**

(031732) 572

CENTRAL INLAND CAPTURE FISHERIES RESEARCH INSTITUTE
BARRACKPORE - 743 101, WEST BENGAL

ORGANIZATION CHART, 1991-92

