ANNUAL REPORT 1981
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
BARRACKPORE

DIRECTOR'S INTRODUCTION

HISTORY

The Central Inland Fisheries Research Station was established in the month of March 1947 in Calcutta under the Ministry of Food and Agriculture, Government of India. This was the beginning of institutionalised research in inland fisheries in India. By the growing relevance of inland fishery resources in satiating the perpetual demand for cheap animal protein, the Station has achieved many a strides in developing these resources over the years. 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 the Indian Council of Agricultural Research (ICAR). At present, CIFRI is one of the biggest and reputed research institutes under ICAR with 250 scientific and technical personnel working under 36 centres spread across the country.

OBJECTIVES

The major objectives of the Institute are :—

(i) to evolve aquacultural practices suitable to the country ;

(ii) to conduct investigations on the biology of important culturable organisms of fishery importance ;

(iii) to carry out studies on hydrology and ecology of different fishery waters ;

(iv) to conduct research on the fish populations in reservoirs, estuaries, rivers and other natural waters ;

(v) to solve fisheries management problems concerning both fresh and brackishwaters ;

(vi) to train personnel in the management of the inland fisheries of the country and

(vii) to disseminate scientific information and technical know-how in inland fisheries research, development and management.

ORGANISATION

The scientific investigations are carried out under three major divisions and four coordinated projects.

Freshwater Aquaculture Division :

Freshwater Aquaculture Research and Training Centre is the seat of this Division based at Dhauli. This Division is innovating new avenues in aquaculture practices. Thrust is mainly in the field of fish genetics and hybridization, fish nutrition, microbiology, ichthyopathology and fish health protection etc.

The FAO has adopted FARTC as the Regional Lead Centre under its programme of aquaculture development and coordination.

Riverine and Lacustrine Division :

This Division conducts research to evolve suitable measures for the development of the riverine and lacustrine fisheries of the country involving their conservation and judicious exploitation. The Division has its headquarters at Allahabad with research centres at Srinagar, Bangalore, Buxar, Muzaffarpur, Gauhati, Bhagalpur, Kakinada and Tadepalligudem. The investigations pertain to biology of fishes, riverine spawn prospecting and collection techniques, coldwater fisheries, hilsa fisheries, pollution investigations, fisheries of river basins, bundh breeding, fish culture in running waters, research on freshwater prawns and small reservoirs.

Estuarine Division :

The Estuarine Division with headquarters at Barrackpore and research centres at Madras, Kakdwip and Calcutta investigates the possibilities of culturing finfish and shellfish in brackishwater and studies capture fisheries of the brackishwater lakes and estuaries in the country. Stress is on the breeding and culture techniques of fishes and prawns, environmental studies in the light of pollution and the development of estuarine fisheries.

All India Coordinated Research Project on Composite Fish Culture and Fish Seed Production :

The main centre at Dhauli coordinates the investigations carried out in eight institute-based centres viz., Kalyani, Badampudi, Bhavanisagar, Jaunpur, Karnal, Pune, Ranchi and Gauhati and four centrally sponsored centres viz., Godhra (Gujarat), Tuticorin (Tamil Nadu), Kausalyagang (Orissa) and Durg (Madhya Pradesh).

All India Coordinated Research Project on Culture of Air-Breathing fishes :

With the main centre at Barrackpore, the project has three institute-based centres at Gauhati, Patna and Bangalore. The two centrally sponsored centres are Palair (Andhra Pradesh) and Kalyani (West Bengal).

All India Coordinated Research Project on the Ecology and Fisheries of Freshwater Reservoirs :

The main centre of this project functions at Barrackpore. The institute-based centres are Nagarjunasagar, Bhavanisagar, Rihand, Ranchi and Bilaspur. Ukai (Gujarat) and Kangsabati (West Bengal) are the two centrally sponsored centres.

All India Coordinated Research Project on Brackishwater Fish Farming :

The main centre of this project is at Barrackpore and the only institute-based centre is at Kakdwip. There are five centrally sponsored centres, i.e., at Panaji (Goa), Ernakulam (Kerala), Kakinada (Andhra Pradesh), Madras (Tamil Nadu) and Keshpur (Orissa).

Other Centres and Sections :

There are a few centres and sections that are directly under the control of the Director. *The Operational Research Project Centre, Krishnagar* dealing with the problem of integrating fish culture with livestock (piggery, poultry and duckery), the *Rahara Research Centre at Rahara* (West Bengal) which deals with the problems of sewage-fed fish farming and paddy-cum-fish culture and the *Kalyani Research Centre at Kalyani* conducting investigations on frog farming are such centres away from Barackpore. Besides these, the Inland Fisheries Information Section, the Extension Section, the Fisheries Economics and Statistics Section and Radio isotope tracer laboratory are located at Barrackpore. There is a KVK/TTC at Dhauli and a KVK at Kakdwip imparting training in freshwater and brackishwater aquaculture respectively.

RESEARCH HIGHLIGHTS

Cage Culture in tanks to augment production :

The existing capture fisheries of peninsular tanks can be profitably blended with cage culture. This was demonstrated through an experiment conducted in the Sankey Tank, Bangalore. A 10.5 sq. m. cage produced nearly 100 kg of common carp in 6 months. This is equivalent to 200 tonnes/ha/year. A farmer can easily raise 1000 kg of fish in 50 sq. m. cage area in an year.

In an earlier experiment, the cages were used for raising fingerlings of common carp and silver carp (8 : 1). The fry stocked at the rate of 2,250 per cage yielded fingerlings with 97.5% (common carp) and 90.0% (silver carp) survival.

Silver carp in reservoirs :

The silver carp *Hypophthalmychthys molitrix* has established itself firmly in Gobindsagar Reservoir (H. P.). Although entered accidently from Deoli Fish Farm in 1971, the species has become a fishery of considerable importance in the reservoir. At present it constitutes 12% of the total landings.

Silver carp is thriving well in Bhavanisagar Reservoir too. About 3,000 fry were introduced in the reservoir during December, 1980. Three specimens caught between April and June 1981, measured 950 to 1050 g-a commendable growth. The guts of these specimens were full of *Microcystis*.

Culture of Hilsa in confined waters :

Hilsa culture in confined waters is no longer a remote possibility. The experiments progressing at CIFRI campus indicate that hilsa can be raised to table size in ponds. Hilsa fry of 4—6 cm stocked and reared in a 0.1 ha pond have recorded a growth of about 240—250 g in 448 days. The fry were collected from the Hooghly estuary near the experimental site and were directly transferred to the culture pond. This phenomenal success assumes special significance in view of the fact that hitherto hilsa culture in confined

waters was considered to be a remote possibility.

Earthen Pot Hatchery :

A low cost "earthen pot carp hatchery" suited to rural conditions has been developed at this institute. The hatchery consists of three round earthen pots (vats) with a capacity of 250, 100 and 100 l respectively. The water from the bigger container kept at a higher level is allowed to flow to the middle container placed at a lower level through a rubber tube. From the second container, the water flows to the third container placed at a still lower level, through a spout. About one lakh eggs (20 l) can be hatched in a single unit by providing flow of water through a series of 3 vats. The cost of a unit is about Rs. 50/- only. The same vats can be used for fish breeding and also for short-term rearing of spawn.

New habitat for grass carp :

Weed-choked bherries in West Bengal have been identified as a suitable environment for the growth of grass carp. In an experimental culture conducted by CIFRI in the brackishwater impoundments during the low saline phase, grass carp registered a record growth of 3.225 kg in just 100 days. The fishes could flourish well on weeds. *Ruppia maritima* and *Najas minor*, which were unconventional as a feed for grass carp. The fishes having an intial wt. of 225 g and stocked @ 333/ha gained a weight @ 32.2g/day. This is undoubtedly a spectacular growth-rate for grass carp from saline, and for that matter, even from freshwaters.

The weed-infested bherries of West Bengal are usually kept fallow or an unremunerative type of aquaculture is practised in them during the low saline period. The present experiment has evoked considerable interest among the local fish farmers' community who now consider grass carp as a boon in the production basket.

'Columnaris' detected in rohu :

A case of columnaris has been detected from the Indian major carp *Labeo rohita* by the CIFRI scientists working at FARTC. 'Columnaris' is a widely known bacterial disease that infects salmonids and many species of warm-water fishes, affecting the skin, fin and gills with varying morbidity and lethality. This chronic to subacute infection is caused by a long, thin, gram negative bacterium presumptively identified as *Flexibactor columnaris*. Gray to yellowish lesions appear first on the fin and then progress towards the head. It may cause extensive losses to stock within 1–2 days of the appearance of initial disease signs. The disease is attributed to the injuries during netting, rough handling and to diverse environmental conditions.

At the Fish Pathology Laboratory of FARTC, Dhauli, the bacterium was succesfully isolated in pure culture from skin lesions of the affected fishes. The infection was successfully controlled by treatment with streptopenicillin administration.

Myxosporidiasis

The pathoanatomical studies in the districts of Cuttack and Puri also suggested the enzootic nature of renal myxosporidiasis in Indian major carps. Vacuolar degeneration of cytoplasm with pycnotic nuclei were observed in most of the renal tubules. Dilatations of the lymphatic spaces in the kidney were also noticed.

Successful gynogenesis in carps :

The scientists working in the Fish Genetics and Hybridisation Laboratory at FARTC have been successful in inducing gynogenesis in the Indian major carp *viz.*, rohu. Earlier the attempts on artificial gynogenesis in common carp eggs proved successful. Artificial gynogenesis based on inactivation of sperm and diploidization of maternal chromosome is used for producing

gynogenetic populations. Here the spermatozoan enters and activates the egg but degenerates without its nucleus getting fused with that of the egg.

Genetic inactivation of rohu milt was achieved by exposure to ultraviolet rays. Eggs were fertilised by the genetically inactive sperms. Later, the restoration of diploidy was achieved through cold shock at 12°C or heat shock at 39°C. In case of common carp the cold shock was given at 4°C. The embryos could develop successfully.

This achievement is a major breakthrough in genetic selection work on Indian major carps. Gynogenesis facilitates production of offsprings of purely maternal inheritance. This is an important tool in fish genetics research to produce inbred lines with a high degree of homozygosity of characters aimed at improving productivity of fish.

Derris plant in nonsaline soil ; Growth retardant to increase rotenone

The derris plant, *Derris trifoliata* var- *uliginosa* which is often met with in the char islands of Sunderbans area (salinity about 19‰.) was successfully transplanted and acclimatised to the soil at CIFRI campus (soil salinity about 0.01‰ by salinizing the soil with NaCl application. The plants thrived well at a salinity (artificially provided) less than 4.5‰.

After having failed to increase the rotenone content with the application of growth promoting substances, an unconventional idea of employing growth retardant cycocel was tried and that clicked in an instantaneous success. The plant recorded an increase in rotenone content from 2.2% to 3.5%.

The achievements viz., transplantation to nonsaline soil and the increase in rotenone content are two big leaps towards the goal of a dependable alternative for 'mahua oil cake', the conventional but scarce fish toxicant.

The techniques of artificial fecundation, hatching, spawn rearing and culture of hilsa have since been perfected. The physiological aspects of hilsa breeding is now better understood. This breakthrough will go a long way in fostering recovery of the depleted hilsa fisheries of riverine systems in the country.

CIFRI steals show in National Fair :

The pavilion highlighting CIFRI's achievements in aquaculture research and training was adjudged the best among Govt. of India stalls in the National Agricultural Fair-'81 at Ludhiana. In addition, the stall was also awarded a certificate of merit.

In the stall the progressive farmers were told by the CIFRI extension scientists about the advanced fish culture techniques evolved at the Institute. An estimated stream of over a lakh people was attracted to the pavilion.

The fair was jointly organised by the Ministry of Agriculture, Government of India and the Punjab Agricultural University, from 2 to 13 April, 1981.

IMPORTANT EVENTS

CIFRI scientists awarded Kidwai Memorial Prize :

Three of the CIFRI scientists were jointly awarded the Rafi Ahmed Kidwai Memorial Prize for Agricultural Research for the biennium 1978-79. It was for the third time in a span of eight years that CIFRI's research accomplishments were recognised by this award. In

1978-79 Shri J. C. Malhotra, Shri S. N. Mehrotra and Dr. M. Peer Mohamed successfully achieved artificial propagation and culture of Indian shad, *Hilsa hilsha*, a commercially important riverine fish.

World Environment Day at CIFRI

CIFRI reapts the call for conservation :

CIFRI observed the world Environment Day on 5th June, 1981 with awareness and enthusiasm. On the occasion, Dr. A V. Natarajan expressed CIFRI's deep sense of concern with regards to the severe strain our environment is being subjected to. He cited several examples indicating degradations of environmental quality and advocated adoption of management measures on a wider scale so that the nature's treasures were saved from the scourge of degradation for posterity. He particularly referred to our aquatic resources.

Special lectures on conservation of hilsa of Lower Ganga were delivered by S/Shri K. K. Ghosh and B. B. Ghosh, Scientists of the Institute In the deliberations followed, several scientists exhibited active interest in creating environmental awareness among masses. Mr. P. Das in his concluding remarks urged the scientists to spread the message of conservation far and wide.

At Kalyani Centre of CIFRI, the Day was observed by releasing a large number of farm-produced young frogs in to the nature.

Summer Institute on Integrated Farming Systems.

A Summer Institute on farming system integrating agriculture, livestock and fish culture sponsored by ICAR, was conducted at CIFRI from 6 July—6 August, 1982. This was attened by 20 participants representing different Universities, State departments and Agricultural Institutions. The Summer Institute consisted of demonstrations, field trips, lectures and group discussions relating to the concept of integrated farming systems.

Dr. A. N. Bose, Ex-Vice Chancellor, Jadavpur University in his inaugural address emphasised the importance of integrated culture systems in the wake of our recent awareness on limitations of uncontrolled exploitation of food resources. He appreciated the techniques developed at CIFRI in integrating paddy culture, poultry, duckery and piggery with fish culture. In the validictory function, Dr. A. V. Natarajan opined that this Summer Institute dealt with a theme of great relevance. Scientific investigations have brought to light new avenues for enhanced production at lower costs by adopting these techniques. Norms of utilizing wastes as resources and attaining higher return from unit area well fit in this farming pattern. Dr. Natarjan while distributing the certificates and gift books to the participants appealed them to make use of the knowledge acquired in the Summer Institute whenever opportunity arose.

Seminar on role of inland fisheries in IRD

At the instance of Ministry of Rural Reconstruction a three days Seminar on Fishery (Inland) as Economic Programme for IRD was held at CIFRI, Barrackpore during September 28-30, 1981. The Seminar was attended by 57 participants from ten states and the Union Territory of Pondicherry.

Objectives :

Recognising the immense development potential of inland fisheries in raising income and standard of living of vulnerable sections of the population the Seminar was to subserve the following objectives :—

i) to enable the assisted beneficiaries to achieve substantially higher income and attain a standard of

living which could be considered well above the poverty line ;

ii) to assist the beneficiaries in taking up productive enterprises, suitable in local conditions; and

iii) to develop and strengthen the skills at district levels for indentifying, formulating and implementing projects with potential benefits to the poorer sections.

Deliberations

The Seminar spanned into six technical sessions viz., Freshwater Aquaculture, Brackishwater Aquaculture, Reservoir Fisheries, Fish culture Integrated with Agriculture and Livestock. Strategies for Rural Aquaculture and Operational problems identified by participants from each state. The Seminar was inaugurated by Shri B. C. Sharma, Secretary, Fisheries, Govt. of West Bengal and the presidential address was delivered by Dr. A. V. Natarajan, the Course Director for the Seminar. Scientists of CIFRI and renowned experts from Govt. of West Bengal made significant contribution by their animated erudition and down to earth approach in dealing with operational problems confronting inland fisheries sector.

Some of the major recommendations adopted in the Seminar are as follows :

i) The devolution of ownership of water bodies should vest with Department of Fisheries only as against the existing diffusion of ownership among several state departments.

ii) The tenure of lease should be at least for 12 years as against leases for short duration which do not meet the criteria of bankability.

iii) The amount of subsidy should be raised upto Rs. 5000/- from a present level of Rs. 3000/-. The involvement of District Fisheries Officers should be more intense to ensure proper utilization.

iv) Closer cooperation among Departments of Agriculture, Irrigation and Fisheries is very essential to meet the water requirements of fishery sector. The aquaculture should be treated at par with agriculture with regard to sharing of waters.

v) The district level marketing co-operatives should be set up for the timely supply of fishery requisites as also their distribution to blocks through fishery extension officers.

vi) The IRD funds should be made available for the development of hatcheries at district levels without linking the same with matching grants in block general fund.

vii) In view of the low level of assets of fishermen the bank loan should be invariably under-written by the respective State Governments as is being done by the State of Tamil Nadu.

Dr. A. V. Natarajan, the Course Director in his concluding remarks reposed full confidence and trust in the management cadre of the State Governments for accelerating the pace of fishery development through integrating it with IRD programme. On his part, he assured the states with regard to appropriate research support for rural development.

Workshop on brackishwater fish farming :

The IV Workshop on All India Coordinated Reseach Project on Brackishwater Fish Farming was jointly held by CIFRI and Andhra Pradesh Agricultural University during 24-25 October, 1981. Welcoming the delegates Dr. A. V. Natarajan, stressed the growing importance of brackishwater aquaculture in the country. He desired for more perfection in techniques of seed production and culture of brackishwater fishes and

prawns. Dr. Appa Rao, Director of Research, APAU appealed to the scientific community to disseminate the scientific know-how to the fish farmers in order to enable them to adopt brackishwater aquaculture on scientific lines. Shri G. N. Mitra, Retired Joint Commissioner (Fisheries), Government of India in his inaugural address outlined the employment potential of brackishwater aquaculture in backward areas. He suggested a critical appraisal of the course and progress of the research being carried out in the field.

In the discussions followed, the work programme and achievements of various centres under the project were critically reviewed. Dr. Natarajan remarked about the necessity for uniform sampling and management procedures. The programme for coming years would consider the operational costs involved in culture practices and seed procurement proceedures.

While finalising the project programme for 1982, monoculture of *P. monodon* and *P. indicus* was given due importance. Detailed programme for polyculture of parwns and compatible fish species also was chalked out. Dr. Rajyalakshmi, Professor of Fisheries, APAU Proposed a vote of thanks for the participating delegates.

COLLABORATION

National :

Work on selective breeding and hybridisation of commercially important species of frog is being continued at Kalyani Centre of CIFRI in collaboration with Genetics Research Unit of the Zoology Department of University of Calcutta.

Paddy-cum-fish culture experiments were conducted in collaboration with the Rice Research Institute, Chinsurah (Govenment of West Bengal). Three pairs of identical paddy plots (0.01 ha) belonging to that Institute were kept at the disposal of CIFRI for conducting the experiments.

Department of Fisheries, Government of Sikkim successfully adopted the techniques of frog breeding and tadpole rearing after their officials getting trained at the Frog Culture Unit of CIFRI.

Research work under the four All India Coordinated Research Projects were continued during 1981 in collaboration with various state governments.

International :

Dr. M. Subrahmanyam, Scientist—2 of the Kakinada Research Centre had been to the Socialistic Republic of Vietnam on a U. N. consultancy assignment under ESCAP programme. He offered his expertise to that country for two months in prawn hatchery management.

A 21-member team of Senior Aquaculturists was at CIFRI to get trained in fish culture practices adopted in India. They represented thirteen countries, *viz.*, Bangladesh, Brunea, Burma, China, Philippines, Indonesia, Malayasia, Pakistan, Papua New Guinea, Sri Lanka, Thailand and India.

Ms. Srima Markalande, Department of Zoology University of Colombo was at CIFRI for three months on a training programme under Colombo Plan sponsored by the British Council. Ms. Markalande was offered training in various aspects of inland aquaculture practices at different centres of CIFRI.

A training progamme for three days on induced breeding on Indian and exotic carps was organised for three Bangladesh officials, Mr. Mohiuddin Khan, Mr. Amin Ullah and Mr. Abdul Ouddus. They were sponsored by the Danish Government under the DANIDA-NIROP Programme.

Mr. A. K. Hamza from Fisheries Research Institute, Egypt has successfully completed his Ph. D. programme on the biology of *Notopterus*. He has been working at CIFRI under the INDO-ARE Cultural Exchange Programme. He was awarded the Degree of Ph D. for his work by Calcutta University.

Six trainees from Laos, Mr. S. Panokeo, Mr. P. Ouday, Mr. S. Bonnxou, Mr. P. Phomma, Mr. T. Xaisavanh and Mr. T. Chankey Visited KVK/TTC on 8.9.81 and had discussions with CIFRI personnel on fish culture training programmes.

Mr. Clifford A. Mbakaogu, FAO Fellow from Nigeria joined FARTC on 6 November, 1981 for a period of four months for training in different disciplines of freshwater aquaculture.

The first coordination committee meeting of the Project on Intensification of Freshwater Fish Culture and Training (IND/75/031) was held at FARTC, Dhauli in March.

Some of the CIFRI Staff were trained in various disciplines, *viz.*, fish pathology, fish genetics, fish nutrition and feed technology and fish culture economics (Bioeconomic modelling) by FAO experts at Dhauli.

Shri R. D. Chakraborty, S-3 and Head, Cuttack Centre left for Sri Lanka on deputation as Fishery Expert under ITEC Programme.

Shri R. M. Bhowmick, Chief Training Organiser, KVK/TTC, Kausalyagang has joined as Senior Advisor in Fisheries in Sri Lanka on deputation under FAO.

HONOURS AWARDS, ETC.

For the third time in a span of eight years, CIFRI was awarded the coveted RAFI AHMED KIDWAI MEMORIAL PRIZE in agricultural research. For the biennium 1978-79 this prize was awarded to three of the CIFRI Scientists, *viz.*, Shri J. C. Malhotra, Shri S. N. Mehrotra and Dr. Peer Mohammed for their outstanding work on hilsa fisheries.

Shri G. N. Saha, Scientist—2 was honoured by the DHIRU MORARJI MEMORIAL AWARD (second prize and a citation) for his article 'Techniques of pond fertilization and use of fertilizers in aquaculture for increased fish production'. The prize winning article appeared in November 1979 isssue of 'Fertilizer News'.

The scientists who were awarded Ph. D. degree during the year are :

Scientist	*University*	*Subject*
S. M. Pillai	Annamalai University	Histophysiological studies of the thymus in *Rachophorous maculatus* (Grey).
S. Sivakami	University of Kerala	Studies on the cyprinid fishes of the genus *Rasbora* of Kerala.
V. Pathak	Ranchi University	Evaluation of productivity in Nagarjunasagar reservoir as a function of hydrological and limno-chemical parameters.
L. H. Rao	Andhra University	Studies on the taxonomy of fishes and on the biology of *H. fossilis* (Bloch, 1974) of lake Kolleru in A. P.

Smt. Anjali De, Sr. Librarian obtained the degree of Master of Arts from University of Calcutta.

MAN POWER DEVELOPMENT

Shri T. Ramaprabhu, S—2 of Cuttack Centre rejoined the Institute after completing a one-year study programme under IDRC Research Associate Award at the University of Florida, USA. ☐

S/shri B. N. Saigal, M. Rout, and B. R. Shirsat, Scientists underwent trainining in computer programming for ten days at IASRI, New Delhi. Shri M. Rout also participated in a 15-days training programme on the use of H-3000 computer and Aquaculture Information System at Rome, sponsored by FAO. ☐

Shri Apurba Ghosh, S—2 underwent a short-term training course at the Institute of Engineers, Calcutta from 6-13 July on 'Waste treatment plant design and treatment : ☐

Under the FAO/UNDP Scheme Mr. R. M. Rao, Scientist-2 proceeded to Philippines on 29.4.81 to undergo training in aquaculture for a period of one year. The successful completion of this training course will also enable him to obtain M. Sc. degree (Aquaculture) from Philippines University. ☐

Dr. Babulal, S-1 attended a three months' training course in 'Use of Isotopes and Radiations in Agriculture and Biology' conducted by Nuclear Research Laboratory, Indian Agricultural Research Institute, New Delhi during March 3—June 2, 1981. ☐

Mr. Ansuman Hazra, Scientist (Bio-chemistry) participted in the Summer Institute on 'Nontraditional Diversified Fish Products and Byproducts' sponsored by ICAR. The Summer Institute was held at Central Institute of Fisheries Technology, Cochin during April 27 to May 26, 1981. ☐

Mr. B. N. Saigal, S-2 and Dr. V. K. Unnithan, S-1 attended one week 'Management Course in Reprography' conducted by Indian Association for Special Libraries & Information Centres, Calcutta in the premises of Indian Statistical Institute from 25 to 30 April, 1981. ☐

Mr. V. V. Sugunan, S-1, participated in the fifteenth 'National Course on Information Storage and Retrieval System' at Small Industries Extension Training Institute, Hyderabad from 1-26 June, 1981. ☐

Mr. R. K. Singh, S-1 attended the Summer Institute on 'Fertilizer use and efficiency in relation to crop production' held at ACRIP, Madurai. ☐

S./Shri Aioy Kumar Ghosh, K. P. Srivasthava, N. K. Das, V. R. Desai, R. M. Rao, M. Ramakrishnaiah, K. K. Bhanot, S. N. Dutta, S. B. Saha, S. K. Wishard, K. N. Krishnamurty, Drs. M. L. Bhowmick, M Peer Mohammed, C. R. Das, S. P. Singh and S. K. Mukhopadhyay completed the Orientation Course in Agricultural Research Management at NAARM, Hyderabad. ☐

Dr. H. C. Joshi, Scientist—S-1 attended the 19th Pesticide Residue Analysis Course sponsored by the Directorate of Plant Protection Quarantine & Storage. Ministry of Agriculture and Irrigation, Government of India, Faridabad at Central Plant Protection Training Institute, Hyderabad-30 from 1-10-'81 to 31-12'81 and obtained first position in the examination. He also delivered a lecture on 'pesticides in aquatic enviroments'. ☐

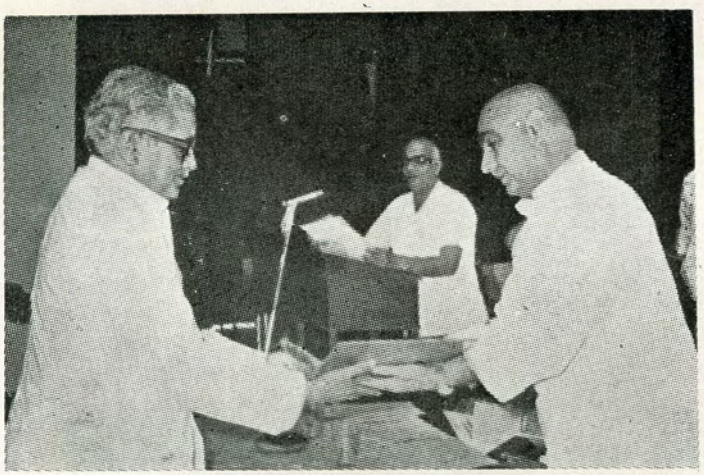
Sri K. C. Roy, Assistant Administrative Officer underwent a Refresher Course for Section Officers/ Administrative Officers conducted from October 5 to November 13, 1981, by the Department of Personnel and Adminitrative Reforms, New Delhi. ☐

Shri G. N. Mitra inaugurates the Fourth Workshop of All India Coordinated Project on Brackishwater Fish Farming at Kakinada on 24-10-'81.

A technical session of IRD Seminar in progress. Dr. K. L. Sehgal speaks. Shri S. D. Tripathi, Dr. A. V. Natarajan and Shri B. C. Sharma (from left to right) are on the dais.

The first D. N. Ganguly memorial lecture was delivered by Dr. A. V. Natarajan at Department of Zoology, Calcutta University on 18th December, 1981. The lecture was organised by the D.N. Ganguly Academy of Biosphere, Department of Zoology, Calcutta University. Dr. Natarajan spoke on "Recent trends in inland fisheries research in India".

During the year, 1981 a large number of scientists, entrepreneurs, students and fish farmers visited the Institute. They were apprised of the activities of the Institute. The picture shows a team of scientists, professors and teachers from University of Helsinki who called on the Institute. They are being taken around the recirculatory filtering system at Barrackpore. They were also briefed on the various activities of the Institute during their visit.



Shri J. C. Malhotra receiving Rafi Ahmed Kidwai Memorial Prize from Shri Rao Birendra Singh, Union Minister for Agriculture.

The prize winning CIFRI pavilion in the National Agricultural Fair '81 at Ludhiana.

VISITORS :

Many distinguished personalities including eminent scientists from different parts of the country and abroad visited the Institute during 1981. The following names among them merit a mention :—

Abisksharoon, A. K.	General Director, Project Dept. Govt. of UAR, Ministry of Agriculture, UAR.
Ahsan, A. K. M.	Consultant, National Committee on Rural Training & Planing Commission, Dacca, Bangladesh.
Ahmed, M.	Director of Fisheries, Assam, Gauhati.
Alwan, A. S.	FAO Representative in India, New Delhi.
Bassily, Riad Nabil	Controlling Manager, Project Dept. Govt. of UAR, Ministry of Agriculture, UAR.
Bakos, Janos	Fish Geneticist, FAO/UNDP Project, FAO, Rome.
Beardmore, J. A.	Prof. of Genetics, University College of Swanson, Swanson, U. K.
Banerjee, A.	Project Director, WRW, Calcutta.
Banerjee, S. S.	Joint Director of Agriculture, Govt. of W. B., Calcutta.
Bandhopadhyay, K. L.	Training Organiser, KVK, Nimpith, 24 Parganas, W. B.
Bhattacharjee, N. K.	Chief Technical Officer (A & H), SBI Regional Office. Calcutta.
Bhakla, N. P.	Director, PISFA, Bangalore.
Bhusari, B. V.	Assistant Director (Fish Seed), Govt. of Maharashtra, Bombay.
Biswas, P. K.	College of Agricultural Banking, Pune.

Bose, A. N.	Professor & Head of Agriculture Engineering Dept., IIT, Kharagpur, W.B.
Chakraborty, S. K.	Professor of Zoology, Cotton College, Gauhati.
Chen, F. Y.	Coordinator, Network of Aquaculture Centres in Asia, C/o UNDP, Bangkok.
Chensha, Tian	State Bureau of Aquatic Products, China Lead Centre, China.
Chow, R. K. W.	Fish Feed Technologist, FAO/UNDP Project.
Chua, T. E.	FAO, C/o SEAFDEC Agriculture Department, Tigbavan, Philippines.
Copeland, Christopher	C/O Dr. Ken Chew, College of Fisheries, University of Wathington, Seattle, Washington, USA.
Deshmukh, Nanaji	New Delhi.
Dhital, B. P.	Regional Agriculturist, Planning Economist, FAO, Bangkok.
Drewes, Edel	FAO, Post Bag No. 1054, Madras.
Dudani, A. T.	Scientist (Lab to Land Programme), ICAR, Krishi Bhavan, New Delhi.
Dutta, N.	Head, Department of Zoology, Calcutta University, Calcutta.
Dutta, N.	Deputy Director of Agriculture, Govt. of W.B., Calcutta.
Dutta, T. C.	Secretary, Department of Agriculture, Govt. of W.B. Calcutta.
Dwivedi, S. N.	Director, Central Institute of Fisheries Education, Bombay.

Editor, Cherles	Director, Centre of Develoment Studies, University of Wales, U. K.
Elliot, Charles	CDS/UCS, Swanson, Swansea, U. K.
Fijan, N.	Fish Pathologist, FAO/UNDP Project, FAO Rome.
Hunyser, J. P.	UNDP Research Representative, New Delhi.
Jani, T. C.	Assistant Director General, ICAR, New Delhi.
Jain, Jagadish	M. P. (Rajya Sabha), The Parliament House, New Delhi.
Jayakrishnan, P. V.	Chief Secretary, Pondicherry.
Jain, Shan	Deputy Project Director, China Lead Centre of FAO/ UNDP Project, Wuxi, China.
Karim, M.	Adviser, FAO Smallscale Fisheries Development Programme, Madras.
Kamaluddin, A. S. M.	Consultant, National Committee on Rural Training & Planning Commission, Dacca, Bangladesh.
Kaushik, D. K.	Director of Fisheries, Haryana, Chandigarh.
Ke, Lu Young	Engineer, China Lead Centre of FAO/UNDP Project.
Kovari, J.	Sr. Aquaculturist, FAO, Rome.
Kuthalingam, M.	Dean, Tamil Nadu Fisheries College, Tuticorin.
Lahiri, T. B.	Member-Secretary, Sunderban Development Board, Calcutta.
Mallick, Lakshman	M. P, (Lok Sabha), New Delhi.
Malhotra, D. R.	UNDP Senior Programme Officer, New Delhi.

Macintosh, Donald J.	Institute of Agriculture, University of Stirling, Stirling,
Markalande, Sreema	Laboratory Technician, Zoology Dept., University of Colombo, Sri Lanka.
Mendiratta, A. L	FAO Programme Officer, New Delhi.
Mitra, G. N.	Hony. Fishery Adviser, Govt. of Orissa, Cuttack.
Mondal, B.	Director of Agriculture, Govt. of W.B., Calcutta.
Mondal, Pravanjan	M.L.A., Sagar Islands, W.B.
Mondal, R. T.	Reserve Bank of India, Ahmedabad.
George Mundackal	M. P., New Delhi.
Mahiuddin Khan	
Amin Ullah	
Abdul Ouddus	
Naik, S. S.	Director of Fisheries, Govt. of Maharashtra, Bombay.
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Natarajan, M. R.	Secretary (Fisheries), Govt. of Maharashtra, Bombay.
Nimbalkar, Ajit	Dist. Collector, Pune.
Padlan, P. G.	Agriculture Engineer, FAO, Rome.
Pawar, D. B.	Minister of Fisheries & Ports, Govt. of Karnataka.
Phimmasoni, Phomma	Chief of Livestock & Veterinary, Xam Nena Poism Laos.

Phitsarath, Onday	Manager of Vientiane State Farm, Vientiane.
Pillay, T. V. R.	Programme Leader, Aquaculture ; Development & Co-ordination Programme, Fisheries Department, FAO, Rome.
Purkar, A. K.	Plant Quarantine Station, Calcutta.
Rajasekar, D.	Canara Bank, Madras.
Reddy, Satyanarayana	M. P., New Delhi.
Samsi, Soleh Siregar	T. C. D. C. Mission from Indonesia.
Saxena, G. V. L.	Deputy Secretary (Parliament Affairs), New Delhi.
Saran Daulat Ram	M. P., New Delhi.
Sebastian, M. J.	Dean, College of Fisheries, Cochin.
Shanbogue, S. L.	Associate Professor, College of Fisheries, Mangalore.
Sharma B. C.	Secretary, Fisheries Dept., Govt. of W.B., Calcutta.
Sihar, Martomo	T. C. D. C. Mission from Indonesia.
Singh, Sujan	M. P. & Member of Governing Body (ICAR), Krishi Bhavan, New Delhi.
Singh, Jag Pal	M. P. (Lok Sabha), New Delhi.
Singh, Rana Vir	M. P. (Lok Sabha), New Delhi.
Singh, Chandra Shekar	M. P. (Lok Sabha), New Delhi.
Singsourinha, Pengke	Head of Fisheries of Lao PRD.
Sourya, Bonnson	Chief of State Farm, Dept. of Genetics, University College of Lousiana, U. K.

Subramaniam, N.	Secretary, (Fisheries), Govt. of Maharashtra, Bombay.
Tampi, P. R. S.	Assistant Director General (Fisheries), ICAR, New Delhi.
Thongsa, Xaisavanli	Chief of Livestock & Veterinary, Xam Nena Poism.
Thoumpotavanh, Chaumy	Deputy Chief of Agriculture, Xam Nena Poism.
Umali, D. R.	ADG Representative to FAO, FAO Regional Office for Asia & Pacific, Bangkok, Thailand.
Upadyaya, R. P.	Senior Area Officer, UNDP, New York.
Verghese, T. J.	Prof. of Aquaculture, College of Fisheries, Mangalore.

SYMP./SEMINAR

Conf., Symp etc.	*Place*	*Title of the paper presented*	*Authors*
Workshop on "Aquaculture" January 15-16, 1981	Seva Bharati, KVK, Kapgari		Attended by B. Roy
Seminar on "Aquaculture" February 21, 1981	KVK, Nimpith	"Aquaculture practices"	B. Roy
Workshop on "Inland Aquaculture with operational economics" May 29 to June 3, 1981	R. K. Mission, Narendrapur, Calcutta	"Inland aquaculture with operational economics"	P. Das
Workshop on "Economics of Aquaculture Research" 2-3 June, 1981	Singapore	An economic analysis of composite fish Culture	S. D. Tripathi & M. Ranadhir.
Workshop of "All India Fishermen's Cooperative Federation Ltd.", 17-18 June, 1981	New Delhi	Post independence trends in fisheries cooperatives and their relevance in India.	A. V. Natarajan & S. Paul.
Seminar on "Water-Pollution Control" July 18, 1981	Patna	Aquatic pollution in relation to inland fisheries.	A. V. Natarajan & B. B. Ghosh
Seminar-cum-Training Programme on "Problems Relating to Fish culture Practices" August 4-5, 1981	R. K. Mission Ara Panch		U. Bhaumik & P. K. Pandit
Seminar on "Agriculture Extension Week" 8-11 August, 1981	Sriniketan, Visha Bharati, Palli Siksha Sadan, Santiniketan		Participated in discussion by B. K. Banerjee
"VII International Symposium on Tropical Ecology" October 5-10, 1981	Bhopal	An ecological approach towards stocking policy formulation in Gulariya, a small irrigation impoundment.	A. G. Jhingran, R. K. Dwivedi, K. P. Srivastava & D. N. Singh
—do	—do—	Effect of effluents on the ecology of Rihand Reservoir India	D. N. Singh, K. Chandra, R. S. Panwar & R A. Gupta

Seminar on "Advances in Life Sciences in the Jammu & Kashmir State" October 22-24, 1981	Dept. of Botany, University of Kashmir, Srinagar	4 Papers were presented	Attended by the scientists of the Srinagar Centre.
50th Annual Meeting of the Society of Biological Chemists, India, November 18-20, 1981	M. S. University Borada	Effect of different dietary proteins on the growth and metabilism in *Clarias batrachus* (Linn).	B. Venkatesh A. P. Mukherjee P. K. Mukhopadhyay & P. V. Dehadrai
Eighth Conference of the Asian-Pacific Weed Science Society November 22-29, 1981	Bangalore	Evaluation of some aquatic weeds collected from different sites for their water, nitrogen and protein content	S. Patnaik
—do—	—do—	Efficacy of paraquat for control of submerged weeds	S. Patnaik & K. M. Das
Seminar on "Library and Information Services in an R & D Organisation" 26th November, 1981	Indian Institute of Experimental Medicine Jadavpur, Calcutta		B. N. Saigal V. K. Unnithan Sukla Das
The National Seminar on Fish Biology November 26-28, 1981	Muzaffarpur Bihar	Observations on the efficacy of carboric acid as anesthetic for Indian major carps.	Dilip Kumar B. K. Mishra and B. Biswas.
The National Seminar on Fish Biology, November 26-28, 1981	Muzaffarpur Bihar	Observations on the use of carboric acid anesthetic in fish seed transport	B. K. Mishra Dilip Kumar & R Mishra
Seminar on "Challenges in Extension in Eighties" 26-28 November, 1981	IARI, New Delhi		U. Bhaumik
Workshop on "Exploration and Exploitation of Marine Living Resources" Organised by the CSIR and Dept of Ocean Develoment, December 3-4, 1981	Cochin		K. Raman
Seminar on "Estuaries : their Physics, Chemistry, Biology, Geology & Engineering aspects" December 7-11, 1981	Dona Paula, Goa	Observations on the ecological changes of the Hooghly estuary in the context of freshwater release from Farakka barrage with special reference to its impact on fisheries.	A. C. Nandy M. M. Bagchi & S. K. Mazumdar

International symposium on "Water Resources Conservation Pollution & Abatement" December 11-13, 1981	University of Roorkee Roorkee	Observation on environmental pollution caused by zinc-borne waste disposed from rayon industries into the Hooghly estuary.	B. B. Ghosh & M. M. Bagchi
—do—	—do—	Effects of industrial and municipal waste on the trend of fisheries in the Hooghly estuary (W. B.)	P. Ray & G. C. Laha
—do—	—do—	A case study of use of Calcutta municipal waste for fish culture in the Bidyedhari Kulti complex West Bengal.	P. Ray, S. B. Saha & R. K. Banerjee
—do—	—do—	Bioassay studies on the effect of selected biocides on freshwater fish, *Labeo Rohita* (Hamilton)	R. S. Panwar & R. A. Gupta
International symposium on "Water Resources Conservation Pollution & Abatement" December 11-13, 1981	University of Roorkee, Roorkee.	Effects of industrial effluents on fish and fish food organisms of Rihand Reservoir (U. P.)	B. N. Singh R. A. Gupta & R. S. Panwar
—do—	—do—	Pollution from wastes of industries manufacturing nitrogenous fertiliser–A case study from River Ganga near Allahabad (India).	K. Chandra, B. Singh, G. N. Srivastava & S. N. Mehrotra.

FINANCE

The provision of funds for the financial year April 1981 to March 1982 was as under :-

Non-Plan	Rs.	1,25,96,000
Plan	Rs.	75,80,000
TOTAL		2.01,76,000

Against the above provision, the expenditure from 1-4-1981 to 31-12-1981 was as follows :-

Non-Plan	Rs.	94,54,763.39
Plan	Rs.	20,53,888.88
TOTAL		1,15,08,652.27

EXTENSION AND NATION BUILDING ACTIVITIES

CIFRI has a built-in arrangement for the dissemination of the technologies developed at the Institute to the fish farmers and entrepreneurs. The Institute organises quite a number of demonstrations for the benefit of fish farmers and others related to the field of fisheries. It also participates in and organises exhibitions. Talks and film shows are other frequent activities.

Spearheaded by the Extension Section, the Institute had an active extension programme in 1981. The highlights are :

Demonstrations undertaken

Other than under the Lab to Land Programme, Extension Section conducted many demonstrations covering various aspects in fish culture. By these, a large number of fish farmers were benefited at Rishra, Chanditola and Belgharia. From these, about 1.6 million spawn of Chinese carps, 8.9 million of Indian major carps and 2.8 million of common carp were produced. The produce were handed over to the farmers.

Demonstrations were also arranged for 30 trainee officers of ARDC, 20 FAO/UNDP trainees, Dr. A. T. Dudani, Scientist (ICAR), Lab to Land Programme and Dr. Christopher Copeland of University of Washington.

Training imparted

The following short-term training courses were organised during the period under report.

— A 3-day training course for six farmers of Arunachal Pradesh

—One week training programme on fish culture for two M.Sc. students of Jawaharlal Nehru University, Imphal, Manipur

—5-day programme for three UAR officials of Ministry of Agriculture

—One week training in frog culture for S/shri P. W. Bhutia, Asst. Fisheries Development Officer, and S. T. Lapeha, Sub-Inspector of Fisheries, Directorate of Fisheries and Wildlife, Govt. of Sikkim, Gangtok

—One month training for Ms. Sreema Markalande, Laboratory Technician, Department of Zoology, University of Colombo

—5-day training programme for S/shri M. Saharin, M. S. Takae, A. F. Egies and M. C. Barua of Department of Fisheries, Assam on the survey of capture fisheries resources, at Allahabad

—12-day training for 20 officers and farmers of Assam, at Barrackpore and Cuttack

—A training programme for 6 Laotian officers at Barrackpore and

—4-day training for 7 officers and 8 fish farmers from Fisheries Department, Government of Assam.

Six Field visits were also arranged for these trainees.

Fish Farmers' Days organised

The CIFRI Extension Section participated in Fish Farmers' Days organised at Chanditala on 3.6.81, Nilgunj on 25.5.81 and Sriniketan on 11.8.81. During these occasions, the scientists held discussions with the fish farmers in addition to the demonstrations conducted.

Exhibitions conducted

The Extension Section organised/participated in exhibition at the following places with posters, charts, photographs, lighted pannels, live specimens, models etc, for the propagation of modern technologies developed at the Institute among the fish farmers and other interested persons—

At Krishi Vigyan Kendra, Ramakrishna Ashram, Nimpith from 16-22 Feb. 81

At Ludhiana, Punjab in National Agriculture Fair '81 from 2-13 April, 1981. The stall was adjudged the best amongst the Govt. of India Stalls

A poster exhibition at Chorpalea from 9-10 March 81 and

At Dinhata, Uttar Banga Krishi Mela '81 organised by Marketing Board, Govt. of W. B. in collaboration with Dinhata Regulated Marketing Committee from 18.4 to 3.5.1981

Posters were supplied for exhibition arranged at the Zoology Dept., Burdwan University in April, 1981 Also.

At JARI, Nilganj from 28-29 May 1981 organised by JARI and

A poster exhibition at Pallisiksha Sadan, Sriniketan from 8-11 Aug. 81

Posters depicting the activities of the Institute were supplied to the Deputy Programme Officer, National Service Scheme, Ministry of Education and Social Welfare, Govt. of India for the exhibition on World Food Day from 16-17 Oct. 81 at Jadavpur University Campus.

A poster exhibition was arranged at Kamarpukur on 25.12.81.

Participated in Janata Krishi Mela held at Akuni (Bandpur) from 25-31 Dec. 1981.

Visitors briefed

Lectures, field visits, film shows and explaining of exhibits were arranged for trainees from various establishments, students, farmers and people from various walks of life.

During the year a total of more than 200 students from R. S. N. College, Barrackpore ; Children's Own Health Home, Uttarpara ; Calcutta University ; Govt. Polytechnique, Gyanpur (UP) ; B. C. Krishi Viswa Vidyalaya, Mohanpur ; M. D. Vidyapith, Digha ; Bethune College ; Centre of Advanced Studies, CMFRI, Cochin ; etc. were at Barrackpore to benefit from the extension services of CIFRI. Besides, trainees from Fisheries Staff Training Institute, Madras ; Health Dept., Govt. of W. Bengal ; Netaji Subhas Cooperative Training Institute, Kalyani ; Gramsevak Training Centre, Lumbucherra ; KVK, Kakdwip ; Work Education Teachers' Training Centre, Berachampa and UGIC, Lumbucherra (Tripura) were also at CIFRI to acquaint themselves with the latests in freshwater fish culture. About 160 of such trainees came to the Institute during the year. In addition, officials from banks, ARDC and various state government departments were also at the campus. Many other national and international visitors mentioned elsewhere in this report were also attended by the extension personnel.

Talks delivered

S/Shri P. Das, U. Bhaumick, P. K. Pandit, S. N. Sar and B. Roy, extension personnel of CIFRI delivered several talks at various gatherings comprising farmers, trainees, students, government officers, extension workers, voluntary social workers, etc.

The topics covered were '*Recent advances in inland aquaculture, Multiple fish cropping, Composite fish culture, Different aspects of inland aquaculture practices, Fish diseases and their control, Composite fish culture for landless labourers, Bankable projects on nursery pond managment, Different techniques and communication systems followed in fisheries extension, Concepts, principles and objectives of fisheries extension*, etc.

The extension scientists participated on twelve occasions in extension seminars, workshops, group discussions, etc. and talked on various topics in inland aquaculture sphere.

Advisory services provided

—Necessary advices/suggestions on various aspects of inland aquaculture were rendered to 177 fish farmers for their 387 ponds, and three voluntary agencies and one private entrepreneur for their respective problems.

—Information regarding scientific fish culture were provided through a number of letters to a number of persons, agencies and institutions. Relevant pamphlets also were sent to them as per requirements.

—Suggestions were offered to 12 fish farmers, one voluntary organisation and one military welfare organisation (Bihar Regiment) as per prevailing conditions after visiting their ponds for adoption of scientific fish culture for higher rate of fish production.

—A detailed note on the progress made in frog culture research in India was submitted to the Joint Commissioner (Fisheries), Government of India as desired by him.

—Dr. A. K. Mondal, Officer-in-Charge of Kalyani Research Centre attended the 3rd meeting of the Task Force organised by the Union Ministry of Commerce for the purpose of finding out research for decline in marine products export during 1980. Both short-term and long-term remedial measures were suggested at the meeting.

—The Pune Research Centre provided necessary advice to the A.N.C., Kakrki and Bharat Agro-Industries Foundation for enabling them to undertake fish farming.

—Breeding of magur was demonstrated at Malampuzha Fish Farm (Govt. of Kerala) by Shri B. Venkatesh, Scientist working under air-breathing fish culture project.

—Dr. V. R. P. Sinha, Head, FARTC, held discussions with the university research workers and government authorities and suggestions were made on aquaculture research and development in Haryana.

—Members of Cooperative Colony, Bokharo Steel City were benefited by the extension service of Rahara centre, on utilization of domestic wastes in fish production.

—Several farmers were benefited by the extension services rendered by Kakinada, Calcutta, Khardah, Cuttack, Madras, Allahabad and Dhauli centres of CIFRI.

KVK/TTC

a) Dhauli

Training Activities :

During 1981 a batch of 20 extension officers deputed by the Dept. of Fisheries, Govt. of Orissa have successfully completed their training courses in freshwater fish culture and fish breeding at TTC. It was a training course of 10 months' duration which commenced on 1.11.1981. A fresh batch of trainees are expected to be deputed by the State Department of Fisheries from November this year.

At KVK, during the year under report, a total of 46 farmers have hitherto been trained, the details of which are as under.

Batch No.	Total no. of trainees	Training period	Aspect of training
1	12	24.11.80—31.3.81	Composite fish culture, fish farm management and common carp breeding.
2	20	1.4.81—30.6.81	Freshwater fish culture and brood-stock maintenance.
3	14	2.7.81—30.9.81	Fish breeding and fry rearing.

A batch of 8 trainees sponsored by the Lutheran World Service, Calcutta had also received training in fish culture and fish breeding with special emphasis on induced breeding of Chinese carps and Indian major carps under KVK/TTC during fish breeding season. Their training programme commenced on 1.7.81 and ended on 21.7.81.

Off-campus training programme :

The KVK conducted certain off-campus training programme on composite fish culture in the rural areas by organizing village level meeting of the farmers and through practical demonstration of the technology in the village ponds. Two ponds (0.1 ha each) at village Sardaipur were stocked with fry of Indian major carps and exotic carps in connection with organizing an off-campus training programme. During the year under report, two more ponds, one each at village Tikkerpada and Jayapur (Pipili) have been selected for demonstration.

As a part of the off-campus training programme, some demonstrations on induced breeding of Indian major carps were given during this year's breeding season at village Nakhaurpatna taking the assistance of local farmers. In all, two sets of catla, 17 of rohu and 10 of mrigal were tried, out of which only 15 sets of rohu and 8 of mrigal gave positive response. Altogether one lakh spawn of rohu and 2.3 lakhs spawn of mrigal were produced which were handed over to the farmers for use in their fry rearing programme.

Fish seed production :

Incidental to the training on fish breeding imparted to the KVK and TTC trainees, considerable amount of fish seed of Indian major carps and exotic carps was produced during the year under report. See the details given below.

Species tried for induced breeding during 1981	Number of sets tried	Positive result	Total number of spawn produced (in lakhs)
Rohu	114	82	16.45
Catla	21	4	0.60
Mrigal	16	13	0.72
Grass carp	16	3	0.60
Silver carp	28	5	0.15
Common carp	16	16	2.00

b) Kakdwip

During the period under report the Kendra organised 34 training courses both on-campus & off-campus programmes in various technologies under fish culture, agronomy and horticulture. A total of 322 candidates comprising practising farmers and fishermen, school drop-outs, unemployed educated youth, school teachers and prospective borrowers of the State Bank of India under Agriculture Finance Development Scheme have been trained as detailed below :

Fish Culture

Sl. No.	Name of course	No. of course	Duration	No. of trainees	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
1.	Rearing of mullets and prawn	1	6 weeks	9	Private
2.	Pond preparation and seed identification	4	1 day	25	do
3.	Composite fish culture	4	6 days	28	S.B.I. nominated.
4.	Induced breeding of carps	3	2-6 days	33	Pvt.
5.	Nursery pond management	3	2-6 days	30	do
6.	Paddy cum fish culture	4	2-6 days	12	do
7.	Composite fish culture	2	2-6 days	25	do

Agronomy and Horticulture

Sl. No. (1)	Name of course (2)	No. of course (3)	Duration (4)	No. of trainees (5)	Remarks (6)
8.	Plant protection in paddy cum fish culture (4 centres)	2	1 day	5	do
9.	Plant protection in paddy (6 centres)	4	1 day	65	do
10.	Advisory service cum extension in the field of fertilizer application in rice and soil management (2 centres)	3	1 day	35	do
11.	Cultivation of chilli	1	3 days	50	do
12.	Cultivation of watermelon	1	2 days	11	do
13.	Cultivation of potato	1	2 days	11	do
14.	Rabi crop under limited irrigation facilities	1	1 day	70	do
15.	Collection and preservation of soil samples for soil testing.	1	1 day	5	do

Village Survey

Under village survey programme 10 villages have been covered with bench mark survey for 40 farm families. Advisory services have been rendered to 35 enthusiastic farmers for solving their field problems.

LAB TO LAND PROGRAMME

Lab to Land Programme initiated in 1979 was continued. Seven farm families adopted (by the Extension Section) under the programme at Kolaghat, Midnapur, Chanditala and Belgharia in the districts of Hooghly and 24-Parganas were benefitted. Fish production in 8 months at Kolaghat varied from 2,559 to 6,624 kg/ha in composite fish culture and at Chanditala area, from 2,506.25 to 3,897.70 kg/ha/6 months.

Five thousand fry of silver carp produced from CIFRI centre at Cuttack were distributed to the fish farmers under Lab to Land Programme.

The Extension Section continued to coordinate the LLP of the Institute in 31 centres covering 408 farm families.

At Kalyani

As a part of Lab to Land Programme, practical and theoretical training was imparted in frog hatchery techniques and nursery management.

At Pune

Seven selected fish farmers' families from the village of Loni, Kunjerwadi and Furaunji were given technical guidance in composite fish culture under the programme. From derelict waters a total 1025.5 kg of fish was harvested. The rate of production worked out to be 427 to 1470 kg per hactare.

At Cuttack

The benefits under Lab to Land Programme were extended to 38 adopted fish farming families of villages under Raghunathpur, Salepur, Biridi, Sadar and Barang Blocks of Cuttack District. Transfer of technologies in fish breeding, fry fingerlings, and table-size fish raising to the fish farmers were the highlights of this year's Lab to Land Programme. Induced breeding of rohu was demonstrated in two farmers' ponds and a total 0.09 m spawn were produced. Weed control measures and pond management techniques were also detailed out to them.

Details of fry supply to different agencies are given at the next page :

FRY SUPPLY TO DIFFERENT AGENCIES FROM KILLA EXPERIMENTAL FISH FARM
From 1. 1. 1981 to 31. 12. 1981

	Agencies	Indian major carps		Chinese carps		Common carp	
		Spawn (in lakhs)	Fry & fingerlings	Silver carp fry	Grass carp fry	Spawn (in lakhs)	Fry & fingerlings
1.	Orissa Fisheries Deptt.	—	6,500	7,300	500	1.0	5,000
2.	Orissa University of Agriculture & Technology	—	10,650	1,300	—	—	—
3.	Central Rice Research Institute	—	7,650	—	—	—	2,700
4.	Project Co-ordinator Kausalya Ganga	—	—	700	—	—	—
5.	KVK/TTC, Kausalyagang Centre	—	5,000	3,000	—	—	5,000
6.	Government of Assam, Fisheries Department	—	—	—	135	—	—
7.	Lab to Land Programme (Raghunathpur, Barang, Salepur & Tangi Block of Orissa)	3.67	10,095	5,845	440	—	4,925
8.	C. I. F. R. Institute, Barrackpore	—	—	10,000	—	—	—
9.	F. A. R. T. C., Dhauli Fish Farm	—	1,11,980	22,700	—	2.75	10,000
10.	Private Fish Farmers	—	1,300	50	—	—	3,000
11.	C. I. F. R. I. Centre, Cuttack (for stocking)	13.5	48,575	16,095 & 5.6 (lakhs spawn)	4,000 & 0.7 (lakhs spawn)	3.0	3,000

At KVK/TTC, Dhauli

Out of the 17 centres selected in nine villages falling within the radius of 15 km. of Kausalyagang, the only ongoing programme under the Lab to Land programme during the year under report are the following :

i) A demonstration on composite fish culture with six species combination at village Nakhaurpatna in one 1.25 ha pond.

ii) A demonstration on composite fish culture with six species combination at village Pratashasan in one 0.1 ha pond.

iii) A demonstration on composite fish culture with six species combination at village Uttarashasan in one 0.1 ha pond.

During the year under report, a demonstration on induced breeding of common carp was also taken up at village Nakhaurpatna in which a total of 10.25 lakhs of spawn was produced.

Due to the unavailability of funds in time, the work under the Lab to Land programme at other centres has been discontinued.

At Khardah

A farmer's plot (1.09 ha) at Bandipur was taken up for paddy-cum-fish culture in an integrated way. A fish production of 4,200 kg/ha (Kharif) and 3200 kg/ha (Rabi) were recorded. Besides, vegetables (ladies finger 105 kg, Corns 60 kg and Beans 85 kg) were raised from the dykes.

In another farmer's pond (0.08 ha) a production rate of 1,300 kg/ha of fry and fingerlings was achieved. The stocking density was 7500 and cattleshed washings were usually used as manure. Survival was about 50% in the pond.

LIBRARY AND DOCUMENTATION

Library

CIFRI Library now has about 5000 books, 4000 reprints and 2000 miscellaneous publications. This excludes the bound and loose volumes of journals, pamphlets, maps, departmental publications, etc. The library subscribes 47 foreign and 43 Indian journals. Another 175 journals are received in exchange or gratis basis. During 1981, 256 books 1644 issues of periodicals 78 miscellaneous publications and 24 reprints were added to the library. The Institute had arrangements, to exchange publications with 427 organisations. Fifteen new exchange relationships were establised during the year under report. They include

1) Dr. R. D. Deshpande, Science Councellor, Embassy of India, 2107 Massachusetts Avenue, N. W., *Washington* D.C. 20008, *U.S A.*

2) The Adviser (Agricultural Products) Indian Mission to the European Economic Community Trade Centre, Chaussee de Charlerol, 148 *1060 BRUSELLES*

Information

Consequent to the increase in scientific manpower the information activities were geared up to offer meaningful service to the fisheries fraternity in general and CIFRI scientists in particular.

Abstracting Service

'Bibliography of Indian Fisheries' published by the Information Section of CIFRI had been discontinued from 1976. It has been revived and the material for publication of the journal from 1976 to 1981 were prepared. More than 3,000 scientific articles appeared in different journals were scanned and informative abstracts made. The journal has been rechristened 'Indian Fisheries Abstracts.'

Current Awareness Service

The institute continued to publish its current awareness service viz. *Current Contents.* Eight issues (1-8) for the year 1980 were compiled and published.

The *Library accession list* no. 7-12, 1979, no. 1-6, 1980, 7-12, 1980 and 1-3, 1981 were released.

CIFRI Newsletter

CIFRI Newsletter which had been discontinued in 1979 got revived during the year. Its periodicity has been changed to bimonthly (once in two months). Four issues of the Newsletter Vol. 4 (no. 1 to 4) were published during the year. CIFRI Newsletter has become very popular in fisheries circles as can be judged by the unending requests for its copies from different quarters.

Publications

The following are the publications made by CIFRI during the year 1981.

1) Annual Report for the year 1979.

2) Bulletin No. 33 entitled 'Feasibility survey report on utilisation of saline ground water of Gurgaon District for aquaculture'.

3) Bulletin No. 34 'Ecological considerations in introduction of exotic fishes in inland waters of India.'

4) Technology bulletins a) Carp culture b) Carp seed raising c) Hatchery for carp eggs d) Fish-cum-duck culture and Fish-cum-pig culture e) Paddy-cum-fish culture f) Development of a

multipurpose production technology based on recirculatory filtering system (RFS) as a hatchery, seed production factory and commercial-scale production unit for table size fish g) Massive effort at technology transfer in west Bengal and Orissa through CIFRI/IDRC rural aquaculture project h) Lab to Land Programme at CIFRI i) Weed problem in fishery waters j) Reservoir fisheries k) Brackishwater fish and prawn culture l) Giant freshwater prawn culture, m) Shrimp culture and n) Frog seed production.

5) Report on Fifth Workshop, All India Coordinated Research Project on Composite Fish Culture and Fish Seed Production held at Puri.

6) "Report on composite fish cultue under operational research project at Gosaba, Sunderbans, of the Jute Agricultural Research Institute during 1976-78.

7) Brochure on 'Progress and achievements in aquaculture'.

8) "Final Report, 1971-1981, All India Coordinated Research Project on Ecology and Fisheries of Freshwater Reserviors, Bhavanisagar Reservoir."

9) Report, Seminar on fishery (Inland) as an economic programme for IRD, 28-30 September, 1981.

10) Report on Fourth Workshop, All India Coordinated Research Project Brackishwater Fish Farming, 24-25 October, 1981 at Kakinada Centre, A. P.

11) Summer Institute Lecture notes on "Farming System Integrating Agriculture, Livestock and Fish Culture" held at Barrackpore, during July 6-August 4, 1981.

12) Accession List Nos. 7-12, July to December 1979; 1-6, January to June 1980; 7-12, July to December 1980 and 1-3, January to March, 1981.

13) CIFRI Newsletter, Vol. 4, 1-4, 1981.

14) Contents List Nos. 1-8, 1980.

Technical Information Service

CIFRI is looked upon as a reliable source of information by a large section of the society comprising students, entrepreneurs, research workers policy makers and a large number of organisations associated with the fisheries industry. More than hundred querries from India and abroad were attended to by the information section. In many cases useful reprints, publications and zerox copies were supplied. The Institute also supplied 65 issues of journals to INSDOC, Zoological survey of India, etc.

Reports

Apart from the Annual Report 1979, 38 reports on projects and achievements of the Institute were sent to ICAR.

Ongoing Projects

Project-1 : Optimum per hectare production of fry, fingerlings and fish in culture fishery operations.

Problem No. : 1.34 : Possibilities of fish culture in jute-retted waters.

Personnel : B. N. Saigal, V. V. Sugunan, G K. Vinci, V. K. Unnithan, M. J. Bhagat, A. R. Chowdhury, G. N. Chattopodhyay and K. S. Banerjee.

Duration : 1976-81.

Location : Patulia (West Bengal)

PROGRESS OF RESEARCH :

Under this project fish culture experiments were conducted in a pond of 0.07 ha at village Patulia, West Bengal. A month after jute retting (October, 1981) the pond was stocked with fingerlings of catla, mrigal, rohu and silver carp in the ratio 25 : 12 : 10 : 3. Total catch after the rearing period of six months was 162 Kg (1,800 kg/ha/six months). Considering the fact that feeding was very low and the fish mostly utilize the natural food this growth is quite impressive.

Problem No. 1.44 : Studies on ecological changes in newly constructed ponds and their management.

Personnel : D. K. Chatterjee, S. Jena and K. C. Pani.

Duration : 1977-1982.

Location : Dhauli (Orissa)

Investigations on ecological changes in 18 newly constructed ponds at Dhauli have been initiated. The ponds are being treated with organic manure (cattle dung at 10,000 kg/ha) and super phosphate (@ 20, 40 and 80 kg/ha) alone and in combination with nitrogen @ 100 kg/ha at fortnightly intervals. The changes in water quality, primary productivity and plankton density are being recorded.

Problem No. 1.52 : Economic methods of increasing yield of carps in ponds (Lead Centre project)

Personnel : D. K. Chatterjee, V. Ramachandran, M. Ranadhir, K. Suresh, H.A. Khan, D. N. Swamy and C. R. Das.

Duration : 1981-1984.

Location : Dhauli (Orissa)

Experiments on increasing carp yield were conducted in 18 ponds (0.02 ha). The ponds were stocked with the fry of Indian major carps catla, rohu and mrigal (1 : 1 : 1) and treated with inorganic fertilizers at 100, 40 and 20 kg/ha of nitrogen, phosphorous and potassium singly or in combination at fortnightly intervals. Each treatment had two replicates and a control. The environmental conditions were monitored at regular intervals but did not show any marked differences. However, ponds treated with nitrogen+phoshphorous indicated slightly higher primary production (0.069 mg 0_2/l/hr) compared to other treated ponds and the control (0.053 mg 0_2/l/hr).

Problem No. 1.53 : Effect of water level on fish production (Lead Centre project)

Personnel : V. R. P. Sinha, S. patnaik, C. R. Das, D. K. Chatterjee, Dilip Kumar, C. D. Sahoo and B. R. Shirsat.

Duration : 1981-84.

Location : Dhauli (Orissa).

Studies on the effect of variations in water level on fish production have been initiated in 1replicate in 0.02 ha ponds maintaining three water levels *i. e.* 0.5 m, 0.75 m and 1.0 m. The ponds have been stocked at a uniform density of 5000 fingerlings/ha of Indian major carps viz., catla (89.0 mm/7.8 g), rohu (85.6 mm/4.3 g), and mrigal (82.9 mm/4.6 g). The work is in progress.

Problem No. 1.54 : Investigations on increasing fish production particularly in non-drainable ponds.

Personnel : R. D. Chakrabarty, P. R. Sen, N. G. S. Rao, S. N. Datta, N. K. Thakur, S. R. Ghosh, R. K. Dey and M. Rout.

Duration : 1981-1984.

Location : Cuttack/Dhauli.

The experiment set up in August 1981 in a pond of 0.4 ha area with the three Indian and three exotic carps at 7500/ha stocking density in the ratio of C 10 : R 20 : M 15 : Sc 25 : Gc 15 is in progress. Management measures include fertilization and daily provision of supplementary feed and weed for grass carp.

Problem No. 1.55 : Nursing of fry and fingerlings.

Personnel : P. R. Sen, C. R. Das, S. Jena, B. K. Mishra, R. K. Jana, D. K. Chatterjee, A. N. Mohanty and H. K. Muduli.

Duration : 1981-1983.

Location : Cuttack and Dhauli.

In fry rearing experiments with the Indian major carps, *Labeo rohita*, *Catla catla* and *Cirrhina mrigala* at the stocking density of 3.75 m/ha, about 70% survival was estimated.

Rearing of the Silver carp *(Hypophthalmichthys molitrix)* at a stocking density of 2.5 m/ha was done and about 50% survival was estimated. The grass carp rearing is in progress.

Fingerling rearing experiment with the Indian major carps and silver carp at stocking densities of 0.1 m and 0.2 m/ha is in progress.

Problem No. 1.56 : Studies on the ecology of a freshwater swamp and newly constructed ponds.

Personnel : Radheshyam

Duration : 1981-85

Location : Kausalyagang, Orissa.

Morphometric study of the Kausalyagang swamp (5.32 ha) was started in 1981. Six sampling spots at varying depth zones (1.0, 1.3, 1.6 and 1.69 m) were fixed for carrying out investigations. Two newly constructed ponds of 0.08 ha each with an average depth of 1.71 m have also been selected to make a comparative study. Studies on plankton, benthos, vegetation and water quality were initiated in September, 1981.

Project 2 : Induced Fish Breeding/Physiology of reproduction.

Problem No. 2.8 : Induced fish breeding of important cultivated fishes (other than carps).

Personnel : G. V. Kowtal, S. D. Gupta and A. K. Sahu.

Duration : 1974-1981.

Location : Cuttack.

No work could be done as mass-scale removal of brood fish by intruders took place before the commencement of fish breeding season.

Problem No. 2.9 : Studies on the process of maturation ovulation and resorption of gonads in Indian major carps.

Personnel : G. V. Kowtal and S. D. Gupta.

Duration : 1974-1981.

Location : Cuttack.

No work could be done as large-scale removal of brood fish by outsiders took place before the onset of fish breeding season.

Problem No. 2.10 : Pituitary—gonad relationship in free spawning and non-free spawning carps.

Personnel : H. A. Khan and V. R. P. Sinha.

Duration : 1977-1983.

Location : FARTC, Dhauli.

Cyclic changes in the histology of pituitary cells

and gonads of *Labeo rohita* collected from ponds were studied. Histochemistry of cells producing steroid hormones responsible for vitellogenesis in gonads are in progress.

Problem No. 2.12 : Activities of interrenal and chromaffin tissue during the process of maturation of gonads of Indian major carps from still and running waters.

Personnel : R. C. Das and H. A. Khan.

Duration : 1978-1983

Location : FARTC, Dhauli.

Preliminary observation on the histology of gonad and interrenal tissues indicates that the activity of the interrenal tissue increases during the period of gonadal maturation and reduces during the resting phase of gonadal cycle.

Problem No. 2.13 : Studies on the factors responsible for multiple spawning of carps

Personnel : R. M. Bhowmick and S.K. Sarkar.

Duration : 1978-1982.

Location : Dhauli.

Histological preparations of the preserved gonads and pituitary glands of rohu and mrigal collected during last year's breeding season, are in progress.

Problem No. 2.14 : Studies on interrelation between thyroid and gonads of the major indigenous carps.

Personnel : A.K. Sahu and H.A. Khan

Duration : 1979-1983.

Location : Cuttack and Dhauli.

Histological localization of thyroid follicles were made at the pharyngeal region as well as on head kidney and their cellular activities were studied in relation to gonadal maturity in *Labeo rohita*. Experiments were conducted by using thyroid inhibitor to confirm the relationship of gonadal maturity and thyroid activity.

Problem No. 2.16 : Seasonal changes on the hypothalmohypophyseal complex in relation to reproduction in some freshwater Indian major carps and exotic carps.

Personnel : S. K. Sarkar, R. M. Bhowmick and B. R. Datta.

Duration : 1980-1983.

Location : Dhauli.

Brain, pituitary gland and gonad from catla and silver carp are collected, fixed and processed for histological preparations.

Problem No. 2.17 : Quantative analysis of gonadotropin in common carp pituitary at different sexual stages for induced breeding. (Lead Centre Project).

Personnel : H. A. Khan, D. K. Chatterjee, R. C. Das, George John, B. R. Shirsat and V. R. P. Sinha.

Duration : 1981-1984.

Location : FARTC, Dhauli.

Study on the culture of common carp is in progress.

Problem No. 2.18 : Techniques of rearing and maintaining of brood fish of carps for large-scale prodution of seed.

Personnel : N.G.S. Rao (Upto October, 1981), S. D. Gupta, S. R. Ghosh, R. K. Dey, P. V. G. K. Reddy, M. Rout, Paul Raj (Upto 5.9.1981), and H. K. Mudali.

Duration : 1981-1984.

Location : Dhauli/Cuttack (Orissa).

Effect of stocking density on maturation of silver carp and grass carp was studied in six ponds at stocking densities of 500, 750 and 1000 kg/ha. No significant difference was noted. For inducing early maturation, selected fishes from above ponds were administered with pituitary gland extract @ 1 mg/kg body wt. at fortnightly intervals.

Experimental brood fishes (grass carp, silver carp and Indian major carps) were spawned and a total of 2.49 million spawn was obtained.

Project 3 : Reservoir Fisheries.

Problem No. 3.8 : Fisheries of the peninsular tanks. Introduction and propagation of less commonly known culturable species.

Personnel : B. V. Govind, M. F. Rahman, S.L. Raghavan & P. K. Sukumaran.

Duration : 1979-1982.

Location : Bangalore.

Cirrhinus cirrhosa, Labeo fimbriatus and *Pangasius pangasius* were introduced into the culture system. The growth recorded by these species for a two years was as follows :

Species	Initial September 1979 TL(mm)/wt(g)	Final September 1981 TL(mm)/wt(g)	Net increment TL(mm)/wt(g)
Cirrhinus cirrhosa	32/ 0.7	260/210.0	228/209.3
Labeo fimbriatus	30/ 0.7	333/605.0	303/604.3
Pangasius pangasius	198/54.0	288/231.0	90/177.0

Problem No. 3.13 : Composite fish culture of Indian and exotic major carps in tanks simulating long seasonal irrigation tanks.

Personnel : S. Ayyappan, P. K. Sukumaran, S. L. Raghavan, B. V. Govind and M. F. Rahman.

Duration : 1980-1982.

Location : Bangalore.

The project pertains to composite fish culture experiments in two tanks, viz., The Army Supply Corps (ASC) Centre (South) tank (1.25 ha), and Indian Telephone Industries (ITI) tank (0.33 ha). The total fish yield from ASC tank during the period under report amounted to 1612.60 kg and the complete catch from ITI tank was 21.05 kg. The catch from both the tanks was mainly contributed by *Cirrhinus mrigala*. Other species constituting the catch were catla, rohu, mrigal, grass carp and *Labeo fimbriatus*. The culture experiment in the tank is underway. The low production from the ITI tank was due to forceful poaching occurred during the Central Govt. employees strike at Bangalore early this year.

One thousand fry of catla (20 mm/90 mg), 1500 + 1500 advanced fry of rohu and mrigal (29 mm/280 mg) and 100 fingerlings of grass carp (69 mm/2.7 g) were released in the tank on 10.9.1981 for culture, working out to a density of 3200/ha.

Problem No. 3.15 : Ecology and fisheries of peninsular tanks.

Personnel : B. V. Govind, S. L. Raghavan, S. Ayyappan, P. K. Sukumaran and M. F. Rahman.

Duration : 1981-1985

Location : Mysore District (Karnataka).

After surveying a few tanks in Karnataka, Turaganur tank in Mysore district (about 110 km from Bangalore and 18 km from Mandya) was selected for the study. This is a canal-fed, perennial, irrigational tank with a water-spread of 21 hectares and a mean depth of 2.50 meters. Trial netting conducted in the tank yielded common carp with an average weight of over 1.5 kg. The catch also included *Cirrhinus reba*, *Labeo bata* and *Puntius sarana*. Other species available were *Puntius stigma*, *P. ticto*, *Rasbora daniconius*, *Nuria danrioa*, *Amblypharyngodon mola*, *Danio aquipinnatus*, *Ompok bimaculatus*, *Glossogobius giuris*, *Notopterus notopterus* and *Clarias batrachus*.

Good amount of weeds like *Hydrilla* spp. *Ceratophyllum* sp. and *Vallisnaria* sp. are available in the tank which makes it suitable for introducing grass carp. The water is medium productive with plankton volume ranging from 5 to 10 ml/cu.m. Considering these features and the potential for fishery development, the tank was chosen for study. It is proposed to stock the tank with fish fingerlings at a density of 2500/ha, in the ratio of catla 0 7 : rohu 1.5 : mrigal 0.5 : common carp 2.0 : silver carp 0.1 : grass carp 0.2.

Problem No. 3.15.1 : Investigations on the nutrient cycles and microbial activity influencing productivity in an aquatic ecosystem.

Personnel : S. Ayyappan, B.V. Govind, P. K. Sukumaran, and S.L. Raghavan.

Duration : 1981-84.

Location : Sankey tank, Bangalore.

The project was initiated in Sankey tank, Bangalore (water spread 16 ha, mean depth 4.0 m) in May, 1981, with studies on plankton and primary production in relation to its hydrographic parameters and nutrient concentration of the soil. The water is alkaline with pH 8.15. Bicarbonate alkalinity values ranged from 400 to 500 ppm. Specific conductivity values were around 200 micromhos/cm. Gross production values recorded was upto 240.44 mg C/m^3/hr. and plankton volume upto 40 ml/m^3. The bluegreen alga *Microcystis* sp. dominated in all the collections. The soil pH was around neutral and the organic carbon content was 3-5%. The microbiological work is proposed to be started in January, 1982, with the enumeration of total bacterial count in water and soil.

Problem No. 3.16 : Biology of *Puntius dorsalis* (Jordon).

Personnel : P. K. Sukumaran.

Duration : 1979-1982.

Location : Bangalore.

Puntius dorsalis (Jordon) a minnow carp forms 8 to 10% of the fish catch in the tanks of Karnataka. Every month fish samples were collected from Nagalkere tank (area 72 ha), Daddaballapura, about 40 km from Bangalore. The fish was found to be an omnivore and the phytoplankton consisted of diatoms, green algae and blue-green algae. The length-weight relationship was $\log w = -1.7470 + 2.8160 \log l$ ($r = 0.9294$) for males and $\log w = -3.007 + 4.1010 \log l$ ($r = 0.8982$) for females. Length at first maturity was found to be 81 mm and intermittent breeding was observed though the intensity was higher during February-March, July-October and December-January. Sex ratio was, male : female : : 1 : 1.2.

Problem No. 3.17 : Culture of fish in cages in peninsular tanks.

Personnel : B. V. Govind, S. L. Raghavan, S. Ayyappan and M. F. Rahman

Duration : 1981.

Location : Bangalore.

In the first phase of the experiment at Sankey tank, Bangalore on cage culture of common carp and silver carp, they were raised from fry to fingerling stage. At a stocking density of 21 3 lakhs/ha (2000 and 250 respectively in 10.56 sq. m· cage) the survival at the end of four months was 97.5% in case of common carp and 88% in case of silver carp. The average final weight attained by common carp was 20 g and that of silver carp was 8.6 g. The gross and net production for the cage were 41.0 and 40.5 kg respectively.

The second phase of raising fingerlings of common carp to table size was initiated with stocking of 300 common carp in the cage (stocking density 2.86 lakhs/ha). Artificial feed comprising deoiled silkworm pupae (40%), ricebran (44.7%), groundnut oil cake (15%) and mineral mix (0.3%) was given daily at about 10% of the body weight on an average. With a cent percent survival, the yield after six months culture period was 97.0 kg, amounting to a production of 92.0 metric tonnes/ha in six months.

The next experiment with stunted yearlings of common carp for raising them to table-size was initiated on 7.12.81 with stocking of 400 common carp each in trial and control cages, at a density of 3.79 lakhs/ha. In another experiment of raising fry of silver carp to fingerling stage, 4000 fry were stocked (37.9 lakhs/ha) on 24.11.1981. Both the experiments are in progress.

Problem No. 3.18 : Ecology and fishery development of a small reservoir.

Personnel : A. G. Jhingran, S. K. Wishard. K. P. Srivasthava, S. N. Mehrotra, D. N. Singh and R.K. Dwivedi.

Duration : 1981-1985.

Location : Bachhra reservoir, Allahabad Dist.

Ecological studies in Bachhra reservoir were initiated in the month of April, 1981. Impounded on Bachhra nala during the year 1980-81, the reservoir is situated in Meja Tehsil at a distance of about 55 km from Allahabad. The waterspread area at the full storage level of 111.0 metre above MSL is 142 ha, the gross storage capacity being 7.42 million cubic metres. The dead storage capacity at DSL 100 m MSL is 0.03 mm^3. The earthen embankment and waste weir are 558 m and 98 m long respectively and a single irrigation channel originates from the reservoir.

Observation on the physico-chemical properties of water and soil during, the year gave these results.

a) *Water*

Temperature	:	21.8°C (November)-32.0°C (May)
Transparency	:	38.0-151.0 cm
pH	:	7.8-8.4
Alkalinity	:	96.0-152.0 ppm
Hardness	:	25.0-42.0 ppm
Dissolved oxygen	:	5.2-7.8 ppm
$C0_2$	:	2.4-4.2 ppm (in monsoon months only)
Ca^{++}ions	:	24.0-41.0 ppm
Nitrates	:	0.11-0.16 ppm
Phosphates	:	0.09-0.16 ppm
Specific conductivity	:	220-416 micromhos/cm
Primary productivity		
—Gross production	:	68.75-125.0 mg C/m^3/hr
—Net production	:	50.0-100.0 ,,
Respiration	:	12.5-25.0 ,,

Sand	:	66.0-72.0%
Clay	:	10.0-14.0%
Silt	:	16.0-20.0%
pH	:	6.8-7.5
Organic carbon	:	0.33-0.4%
Conductivity values	:	675.0-860.0 micromhos/cm.

Plankton : Plankton does not appear to have established itself in the new reservoir, as evident from the low values (79 u/1) encountered in April. However, after the monsoon rains in July, blooms of blue green *(Anabaena* sp*)* and green algae *(Ulothrix* sp.*)* the population to 16,503 u/1, the average was estimated at 2920 u/l. Phytoplankters (86.8%) invariably dominated over the zooplankters (13.2%). Amongst the phytoplankters, Chlrophyceae (62.40) dominated over Myxophyceae (17.6%) and Bacillariophyceae (6.8%). *Ulothrix* sp., *Oedogonium* sp., *Spirogyra* sp. and *Microspora* sp. were encountered in abundance during summer months. Blue green algae viz. *Anabaena* sp., *Microcystis* sp. etc. which had started appearing in June, continued to rise till they outnumbered the green algae in post-monsoon months. Amongst the diatoms, *Navicula* sp., *Synedra* sp., *Nitzschia* sp. etc were the dominant forms. No desmids were encountered in the collections.

Amongst zooplankters, rotifers were the dominant form constituting 5.9% in the total and represented by *Keratella* sp., *Brachionus* sp., *Polyarthra* sp. and *Lecane* sp. Copepods were graded next in abundance (4.1%) with *Cyclops* sp. *Diaptomus* sp. and nauplii as the representatives while cladocerans were the least abundant (3.2% only) with *Moina* sp., *Sida* sp., *Bosminopsis* sp. etc. appearing occasionally in the samples.

Macrobenthic fauna : Bottom fauna of the reservoir fluctuated between 123 u/m² (August) to 7.98 u/m (April*)* and was dominated by dipteran larvae (64.4%) and followed by oligochaetes (35.6%). The insect larvae comprised *Chironomus* sp. *Coleoptera* sp. *Chaoborus* sp. *Phylopotamus* sp. etc.

Fish Fauna : Endemic fish population comprised all the major carps, viz. mrigal, catla, rohu and kalbasu ; catfishes *M. seenghala* and *W. attu* besides carp minnows, clupeids, perches, murrels and other trash fish. Practically all the fish stock is reported to have been harvested during summer months.

Problem No. 3.19	:	Studies on the limnology and productivity of McPherson lake.
Personnel	:	D. N. Singh, K. Chandra, R. A. Gupta & B. D. Saroj.
Duration	:	1981-1984.
Location	:	Allahabad.

Limnological studies of an ox-bow lake McPherson were initiated in the month of March 1981. Physico-chemical observations revealed that temperature ranged from 15.4 to 30 5°C, pH from 7.9 to 8.2, D.O. from 7.65 to 9.6 mg/l, alkalinity from 205 to 286 mg/l, chloride from 31.05 to 46.85 mg/l hardness from 62 to 72 mg/l, transparency from 63.5 to 180 cm, silicates from 8.65 to 12.5 mg/l and phosphate from 0.095 to 0.120 mg/l.

Zooplankton population dominated over the phytoplankton quantitatively, while phytoplankton dominated qualitatively. Low values (114 u/l) were recorded in the month of March while maximum was (1036 u/l) in August. Copepodes *(Cyclops, Diaptomus soitalics)* Cladocerans (*Sida, Moina, Bosmina, Diaphanosoma*) and rotifers *(Brachionus, Filinia, Lecane Trochospaera*) were the main groups encountered amongst zooplankters. Blue green algae (*Oscillatoria, Tribonema, Anabaena, Gloeotrichia*), green algae (*Oedogonium, Scenedesmus, Pediastrum, Spirogyra, Oocystis)* and diatoms (*Synedra, Navicula, Surirella, Tabellaria*) were recorded in sizeable

quantity throughout the period. Diurnal studies were done in the month of June and September where the maximum number of plankters were recorded at 06.00 hrs followed by 18.00 hrs. A few chironomid larvae and molluscs especially *Viviparus bengalensis* were recorded in bottom samples. Marginal areas of the lake were found to be fully choked with aquatic weeds like *Potamogeton pectinatus*, *Hydrilla verticillata*, *Vallisnaria spirates* and *Spirodilla polyrhiza*. Periphyton collection showed maximum representatives of Bacillariophyceae in terms of species.

Project 4 : Riverine carp spawn prospecting and collection techniques

Problem No. 4.5 : Yearly variation in the quality and quantity of spawn of river Yamuna and rearing and culture of riverine spawn.

Personnel : K. P. Srivastava, A. G. Jhingran, Ravish Chandra, R. K. Dwivedi, R. K. Tyagi and N. K. Srivastava.

Duration : 1972 onwards.

Location : River Yamuna.

Investigations under the project were conducted at Madhauka centre on river Yamuna for a period of 46 days. During this period five spurts of flood were observed, the first three touching the marks at 4.91 m, 3.43 m and 4.56 m above the first day of observation. A total of 21,460 ml spawn (*c.* 1,07,30,000 hatchlings) was collected by five standard spawn collection nets, which was an all time record of yield. First to fifth spurts contributed 576 ml (2.7%), 20.365 ml (95.0%) 243 ml (1.1%), 53 ml (0.2%) and 223 ml (1.0%) respectively to the season's total yield. The most remarkable fact was that the second spurt, occurring in the second flood, contributed the maximum spawn in bulk.

Microscopic analysis of the spawn spurts revealed that the average percentage of major carps was 40.5% while minor carps and 'others' constituted 54.6% and 4.9% respectively. The percentage of desirable spawn in different spurts *i.e.* from 1st to vth was estimated at 65.3, 42.4, 39.1, 37.4 and 18.1 respectively. Seasonal index of quantity and quality was estimated at 3977.3 ml and 65.8% respectively.

Nursery and plastic pool rearing denoted the average percentage of major carps to be 65.8%, *C mrigala*, *C. catla* and *L. rohita* constituting 36.6%, 8.9% and 20.3% respectively and the minor carps, represented by *L. bata* and *C. reba* etc. contributing 34.2%.

Current velocity of the river ranged between 0.42 to 1.75 km/hour at the site and during the availability period it fluctuated between 0.66 and 1.16 km/hr. Amongst the various parameters studied, the range of variation in the turbidity values was of a high order *i.e.*, 157 to 1200 ppm but the spawn was available when these values ranged between 330 to 500 ppm.

A remarkable achievement of the project was towards the progress made in the direction of segregation of desirable spawn from the mixed riverine collections. Based on the success of last years' experiments more concentric sieves with a range of 1/20" to 1/36" mesh size were farbicated and the results obtained were very encouraging. It was interesting to note that during one hour duration, some of the mixed hatchlings (5 ml) which had been kept in the innermost compartment, escaped on their own through different sieves. The number of hatchlings retained in different sieves were as follows :

Mesh-size of sieve	No. spawn retained	Percentage
(a) 1/20"	168	6.7
(b) 1/24"	334	13.2
(c) 1/28"	740	29.3
(d) 1/36"	1255	49.7
(e) Escaped from 1/36"	27	1.1
	2524	

In the two sets of experiments, spawn samples retained and escaped through sieves of different mesh sizes were analysed and the results summarised are as below :

Sieve	*1st set* Percentage of		*II set* Percentage of		Average %
	Desirable	Undesrable	Desirable	Undesrable	
(a) 1/20" (Retained)	88.0	12.0	90.8	9.2	89 4
(b) 1/24" —do—	70.0	30.0	76.0	24 0	73.0
(c) 1/28" —do—	48.0	52.0	44.0	55.6	46.2
(d) 1/30" —do—	37.0	63.0	47.0	53.0	42.0
(e) 1/36" —do—	26.0	74.0	44.0	56.0	35.0
(f) 1/36" (escaped)	12.0	88.0	0.0	100.0	6.0

Thus the average percentages retained by 1/20", 1/24", 1/28", 1/30", 1/36" mesh-sized sieves respectively were 89.4, 73.0, 46.2, 42.0 and 35.0 respectively while the percentage escaped through 1/36" meshed sieve was 6.0 only. More experiments have been planned.

About 200 ml of spawn (c 1.0 lakh hatchlings) was reared in recirculatory pond and the average size of mrigal, catla and rohu were observed in the size and weight ranges of 136-172 mm ; 25.45g, 224-295 mm ; 120 to 280g and 180-284 mm ; 60 to 240g respectively during a period of about four months.

Plankton population of the recirculatory pond was estimated to be in between 3742 (October) and 6934 u/1 (June 81), with the phytoplankton dominating over the zooplankton.

D.O. of the pond water was between 3.5 and 7.0 ppm pH, 7.6 and 8.0 and alkalinity, 50.0 and 84 0 ppm.

Project-5 : Brackishwater Fish Farming

Problem No. 5.17 : Brackishwater shellfish breeding and culture in Madras region.

Personnel : K. Raman, K. V. Ramakrishna, G. R. M. Rao, S. Srinivasagam, K. Gopinathan, Munawar Sultana, P. M. A. Kader and S. Krishnan.

Duration : 1978-1984.

Location : Madras.

Field experiments conducted in a 0.01 ha nursery pond with *P. monodon* (75-81 mm) and *P. indicus* (52-76 mm) at a ratio of 1 : 6 and density of 35,000/ha and with artificial feed (prawn meal+gram+tapioca in the ratio 2 : 2 : 2). *P. monodon* gave an average increment of 58.8 mm/18.8 g in two months. The survival was 64% and the yield was 709g. Three experiments on culturing *P. monodon* in nylon cages fixed in the lake also were carried out. Various types of feed mixtures like prawn meal + gram + tapioca (2 : 2 : 1), fish meal + rice bran + wheat powder (1 : 1 : 1) and prawn meal + rice bran + wheat powder (1 : 1 : 1) were tried and recommended the first one *i.e.* prawn meal + gram + tapioca mixture. Six short-term experiments were conducted on rearing crab juveniles fed on trash fish. Growth varied between 7.25 mm and 11.00 mm of carapace width and 9.5 g and 49.85 g in wt. Fish and shellfish seed survey was continued.

Problem No. 5.18 : Oyster-cum-Fish culture.

Personnel : K. V. Ramkrishna, K. Raman, R.D. Prasadam, G. R. M. Rao, M. Kaliyamurthy, S. Srinivasagam, K. O. Joseph and S. Krishnan.

Duration : 1979–1984.
Location : Madras.

The spat fallen during December 1980 have grown to a maximum height of 48.0 mm and length of 43.0 mm. Fresh spat fall was noticed during first quarter of this year. They measured 25-65 mm in height and 20-55 mm in length at the end of 8 months.

Fibre glass tanks (2.7 x 0.85 x 0.75 m) provided with partitions designed for vertical circulatory movment of water have been ordered for the work. It is envisaged to make use of the water pumped up the recently installed solar water pump at Pulicat for this experiment.

Problem No. 5.38 : Culture of *Lates calcarifer*.
Personnel : D. D. Halder, M. K. Mukhopadhyay, N. K. Das, S. K. Mondal and D. Sanfui.
Duration : 1978-1982.
Location : Kakdwip.

L. calcarifer fingerlings were stocked @ 1600/ha in a 0.06 ha feeder canal. Regular flushing of tidal water was maintained in the canal during spring tides to provide forage fish and prawn to the stocked fishes. In about 30 days the fishes had grown to 141.36 mm/36.707g from the initial size of 127.52 mm/24.0 g. In a bigger canal of 0.13 ha, stocking of *L. calcarifer* has been initiated and the fishes are regularly fed with forage fish and prawn drawn into the canal through tidal ingress. The experiment is in progress. The experiment on prey-predation relationship is also in progress. Studies on racial difference of *L. calcarifer* is continuing.

Problem No. 5.40 : Mullet Culture.
Personnel : N. K. Das, N. M. Chakraborti, R.K. Chakraborti and S.K. Mondal
Duration : 1976-1982.
Location : Kakdwip.

Culture of mullets was taken up in two 0.06 ha ponds. Since *L. parsia* fry were not available for stocking, only fingerlings of *L. tade* of av. size of 57.7mm 3.06g were stocked @ 20,000/ha in both the ponds. As per the sampling on 12.11.1981, fishes had attained the size of 152 0 mm/41.4 g in one pond and 125.6 mm/ 30.0 g in the other pond. When assessed through repeated netting, survival was found to be low due to inadvertent entry of the carnivorous fish, *L. calcarifer*. As a result, the experiments were discontinued and fresh experiment was initiated in one pond of 0.06 ha with *L tade* of the size of 138.5 mm/35.7 g, @ 5000/ha on 12.11.1981. The fishes are daily fed with rice polish @ 2% of body weight.

Fertilisation and manuring of the ponds and analysis of physico-chemical parameters of the culture ponds are being carried out.

Problem No. 5.47 : Utilization of municipal agricultural and industrial wastes in aquaculture.
Personnel : R. K. Banerjee, P. Ray, H. C. Karmakar, N. N. Majumdar and S. K. Chatterjee.
Duration : 1977—1982.
Location : Calcutta.

Observations were made on the chemistry and manurial values of the antibiotic factory waste, penicillin mycellium, the compostable fraction of Calcutta city garbage and sewage sludge. The possibilities of increasing the protein content of the waste through aerobic and anaerobic ensilage and intermixing of several wastes were explored. The chemical composition of penicillin

mycellium found to contain nitrogen 4.94-6.53%, P_2O_5 1.87-2.75%, calcium 14.3-32.5 ppm, iron 15.7-36.7 ppm, manganese 4.9-8.4 ppm, organic carbon 58.8-77.5% and C/N ratio was 10.01-12.23 pH was 6.8-7.2. The mineralisation % rates were 20.87 and 22.74 in fresh and brackishwater respectively. Nitrogen, P_2O_5 and K_2O levels of the compostable fraction ranged between 1.23-1.47%, 0.29-0.31% and 0 69-1.18% respectively. A rich source of animal protein could be evolved when certain wastes were mixed together. Maximum production of maggots (insect larvae) could be achieved when poultry dropping, cotton seed wastes and distillery wastes or penicillin mycellium were mixed. 100-229 maggots/13cm^2 could be produced on the 5th day of processing the wastes.

Problem No. 5.51	:	Ecology of brackishwater impoundments.
Personnel	:	S. C. Thakurta, G. N. Saha, A. C. Banerjee, N. N. Majumder, S. P. Ghosh and B. B. Das.
Duration	:	1980—1983.
Location	:	24-Parganas Dist (W.B.).

Studies on the ecology of two brackishwater impoundments were carried out during the year. Soil qualities of Sikdar bheri (available nitrogen 23.8-39.8 mg, available P_2O_5 2.8-3 2 mg/100 g and organic carbon 0.5-10%) were richer than of Ahir bheri (avl. N. 19.5-23.7 mg, available P_2O_5 2.2-2.4 mg/100 g and organic carbon 0.29-0.63%. The concentration of phosphate (0.12-0.25 ppm) and nitrate (0.08-0.20 ppm) was also higher in the former as compared to the latter (0.08-0.20 ppm and 0.05-0.1 ppm respectively). The variation in pH (7.4-8.6) and salinity (8.1-35 3%) between the two bheries was not very remarkable. Redox potential value indicated that Sikdar bheri (— 300 mv to + 310 mv) was in more reduced condition as compared to Adhir (—190 mv to + 230 mv). The average biomass production was also recorded higher in the former (200 mg-350 mg/m^2) than in the latter (170-330 mg/m^2).

Problem No. 5.52	:	Fertilization of brackishwater impoundments.
Personnel	:	G. N. Saha, H. Singh, S. B. Saha, S. P. Ghosh and B B. Das.
Duration	:	1978 onwards.
Location	:	Calcutta/Basirhat (West Bengal).

Two yard and one field experiments were conducted to evalute the effect of superphosphate alone @ 20 kg P_2O_5/ha and in combination with urea in the ratio 1 : 4 P and N on survival and growth of postlarvae of *P. monodon* and fry of *Mugil* spp Among the treatments, the fertilizer combination 1 : 4 gave better results Respective survival and growth of these were recorded as 76% ; 19.89 mm/34.7 mg and 100% ; 34.0 mm/510.4 mg. In another experiment the combination of inorganic fertilizers and organic manure in the ratio 1 : 1 : 20 (N : P : organic) gave maximum density of *Brachionus* sp. in which significant results in survival and growth of *P monodon* (71%; 22 0 mm/69.0 mg) was achieved under a higher density of prawn post-larvae (100/tub) than the above experiment (25/tub). Results indicated that the survival and growth of prawn post-larvae was enhanced by the abundance *Brachionus* sp.

Field experiment at Arbelia was vitiated due to breaches in bundhs caused by heavy rains.

Problem No. 5.57	:	Induced breeding of penaeid prawns
Personnel	:	D. D. Halder. P. Ravichandran, S. M. Pillai and R. K. Chakraborti
Duration	:	1978-1982
Location	:	Kakdwip

Trials were made for maturing *P. monodon* in confined conditions. The prawn didn't mature due to low saline conditions. Regular experiments could not be carried out at Bakkhali due to unavailability of adult prawns.

Problem No. 5.58(a) : Intensive culture of brine shrimp, *Artemia salina* Leach for smallscale hatchery use.

Personnel : A. C. Nandy, H. Singh, H. C. Karmakar, N. N. Majumder, D. D. Halder and R. K. Chakraborti.

Duration : 1981-1984

Location : Calcutta/Kakdwip.

Observations were carried out in the laboratory on mass rearing and survival of the brine shrimp, *Artemia salina* nauplii to adult under different stocking densities using three types of cheap inert diets such as rice bran suspension, dried brewer's yeast and activated yeast. Nine cylindrical glass jars each of 3 litres capacity were used as culture conatiners.

These were stocked with newly hatched nauplii at 1000/litre, 2000/litre and 3000/litre. The results of the trials made on different stocking densities using different diets revealed 85.2% survival with rice bran suspension at high stocking density of 3000/litre as against 82% and 72% using dried and activated yeast respectively. Laboratory experiments were carried out for production of viable cysts of the brine shrimp, *Artemia salina*.

Problem No. 5.60 : Standardisation of transport techniques of commercially important brackishwater prawn and fish seed.

Personnel : Hardial Singh, G. N. Saha and S. K. Chatterjee.

Duration : 1979-1981

Location : Calcutta.

Chloral hydrate was found to be a good sedative for transporting seed of *Penaeus monodon* when 94% post-larvae survival up to 20 hrs in oxygen-packed cotainers. In a plastic bag under oxygen pressure 2500 post-larvae of *P. monodon* (10-12 mm) was safely transported from Calcutta to Gujarat covering a period of 28 hours. Sand @ 250 mg/bag was found useful in preventing the larvae from getting entraped into the folds of knotted bag. Juveniles of *Macrobrahcium rosenbergii* (80-115 mm) were safely transported in oxygen filled polythene bags (@ 50/bag) when the journey period was limited to 9 hours.

Problem No. 5.62 : Multiple cropping of *Penaeus monodon* and mullets in low saline ponds at Bakkhali

Personnel : M.K. Mukhopadhyay, S.M. Pillai S.K. Mondal, D.D. Halder and R.K. Chakraborti.

Duration : 1979-1981.

Location : Kakdwip, Calcutta.

The 0.25 ha low saline R-pond has been stocked @ 10,000/ha with *L. parsia*, *L. tade*, *M. cephalus* and *P. monodon*. The average stocking size of *L. parsia* and *L. tade* was 60.0 mm/4.0 g and 185.0 mm/60.0 g, respectively. The fishes were daily fed with rice bran and mustard oilcake @ 5% of the body weight. The experiment is in progress.

Problem No. 5.63 : Culture of *Penaeus monodon*

Personnel : P. Ravichandran, S. K. Mondal, R. K. Chakraborti, S. M. Pillai, and D. Sanfui

Duration : 1979-1981

Location : Kakdwip

Nursery rearing of *P. monodon* was carried out in five 0.02 ha ponds. The rearing period was extended to three months to study stunting process. Postlarvae of *P. monodon* in the average size of 11.5 mm were stocked @ 10 nos/m^2 in four ponds and 7.5 nos/m^2 in one pond. The average final size attained by the prawns in 90-100 days ranged from 61.5 mm/1.8 g to 119.1 mm/12.2 g. The survival rate varied from 13.7% to 90.4%. At higher survival of 90.4% stunting of the prawn was significant and they attained only 61.5 mm/ 1.8 g. At low survival of 13.7%, the prawns had grown better and attained 119.1 mm/12.2 g.

Culture of *P. monodon* was carried out in three ponds of 0.02 ha. Juveniles of *P. monodon* of 52.4mm/ 0.5g size stocked @ 25000/ha attained 126.1mm/16.2g to 129.9 mm/17.8g in 159 to 161 days. The survival and production of the prawns varied from 11.4-320% and 50.0-141.5 kg/ha/crop. During the culture operation pond depth, temperature, turbidity, salinty, DO, pH, alkalinity, phosphate and primary productivity fluctuated from 53-85 cm, 25.5-305°C, 135-240 mm, 2.6-6.0 ppt, 4.8-11.5 ppm, 8.4-9.1, 56-130 ppm, 0.001-0.02 ppm and 148-733 mg C/m^3/hr, respectively.

Problem No. 5.65 : Induced breeding of brackish-water fishes in Madras region.

Personnel : K. V. Ramakrishna, C.R M. Rao, R. Radhakrisnan, C. P. Rangaswamy, M. Kaliyamurthy, K. C. Joshep and S. Krishnan

Duration : 1979-1684

Location : Madras

Six sets of *Liza macrolepis* and three sets of *Sillago sihama* were subjected to hypophosation with no success. In field experiments on culture of fish food organisms in pits using different organice and inorganic fertilizers, a combination of NPK (17 : 17 : 17) and muriate of potash in 1 : 1 ratio @ 1000 kg/ha gave the best results in producing diatoms and blue green algae.

In laboratory cultures of diatoms, modified Miquels' solution produced a diatom concentration of 5500 units/ml in 7 days, in which *Skeletonema* sp. formed 74%.

Problem No. 5.66 : Studies on nutrition of the prawn, *Penaeus monodon.*

Personnel : S.M. Pillai, N.A. Reddy, P. Ravichandran, S. K. Mondal, D. D. Halder and D. Sanfui

Duration : 1979-1982

Location : Kakdwip

Two types of feed pellets (I & II) were prepared usingplant and animal ingredients in various proportions, fortified with vitamin and mineral premix. In both feeds animal ingredient, prawn meal in feed I and fish meal in feed II, accounted for 70% of the diet. Biochemical analysis of the feeds showed 34.31% protein and 0.55% fat in feed I and 22.93% protein and 0.60% fat in feed II. Protein content of few ingredient was also estimated and it was found that prawn meal, fish meal and groundnut oil cake contained 51.6%, 35.7% and 51.5% protein, respectively.

Biochemical analysis of *P. monodon* revealed that early juveniles of prawn in the size of 20mm-30mm contained 61.5% protein. Calcium matabolism of *P. monodon* in relation to moulting cycle was initiated and it is estimated that the calcium content of *P. monodon* of 75-80mm/4.0g in pre-and post moult stages was 46.68mg/100g and 36.55mg/100g on wet weight basis.

Problem No. 5.67 : Cultivation of *Derris* plant for increasing rotenone content

Personnel : P.R. Das (CIFRI) and B.K. Gupta (Jadavpur University)

Duration : 1980-1983

Location : Barrackpore

The haloplytic plant *Derris trifoliata* var *uliginosa* was collected from Sunderbans and acclimatised in the non-saline soil of Barrackpore. The plants were treated with a growth retardant hormone, cycocel and the rotenone content increased from 2.2% to 3 5%. Further studies are in progress.

Problem No. 6.68 : Pen and cage culture of fishes and prawns in the shallow areas of Pulicat lake.

Personnel : R.D. Prasadam, G.R.M. Rao, K. Kaliyamurthy, C. P. Rangaswamy, Munawar Sultana, S. Srinivasagam, K. V. Ramakrishnan, K. Raman, K. Gopinathan and P.M.A. Kader.

Duration : 1980-1982

Location : Madras

Through mized culture of *P. indicus*, *P. monodon* and *L. macrolepis* @ 50,000/ha in a pen of 0.06 ha, a production of 219.3 kg/ha was obtained in 8 months. Cage culture of *Chanos chanos* @ 5,000/ha yielded 750 kg/ha in 139 day with a survival of 52%, 11,000 fry of *Chanos* collected in September are ready for stocking. Culture of *Nematalosa nasus* and *Hemiramphus gaimardi* suffered a set back due to heavy mortality. Mullet fry reared at the stocking densities of 1.2 and 2½ lakhs/ha registered monthly growth rate of 9mm to 15.6 mm.

Problem No. 5.70 : Controlled breeding and development of hatchery techniques for brackishwater shrimps and fishes.

Personnel : G. V. Kowtal

Duration ; 1980-1984

Location : Puri

Four sets of *L. macrolepis* were successfully bred and 4 lakhs of eggs were fertilized following dry method Development was followed up and 1.5 lakhs of hatchlings were reared for 4 days.

One gravid *P. merguiensis* (161 mm/38 g) was partially bred and yielded 1.2 lakhs of eggs. The hatching was successful with a hatching rate of 66.7%. The larvae could be reared beyond post larval stage V.

Problem No. 5.71 : Influence of salinity on the growth and survival of penaeid prawns in brackishwater impoundments.

Personnel : Hardial Singh, S.C. Thakura, S K. Chatterjee and B.B. Das

Duration : 1981-84

Location : Calcutta/24 Parganas

Observations on the growth of *Penaeus monodon* were made in eight bheries, located in Arbelia, Haroa, Nazat and Sandeshkhaii in the district of 24-Parganas, West Bengal. Low salinity (3.0 to 17.5 ppt) and favourable temperature (between February and June) were conducive for the growth of *P. monodon* which attained and average size of 155-175 mm within 120 days. Primary productivity values recorded higher at Nazat and Sandeshkhali (204-330 mg/C/m^3/hr).

The bottom biota was also higher both qualitatively and quantitatively at Nazat and Sandeshkhali (14.0-45.59g/m^2) than Arbelia and Haroa (4.0-15.0g/m^2).

Problem No. 5.72 : Fertilizer-soil-water interaction in brackishwater impoundments

Personnel : R.K. Chakraborti and D. Sanfui

Duration : 1981-1982

Location : Kakdwip

Three sets of laboratory and field experiments were conducted. In the first experiment, superphosphate was applied @250 kg/ha/yr in monthly instalments at 5.4 ppt, 9.2 ppt, 14.5 ppt and 18.67 ppt water salinity levels. At 5.4 ppt and 9.2 ppt levels, phosphate availability increased upto first 21 days but at 14.5 ppt and 18.67 ppt levels phosphate availability increased only for the first 10 days.

In the second experiment, at a salinity level of 7.3 ppt, superphosphate was applied at the rate of 200kg, 250 kg and 300 kg/ha/yr. Analysis of variance of data on phospate availability showed that there was significant interaction between period and treatment. Phosphate availability in ponds treated with 300kg was signaficantly higher than that of other ponds.

The third set of experiment was done with a combination of inorganic and organic fertilizers, urea and superphosphate @ 200 kg, 250 kg and 300 kg/ha/yr and poultry droppings @ 1000 kg/ha/yr applied in monthly doses showed significant increase in primary productivity with increased doses. Over a period of 75 days, primary productivity was estimated to be 254, 274 and 284 mg C/m^3/hr, respectivley at these three levels of fertilization.

Problem No. 5.73 : Studies on the metabolism of *Penaeus monodon* in relation to moulting cycle and environmental factors

Personnel : N. A. Reddy, P. Ravichandran, R. K. Chakraborti and P. K. Mukhopadhyay

Duration : 1981-1983

Location : Kakdwip

Experiments were conducted to study the changes in matabolic rate (rate of oxygen consumption) of postlarvae (10-15 mm/6.5-8.0 mg) and early juveniles (20-30 mm/50-150 mg) of *P. monodon*, subjected to different salinity-temperature regimes. Prawns acclimated to 7.5-8.2 ppt salinity were subjected to sudden transfer to 1.8 ppt (lower limit) and 14.5 ppt and 30.25 ppt (higher limit). Similarly animals acclimated to 23-24°C were transferred to 32-33°C and metabolic rates assessed. Combined effects of salinity and temperature on metabolic rates were estimated. Prawns acclimated to particular salinity showed increase in metabolic rate when transferred to lower regime and decrease in higher regime. At higher temperatures animals consumed more oxygen than at lower regimes. Postlarvae acclimated to a salinity-temperature regime of 8.5 to 9.0 ppt-23 to 24°C when subjected to a sudden transfer to 2.1 ppt ; 33°C and 14.9 ppt ; 33°C regimes, resulted in 50% and 90% mortality, respectively within three hours. But when the animals were maintained at 9 ppt ; 32°C, no mortality was observed within the same duration.

To study the moulting cycle of *P. monodon*, the animals are being maintained in split bamboo cages (2'x1'x1') kept in ponds. Studies on the effect of eye-stalk ablation on moulting frequency are in progress.

Changes in biochemical constituents are being analysed in pre-moult and post-moult animals (75-80mm/4.0 g). There are significant changes in ash and calcium contents of the prawns from pre-moult to post-moult stage. Calcium content of pre and post-moult prawns is 46.68 mg/100 g and 36.55 mg/100g on wet weight basis. While the ash content of the prawn in pre-moult stages was 3.10% and 2.70%, the lipid content was 3.10% and 3.03% in pre—and post-moult stages. Protein content of early juveniles of *P. monodon* was 61.5% on dry weight basis.

Project 6 : *Freshwater Prawn Culture*

Problem No. 6.2 : Breeding and culture of *Macrobrachium malcolmsonii*

Personnel : K.V. Rao, K.J. Rao, D.S. Murthy, T.S.R. Raju and K.S. Rao.

Duration : 1974-1982.

Location : Badampudi fish farm, W. Godavari : Dist., A.P.

Experiments on the culture of *M. malcolmsonii* were continued in the three ponds of approximately 0.1 ha each. Mixed culture of the species in all the ponds with selected species of fish like catla, rohu, silver carp and grass carp was carried out. Due to extreme adverse conditions during the summer of 1980, only one crop of prawn could be raised. Juveniles of *M malcolmsonii* (av. size 34 1 mm/0. 3g.) were obtained from Chilakampadu lock on Undi irrigation cannal.

Fingerlings of selected fish species were stocked at different ratios in different ponds at the rate of 4,500/ha. The stocking rate of *M. malcolmsonii* was kept at 50,000/ha.

Regular monthly manuring with cattle dung at the rate of 10,000 kg/ha and liming of the ponds at the rate of 200 kg/ha was done. The fish and prawn were fed with rice bran and groundnut oil cake in the ratio of 1.1 at the rate of 2% of body weight of fish and 10% body weight of prawns. Aquatic weed, *Hydrilla*, was given to the grass carp regularly.

Problem No. 6.5 : Culture and breeding of *Macrobrachium birmanicum choprai* in freshwater ponds.

Personnel : J. C. Malhotra and D. R. Kanaujia

Duration : 1977–82

Location : Buxar

Rearing of *M. birmanicum choprai* continued in two ponds. Liming was done and feed consisting of groundnut oilcake, rice polish and maize in the ratio of 1 : 1 : 1 was provided. Harvesting was done in April-May, after 7-8 months of rearing. Growth was not found satisfactory. At later part of the experiment, the prawns were in berried condition, but failed to breed.

In another set of experiment in each of the two ponds 100 nos. of berried females were released. Both were filled with monsoon water, one treated with 20 ppm lime and 10 ppm at sodium chloride. Though hatched out in both the ponds, none did survive. Moreover the larvae found to be infected with ciliates. The females once again found to be in berried condition in the 1st week of October without the presence of males. Larvae were hatched out in laboratory. Experiments were conducted for rearing and breeding the adults and hatching & rearing of larvae under laboratory conditions in glass jar aquaria (16″x 8″ x 8″) and plastic tanks (3′×3′). The adult berried females were collected from river Ganga. Larvae were hatched out in 9-12 days but did not survive after two weeks. Pond water, tapwater, water from Ganga and water treated with 5-10 ppm NaCl were used as rearing media.

Rivers Ganga, Sone, Gandak, Ghaghra and Karmanasha were surveyed for adult, berried and juvenile *M. choprai*. The places covered under the survey were Tarighat, Chousa, Buxar, Sinhaghat, Chaapra, Chain chapra, Sonepur, Hajipur, Patna, Moongor, Bhagalpur, Sahibganj and Farakka. Adult and berried prawns were found at all the places. At Buxar the landing was 10-20 kg/day during August and September. Compared to last few years, *M. choprai* figured more in the commercial landings this year. However juveniles were not found at any of these places.

Problem No. 6.9 : Culture of commercially impor-

tant fishes and prawns in cages and pens in Kolleru lake in A.P.

Personnel : K.V. Rao, K.J. Rao, D.S. Murthy, T.S.R. Raju and K.S. Rao

Duration : 1981-86

Location : Tadepalligudeam (A P.)

Experiments on pen and cage culture of fish and prawn in Kolleru Lake, were continued.

Rohu, silver carp and grass carp in 3 : 1 : 2 ratio were stocked at the rate of 40,000/ha in the pen enclosure of 0.01 ha. *Macrobrachium rosenbergii* was also stocked in the pen at the rate of 40,000/ha. Periodic sampling could not be done in the pen enclosure due to higher depth exceeding 2 m. during the monsoon and postmonsoon months. Sampling of the biomass was done only once on 12.5.81, when the average size of rohu, silver carp and grass carp were recorded to be 252.5 mm, 300.0 mm and 300.0 mm respectively. *M rosenbergii* did not appear in the catches

One cage of 2 sq.m was stocked with *Channa striatus* at the rate of 30/sq.m. It has recorded a growth from 150 mm to 205 mm by 12.5.81 and 261 mm by 23.10.81 The second cage was stocked with *M. rosenbergii*, but all of them were dead within one month.

One cage was stocked with *Pangasius pangasius* at the rate of 40/sq.m on 15.10.81 with a stocking size of 90.6 mm/5.67 g. It has been observed to have gown to 125.5 mm/14.7 g. by 4.12 81.

Regular data on plankton, bottom fauna and physico-chemical features of the ponds was collected.

Occassional harvesting of grown up prawn was done.

The experiment was continued for 10 months and a production of 2.2 t./ha of fish and 113.5 kg/ha of prawn from pond I, 1.4 t./ha of fish and 178.8 kg/ha of prawn from pond II and 2.5 t./ha of fish and 427 kg/ha of prawn from pond III could be obtained.

Problem No. 6.6 : Seed production of the giant freshwater prawn *Macrobrachium rosenbergii*

Personnel : M. Subrahmanyam, A. V. P. Rao, L. H. Rao and D. R. Rao

Duration : 1979-1982

Location : Kakinada (A.P.)

Mass larval rearing trials in 3.5 tons capacity F.R. P. Tank were only partially successful due to insufficient number of berried females.

In one of the trials, at a stocking density 19,260 (10/1), 18% survival was obtained at the end of 52 days of rearing. The cost of production (power+feed +labour) per thousand seed worked out to be about Rs. 110/-.

At normal stocking density (40-60 larvae/litre) the cost of production would be Rs. 18.39-27.58. The stocking density the present case was only 1/4-5/6 of the normal due to paucity of berried individuals

Although some initial set-backs occurred during the first half of the year, from July onwards laboratory-bred brood stock of small sizes was available for production of seed The number was however, insufficient for mass rearing trials due to their small size and low fecundity. The target prodution for the year was achieved.

A trial of 46,885 seed produced under the project were distributed to the farmers.

Seed distributed to farm families

February—May 1981	:	14,937
August —December, 1981	:	31,948

Production of baby worm work was vitiated due to continuous seepage loss of water from worm beds.

Problem No. 6.7	:	Development of artificial feeds for rearing the larvae of commercially important palaemonid prawns.
Personnel	:	K. Janaki Ram and P.S.C. Bose
Duration	:	1976-1982
Location	:	Kakinada

During the first half of the year i.e., February to May 1981, larval rearing trials of the prawn *Macrobrachium rosenbergii* were conducted in green seawater in ($12\pm2‰$) plastic pools (500 l) maintained in outdoor conditions to confirm the utility of some soft slaughter house products as feed for the larvae. The green water harboured population of rotifers which formed food for initial stages of larvae. In nearly all the trials made, the larvae reached VIII to IX zoeal stage in 20-25 days but subsequently died due to deterioration of water condition. In one trial conducted during the period 7.4.81 to 18.5.81 in which newly mixed seawater was employed, 17 nos. of postlarvae along with 18 nos. of advanced larvae (II zoeal stage) were obtained During the later half of the year viz., October to December 1981, the larvae in outdoor experimentation could reach only VII to VIII zoeal stage and then died because of low ambient temperatures.

The experiments on larval rearing of the prawn *M, malcomsonii* were conducted during the period July to October 1981 with same feeds like natural plankton and some soft slaughter house products, in mixed medium of three different salinities i e $3\pm2‰$, $6\pm2‰$ $9\pm2‰$ in plastic pools (500 L). The larvae reached V zoeal stage in $6\pm2‰$ medium of sea water, while the larvae died with in few days after stocking in rest of the saline media.

A transparent canopy was fabricated for outdoor experiments in future to facilitate sunrays to pass through preventing dust and rain water entering the rearing medium.

Project 8 : Estuarine and Brackishwater lake Fisheries.

Problem No. 8.1	:	Brackishwater fish and prawn prospecting of the Hooghly-Matla estuarine system.
Personnel	:	K. K. Bhanot, D K. De, R. N. De and H. S. Mazumder.
Duration	:	1968-1984
Location	:	Hooghly-Matla estuary.

Trials were made with standard Midnapur type cotton shooting nets and nylon drag net to determine the suitability of the gear.

Shooting net callections have indicated that mostly mixed species are eaught by this gear. The net has since to be adjusted every 15-20 mts, according to the rise or fall of the tidal level, it has been noticed that quantitatively the catches are more within the first 2 or 3 collections as compared with the latter catches. The per net hour catches around Nurpur in the Hooghly estuary have indicated the area as a potential source of *Metapenaeus brevicornis*, *M. monoceros*, *Macrobrachium sude*, *M. mirabilis* and *Palaemon styliferus*. Amongst fishes, mostly catches comprised trash fish like *Anchoriella*, gobids and *Ambassis* species. The peak periods of availability of the species has been

indicated in the table below :—

Species	Size range mm	Number	Months
M. brevicornis	24-30	496,648	October, November
M. monoceros	23-30	840,320	August, September
M. mirabilis	15-39	608,760	September, October
M. rude	24-43	65,188	July, August
M. styliferus	20-30	26,72	June, September

The collections were also made with a 100'x15' nylon drag net around Canning. Three hundred numbers of *Liza parsia* in the size group of 30-50 mm could be collected within one hour by employing six fishermen. Seed collected by this gear was in healthy state and devoid of debris and other unwanted species.

The shooting net collections did not yield *L. parsia* though the commercially important species of prawns were obtained. The per net hour catches are given below :—

Species	Size range mm	Number	Months
P. monodon	15-20	52,168,40	May, June, September
P. indicus	20-35	87,122,100	April, May, June
M. brevicornis	15-35	62,50	May, June
P. styliferus	13-25	50,88	April, July
M rude	10-25	25,77	June, July

The food and feeding habit of 110 young ones of *Hilsa ilisha* ranging from 20-100 mm in length were studied. The specimens were obtained from different centres of the upper stretch of the Hooghly estuary viz. Dhatrigram, Nawabgunj and Barrackpore. The stomach contents were analysed for various size groups Viz. 21-50 mm and 51-100 mm in order to see if there was any difference in dietary habits of the fish at various stages of its growth. Fry of the size 21-50 mm subsisted mainly on Zooplankton consisting of copepods (35%), rotifers (5%) and copepod fragments (40%). Copepods were represented by *Cyclops* sp and *Diaptomus* sp & rotifers chiefly by *Keratella* sp and *Brachionus* sp. The size group 51-100 mm showed cladocerans (10%) and Diatoms (5%) in addition to planktonic copepods (20%), rotifers (8%) and copeod fragments 35%. *Moina* sp. and *Diaphnia* sp. were the main cladocerans. Among diatom, *Trichocera* sp. and *Melosira* sp. were more common. Phyctoplankton were scarcely observed. No distinct period of abundance of any particular group of food items was observed.

Problem No. 8.7 : Reproductive biology of few brackishwater lake fishes

Personnel : K. K. Bhanot

Duration : 1975 to 1981

Location : Barrackpore

No mature specimens were available beyond the third stage of maturity in the area around Kakdwip. The salinity in this area ranged from 2-6‰ during the year.

Problem No. 8.11 : Studies on prawn seed catch in West Bengal based on sample census.

Personnel : G. C. Laha, H. C. Karmaker, P.B. Das and B. B. Das

Duration : 1978 82

Location : Calcutta

The Calcutta fishing and assembly centres of *P. monodon* covered during the period under report were Nazat complex, Deharani, Barunhat, Kakdwip, Itindaghat, Sandeshkhali, Kulpi, Bibiabad, Taldi, Nischintapur, Hingalganj, Sangrampur and Par-hasnabad. Total estimated *P. monodon* and *M roesenbergii* seed in West Bengal was estimated to be 588 million and 26,576 kg

respectively. Nazat contributed maximum (61.9%) to the catch of *P. monodon*. The peak period of abundance was noted as February to May in all centres.

The peak availability of *Penaeus monodon* recorded per net per hour was 9400 in Nischintapur, 7932 in Kulpi and 1239 in Kakdwip. *M. rosenbergii* was obtained in large numbers (1370/net/ha) during July at Ghatal. *P. monodon* contributed 9% of the total catch in Nazat when the size and weight ranged from 9.92 to 12.00 mm and 2.9 to 4.1 mg.

Project No. 9 : Fish Genetics and Hybridization

Problem No. 9.4 : Fish chromosome investigations of Indian major carps and studies on cytological features of Indian major carp hybrids.

Personnel : R. K. Jana and V. R. P. Sinha

Duration : 1977-1982

Location : FARTC, Dhauli

Fifty diploid chromosomes were recorded in the cytological preparations of the kidney cells of F_2 generation of catla x rohu hybrid The same number of chromosomes were also noticed in the metaphase stage of the parent catla which has four types of chromosomes viz., meta centric, sub-metacentric, sub-telocentric and telocentric.

Problem No. 9.7.1 : Studies on the morphology, food and feeding habits, growth and cytological aspects of the hybrid between grass carp female and silver carp male.

Personnel : P.V.G.K. Reddy and V.R.P. Sinha

Duration : 1978 onwards

Location : FARTC, Dhauli

Observations on the morphological and meristic characters of the fingerlings of grass carp female x silver carp male hybrid and their parents indicated that the hybrid expressed more of maternal characteristics. Cytological studies have shown that both grass carp and silver carp have metacentric, sub-metacentric and telocentric types of chromosomes.

Problem No. 9.8 : Investigations for evolving specific markers like protein and isoenzyme for selective breeding and hybridisation of important cultivated carps.

Personnel : G. V. Kowtal and S. D. Gupta

Duration : 1981-1984

Location : Cuttack and Dhauli

Common carp male x silver carp female hybrids produced in 1980 have attained an average size of 242 mm/142 g. in fourteen months. During the breeding season of 81, hybrids of *C. carpio* male x *C. catla* female were produced successfully though most of the hatchlings were deformed and did not survive.

Problem No. 9.9 : Establishment and maintenance of the living gene pool of Indian major carps to collect the different land races, elaborate practical marketing systems, propagate for renewal of population in every five years.

Personnel : H. A. Khan, S. D. Gupta and George John

Duration : 1981 onwords

Location : FARTC, Dhauli

Though fingerlings ot Indian major carps were collected from the river Gomati, a tributary of Ganges and Brahmaputra, heavy mortality during transportation resulted in poor stock availability, Further collection of fingerlings of Indian major carps from different river systems would be taken up.

Problem No. 9.10 : Production of polyploid and androgenetic fish populations in Indian major carps and common carp.

Personnel : P.V.G.K. Reddy and George John

Duration : 1981-1983

Location : FARTC, Dhauli

Attempts to produce polyploid rohu by cold shock treatment at 4-5°C and 8-10°C resulted in the development of fertilized eggs upto blastula stage in 20-30% of eggs. All the eggs turned opaque after 10 hours of fertilization while the development of eggs in control was normal.

Common carp eggs, irradiated with U. V. rays to denature DNA contents, were fertilized with carp milt resulting in 4-5% development. Since all the eggs died within 24 hours of fertilization it was not possible to ascertain the haploid or diploid condition.

problem No 9.11 : Artificial gynogenesis and hormonal sex reversal of silver carp and grass carp with crossing gynogenetically inbred female and male lines.

Personnel : R.K. Jana and P.V.G.K. Reddy

Duration : 1981-1983

Location : FARTC, dhauli

Raising and rearing of grass carp and silver carp brood fishes are in progress.

Problem No. 9.12 : To develop practical methods of artificial gynogenesis and hormonal sex reversal of common carp.

Personnel : S. D. Gupta and George John

Duration : 1981-1983

Location : Dhauli

Gynogenetic offsprings of common carp were obtained from cold shock treated eggs. Further work is in progress.

Problem No. 9.13 : Artificial gynogenesis in Indian major carps

Personnel : George John and S.D. Gupta

Duration : 1981-1983

Location : FARTC, Dhauli

Gynogenetic rohu has been produced for the first time by fertilizing eggs with genetically inactivated sprem, followed by a cold shock of eggs. Genetic inactivation of sperms with a 15-watt U.V. tube for 15-20 minutes irradiation was found to be most suitable. Haploidy in eggs was observed in eggs fertilized with inactivated sperm. Haploidy was also demonstrated through the haploid syndrome in hatchlings.

It has been experimentally demonstrated that restoration of diploidy in eggs fertilized with activated sperm through cold shock (12°C) and heat shock (39°C) is possible.

Project 10 : Fish Farm Designing

Problem No. 10.2 : Studying seepage loss in ponds

Personnel : C.Saha, M.D. Mantri, C.D. Sahoo and S. L. Kar

Duration : 1975-1981

Location : FARTC/Dhauli

Work under this project remains suspended.

Project 11 : Economics in Fishery Investigations

Ptoblem No. 11.10 : Evaluation of existing infrastructural base in relation to institutional finance, marketing and legislation for propagation of aquaculture in West Bengal

Personnel : S. Paul and H. K. Sen

Duration : 1979-1981

Location : Barrackpore

The research work pertaining to the Project No. 11.10 was completed within the stipulated time in December 1981. After having examined in depth the relevant aspects the following conclusion has emerged.

Despite sustained research support the performance on production front in the state of West Bengal is not commensurating with requirements. This situation is attributable mainly to glaring disparity between the poor resources base of the receipients of technology and and higher capital requirements in the wake of heavy dependence on monetised inputs. The institutional finance is yet to make a dent on the situation. Contrary to popularly held belief the marketing system with all its infirmities does not seem to have arrested the pace of adoption of fish culture technology.

Problem No. 11.11 : Economic analysis of experimental, pilot-scale and large-scale freshwater aquaculture operations in India (UNDP/FAO Project)

Personnel : M. Ranadhir, B R. Shirsat, N. K. Tripathy and M. Rout

Duration : 1980-1983

Location : FARTC, Dhauli

Detailed data on input and output, both in terms of quality and value, from existing management practices and from ongoing experimental projects are being collected. Various economic indicators are being tried to compare the productivity of major inputs under experimental, pilot-scale and large-scale fish culture establishments. The economic feasibility of new scientific techniques are being investigated to find out whether additional revenue offsets the additional cost.

Problem No. 11.12 : Economic feasibility study of a well laid-out farm with dependable water supply and determination of minimum economic size of farm (UNDP/FAO Project)

Personnel : B. R. Shirasat, M. Ranadhir, N.K. Tripathy and M. Rout

Duration : 1980-1982

Location : FARTC, Dhauli

Data on input cost, price of fish at farm site and at market have been collected from relatively planned fish farms. Emphasis has also been given on collection of information on family holdings, optimum holdings, economic holdings etc. to workout a viable minimum economic size of a farm.

Problem No. 11.13 : Economics of the use of diffe-

rent sources of water in undrainable ponds.

Personnel : M. Rout, C. Saha, M. Ranadhir and B. R. Shirsat

Duration : 1980-1982

Location : FARTC, Dhauli

Data on conventional pumps operated by diesel and electricity with special reference to discharge and head, depreciation cost and operating cost of bamboo tubewell were collected. A solar pump has also been installed at FARTC to study its performance regarding water supply to fish ponds.

Problem No. 11.14 : Cost-price structure of aquaculture in eastern region of India

Personnel : S. Paul and H. K. Sen

Duration : Upto 1982

Location : Barrackpore

The progress of the work relating to Project No. 11.14 has been tardy mainly due to non-availability of time-series data on yield, input levels and returns. Attempts are being made to procure the necessary data. Preliminary investigations based on EA's All India indices of wholesale prices do reveal a pronounced upsurge in prices of both inputs and output.

Project No. 13 : Cold Water Fish Culture

Problem No. 13.16 : Breeding and nursery management of schizothoracid fishes.

Personnel : 1st Group (*Schizothorax niger* and *S. esocinus*)
H.B. Singh, Shyam Sunder, R.K. Langer (Central Unit), and G.N. Gazi (State Fisheries), upto August, 1981.
2nd Group *(Schizothorax curvifrons & S. plagiostomus)*
K.K. Vass (Central Unit), N.A. Qureshi (State Fisheries),

Duration : 1978-1982

Location : Harwan, Srinagar.

This year attempts were made to standardize the breeding and rearing techniques from egg to advanced fry and fingerling stage.

(a) *Schizothorax niger* and *S. esocinus :*

Out of these two species only one species, *Schizothorax esocinus*, could be procured and work was continued on this species.

In May, four ripe specimens of *Schizothorax esocinus* were bred by stripping at Telbal stream. Stripping was done by dry method. The size of brooders ranged from 250 to 500 mm in total length and from 500-1, 300 g in weight. The total number of eggs stripped was approximately 10,000 and rate of fertilization was between 80 and 90%.

Hatching experiments were conducted in trays under running water and stagnant water conditions. Under running water, a 10-15% higher survival of hatchlings was observed. Prophylactic treatment also resulted in 7-10% higher survival. At different egg densities in trays the following percentage of survival were observed. 250 eggs-40-55% ; 500 eggs-28-50% and 1000 eggs-25-40%.

Nursery rearing :

The fry produced were stocked in the third week of June @ 600, 800 and 1,600 in mud and cemented ponds (2.0-40 m^2 area). The fry were intially fed on skimmed milk and zooplankton in troughs and later on shifted to supplementary feeding in the ponds. The supplementry

feed consisted of a mixture of wheat bran, mustard oilcake and fish meal in 1 : 1 : 1 ratio with a pinch of salt and cobalt chloride, given 2-3 times a day.

The fry during a rearing period of about 170 days increased from an initial average weight of 0.040 g to a weight range of 0.750-1.500 g and from an initial length range of 9-12 mm to 60-75 mm. The overall rate of survival was 55.70%. About 30% of the stock was washed away due to flood.

The advance fry of *S. esocinus* produced in 1980 were also stocked in a different pond in January 1981 to study further behaviour. These advanced fry during the year were fed on a 1 : 1 mixture of mustard oil cake and wheat bran. The fish showed an increase to 90-120 mm by November 81 from the initial length range of 27-52 mm in January 1981. Similarly fish increased to a range of 4-5g from the initial average weight of 0.450 g. The survival from advanced fry to fingerling stage was recorded as 65%.

Physico-chemical features

Physico-chemical parameters of pond water during the period were temperature 5.8-27.5°C ; pH 7.1-7.4 ; total alkalinity 48-64 ppm ; silicates 0.010-0.032 ppm and dissolved oxygen 5.8-9.6 ppm.

Problem No. 13.20 : Standardisation of rearing techniques of brown and rainbow trouts from fry to yearing.

Personnel :

Brown trout : K. K. Vass, H. B. Singh, V. K. Bali (upto 30.9.81) (Central Unit) and Bashir Ahmed (State Fisheries).

Rainbow trout : G.N. Bhat, G.N. Gazi (State Fisheries) and R.K. Langer (Central Fisheries).

Duration : 1978-1982.

Location : Harwan, Srinagar.

Brown trout :

In the first week of March about 7,000 early swim-up fry were made available by the State Fisheries Department. The fry were stocked initially at two densities (1,000 and 500 per tank). These early fry, initially between March and April were fed on wet feed and between May and June on 1 : 1 mixture of wet and dry feed. Then from June onwards the fish were exclusively fed on dry powdered feed. This year feed having 35% of crude protein was tried. The feed was locally made in laboratory and the chief ingredients used were : animal meal 60% ; vegetable meal 30% ; brewer's yeast 4% ; shark liver oil 4% ; and supplemented with 2% mixture of vitamins and minerals. Pellet size ranged between 0.20 and 2.5 mm for the fry/fingerling of size range between 20 and 150 mm.

The brown trout fry after a rearing period of about 270 days (between March and November) increased to a length range of 70-140 mm and weight range of 3-25 g from the initial range of 17-20 mm in length and 80-100 mg in weight. An overall survival upto fingerling stage ranged between 35-40%. The weight to weight conversion ratio with this feed obtained was 2 : 1 having a feed efficiency of 56%.

The effect of density on the survival of fry in the first three months revealed that fry stocked at 500/tank (200/m²) gave 60-80% survival while the fry stocked at 1,000/tank (400/m²) gave only 50-60% survival during the same period. It was also observed that growth at low stocking was better. Subsequently when fingerlings were stocked with 100 and 150/m², there was hardly any difference either in their survival or growth.

The investigations on the causes of fry mortality in early phase were also taken-up this year. It was revealed that apart from heavy load of silt that comes into fry tanks during this period (since there is no proper desilting arrangement in the State Farm) taking a heavy toll of fry, there was protozoan infection on the tender fry. Main forms identified were *Costia, Trichodina, Chilodonella,* and *Icthyopthiris.* Frequent treatment of fish stock checked the spread of infection to a large extent.

Utmost care was taken to maintain good hygenic conditions in the ponds. Every fortnight the accumulated silt and faecal matter of the fry were cleaned from the ponds. The fish stock and the ponds were regularly given the required prophylactic treatments.

During the period the physico-chemical features of the water was, temperature 5-16°C ; dissolved oxygen 8.5-10.4 ppm ; pH 7.2-7.4 and total alkalinity 30-68 ppm. Fry/fingerlings were periodically restocked after size grading.

Problem No. 13.21 : Induced breeding of *Tor putitora*; rearing of stocking Material of *Tor putitora* in ponds.

Personnel : K.L. Sehgal, C.B. Joshi.

Duration : 1980-1981.

Location : Bhimtal, U.P.

No progress could be achieved since all efforts to get ripe spawners in gill net catches in Pong reservoir, the Baner and the Gaj rivers, met with no success.

Problem No. 13.24 : Ecology and energy flow studies in a sar (Kashmir).

Personnel : Shyam Sunder, K.K. Vass, H B. Singh and R.K. Langer.

Duration : 1981-82.

Location : Srinagar.

From May, the work on Naranbagh Sar was initiated. The sar about 35-40 km away from Srinagar (Lat.34°12'N and Long. 74°41' E and Alt. 1,587 m.a.s.i). The surface area of the sar is approximately 24 hectares (Max. length 0.80 km and max. width 0.40 km). During the period under report following investigations were conducted.

Detailed data for bathymetric mapping and morphometry has been recorded.

Various biological features of the system have been investigated by monthly sampling both at the pelagic and littoral zones. Sampling at pelagic zone was done all along the column with the help of indigenously devised water sampler. The results are summarised below :

a) **Zooplankton :**

Zooplankton analysis from different depths of the sar, showed that four main groups viz. Protozoa, Rotifera, Cladocera and Copepoda were dominant. The population density of total zooplankton from various depths ranged from 110 to 460 units/1 at surface (with Rotifera forming 20-78% ; Cladocera 15-20% ; Copepoda 5-54% and Protozoa nil-26%). At 1 m depth zone the zooplankton density was 150 to 760 units/1 (with 50-70% rotifer population) ; 350-2,800 units/1 at 2 m zone ; 420-680 units/1 at 3 m ; and 60-1,600 units/1 at 4m depth zone. At 4 m depth zone Protozoa formed 35-65% of population. At the littoral zone the total zooplankton density ranged between 20-540 units/1 during the period.

b) **Phytoplankton :**

Phytoplankton forms recorded from the sar belonged to Myxophyceae, Bacillariophyceae, Chlorophyceae

and Euglenophyceae. Members of Myxophyceae (mainly *Microcystis* and *Oscillatoria*) were recorded almost throughout the water column but were more abundant between surface and 2 m depth zone. Bacillariophyceae (mainly represented by *Eunotia, Navicula, Gomphonema, Fragilaria* and *Asterionella*) was a dominant group between 3/4 m depth zone. Chlorophyceae was mostly dominated by *Scenedesmus, Pediastrum, Saturastrum* and *Cosmarium*. The total phytoplankton density in the upper zones was usually below 20,000 units/l while in the deeper zones the density was higher often exceeding 50,000 units/l.

c) **Benthic fauna** :

Benthos were collected from sar at different depths and analysed. The major groups encountered in the monthly samples were oligochaetes (4.23%) ; Diptera (21.47%) ; Mollusca (71.98%) and others (2.32%). Others included nematodes and insects. Density of benthic organisms during the period ranged from nil-1.75,555/m^2.

d) **Periphyton** :

Periphyton samples were collected from natural vegetation in the sar (*Ceratophyllum, Potamogeton* and *Nymphoides*) and from artificial substrates (incubated glass slides). The samples were analysed both qualitatively and quantitatively. The analysis revealed that from natural vegetation the composition was Protozoa (74.18%); Rotifera (14.8%); Crustacea (2.0%) and miscellaneous (9%). In the samples from glass slides the composition was Protozoa (76.5%) ; Rotifera (12.1%) ; Crutacea (3·8%) and miscellaneous (17.6%). Miscellaneous group included nematodes, ostracods, oligochaetes and diptera.

e) **Macrophytes** :

The dominant submerged macrophytes encountered in the sar were *Myriopyllum spicatum* and *Ceratopyllum demursum* covering almost the entire pelagic zone. Towards the shores mostly *Potamogeton natans, Potamogeton crispus* and *Nymphoides peltatum* were the dominant forms. The shallow regions of the sar was invaded by *Salvinia natans* with some areas covered with *Phragnmites communis*. Macrophyte production is being assessed by dry matter production and their contribution as organic matter to thc lake metabolism.

f) **Physico-chemical features :**

The sar water was analysed for various physico-chemical factors both at the pelagic and littoral zones. At the pelagic zone depth-wise analysis was also carried out and the following observations were made :

Temperature (°C) May-November	...	31.0–18.5
Transparency (mm)	...	2.10-5.0
D. O. (ppm)	...	1.0-12.2 (Bottom) (Middle)
pH	...	7.2-8.6
Total alkalinity (ppm)	...	82-276
Specific conductivity (Mhos/25°C)	...	198-572
Silicates (ppm)	...	0.012-0.066
Chloride (,,)	...	5-14
Calcium (,,)	...	25-62
Magnesium (,,)	...	4-12
Nitrate-N (,,)	...	32-528

Sar was isothermal in the last week of November while during summer thermal variation at different columns was detected.

The gross primary productivity at the pelagic zone of the sar ranged from 31-67 ; 43-278 ; 31-296 ; nil-268 ; and 21-200 mg C/m^3/hr at surface, 1 m, 2 m, 3m, and 4m depth zones respectively.

g) **Fish and Fisheries :**

The sar abounds mainly indigenous carps (*Schizothorax* spp.) and exotic carps (*Cyprinus carpio*) in addition to *Gambusia affinis*, (mostly in the littoral zones in abundance), *Puntius conchonius* and *Crossocheilus latius*. The major fishing method in the sar is by rod and line and longe lines since cast net is difficult to operate due to heavy infestation of submerged macrophytes. The catch per man-hour ranged from 10-500g with exotic carps comprising about 75-80% of the total catches. Regular fishing is not done in the sar.

Project 14 : Riverine Fish Catch Statistics

Problem No. 14.1 : Fish catch statistics of middle and lower stretches of Ganga River System.

Personnel : S.J. Karamchandani, R.A. Gupta, G.N. Srivastava, Balbir Singh, R.K. Tyagi, D.N. Srivasthava, A.K. Laal, R.C. Singh, A. Sarkar, B.L. Pandey and P,K. Chakrabarti.

Duration : 1968 onwards.

Location : Upper and lower stretches of river Ganges.

The total fish landings were estimated to be 130.74 t at Sadiapur and 14.12t at Daraganj from December 1980 to November 1981, 30.98 t at Rasulabad from September 1981 to November 1981, 16.49 t at Buxar, 129.85 t at Bhagalpur and 46.36 t at Lalgola from January 1981 to December 1981. The details of species-wise landings are given in Table—1.

In the middle river stretch, the fish catches at Sadiapur showed increase by 13.0% this year compared to the previous year ; the increase being largely due to higher landings of *Labeo calbasu*. The landings at Daraganj did not show much variations in comparison to those of the last year. In the lower stretch of the river the production increased by 1.11% at Bhagalpur and decreased by 14.58% at Lalgola, when compared with that of the preceding year.

The data on length frequency of eight commercially important species were collected from Sadiapur fish landing centre. The mean lengths of these species for the year 1981 are presented along with their respective mean lengths of the year 1979 and 1980 in Table II for comparison.

Age and growth of *C. mrigala*

Based on the study of 88 scale samples of *C. mrigala* the relationship between scale radius (R) and length of fish (L) was found to be $R=0.0016+0.197$ L. Lengths attained by fish at ages I to V were calculated to be, I-212 mm, II-338 mm, III-450 mm, IV-541 mm and V-615 mm, the growth rates being 212, 126, 112, 91 and 74 mm respectively. The growth pattern of this fish was further described by Von Bertalanffy's growth model.

$$L_t = 10\ 15\ \left[1 - e^{-0.175(t+0.329)} \right]$$

TABLE—I

Species	Sadiapur (Dec'80-Nov'81)		Daraganj (Dec'80-Nov'81)		Rasulabad (Sept'81-Nov'81)		Buxar (Jan'81-Dec'81)		Bhagalpur		Lalgola	
	t	%	t	%	t	%	t	%	t	%	t	%
C. mrigala	8.23	6.29	1.76	3.98	4.21	13.60	0.64	3.88	3.18	2.45	0.48	1.04
C. catla	4.69	3.60	0.58	1.33	0.30	0.97	0.39	2.36	4.31	3.32	0.94	2.03
L. rohita	2.69	2.05	0.32	0.73	0.22	0.69	0.91	5.52	1.68	1.29	1.73	3.73
L. calbasu	21.02	16,08	1.21	2.75	0.34	1.12	1.17	7.10	0.64	0.49	0.01	0.02
Major carps	36.63	28.02	3.87	8.79	5.07	16.38	3.11	18 86	9.81	7.55	3.16	6.82
M. aor	12.05	9.22	1.01	2.29	7.70	24.85	2.15	13.04	10.89	8.39	1.90	4.10
M. seenghala	9.28	7.10	6.81	15.44	5.76	18.59	1.48	8.98	4.58	3.53	1.04	2.24
W. attu	4.07	3.10	2.58	5.84	5.78	18.65	0.99	6.00	18.35	14.13	0.71	1.53
Catfishes	25.40	19.42	10.40	23.57	19.24	62.09	4.62	28.02	33.82	26.05	3.65	7.87
H. ilisha	0.20	0.15	0.13	0.30	0.01	0.02	0 50	3.03	0.25	0.19	11.06	23.86
Miscellaneous	68 51	52.40	29.72	67.33	6.66	21.50	8.26	50.09	85.97	66.21	28.49	61.45
Total :	130.74	100.00	44.12	100.00	30.98	100.00	16.49	100.00	129.85	100.00	46.36	100.00

TABLE—II

Species	Mean lengths (mm) 1981	1980	1979
C. mrigala	479	480	466
C. catla	657	572	562
L. calbasu	382	670	438
L. rohita	704	450	672
M. aor	425	470	472
M. seenghala	460	530	522
W. attu	435	590	553
H. ilisha	453	420	433

The estimates of empirical langths at various ages were derived from the above equation which were found to be in close conformity with those derived by scale method.

Problem No. 14.14 : Comparative study of fisheries and ecology of river Ganga and *Kol* at Bhagalpur.

Personnel : A. K. Laal, S. K. Sarkar and A. Sarkar.

Duration : 1979 onwards.

Location : Bhagalpur.

Comparative ecological studies at Hanumanaghat on river Ganga and at Adampurghat in Sirighat *Kol* of river Ganga at Bhagalpur are being carried out as per programme.

The *Kol* which exists during September to June shows higher mean value compared to the river in respect of free $C0_2$ (10.33 and 2.28 ppm), bicarbonate alkalinity (221.08 and 144.67 ppm), phosphate (0.336 and 0.091 ppm), nitrate (0.243 and 0.224 ppm), silicate (13.4 and 12.6 ppm), iron (ic) (0.127 and 0.091 ppm), dissolved organic matter (9.7 and 8.53 ppm), chloride (61.89 and 41.51 ppm) and specific conductivity (10^2 x 5.48 and

10^2 x 3.24 micromhos/cm^2 at 25°C). Dissolved oxygen (5.58 and 7.24 ppm), pH (7.6 and 7.8) and carbonate alkalinity (13.63 and 26.28 ppm) show higher values at Hanumanaghat in the main river than in the *Kol* at Adampurghat. The values in the parenthesis pertain to the Kol and the main river respectively.

The average gross and net primary production and respiration values in *Kol* at Adampurghat (166.32, 104.13 and 70.48 mg C/m^3/hr respectively) are much higher than those in the main river at Hanumanaghat (43.29, 26.18 and 20.49 mg C/m^3/hr respectively).

Plankton study at Hanumanaghat: Phytoplankton ranged from 32 u/l (September) to 740 u/l (February). *Tribonema* sp., and *Bumillaria* sp. were dominant but in July *Fragilaria* sp., *Pinnularia* sp. and *Blastocladiopsis* (fungus) were found. Although these were inhabitants of the polluted zone, their occurrence in river Ganga could be due to flood which washes the polluted zones.

Zooplankton ranged from 12 u/l (September) to 576 u/l (December). Amongst rotifers *Keratella* sp. and amongst Cladocera *Bosmina* sp. were dominant. Three varieties of *Keratella* i.e., *K. tropica*, *K. procurva* and *K. odmondsonii* were found. Only in July *Chironomus* (larvae) were also observed probably due to the facts stated above (flood).

Phytoplankton in Sirighat Kol at Adampurghat :

Plankton encountered in winter (January) and summer (June) was 1055 u/l and 11814 u/l respectively. The phytoplankton peak coincided with the zooplankton peak. The phytoplankton population was nearly 6 and 1.5 times more than zooplankton in winter and summer peaks respectively. The phytoplankton comprised 27 algal genera, the peaks being contributed by the Bacillariophyceae in winter and Myxophyceae in June.

The zooplankton peak in winter (Jan.) comprised *Moina* sp. and in summer (June) by *B. forficula*, *B. rubens*. *Cyclops* sp. were always present in plankton sample. Apart from all these, nematodes, *Chironomesus* (larvae), *Culex* (larvae) and Ostracods were also found in plankton sample.

Presence of *Oscillatoia* sp., *Anabaena* sp., *Spirulina* sp., *Cosmarium* sp., *Eudorina* sp., *Scenedesmus quadricauda* and Euglenids members amongst phytoplankton and nematodes, *Chironomous* (larvae), *Culex* (larvae) and ostracods confirm the polluted nature of the *Kol*. This is probably due to domestic and cattle yards waste discharge in *Kol*.

The plankton peak was noticed in June (3216 u/l) in Maniksarkarghat confluence zone. The composition is very similar to that of Adampurghat. In main sewage maximum plankton (6180 u/l) was noted in April.

Fish fauna of river Ganga was the same as that of preceding year although declining trend in the carp population was obvious.

Problem No. 14.16 :		Pilot survey to evolve sampling methodology for estimating inland resources and total catch of fish in West Bengal
Personnel	:	K.K. Ghosh, O.P. Kathuria, S.K. Raheja, P. M. Mitra, A. Chowdhury, R.N. De, A.K. Roy, N.D. Sarkar, N.C. Mondal and A.R. Paul.
Duration	:	1978-1981
Location	:	24-Parganas District of West Bengal

The average area of water unit in 24-Parganas District as a whole was worked out as 0.097 ha., 94%

of the water units were perennial in nature. All the water units were reported to be rainfed ; 3.06% of the village area was observed under ponds. Average number of ponds in a village was worked as 42. Only 33% of the ponds were used mainly for fish cultivation, while 61.6% of them were mainly used for all other purposes but also used for fish cultivation. 3.1% of the ponds were not used for fish cultivation of all. Majority of the ponds (67%) had a depth of 1 to 3 metres at the time of visit by enumerator. The survey revealed that weeds were not a major problem in the water units of the area. 95% of the water units had low infestation of weeds. In fact, 77% of the ponds reported no floating weeds.

In 99% of the ponds ordinary pisciculture techniques were adopted, while in 1% of the ponds composite fish culture technique was adopted. Three major species of fish cultured in the area were catla, rohu and mrigal released together in different ratios which accounted for 97.6% of the ponds. Other species cultured were common carp, silver carp and grass carp ; magur, koi, singhi and chital etc. taking 3 or 4 together along with the above mentioned three major species. 38% of the water units yielded fish throughout the year. while 50% of them yielded fish during summer months only. Only 12% of water units yielded fish during monsoon and post monsoon months. 50% of the water units used as nursery ponds, 36% of them were used for stocking and 14% as nursery-cum-stocking ponds.

Details of pond resources in sample villages

(1) Area (ha)

	Perennial	Seasonal	Total	Exploited	Unexploited	Total
1	2	3	4	5	6	7
Total area	141.15	10.75	151.90	137.00	14.90	151.90
Average/village	3.53	0.27	3.80	3.43	0.37	3.80
Range	0.34-12.39	0.03-1.39	0.39-12.39	0.29-11.39	0.03-12.39	0.39-12.39
% in total] Av.	3.02	0.23	3.25	2.93	0.32	3.25
village area] Range			0.3-11.9			0.3-11.9

(2) Number

1	2	3	4	5	6	7
Total No.	1582	103	1685	1500	185	1685
Average/village	39.5	2.6	42.1	37.5	4.6	42.1
Range	5-165	0-17	7-165	4-159	0-14	7-165

The analysis of second phase data on catches made during the year 1980-81 for development of a suitable design is under progress at the IASRI, New Delhi.

Problem No. 14.17 : Assessment of wanton destruction of early juveniles of commercial species in upper Hooghly estuary.

Personnel : H.C. Karmakar, G. C. Laha and P. B. Das.

Duration : 1980-82.

Location : Calcutta.

Total catch of early juveniles of commercially important species from the stretch of 50 km of the freshwater zone of the Hooghly river was estimated to be 52.13 tonnes in 1981. The estimate was based upon the data collected from three selected centres, Malatipore, Guptipara and Khamargachi. Maximum catches amounted to 34.08 tonnes and 18.05 tonnes by Chatjal and Binjal respectively. The major species in the catches were *Hilsa ilisha* (16.59%), *Glossogobius giuris* (11.9%), *Gadusia chapra* (7.15%), followed by *Cirrhinus reba* and other species.

Problem No. 14.18 : Fisheries of Kolleru Lake and its connected waters.

Personnel : K.J. Rao, K.V. Rao, T.S.R. Raju and K.S. Rao.

Duration : 1981-1986.

Location : Tadepalligudem.

A preliminary survey was undertaken during the month of June 1981 to visit important fish landing centres along the Kolleru lake to collect information on the landings, dispersal and disposal of the fish and prawn catches. Based on this information, three fish assembly centres at Eluru in the western sector, Akivedu in the eastern sector of the lake and Bhimavaram in the estuarine sector were chosen for regular sampling to collect fish catch statistics.

Fish catch statistics were collected at each of these centres for one day in a week and the total production from the lake during the six months period from July 1981 to December 1981 was estimated to be 923,181 kg of which Eluru centre contributed 1,51,685 kg, Akivedu 3,38,102 kg and Bhimavaram 4,33,394 kg. At Eluru centre July month recorded the lowest landings and December the highest. The lean month in the case of Akivedu centre was July, while August was the productive month. On the contrary, at Bhimavaram centre, July accounted for highest landings while the month of November provided the lowest landings. Prawns formed the major constituent of the fishery, contributing 61.49% to the total production followed by carps 10.55%, perches 9.63%, catfishes 6.80%, murrels 5.36% and spiny eels 2.27%.

Project 15 : Icthyopathology and fish health protection.

Problem No. 15.2 : Investigations on the parameters of fish blood to monitor fish health in culture fishery operations.

Personnel : R.K. Dey and B.K. Mishra.

Duration : 1980-1983.

Location : Dhauli.

Measurements of the erythrocytes and leucocytes of healthy rohu and myxosporidia-infected rohu indicated an increase in the size of the cells of infected fishes ; the average length/width of R.B.C. in healthy rohu being 11.25/7.91 microns compared to 11.75/8.50 microns in myxosporidia infected ones. The W B.C. of healthy rohu measured 8.5 in size as against 9.95 microns in infected fishes.

Problem No. 15.4 : Histo-pathology of diseased brackishwater fishes.

Personnel : N.A. Reddy and R.N. Pal.

Duration : 1981-82.
Location : Calcutta/Kakdwip.

Initial observations were carried out to find out the intensity of parasitization (endoparasites) on *Liza parsia*, *Liza tade*, *Eleutheronema tetradactylum* and *Lates calcarifer* collected from Kakdwip farm. Infection of nematodes and helminth cysts were encountered occasionally. Diseased prawns with black spots on cephalothorax and telson were also observed in farm ponds while sampling.

Problem No. 15.5 : Isolation of bacteria causing fish disease in sewage-fed Kulti estuary.
Personnel : R.N. Pal and Hardial Singh.
Duration : 1980-1985
Location : Calcutta

There are 522 registered bheries in the district of 24-Parganas, West Bengal, of which 26 bheries were surveyed to find out the relationship among fishes, their pathogens and the environmental conditions. Of these 26 bheries, 16, 6 and 4 belonged to Stratum-I (22°35'N) Stratum-II (22°35'N—22°16'N) and Stratum-III (22°-10'N and below).

Pulpiness, locally called P. D. or muscle necrosis of prawn was observed in all the strata—56%, 67% and 100% in Stratum I, II and III respectively. Average total plate count (TPC) of bacteria from diseased prawn was 2.5×10^6/gm. Whirling disease of tilapia was reported from Stratum I and II. Average total plate count of bacteria from macerated haematopoietic tissues (dilution 1 : 10) was 7×10^4. Mortality of prawn recorded from Stratum I, II and III was 20-90%, 5-50% and 5-30% respectively when maximum total plate count of bacteria collected from hepatopancreas was as high as 3×10^6 which revealed infection of both *Pseudomonas* and *E. coli*. Major carp fingerlings collected from Stratum I also revealed bacterial infection when smear preparations of the haematopoietic tissues were examined. 50% of the *Lates* fry collected from Stratum III also revealed bacterial infection when their haematopoietic tissues were examined.

Problem No. 15.6 : Investigations on diseases of Indian major carps caused by parasites and malnutrition (UNDP/FAO Project)
Personnel : B.K. Mishra and R.K. Dey
Duration : 1981-1983
Location : FARTC, Dhauli

Myxosporidian infection has been found to be endemic amongst Indian major carps in Dhauli area. Use of various drugs in controlling the disease has not shown encouraging results so far.

Problem No. 15.7 : Investigations on histopathological changes in the kidney and liver of Indian major carps and its relation to disease.
Personnel : R. K. Dey, B. K. Mishra and D. Kumar
Duration : 1981-1983
Location : FARTC, Dhauli

Studies on the histopathological changes in the liver, kidney, gill, intestine, heart and muscle tissues of Indian major carps have been made. Most of the kidney tubules have been found to be degenerated. Cytoplasm vacuolated with pycnotic nuclei recorded in myxosporidian infected rohu.

Problem No. 15.8 : Development of primary cell culture and fish cell lines from Indian major carps for virological studies (UNDP/FAO Project)

Personnel : Dilip Kumar and K. Suresh
Duration : 1981-1983
Location : FARCT, Dhauli

Efficacy of several locally available detergents and disinfectants for cleaning of glasswares for the cell culture was studied. Eagle's MEM-, a CSIR product along with foetal calf serum was used as cell culture media. Attempts were made to obtain monolayers from the aseptically taken rohu tissue (ovary, swimblader and whole hatchlings). Partial success was achieved in propagation of cells though monolayer stage could not be obtained due to frequent bacterial and fungal contamination.

Problem No. 15.9 : Investigation on the bacterial diseases of major carps and their treatment (UNDP/FAO Projects)
Personnel : K. Suresh, R. K. Dey and Dilip Kumar
Duration : 1981-1983
Location : FARTC, Dhauli

To ascertain the role of stress as a pre-disposing factor of fish disease, prophylactic antibiotic treatments were given to a group of fishes with 25 mg streptomycin sulphate along with 20,000 Iu of penicillin in 0.5 ml distilled water parenterally which withstood stress and a survival of 99% was recorded against 50% in control. Flexibacter columnaris disease was found to occur due to stress.

Project 16 : Weed control

Problem No. 16.3 : Evolution and evaluation of herbicide formulations.
Personnel : V. Ramachandran, S. Patnaik and K. M. Das
Duration : 1980 onwards
Location : Cuttack

In yard trials 2,4-D ethyl ester granules tried with doses 5,10 and 15 kg/ha against *Najas indica* and *Vallisnaria spiralis* did not yield encouraging results. Dalapon (Dichloropropionic acid) at doses 10 and 15 kg/ha tried against *Cyperus corymbosus* yielded 70-80% clearance in yard trials.

Problem No. 16.15 : Studies on the toxic effect of algicides on fish and consequences of their periodic application on fish pond ecology
Personnel : S. Patnaik and S. R. Ghosh
Duration : 1981-1983
Location : Cuttack

Bloom of *Microcystis* (12.5 ml/l density) in a fish pond treated with two doses of copper sulphate 0.8 ppm at 15 days interval could achieve only 50% clearance in one month. The fish or zooplankton of the pond were not apparently affected by the treatment. In toxicity tests in the laboratory, diuron at 0.3 and 0.5 ppm concentration was observed to be safe for fingerlings of *Labeo rohita* in 48 hours.

Project 17 : Frog farming

Problem No. 17.7 : Development of hatchery complex for Indian commercial frog species.
Personnel : A. K. Mondal and S. C. Mondal
Duration : 1974 onwards
Location : Kalyani

Commercial production of frog seeds by adopting induced breeding and hatchery techiniques was

continued and a record production of about 2.0 million hatchlings of Indian bullfrog and *R. crassa* was achieved. Out of this about 1.7 million hatchlings were released in the nature.

Problem No. 17.8 a : Nursery management for Indian commercial frog species

Personnel : A. K. Mondal and S. C. Mondal

Duration : 1974 onwards

Location : Kalyani

In field rearing experiments, 3-day old tadpoles of *R. tigrina* stocked at 1.0 million/ha gave an average survival of 76.3% of froglet and early frogs on feeding with fresh and powdered silkworm pupae, in addition to their natural food. The reduction in the period of metamorphosis by about 10 days as observed is possibly due to effectiveness of ecdysone present in the silkworm pupae powder. Experiments are being taken up with ecdysone in order to prove the above contention.

Problem No. 17.9 (a) : Monoculture of *Rana hexadactyla*

Personnel : A. K. Mondal

Duration : 1974 onwards

Location : Kalyani

Excellent breeding of the blue bottle, the house fly and one cyclorrhaphan fly as well as the healthy growth of their maggots are obtained in a medium containing raw cowdung, bone meal and mustard oil cake. The maggots became extremely healthy when a little urea and silkworm pupae were added to the above medium. They formed excellent food for carnivorous species of frogs and catfish too. The experiment is in progress.

Problem No. 17.10 (a) : Studies on the digestive enzymes of *Rana hexadactyla* from Bengal

Personnel : A. K. Mondal and J. J. Ghosh

Duration : 1980-83

Location : Kalyani and Calcutta

The studies on degestive enzymes could not be taken for non-provision of scientific staff.

In feeding trials, tadpoles of *R. hexadactyla* accepted silkworm pupae in addition to their normal plant diet in their climax of metamorphosis.

Problem No. 17.11 (a) : Selective breeding and hybridization between frog species of commercial importance.

Personnel : A.K. Mondal and S.C. Mondal

Duration : 1980-1983

Location : Kalyani and Calcutta

Induced hybridization between *Rana tigrina*, *R. crassa* and *R. limnochari* has been successfully carried out and their hybrids were produced.

In crosses involving the former two species, no difference was obseved in the fertilization rate, developmental process, percentage of hatching and post larval developments, excepting in tooth rows and growth. One signifcant finding made is in the size of hatchlings and early tadpoles, which shows female dominance. It appears that the larger the female species involved in the cross the bigger is the size of hatchlings and early tadpoles. The hybrids resulting from the cross between *R. tigrina* female and *R. crassa* male which showed all the morphological features of *R. tigrina*, grew to about 50 mm in size in 2 moths, following metamorphosis. This seems to be better than their natural growth. In the reciprocal cross, about 88 mm was attained in seven weeks. The hybrids showed predominantly *R. tigrina*

features up to three months following metamorphosis and developed *R. crassa* features after that. The work is in progress. The chromosomal analysis produced from crosses between *R. tigrina* and *R. limnocharis* has been completed, and for other species the work is in progrees.

Project 18 : Sewage-fed fisheries

Problem No. 18.1.6 : Production of carps in mixed culture operation with sewage effluent

Personnel : Apurba Ghosh, K. K. Bhanot (Smt.), G. N. Chattopadhyaya, A. K. Roy, B K. Saha, G. P. Bhattacharya and B. Ghosh

Duration : 1977-1981

Location Rahara (Khardah)

(i) Carp culture using primary effluents :

A pond of 0.17 ha was initially treated with lime @ 200 kg/ha and fertilized with primary treated sewage. It was stocked with carp fingerlings @18,000/ and in the combination of C1 : R1 : M1 : Sc 1 (approx.) during July-August 1980. Sewage was applied periodically depending on the hydrobiological conditions of the pond. Neither supplementary feeding nor fertilizer application was resorted to.

In about 10 months fish production was 1136.916 kg (gross) and 1018.45 kg (net) amounting to 5,990.54 kg/ha.

(ii) Rearing of spawn/fry of Indian major carps and common carp in nursery ponds using sewage effluents and sludge as fertilizer.

Rearing of carp fry was initiated in a 0.076 ha pond. The pond was fertilized with 13.68 x 10^5 litres of sewage effluents in the last week of July 1981. The pond got diluted with rain water and was allowed to stabilise. It was then stocked with 1515 advanced fry of catla, rohu, mrigal, common carp and silver carp in the month of September. Fertilization with sewage effluents was done only thrice during the remaining period. No supplementary feeding was done.

In three months' rearing the fishes gained a growth increment of 101 g (catla), 70 g (rohu), 67 g (mrigal), 193 g (silver carp) and 398 g (common carp) at a stocking density of 19934/ha.

Extrapolated production was 1789 kg/ha against the actual production of 136.657 kg from the nursery pond in three months' rearing.

(iii) Relative efficiency of treated and untreated domestic waste in enhancing production of carp.

Influence of raw sewage, primary treated sewage and secondary treated sewage on the availability of P in water as soil phase of a submerged soil system was studied for one month under laboratory condition. Primary sewage application showed higher amount of water soluble P while average increase in available soil P was more in case of raw sewage application. Treatment with secondary sewage recorded the increment in both the cases. Considering the high BOD (1400) of raw sewage and also the importance of water soluble P in case of carp culture, application of primary sewage effluent (BOD_5 value 530) was considered to be better.

Problem No. 18.1.10 : The Etiology and control of common parasitic diseases in fish reared in sewagefed ponds,

Personnel : A.K. Ghosh and G.P. Bhattacharya

Duration : 1977-1981

Location : Rahara

Investigations were continued in a sewage-fed pond and two private ponds receiving cattle-shed washing. Protozoan infection on the gills and body of fingerlings were encountered mostly. Prophylactic measures were undertaken to prevent spreading of infection. During routine sampling heavily infected fishes were given dip treatment in 1 ppm solution of $KMn\ 0_4$. The pond was treated with lime @ 200 kg/ha and the infection was checked effectively.

Silver carp developed white patches caused by bacterial infection in the sewage-fed pond and perimeter canal of the paddy plot. Bacteriological studies on sewage effluent containing specific pathogens in water from faecal sources have been initiated. The water from the primary treated sewage of Titagarh sewage treatment plant and the diluted one from the sewage-fed pond as well as water from the ponds using cattle-shed washings were analysed. The MPN was 542×10^{-4}/100 ml, 11×10^{-4}/100 ml and 11×10^{-4}/100 ml and 8×10^{-4}/100 ml and 9×10^{-4}/100 ml. The total bacterial load in three experimental ponds mentioned above were 4×10^{-6}/ml, 12×10^{-6}/ml and 4×10^{-6} ml. Coliform bacteria was recorded. Both, gram negative and gram positive bacteria have been isolated and stained for proper identification.

Problem No. 18.1.11 : Paddy-cum-fish culture

Personnel : Apurba Ghosh, K. K. Bhanot (Smt), G. N. Chattopadhyay, P. K. Chakrabarti, A. K. Roy, K. R. Naskar, N. M. Chakrabarti, B. K. Saha and B. Ghosh

Duratoin : i & ii 1979-1982
iii 1981-1984

Location : Rahara, Barasat, Nandala, Canning and Sunderbans.

(i) Studies on paddy-cum-fish culture in fresh water area by rennovation paddy plot

Prolonged rains from the month of March this year hampered studies on paddy-cum-fish culture in rennovated paddy plots. 'Jaladhi-2' could not be sown directly due to water logging in the paddy plot. The seedling were utilised by the paddy-cum-fish culture farmers at Bandipur under Lab to Land Programme of this research centre.

To take advantage of the whole sheet of water in the paddy plot, the system was stocked at a density of 5,000/ha with catla, rohu, mrigal, silver carp and common carp to test the efficacy of alternate system of paddy and fish cultivation.

At the time of stocking, catla was 92.45 mm/6.0 g, rohu 102.83 mm/14.8 g, mrigal 83.4 mm/5.2 g, silver carp 257.9 mm/156.2 g and common carp 51.68 mm/2.0 g. About 2000 post-larvae of *Macrobrachium rosenbergii* were also stocked. Supplementary feeding was done with mustard oilcake and rice bran (1 : 1 by weight) at 2% body weight. Based on the sampling data a production of 1200 kg of fish is expected.

The perimeter dyke of the paddy-cum-fish culture plot (about 0.15 ha) were utilised for the production of vegetables.

(ii) Freshwater paddy-cum-fish culture at Rice Research Institute, Chinsurah.

A statistically designed experiment with two replicates for each of three treatments has been initiated in 3 pairs of identical plots (0.01 ha). These treatments are : Paddy-cum-fish culture with supplementary feeding, paddy-cum-fish culture without supplementary feeding, and paddy cultivation alone.

Four out of six plots at Chinsurah Farm have been uniformly stocked with 162 carp fingerlings per plot keeping species combination as Catla 4 : Rohu 4 : Mrigal 4 : Common carp 1. Initial sizes were 75.5/5.0 (catla), 77.4/5.0 (rohu), 99.7/10.0 (mrigal) and 78.8 mm/8.0 gm (common carp). Supplementary feeding with rice bran and mustard oil cake (1 : 1) @ 5% body weight of fingerlings were applied daily in two plots as needed for the treatment.

The growth increment in two months' rearing (September to November) were 75.45/35.62, 25.40/5.80, 53.10/22.22 & 112.70 mm/137.83 gm with feed and 62.70/32.27, 26.20/7.50, 50.00/23.33 and 92.65 mm/106.00 gm without feed for catla, rohu, mrigal and common carp respectively. The respective survival rates were 44,32,39 & 45.8% with feed and 30,10,16 and 24.83% without feed. No significant difference in the growth pattern of fishes under two different treatments was noticed, but survival rates were certainly better in the case of artificial feeding. Gross yield of fish in 2 months was 3.763/plot (with feeding) and 1.654 kg/plot (without feeding). Patnai variety of paddy has been transplanted in all these plots under trial during the 1st fortnight of August 1981 and the yield will be known an harvest of the crop.

Fortnightly study of the biotic environment of these plots was conducted.

(iii) Composting of aquatic weeds by aerobic and anaerobic process in excavated pits and piles to be utilised as fertilizer in the integrated system.

To evolve effective method of recycling of auqatic weeds by composting in integrated farming, the composting of water hyacinth was tried under both, aerobic and anaerobic conditions in fields as well as in the laboratory. For rapid processing, water hyacinth was mixed separately with urea, cowdung and sewage sludge and kept separately in different chambers against suitable control for composting. For determining the suitable C/N ratio for the fastest process of composting the various treatments were done to water hyacinth and the best result was obtained with cowdung as compared to other treatments and control.

Physico-chemical and biological parameters of these composting pits were recorded.

The N-P-K status of the compost being moderately high gave satisfactory results in plastic pool rearing of carp fingerlings as well as in the horticultural practices on the pond or paddy plot dykes.

(iv) Studies on paddy-cum-fish culture in saline areas.

Work is initiated to study the ecosystems of soil and soil-water interphase in low lying coastal areas fed by tidal water and also to assess the possibility of culturing paddy along with the euryhaline species of fishes and prawns in these areas. Observations are being made on the extent of salinisation and other relevant physico-chemical and biological properties of soil and water in farmers' paddy-cum-fish culture plots at low saline (Kulti region), moderately saline (Basirhat region) and highly saline (Taldi-Canning region) areas.

Some important physico-chemical characteristics of the paddy fields in three zones are given below :

Water phase	*Low saline*	*Moderately saline*	*Highly saline*
Salinity (ppt)	3.6-0.5	7.2-0.6	18.8-9.0
pH	8.4-7.2	7.6-8.4	8.4-8.2
DO (ppm)	12.0-4.0	12.8-7.8	10.0-5.6
Alkalinity (ppm)	244-130	320-106	240-90
p (ppm)	2.1-1.5	1.8-trace	1.2-0.8
N (ppm)	4.0-2.1	2.8-1.0	2.1-1.0
Soil phase			
pH	7.9-7.5	8.4-7.9	8.4-8.1
OC(%)	1.23-0.81	0.93-0.36	0.42-0.36
Salinity (ppm)	4.0-0.7	6.7-0.7	8.1-4.9
Available P(ppm)	69-51	62-44	40-32
Available N(ppm)	243-173	257-112	154-112

Salient features of the biotic environment of these paddy fields under study are as follows :

	Low saline	*Moderately saline*	*Highly saline*
Plankton (u/l)	368.6-5180.0	166.3-36,775.7	758.9-81,820.8
Bottom biota (u/m²)	39,475-17.25,950	10,550-116,30,40,192	1662-30,34,061

Percentage contribution by phytoplankters to the total were 83.2-99.9 in most cases. Dominant species among plankters at highly saline region were *Cladophora* sp. ; at moderately saline region *Gyrosigma* sp., *Cladophora* sp., *Pinnularia* sp . *Oocystis* sp., *Chlorella* sp., *Nostoc* sp., *Difflugia* sp., *Closterium* sp., *Lynobya* sp. ; and at low saline region *Cladophora* sp. Dominant species among benthos were *Lyngbya* sp., *Cladophora* sp. and *Vivipara* sp. at highly saline region ; *Rhizoclonium* sp., *Cladophora* sp., *Spirogyra* sp., *Pinnularia* sp., *Anabaena* sp., *Navicula* sp. *Lyngbya* sp. and *Nostoc* sp. at moderately saline region ; *Cladophora* sp., *Pinnularia* sp. *Navicula* sp. at low saline region.

Relative contribution of different groups of fish food organisms in the plankton and benthos are given below :

	Low saline	*Moderately saline*	*Highly saline*
Plankton (100 u/l)			
Diatom	1.14-36.42	0.31-94.09	0.04-4.19
Filamentous algae	1.67-31.14	0.33-349.87	7.29-813.72
Other algae	0.26-24.82	0.56-129.82	0.09-5.57
Protozoans	Nil-2.72	0.03-28.51	Nil-0.36
Rotifers	0.11-4.07	Nil-1.68	0.01-9.18
Crustaceans	0.48-10.84	Nil-7.05	0.11-8.19
Other organisms	Nil-0.23	Nil-0.59	Nil-1.21

Benthos (1000 u/m²)

Macrophytes	Nil-0.25	Nil-0.50	Nil-5.60
Diatoms	9.80-830.00	Nil-3644.00	Nil-224.68
Filamentous algae	17.70-859.50	7.50-1162080.00	0.06-2708.36
Other algae	3.03-535.50	Nil-480.00	Nil-79.56
Protozoans	Nil-31.00	Nil-320.00	Nil-9.16
Helminths	Nil-6.00	Nil-4.00	Nil-1.83
Rotifers	0.11-14.00	Nil-109.45	Nil-9.55
Molluscs	0.03-2.05	Nil-14.50	0.16-6.49
Crustaceans	Nil-28.00	Nil-169.40	Nil-9.76
Insect larvae	Nil-0.50	Nil-8.05	Nil
Annelids and worms	Nil	Nil-0.05	Nil-0.64
Other organisms	Nil	Nil-320.00	Vil-4.65

Both, in plankton samples and in benthos samples, intermingling pattern of plankters and bottom biota was observed, perhaps due to the shallow depth of such waters. Moreover, amidst euryhaline endemic species, sudden occurrence of tide-borne marine forms and freshwater species and sudden change of the ecosystem are two important phenomena in these fields.

Problem No. 18.1.12 : Production of fishes in sewage-fed ponds by multiple stocking and harvesting.

Personnel : Apurba Ghosh, A. K. Roy, N. M. Chakrabarti. P. K. Saha, B K. Saha and B. Ghosh

Duration : 1981-1984

Location : Rahara

A pond (0.17 ha) was treated with lime @ 200 kg/ha initially and then with 10 lakh litres of domestic sewage during the 3rd week of June, 1981. The pond was then stocked with carps @ 18,000/ha during the 2nd week of July excepting silver carp during September and August in the combination of C 2.0 : R 3.0 M 2.5 : Sc 1.0 : Cc 1.5. From an initial size of 224.90/135.00 (catla), 195.17/89.00 (rohu), 132.33/20.50 (mrigal), 161.36/71.57 (common carp) and 124.30 mm/21.30 g (silver carp), the fingerlings have recorded an average increment of 53.70/178.80 (catla), 112.50/270.80 (rohu), 195.00/334.80 (mrigal), 28.00 mm/49.10 g (common carp) in about 5 months and 199.00 mm/337.60 g (silver carp) in 3 months, registering thereby biomass (fish) production from 219.387 to 967 021 kg in about 5 months of culture the in pond. Studies on physico-chemical parameters, biological parameters and bottom biota were also conducted.

Project 19 : Hilsa Fisheries

Problem No. 19.8 : Culture of *Hilsa ilisha* (Ham.) in confined freshwaters.

Personnel : J. C. Malhotra, Peer Mohamed, S.K. Sarkar, B.K. Banerjee, S.P. Singh, Ramji Tiwari, K.K. Bhanot and S.B. Saha.

Duration : 1974-82

Location : Allahabad / Barrackpore / Ukai/ Ganga/Narbada and two centres Hooghly.

Farakka (River Ganga) :

During March 1981 a survey was undertaken at downstream of Farakka Barrage in Ganga and the feeder canal of the Barrage for procurement of mature and oozing hilsa specimens. Stripping of the available ripe females and oozing male hilsa specimen was attempted but hatching did not take place. The failure may be attributed to the non-availability of oozing female

hilsa specimens. The hilsa landings at Farakka araths was poor and also the oozing female hilsa were not available in the landings.

In addition to the above work, the operation of fish-lock was studied at Farakka Barrage, as desired by the Barrage authorities. No hilsa specimens were encountered in the lock chamber during one day fishing operation in August. One injured hilsa specimen was, however, noticed floating downstream near the gate. Probably the fish suffered injury while negotiating the fish lock chamber dashing against the friction blocks, staggered in two rows at the bottom of the lock chamber.

Ukai (River Narbada) :

Hilsa hatchlings (2.5 to 3.0 mm size range) stocked in pond at Ukai on 22 8.79 have attained an average length of 19.50 cm by November, 1981.

Problem No. 19.10	:	Research and development of technology of commercial-scale production of hilsa (*Hilsa ilisha*) seed.
Personnel	:	P.R. Sen, D.K. De, D. Nath and K.K. Bhanot
Duration	:	1981-1985
Location	:	Barrackpore

Mature hilsa specimens for artificial fecundation experiments were collected from upper stretches of Hooghly estuary around Nababganj during September through November.

Nine sets of experiments were conducted, out of which successful ovulation took place in seven sets. In all the experiments development did not proceed beyond the yolk invasion stage thereby formation of embryo. The development of embryo ceased after 8 hours of fertilization.

Sometimes in absence of mature male specimen, the eggs were successfully fertilised with preserved sperms. Milt collected from mature males were preserved in Frog Ringers solution, Holt freter solution and 6% normal saline solution. It has been observed that the sperms of the fishes were in live condition for more than 24 hours at 0^0-5^0C.

Project 20 : Water Pollution Investigations

Problem No. 20.8	:	Effect of pesticides on fish and fish food organisms.
Personnel	:	R.S. Panwar, D.N. Singh, R.N. Seth and R.K. Tyagi
Duration	:	1976-1981
Location	:	Allahabad

The fish toxicants *viz*, Dimicron (based on phosphamidon), DDT, BHC-Y and Malathion have been screened for their toxicity using fish and fish food organisms. Out of the four pesticides Malathion and BHC-Y were tried in 4 : 1 ratio on fish. Bioassay studies with Dimicron on fingerlings of major carp, *Cirrhinus mrigala* (Av. length, 7.92 cm ; av. weight, 4.58 g) was done at 29° to 31°C water temperature by exposing them for 24 and 96 hrs in dechlorinated tap water (pH 7.7, dissolved oxygen 5.2 to 6.8 mg/l, total alkalinity 160 to 170 mg/l and hardness 60 to 62 mg/l). LC50 values of Dimicron were calculated (by Probit technique) at 454 mg/l and 329 mg/l for 24 and 96 hrs exposure period respectively. Safe concentration to test fish was estimated at 3.29 mg/l. LC50 values with mixture of

Malathion and BHC-Y (4 : 1 ration) to test fish, *L. rohita* (av. length 7.1 cm ; av. weight, 4.5 g) were estimated at 0.52 mg/l for 24 hrs and 0.32 ml/l for 96 hrs exposure period at 20 to 22°C temperature. LC-50 values of Dimicron with respect to chironomid larvae for 24 hrs were recorded as 37 mg/l at 20±1°C and 42.5 mg/l at 30±1°C temperature where as with *Daphnia carinata*, the value was found to be 15.5 mg/l at 20± 1°C temperature.

In an experiment with *L. rohita* and *C. carpio* treated with 0.005 ppm DDT for 160 days and 0.01 ppm BHC-Y for 60 days exposure, following histopathological changes were observed :

Liver : Hepatic cells lost its polygonal shape. Vacuolation, necrosis, ruptured cells, liver cord disarray, destruction of R.B.C., etc. were met with during long-term exposure.

Kidney : Vacuolation in epithelial lining of renal tubles followed by its rupture, loss of haemopoetic cells and degenerated glomeruli were the common occurrences.

Intestine : Vacuolation of epithecal lining of villi, rupture of cell walls leading to protruding nuclei and the final collapse of villi were observed.

Problem No. 20.9 : The impact of pesticides on respiratory metabolism and energy utilisation in aquatic animals.

Personnel : M. Peer mohamed, M. A. Khan, S.N. Mehrotra, R.A. Gupta, R.N. Seth, P. K. Mukhopadhyay.

Duration : 1977-1982

Location : Allahabad

Experiments were performed to find out long-term effect of sublethal DDT level on survival and growth in *Puntius stigma*. Fish of almost same size (av. wt. 1.5 g) were exposed in 0.02 ppm DDT at 27.5—29°C. Control set was also maintained. Fish were fed once daily with prepared food. No mortality occurred till 30 days in both the cases. No increase in weight was observed in exposed fish, but an increase of 0.4 g was observed in control fish. The present result supports the earlier observations that sublethal DDT causes increase in the rate of oxygen consumption and random activity resulted due to distress. It is thus possible that *P. stigma* exposed to 0 02 ppm DDT might have used more substrates viz., carbohydrates, protein and fat to meet the energy cost.

Fingerlings of *Cirrhinus mrigala* (av.wt. 4.2 g ; T.L. 6.7 c.m) were exposed to 0.03 and 0.04 ppm DDT at room remperature. The onset of mortality was noted on the 16th day and 23rd day at 0.04 and 0 03 ppm respectively. Within 72 hours after the onset of mortality, 100% mortality was recorded in both the concentrations.

Experiments on metabolism in control and DDT treated (0.02 ppm) *P. stigma* (av. wt. 3.1 g) revealed that the routine metabolic rate of control fish (78 mg/kg/hr) increased to 128 mg/kg/yr when exposed to 0.02 ppm DDT for 96 hours. The random activity in control fish (32 counts/hour) also increased to 90 counts/hour. The persent result, when compared to the earlier observations on *C. mrigala* revealed that the energy requirement of *P. stigma* was significantly different the energy requirement being higher per unit change in effort.

Studies on behavioural pattern in *C. mrigala* (av. wt. 6 2 g) revealed that the diurnal activity changed in fish exposed to 0.01 and 0.02 ppm DDT at 30°C. The peak random activity was observed in the noon, as in the control, but bere was very low random activity in the evening. The activity was indirectly proportional to the time in treated fish.

Experiments to determine the effect of biocide (DDT) on survival and reproduction in *Ceriodaphnia* sp. are in progress. The concentration of DDT varying between 0.02 and 0.4 ppm proved to be lethal and the animals died within 120 minutes. The LC50 for 3 hours was 0.0021 ppm. Experiments at lower concentrations have not shown apparently adverse effect on survival and reproduction.

Problem No. 20.10 : Pollutional effect of industrial wastes on aquatic ecosystem.

Personnel : R. S. Panwar, D. N. Singh, K. Chandra, R. A. Gupta.

Duration : 1677-1981

Location : Rihand (U. P.)

Investigations conducted during 1981 revealed that the industrial wastes released into Rihand reservoir by Kanoria Chemicals, manufacturing caustic soda, bleaching powder and gammexane, were characterised by high values of free chlorine (3442.6 mg/1), chlorides (4686.8 mg/L), specific conductance (12506.2 micro-mhos/cm) total alkalinity (3468 mg/l) and sodium (2050 mg/1). pH was found to range between 6.8 and 10.6 during spring, between 8.4 and 8.6 during premonsoon & monsoon seasons, and between 8.56 and 9.2 during post-monsoon season. Water samples collected at the oufall indicated maximum values of chlorine (198.04 mg/1), specific conductance (2234.4 micro-mhos/cm) and sodium (504.2 mg/1). Dissolved oxygen was found to be nil during pre-monsoon season. Transparency varied between 9.5 and 14.1 cm and pH ranged from 7.2 to 8.6 Free chlorine was estimated at 0.86 to 3.8 mg/1 at Station No. 2 (20 m from the O. F.) during pre-monsoon and in traces during monsoon season. At other stations chlorides, specific conductance, total alkalinity and hardness suddenly dropped ranging from 8.92 to 19.86 mg/1, 70 to 380 micro-mhos/cm, 13.8 to 23.6 mg/1 and 22 to 30 mg/1 respectively. Dissolved oxygen remained at a satisfactory level (6.8 to 7.4 mg/l). pH of the soil at the outfall region was 8.0-8.2 and chloride content in between 72.4 and 76.4 mg/100 g soil.

The highly toxic effect of the efflunet was indicated by the total absence of phytoplankton population upto station No. 2 (20 m from the O. F.) during spring and post-monsoon station No. 3 (50 m) during pre-monsoon and upto station No. 1 during monsoon period. Quantitatively phytoplankton was found to be rich (6836 nos) during monsoon when compared to post-monsoon (4798 nos.), spring (1597 nos.) and premonsoon (317 nos.). Qualitative estimation revealed numerical dominance of *Microcystis* over other phytoplanktonic forms such as *Synedra*, *Navicula*, *Anabaena* and *Oedogonium*. Zooplanktonic forms such as *Cyclops*, *Diaptomus*, *Moina*, *Bosmina*, *Keratella*, *Brachionus* and nauplii were also recorded in sizable quantity. Chlorophyll estimation of *Microcystis* present in polluted and unpolluted zone was found to be 2.34 ug/ml and 5.62 ug/ml respectively. Among bottom dwelling organisms, chronomid larvae and nymph of damselfly were encount are in meagre quantites beyond station no. 3 during all the seasons. Fishes encountered in dead floating condition in the polluted zones were *C. mrigala*, *L. calbasu* *L. rohita* and *M. seenghala* and some of the weed fishes.

Laboratory experiments conducted with 0.19% combined effluent showed 100% mortality of *C. carpio* in 96 hrs exposure time at 30° to 31°C water temperature.

Problem No. 20.11 : Environmental pollution in the Hooghly Estuary with reference to heavy metals disposed through industrial wastes

Personnel : B. B. Ghosh, M. M. Bagchi and D. K. De

Duration : 1977-1981

Location : Barrackpore

Sources of Zn, Cr, and Cu pollution in the Hooghly estuary were noted during the year. Contribution of chromium (28.5 ppm) was maximum from tannery

effluent. The pollution in the estuary was apparent from accumulation of Zn (Max. 381.6 ppm) and Cr (Max. 9.6 ppm) in the bottom sediments as well as bioaccumulation of Zn (120.4 ppm), Cu (127.8 ppm) and Cr (20 ppm) in fishes and max. 112.2 ppm Zn, 10 ppm Cu and 0.3 ppm Cr in shrimps. Zn was well distributed in various tissues of fish with a maximum in gonad. Cr accumulated in gills only. Liver and kidney of *H. ilisha* showed both Cu and Zn. Plankton population was affected (nil-70 nos/l) at the outfall of tannery and paints and varnishes. Benthos were absent at the outfall region.

Problem No. 20.13 : Effect of supernatant waste water of Calcutta Metropolitan city on fisheries of Kulti estuary.

Personnel : P. Ray, R. N. Pal, S. B. Saha, R. K. Banerjee, S. K. Chatterjee and N.N. Majumder.

Duration : 1981-82.

Location : Calcutta.

Extensive survey of Kulti estuary receiving wastes of Calcutta Metropolis, revealed that a stretch of 55 km is polluted where D.O. varied between nil and 1.87 ppm. Recovery was observed at Nazat where D.O. was 4 ppm, conducive for survival and growth of fish. BOD ranged between 64-220 ppm in the upper stretch of the estuary and was restricted to 10 ppm in the lower stretch. COD ranged between 80 and 180 ppm. Tubidity was generally high (maximum 1500 ppm). High values of turbidity, BOD and COD caused low level of DO. As such, plankton concentration was low resulting in low primary productivity (20-24 mg $C/m^3/hr$). Bottom biota was greatly affected and other than *Mystus gulio* and *Pangasius pangasius* no fish could be recorded. Bacteriological load (TPC) in general was low to moderately high (2×10^4—7×10^6) in the stretch of Kulti estuary studied.

Cage culture experiments conducted in the estuary rvealed mortality of test fishes within a period of 4 hours ; though they could survive even in raw sewage when supplied with oxygen and a D.O. of 5 ppm was maintained. Diluted waste when used in bheries indicated appreciable value, where primary productivity as high as 279 mg $C/m^3/hr$ was recorded.

Problem No. 20.14 : Aquatic pollution in the Hooghly estuary with reference to Haldia Oil Refinery Complex.

Personnel : M. M. Bagchi, B. B. Ghosh and S.K. Majumder.

Duration : 1979-1981.

Location : Barrackpore.

Presence of oil, toxicants like phenol, sulphides chromium and zinc, moderately high temp. (33-38°C), and low DO (nil-2 8 mg/l) were noted for the refinery effluent. Reduction in plankton population was recorded in the estuary around 0.5 km below the outfall.

Problem No. 20.15 : Studies on the pollution in Buckingham canal and its effec on the confluent estuarine ecosystems.

Personnel : K. O. Joseph, K. Raman, K. V. Ramakrishna, G. R. M. Rao, S. Radhakrishnan, M. Kaliyamurthy, K. Gopinathan, P. M. A. Kader.

Duration : 1979-1982

Location : Madras

Two more sampling stations were added to the studies on Buckingham Canal. The pollution load at all the centres has abated due to the flushing of coolant waters from the Ennore Thermal Plant. Adyar and Ennore estuaries showed polluation charactertics due to

closure of bar mouth. Water samples were sent to King Institute, Guindy for bacteriological analysis. The density of phytoplankton was generally high with marine and brackishwater forms dominating. The forms encountered belonged for Myxophyceae,

The density of Phytoplankton was generally high with marine and brackishwater forms dominating. The forms encountered belonged to Myxophyceae (*Lyngbya* spp; *Oscillatoria* spp.; *Spirulina* sp. etc.) and Bacillariophyceae (*Chaetoceros* spp., *Bidduephia* spp., *Coscinodiscus* sp., *Skeletonema* sp., *Navicula* sp., etc.). During periods of freshwater influx forms belonging to Chlorophyceae (*Closterium* spp. *Scenedesmus* spp. *Pediastrum* spp. etc.) were also met with. The numerical density of Phytoplankton ranged from 40 (Central and T. V. tower) to 27,520 u/l (Adyar estuary). Zooplankters included nematodes, rotifers etc. and their density varied between nil and 7040 u/l.

Polychaetes, mysids, *Lucifer* sp., *Acetes* sp., amphipods, gastropods, pelecypods, juvenile prawns and fishes were recorded from many of the stations on Buckingham canal.

Four stations were sampled from the Coum river with indications of aseptic conditions throughout except at the upper most station.

Treated effluents from the Petrochemical complex at Manali have eutrophication effect on the Redhills surplus channel.

Problem No. 20.16 : Impact of fertiliser factory wastes on the hydrobiology of river Ganga.

Personnel : K. Chandra, Balbir Singh and G. N. Srivastava

Duration : 1979-1983

Location : Allahabad

Investigations conducted in 1981 revealed that 5,500 cubic metre/day of composite effluent was released to the river Ganga by the IFFCO Complex at Allahabad. The complex manufactuers urea and ammonium sulphate. The characteristics of the effluent, water at outfal area and water at recovery zone were as follows :

Physico-chemical properties	Effluent	Outfall area	Recovery zone (500 m away)
pH	8.6-8.9	8.22-8.40	7.8-8.4
D. O (mg/l)		6.6-8.4	6.8-8.6
Free ammonia (mg/l)	18.12-96.00	2.58-7.65	nil
Nitrate nitrogen (mg/l)	46-62		
Total alkalinity (mg/l)	360-640	360-430	230-310
Chloride (mg/l)	38.86-62.42	12.80-14.60	12.80-14.60
Hardness (mg/l)	100-110		
Calcium (mg/l)	48-52		
Specific conductance (mhos/cm)	1318 -68-1986.04 cm	259.98-298.04	59.75-75.79

High values of suspended solid (342-560 mg/l) and dissolved solid (1320-1340 mg/l) were observed for the efflunets. Water quality in the recovery zone showed significant improvement even during summer. At this zone, the ideal condition existed for planktonic growth was reflected by a higher concentration of plankton (1119 u/l) and microbentic fauna (52 u/m^2).

The highly toxic effect of the wastes was indicated by the total absence of zoo-and-phytoplankton excepting bluegreen algae, upto 300 m away from the outfall in contrast to their concentration upto 4550 u/l recorded at the upper zone of outfall. The benthic community was conspicious by its total absence upto 300 m. Heavy fish mortality was recorded during the course of investigation.

Phytoplankton population was mainly represented by Cholorophyceae, Myxophyceae and Bacillariophyceae. Chlorophyceae was mainly represented by *Ulothorix* followed by *Scenedesmus*. Myxophyceae was represented mainly by *Spirulina* followed by *Anabaena*, where as Bacillariophyceae was represented mainly by *Synedra* followed by *Navicula*. Zooplankton was represented by rotiters, copepods and cladocerans. Rotifers were represented mainly by *Cyclops* followed by *Diaptomus*. *Daphnia* was the only plankton encounted under cladocerans. Bottom biota was represented by chironomid larvae, bivalves (*Corbicula* sp.. *Parreysiafavidens*) gastropods (*Melanoides tuberculatus, Viviparus bengalensis*) and odonate nymphs.

Problem No. 20.17	:	Impact of thermal wastes on the ecology of Rihand reservoir.
Personnel	:	Krishna Chandra, R. S. Panwar, D. N. Singh and R. A. Gupta
Duration	:	1981 1984
Location	:	Rihand (Mirzapur Distt. U. P.)

A stretch of Rihand reservoir from Renusagar to NTPC-work site was surveyed and 3 sampling stations at Renusagar, Anpara and National Termal Power Corporation were selected for study.

Project 21 : Fisheries of River Basins

Problem No. 21.1	:	Ecology and development of *Mans* in Gandak basin.
Personnel	:	V. R. Chitranshi, H. P. Singh and D. Kapoor.
Duration	:	1978-1982.
Location	:	Brahmapura and Manika *Mans* Muzaffarpur.

I Fisheries :

a) *Brahmapura or Sikenderpur Man* : During the period under report the major carps contributed 3.38% of the total catch. The order of their abundance was *L. rohita* (2.80%), *C. catla* (0.42%), *L. calbasu* (0.145%) and *C. mrigala* (0.005%). It is apparent that the major carp fisheries of this *Man* is showing sharp declining trend (against 22% in 1980). The commercially important species of the air-breathing fishes contributed 29.6% of the total catch in 1981 againgst 18.9% in 1980. An increasing trend was observed in the fisheries of air-breathing fishes. The contribution by misc. species in the catehes in order of their abundance were *A. mola* (26.8%), *Puntius* spp. (16.88%), Prawn (7.0%), *C. reba* (3.9%), *Chanda* sp. (3.34%). *N. nandus* (3.52%), *Colisa* sp. (2.72%), *Mystus* spp. (1.22%), *Xenentodon* sp. (0.4%) & *W. attu* (0.47%).

b) *Manika Man* : The major carps contributed 3.09% of the total catch. This is against 8.3% in 1980. The commercially important species of the air-breathing fishes contributed 41.3% of the total catch. The important species of this group were *H. fossilis* 18.0%, *C. punctatus* 15.46%, *C. striatus* 2.68%, *C. marulius*

0.84% & *N. notopterus* 4.33%. The contribution of this group during the preceding year was 43.5% of the total catch.

The contribution of the misc. species in the catches in order of their abundance were prawn (21.64%), *Nandus* (11.5%), *Puntius* sp. (8.5%), *Chanda* sp. (3.73%), *Mystus* sp. (2.89%), *Colisa* sp. (2.54%), *Mastacembelus* sp. (1.15%) *Xenentodon* sp. (1 02%), *W. attu* (0.53) and *A. mola* (0.39%) of the total catch.

II Macrovegetation

A) *Sikenderpur Man or Brahmapura Man* : The Man is heavily infested with the floating and submerged weeds. The infestation density of *Eichhornia* sp. was 11.38 plants/m² by number and 4-21.90 kg/sq. m. by weight. The infestation density of the *Enhydra* sp. and one unidentified grass which formed a distanct mat ranged 0.6-2.9 kg/m². and nil to 1.36 kg/m² respectively.

Among the dominant submerged weeds, the infestation density of *Hydrilla* sp., *Ceratophyllum* sp. and *Najas* sp. was between 1.29 and 11.67 kg/sq. m. and 0.9 and 3.5 kg/sq. m. respectively.

III Plankton : Water samples were collected for analysis.

IV Physico-chemical characteristics of water and soil

Water quality :	*B. Man*	*M. Man* (Feb-April 1982)
Temperature °C	20-27	24-27.5
pH	7.7-8.2	8.1-8.4
Free carbondioxide (ppm)	nil-6.0	2.6-8.2
D.O. (ppm)	3.2-7.0	6.0-8.8
Total alkalinity (ppm)	185-230	72-100.0
Gross production of organic carbon mg/m³/hr	587.5-625.0	487.5-550.0
Net production of organic carbon	475-522.5	360.5-487.5
Respiration value (ppm)	87.5-125.0	62.5-112.5

Soil Characters :

Soil samples collected during the preceding years were analysed at Allahabad. The value of important parameters are given in the following table.

Parameters	B. Man range	M. Man range
Texture		
Clay%	15.0-26.5	29.0-44.0
Silt%	20.0-30.0	22.0-37.5
Sand%	55.0-70.0	22.0-45.0
pH	7.7-8.0	7.9-8.2
R C. mc. mhos/cm.	0.25-1.5	0.2-1.0
Organic matter%	0.4-2.6	0.32-2.2
Total Nitrogen%	0.08-0.14	0.07-0.13
Average phoshorus%	0.4-0.7	0.5-1.0

Project 22 : Fish Culture in Running Waters

Problem No. 22.2 : Catfish culture in running water.
Personnel : S. P. Singh, J. C. Malhotra, R. N. Seth and N. K. Srivastava
Duration : 1974-1981
Location : Allahabad

Assessment of catfish seed resources :

To assess the seed resources of *Mystus seenghala* and *M. aor*, a survey was undertaken during the period, March to June 1981 in a stretch of about 10 km of river Ganga around Shankarghat, Shivkuti, Chandpur Salori and in about 5 km stretch of river Yamuna around Mahewapatti and Mohabbatganj. A total of 15,000 hatchlings/fry (size range : 6-50 mm) of *M. seenghala* were collected from breeding pits during six days of assessment. The breeding pits located in river Yamuna in June were found to be abandoned. The

availability of *M. seenghala* hatchlings increased till May and thereafter with the rise in water level in the river, the breeding grounds got lost and the availability was reduced in June.

The details of seed abailability of *M. seenghala* was as follows :

River	Month	No. of assess-ment days	No. of hat :h-lings of pits	Size range mm
Ganga	March	1	4000/5	10-30
	April	2	4500/6	25-40
	May	2	6000/9	6-45
	June	1	500/2	40-50

During the course of assessment of seed resources, breeding pits of *M. aor* could not be located. This may possibily be due to the fish breeding in deeper waters of the river where even wading through the water to locate pits was not possible.

Rearing and culture of *M. seenghala* in cages :

The hatchlings/fry of *M. seenghala* collected from river Ganga were transported to rearing site at Shankarghat on river Ganga and reared in floating nylon cages (size : 1 x 1 x 1m). Chironomid egg-mass was given as initial feed and was followed by semiboiled trash fish after 5 days. Culture of *M. seenghala* was further continued in the floating nylon cages (1 x 1x 1 m size) in river Ganga and the fry were fed on semi-boiled trash fish @ 5% of body weight twice daily. The details regarding the culture experiments are given below :

Expt. no.	Fish stocked	Size range Av. size mm	Av.wt. g	Rearing period days	Size attained range/Av. size	Av. wt. g	Increment Av. size mm/Av.wt.
I	100	20-44/33	> 1	184	120-182/144	12	111/11
II	25	54-131/84	> 5	184	177-275/244	85	160/80
III	50	215-345/274	135	310	258-414/320	191	46/56
IV	10	285-376/336	234	322	372-482/414	456	78/222

There was no mortality during the course of rearing. However, due to storm the cages got damaged and escapement of few fishes occured. Sudden mortality in two cages occurred in July after a heavy rain and rise in water level. It was observed that the fishes (size range : 70-100 mm) first became sluggish and then mortality took place within 2-3 hours. The fishes in all the experimental cages were KMn04 there was no mortality later. The exact cause of mortality in two cages could not be ascertained. However, it was noticed that catfishes in the same size-range, encountered in the cast nets from the area were found to be in similar sluggish condition before mortality when kept under observation in plastic pool.

The cages had to be shifted from running water site, at Shankarghat to confined water at Teliarganj pond during November due to construction of pantoon bridge at the site in Ganga. Mortality of fishes in cages and in pond was observed which may be because of servere cold spell.

Culture in ponds :

The fry of *M. seenghala* having av. size 70 mm which were stocked at Yusufpur pond in July 1980 attained an average size of 518 mm (size range of 514-522 mm) during the culture period of about 11 months. The increment in weight was from less than 5

to 722 g. The trash fish population in the pond was mainly *Amblypharyngodon mola*, *Puntius ticto*, *P. sophore* and *Ambasis ranga*. No supplementary feed was given to the fry of *M. seenghala* in the pond. The pond had to be filled with freshwater during summer months. Another pond at Allahabad was also stocked with trash fish spawn before stocking *M. seenghala* fry in the size range of 40-70 mm (av. size : 58 mm) The culture is in progress.

Experiments on the suitability of feed for seenghala hatchlings was attempted. The egg-mass of molluscs was tried as feed but wasnot acceptable. Paste of GOC and Fish Meal of semi-boiled fish (1 : 1) was also tried. It attracted the fingerlings but was not acceptable. Cut pieces of raw trash fish were also not acceptable to the growing fingerlings.

Preliminary studies were made regarding the artificial propagation of *Mystus seenghala* and *M. aor*. The procurement of brood stock from nature was found to be the main hurdle. The specimens get injured during fishing and become unsuitable for the experiment.

Problem No. 22.3 : Cage culture in lentic waters.

Personnel : R. K. Saxena, M. A. Khan, N. K. Srivasthava and B. D. Saroj.

Duration : 1976-1981

Location : Allahabad.

Two sets of experiments on *C. mrigala* fiingerlings were conducted in 10 l glass jars.

Growth record in 1st set of experiment :

Initial size : 68.2 mm—88.6 mm

Initial wt. : 2.4 g—5.3 g.

Period of rearing : 150 days

Feed	*Increase in weight*
Dried palnkton	0.4 g
Soyabean+Groundnut oil cake+rice polish+Dried plankton (1 : 1 : 1 : 1)	0.7 g
Rice Polish+ground nut oil cake+ Soyabean (1 : 1 : 1)	1.1 g

Fingerlings fed with live plankton recorded decline in average weight every month.

Second set of experiment :

Experiment was conducted in six glass jars having four fingerlings in each.

Initial size : 89.9 to 92.0 mm

Intial weight : 6.1-6.9 g

Period of rearing—265 days

Feed	*Increase in weight*
Rice polish+ground nut oil cake + F. M.+live plankton (1 : 2 : 0 25 : 0.1)	0.7 g
Rice polish+ground nut oil cake + FM+dried plankton (1 : 2 : 0.25 : 0.1)	0.6 g
Rice polish+ground nut oil cake + dried plankton (1 : 2 : 0.1)	0.4 g
Rice polish+groundnut oil cake + F.M. (1 : 2 : 0.25)	0.3 g
Rice polish+ground nut oil cake+ F.M. (1.2:0.1)	—0.1 g (Negative growth)

These experiments indicated that feed containing an estimated of 31% of protein was found to be the best for growth of mrigal fingerlings. The feeding rate was 2-3% of the body weight.

Experiments were conducted to culture plankton in plastic pools fertilised with raw cowdung.

The plankton population remained at lower ebb ring monsoon and winter months. A maximum 56,500 u/l dominated by Chloroccocales (81.7%) lowed by cladocera (8.6%) was recorded in monsoon nths and in winter a density of 20,500 u/l was recor- l which was dominated by diatoms and Chloroccoca- . During summer months a population of 102,000 u/l minated by Chloroccocales (71.5%) and diatoms .5%) was estimated. RCD media of 7000 ppm ve the best production of zooplankton population *riodaphnia* sp.) which was estimated at 14,500 u/l. e water temperature during the period of experi- nt ranged between 16.5°C to 33°C.

A total of 16.6 g of plankton (dry weight) was rvested from the plastic pools. About 3074.3 g of e plankton was collected from the ponds and tanks ated nearby. This resulted in 220.7 g of dry weight plankton. The same was utilized for feeding the gerlings in the experiments mentioned below.

roject 23 : Bundh Breeding

oblem No. 23.1 (a) : Breeding of major carps through canal breeding technique.

rsonnel : G.N. Mukherjee, Ravish Chandra, S.J. Karamchandani, G.N. Srivastava and Krishna Chandra.

ıration : 1977-1982

cation : Distt. Burdwan (West Bengal)/ M.P.

Successful breeding of *C. mrigala* was achieved West Bengal during the monsoon of 1981. A eeding chamber was constructed by the side of a nal from the river Damodar at village Baidyapur istt. Burdwan). The chamber was 27.5 M long ile its width varied from 15 M to 21.5 M at diffe- t points. The depth of the chamber was 1 M to 1.5 M in the middle with sloping grassy spawning grounds situated length-wise on both the sides The chamber was provided with an inlet and an outlet both fitted with meshed screens and wooden planks. Prior to commencement of the breeding experiments, liming of the breeding chamber was done @ 250 kg/ha. The breeding experiments were initiated on 14th July 1981 with the available 26 brooders of major carps in the following sex ratio :

C. mrigala	Males 3 :	Females 2
L. rohita	Males 2 :	Females 5
C catla	Males 3 :	Females 11

Since the construction of the breeding chamber and procurement of brood fishes by the CADC took sometime, the breeding experiments were delayed, with the result that the brood fishes did not respond initially. As such, one set of catla in the sex ratio of 2 M ; 1 F was given pituitary hormone injection in the evening of 17th July 1981 and released into the chamber. Though vigorous sex play among the brooders was observed scooping operation for collection of eggs was not feasible on account of overflooding of the entire breeding chamber due to sudden breach upstream of the feeding canal. Thus no eggs could be collected immediately, though numerous fry of mrigal were collected within the chamber at a later date which showed that sympathetic breeding of *C. mrigala* did occur around mid-July. Physico-chemical studies during the breeding experiments revealed that DO content varied from 4.84 to 6.0 ppm, pH from 6.60 to 6.80, hardness from 37.0 to 40.0 ppm, alkalinity from 10,0 to 12.0ppm, and chloride from 8.10 to 8.16 ppm. The water temperature was usually on the higher side ranging between 29.0 to 32.5°C.

The canal breeding work was simultaneously conducted with mrigal and rohu at Beniganj in the district Chhatarpur of Madhya Pradesh. The brooders did not respond favourably which was attributed to the poor condition of the brooders.

Problem No. 23.1 (b) : Bundh breeding of major carps

Personnel : S. K. Wishard, S. N. Mehrotra and Balbir Singh

Duration : 1974-1981

Location : U.P./M.P.

Bundh breeding of major carps was successfully achieved in an improvised bundh at Sirmaur, Rewa (M.P.) by drawing water into it from a storage pond. The latter was constructed a month earlier and the rain water was stored in it for the first time. This 'nallah' was meant for flushing out the spilled water from the the storage pond. For the breeding of major carps it was barricaded at a place by two temporary wooden sluice gates. The water was drained into it to fill the the 'nallah' to a depth of about 0.50 m. Seven pairs of rohu were released in the impoundment and spawning was observed between 3.30 and 5.30 a.m., 12 hrs after the stock was released. 8.5 lakh eggs were collected with 87% fertilization.

Five days later, the water was drained out from the 'nallah' and freshwater was allowed to enter from the storage pond to about the same depth. Another set comprising 10 pairs of rohu and six pairs of mrigal were introduced in the bundh and the sex play commenced 10 hrs. later. Spawning was observed in the early hours. 20 lakh eggs were collected (fertilization-84%). Spawners were examined and all of them were found to be normally spent.

A third attempt was also made after 10 days in which 7 pairs of rohu, and 3 pairs of mrigal were introduced. Spawning took place but on examining the brood stock, both, the males and females were found partially spent. Only 2.5 lakh eggs were collected. Fertilization rate wrs 56%. Attempt was made to breed this stock once again by introducing freshwater from the storage pond but it failed. The observations indicated that in the spawning of major carps, longstanding rainwater looses its characteristic property which otherwise makes it conducive for the spawning of major carps.

Physico-chemical parameters were examined and declining values in respect of temperature (30.0-21.0°C), pH (97 4-6.8), hardness (30-20 ppm), total alkalinity (56-20 ppm), specific conductivity (62.4-56.0 umhos/cm), Na (5.0-3.0) and K (2.8-2.6) ; and increasing values in respect of free CO_2 (8.0-11.6 ppm) and DO (6.8–7.4 ppm) were found conducive.

Mechanical, analysis of soil indicated sandy (50%) nature with clay-26% and silt 16% pH was 7.6.

Project 25 Beel Fisheries

Problem No. 25.1 : Pen culture and study of ecology and fishery management of a selected beel in Assam (Dighali beel).

Personnel : Y.S. Yadava, M. Chowdhury, R.K. Singh and V. Kolekar

Duration : 1978-81

Location : Gauhati

A *Catch statistics :*

During December 1980—July 1981. a total of 8.5 tonnes of fishes were estimated to have been caught in the Dighali Beel.

Specieswise analysis of the catch indicated the dominancy of misc species (4415 kg, 52.22%) followed by *W. attu* (1096 kg ; 12.96%), live fishes (767 kg ; 9.07%) ; *L. rohita* (663 kg ; 7.84%), Prawn (579 kg ; 6.85%), *C. catla* (364 kg ; 4.31%), *N. notopterus* (211 kg ; 2.50%), *N. chitala* (160 kg ; 1.89%), *M. tengra* (103 kg ; 1.22%), *C. reba* (35 kg ; 0.42%), Common carp (29 kg ; 0.34%), *L. bata* (17 kg ; 2.00%) and *C. mrigala* (15 kg ; 0.17).

B *Hydrological observations :*

Hydrological parameters of the beel were collected sectorwise for analysis. Water quality of the pen installed in the beel was also studied till May 1981. The observations recorded are as follows :

Parameters	*Beel range*	*Cage range*
Air temperature °C	16.5-33.5	—
Water temperature °C	17.5-32.0	18.0-26.5
Transparency (cm)	29.0-74.0	—
pH	6.4-7.0	6.4-7.0
D.O. (ppm)	1.2-12.0	6.0-8.9
CO_2 ,,	1.2-12.0	3.2-17.0
HCO_3 ,,	25.0-50.0	27.0-40.0
Fe+++ ,,	0.002-0.08	Trace-0.03
P ,,	Trace-0.304	0.081-0.851
NO_3—N ,,	0.012-0.060	0.15-0.65
NH_4—N ,,	0.05-0.38	Trace-0.20
Chloride ,,	4.0-12.8	4.6-8.8
Silicate ,,	1.0-7.0	1.0-8.4
Diss. organic matter ppm	4.0-30.0	2.8-20.02
Electrical conductivity (m/mhos/cm)	50.0-100.0	50.0-98.0
O_2 Saturation %	15.31-141.87	67.31-95.36

Plankton and primary productivity :

The net/gross primary productivity ranged from nil to 98.214 mgC/m³/hr and from nil to 125.00 mgC/m³ /hr. Respiration ranged from nil to 71.25 mgC/m³/hr.

The average monthly occurrence during the period was 574 u/l, which constituted 293 u/l (51.04%) of phytoplankters and the rest zooplankters.

Bacillariophyceae formed the most dominant group (97 u/l) followed by Myxophyceae (78.0 u/l), Chlorophyceae (72.0 u/l) and Desmidaceae (46.0 u/l) among the phytoplankters and copepods (109.0 u/l) followed by protozoans (98.0 u/l), rotifers (56.0 u/l) and cladocerans (18.0 u/l) among the zooplankters.

The common genera observed were *Mougeotia, Spirogyra, Navicula, Synedra; Tabellaria, Oscillatoria, Nostoc, Closterium, Cosmarium* and *Microsterias,* among the phytoplankters and nauplius, *Cyclops, Diaptomus, Brachionus, Filinia, Lecane, Keratella, Bosmina, Sida, Centropyxis, Eudorina* and *Ceratium* among the zooplankters.

Macrobenthos :

The average monthly occurrence of bottom organisms was found to be 287 nos/m². It consisted of Gastropoda (87 nos./m²) Diptera larvae (76 nos /m²), Oligochaeta (74 nos./m²), Pelecypoda (34 nos./m²), Coleoptera (8 nos./m²), *Hirudinea* (1 no./m²), Hemiptera (1 no./m²) Ephemeroptera (1 no./m²), Ostracoda (1 no./m²), prawns (1 no./m²) and miscellaneous (2 nos/m²).

Diptera, oligochaetes and gastropods among molluscs formed the major groups.

The common organisms recorded were *Chironomus* spp. *Culicoides* spp., *Hydrocanthus* spp., *Plea* spp., *Caehis* spp., *Amnicola* spp., *Viviparus* spp., *Gyraulus* spp., *Helisoma* spp., *Campyloma* spp., *Planorbula* spp., *Bythinia* spp., *Pisidium* spp., *Sphaerium* spp., and *Syncaris* spp.

Macrovegetation ;

All the three sectors of beel were infested with vegetation, the density being more in sector II & III. The occurrence of water hyacinth was more during monsoon months, when it completely choked the beel. However, during winter months, when the water recedes to a considerable extent, water hyacinth was relegated to the

background. All this stage the other floating and submerged vegetation displayed their prominence. Common weeds infesting Dighali beel are were fallows :

Free floating : *Eichhornia crassipes*, *Azolla* spp., *Wolffia* spp.,*Leura* spp.

Floating weeds : *Nymphaea* spp , *Nelumbo* spp., *Nuphan* spp.. *Trapa* spp.

Rooted submerged : *Hydrilla* spp., *Vallisneria* spp., *Potamogeton* spp., *Ceratophyllum* spp., *Sagittaria* spp.

Marginal weeds : *Marsilea* spp.

C. *Pen culture* :

Final harvesting of the pen in Dighali beel was done in June due to difficulty in continuing the experiment due to heavy rains and abnormal rise in water level. Forty nos. of the fish (common carp) escaped from the pen in the night of 4.4.81 during a cyclonic storm. The rest 160 fishes harvested showed an av. weight of 200 g and length of 210 mm. The production obtained was 32 kg/20 sq.m.

Project 24 : Freshwater aquaculture in urban and near urban areas

Problem No. 24.1 : Intensive rearing of Indian and exotic carps in recirculatory filtering system

Personnel : A. V. Natarajan, K. L. Sehgal, Kuldip Kumar and D. Nath

Duration : 1978-1982

Location : CIFRI campus, Barrackpore

Experiments were continued for raising of fry of *L. rohita*/*Cyprinus carpio* and fingerlings of silver carp.

In case of *Cyprinus carpio*, trials were conducted seperately in ponds and cages installed in the ponds. The hatchlings (Av. 12 mm) in 45 days of rearing at stocking density of 1 m/ha and 750/m^2 attained average lengths of 49 and 28 mm in ponds and cages respectively. The early fry were fed on formulated mash comprising rice bran (20%) defatted soyabean 20%, mustard oil cake (10%), wheat flour as binder 10% and poultry vitamin mineral premix @ 10 g/kg of feed. The feeding was done @ 4% body weight five times daily with an interval of two hours from sunrise to sunset. A major part of the fry totalling 4170 were later handed over to ICAR Complex, Shillong and Khardah Station of the Institute.

In the second experiment, rearing of fry to fiingerlings of *L. rohita* for 98 days at stocking density of 0.6 m/ha gave survival rate of 70%. The average size attained was 85 mm from initial length of 32 mm. The fry were fed on formulated pellets with the ingredients given above @ 4-6% body weight. The circulation in this pond could not be undertaken during major part of culture period due to break-down of the diesel pump.

In another experiment spectacular results have been achieved on rearing of table size fish. In a rearing period of just 32 days at stocking density of 15000/ha silver carp attained average weight of 638 g (365 mm) from initial weight of 346 a (330 mm) ; Rohu attained average weight of 340 g (390 mm) from initial weight of 114 g and common carp attained average weight of 245 g (205 mm) from initial weight of 111 g. The daily weight increment works out to be 9.3, 7.0 and 3.9 g in case of silver carp, rohu and common carp respectively. Feeding was done with agglomerates comprising rice bran (30%) m. oil cake 30%, soyabeen (30%) and wheat flour 10%. thrice daily with the help of six floating trays suspended at different corners of the pond.

Problem No. 24.4 : Induced breeding of Indian and exotic carps in Recirculatory Filtering System,

Personnel : A. V. Natarajan, K. L. Sehgal, Kuldip Kumar

Duration : 1980-1982

Location : CIFRI campus, Barrackpore

Experimental trials on induced breeding of Indian major carps in RFS ponds were continued. The females of *Cyprinus carpio* were injected pituitary extract at a dose of 3-4 mg/kg and released along with males in the ratio of 1 : 2 in floating net cloth hapas. The water circulation was operated for 4-6 hours after the second injection and fish bred during this period. A total of 5.7 lakhs eggs were collected. The rate of fertilisation was 70% while hatching rate varied from 50-75%. The eggs were incubated in specially designed floating incubation chamber. The RFS was operated for 4-6 hours during incubation period. Experiments on breeding of *L. rohita* were also continued during this year and two sets of brooders were bred during July 1981. The seed is being reared in R.F.S. ponds.

Problem No 25.2 : Ecology and fisheries of beels

Personnel : A. V. Natarajan, S. B. Saha and V. Pathak

Duration : 1980-1982

Location : Kalyani

Fortnightly samples were collected and analysed for hydrological studies. pH fluctuated between 7.5-8.5. Bicarbonate ranged from 120-170 ppm. Av. D. O. was 7.5 ppm. Nutrient level was very poor.

Soil was very rich in nutrients. Average gross and net primary production were 525 mg C/m³/day and 360 mg C/m³/day respectively. Biological productivity was low. The beel was completely chocked with macrovegetation.

Biological studies of a few selected fishes also were done.

Problem No. 25.3 : Ecology and fishery of Dhir Beel in Assam.

Personnel : Y.S. Yadava, M. Chowdhuri, R.K. Singh and V. Kolekar.

Duration : 1981-1984

Location : Assam

A Catch Statistics

A total of 9.4 t of fishes were estimated to be caught from the Dhir beel during October-November, 1981. *G. chapra* dominated the catch (66%), followed by miscellaneous species (14.15%), major carps (7.59%), minor carps (6.75%), feather backs (3.05%), catfishes (2.42%) and *H. ilisha* (0.08%).

Species-wise landing

Species	*Wt. (kg)*	*Species*	*Wt. (kg)*
L. rohita	116	*C. mrigala*	14
L. calbasu	10	*C. reba*	207
L. bata	225	*Barilius* spp.	196
C. catla	570	*W. attu*	205
M. seenghala	21	*N. notopterus*	285
H. ilisha	7	Live fishes	2
S. phasa	93	Miscellaneous	1228
G. chapra	6172		

Proper exploitation of the beel is yet to be initiated. The main fishing will start from December onwards. The present landings represent the catch caught by dip nets (local name-Khora jal) only, installed at several points in the beel.

Fortnightly analysis of water sample gave the following results :

	October	*November*
Air temperature °C	28.5	27.5
Water temperature °C	30.0	22.0
Transparency (cm)	99.0	65.5
pH	6.3	6.7
D. O. (ppm)	4.2	7.5
Dissolved organic matter (ppm)	4.20	6.0
Electrical conductivity (m/mho/cm)	98.5	98.0

C Plankton Analysis

The average monthly occurrence during the period was 124 u/l, which consisted 66 u/l (53.23%) of phytoplankters and 58 u/l (46.77%) of zooplankters.

Chlorophyceae formed the most dominant group (40 u/l) followed by Desmidaceae (18 u/l), Bacillariophyceae (6 u/l) and Myxophyceae (2 u/l) among the phytoplankters and Rotifera (21 u/l), Protozoa (19 u/l) and Copepoda (18 u/l) among the zooplankters.

The common genera observed were *Spirogyra, Ulothrix, Chodatella, Pediastrum, Mougeotia, Kirchneriella Tabellaria, Navicula, Synedra, Anabaena, Microcystis, Micrasterias, Desmidium, Arthrodesmus, Staurastrum* among the phytoplankters and *Brachionus, Euchlanis, Filinia, Keratella*, nauplius, *Trichotria, Pandorina, Eudorina, Synura, Dinobryon Acanthocystis*, among the zooplankters.

D Macrobenthos

The average occurrence of bottom organisms was found to be 619 nos./m². It consisted mainly of Gastropoda (543 nos./m²), Pelecypoda (32 nos./m²), Diptera (22 nos./m²) and Decapoda (22 nos./m²). The frequency of Gastropoda was maximum during November.

The common organisms recorded were *Chironomus* spp. *Campyloma* spp. *Viviparus* spp, *Amnicola* spp., *Helisoma* spp., *Bythinia* spp., *Goniobasis* spp., *Pisidium Syncaris* spp.

Project 26 : Energy flow in aquatic ecosystems

Problem No. 26.1 : Studies on the energy flow in different aquaculture ecosystems

Personnel : A.V. Natarajan and V. Pathak

Duration : 1980-82

Location : Barrackpore

Studies were made in three ponds receiving organic fertilization and two beels. All the three ponds received similar light energy 192 x 104 calories/m²/day but the energy tranfsormation from light to chemical varied considerably being in the range of 18,000 to 39,000 cal/m²/day (0.84 to 1.95% efficiency). The two beels showed very low efficiency of energy transformation 0.14 to 0.5% by phytoplankton. The diel oxygen cycle studied in one beel showed very high fixation of energy 54,760 cal/m²/day as method thereby indicating that the energy transformation by macrovegetation was of vary high order in the beel (52,020 cal/m²/day).

Studies made in three different ponds showed a chlorophyll concentration in the range 15.2 to 65 mg/m³ which is equivalent to 2.4 to 10.5 g/m² of dry weight of phytoplankton or 8.7 to 36.6 kg cal of energy/m² at producer level. The two beels showed only 0.8 to 2.6 mg/m³ of chlorophyll or 0.46 to 1.48 k cal of energy/m².

Study on detritus and bottom energy resource was made in two beels, Kulia beel in West Bengal and

Dhir beel in Assam. In Kulia beel the detritus amounted to 102 g/m² dry weight which is equivalent to 262 k cal/m² while in the other beel the detritus was 95 g/m² (dry wt) and energy 184.7 k cal/m². The studies clearly indicate that detritus energy resource was of very high order in both the beels.

Detailed stuy made in the beel ecosystem revealed that 75% of the available energy was utilized through detritus chain. The efficiency of energy utilization from detritus to fish was 8%. Studies in other ecosystems are progress.

Project 27 : Radio-tracer technique in aquaculture

Problem No. 27.1 : Estimation of primary productivity of freshwater reservoirs, ponds and swamps, using C-14 technique.

Personnel : Babu Lal

Duration : 1979-1982

Location : Barrackpore

In situ experiments were conducted in the ponds of local fish farms in Hooghly district of West Bengal. Primary production of phytoplankton in six ponds were estimated as mg C/litre/hr and calculated as mgC/m³/hr. Average net primary production was found to be about 85.5 to 102.25 ; 100.00 to 110.65 ; 77.75 to 45.85 ; 88.28 to 159.25 ; 166.65 to 168.25 and 145.25 to 160.75 mgC/m³/hr in the fish ponds of S/Shri Gotha Marik of Khirkipukur, Bhabani pandity of Goshipukur ; Madan Mohan Pakira, Sone Kr. Pakira, Tapan Biswas, and Mukul Kr. Pakira of Kalyan baty respectively.

Problem No. 27.2 : Studies on transformation and fate of applied nitrogenous fertilizers in freshwater ponds and swamps, using 15_N.

Personnel : Babu Lal and V. Pathak

Duration : 1980-1982

Location : Barrackpore

Experiments were conducted with three types of soils having 0 70, 0 65 and 0.45% of organic carbon, respectively. 15_N tagged urea fertilizer was applied at the rate of 20, 40, 60 and 80 kg of N/ha respectively. Uptake of fertilizer nitrogen was observed to be about 44.51 to 50.37 42.74 to 50.88 and 47.27 to 58.45% in the soils of high intermediate and low organic carbon containing soils respectively.

Project 28 : Adaptive research in fish culture

Problem No. 28.1 : Low cost fish culture in the village ponds.

Personnel : R.M. Bhowmick, C. Selvaraj, P.L. N. Rao, S.L. Kar, Radheshyam, S.K. Sarkar, B.R. Dutta, C.S. Purushothaman. Kuldeep Kumar and J. P. Verma

Duration : 1980-1983

Location : KVK/TTC, Kausalyagang, Dist. Puri

One pond of 0.75 ha at village Nakhaurpatna was stocked with fry of Indian major carps and exotic carps @ 3500/ha in August, 1980 with the view to find out production potentiality of the ponds in rural areas, with low level of inputs. Samplings done during the year under report indicated the entry of large quantity of unwanted fishes from the surrounding wild waters due to the breaching of embankments during the later part of the monsoon of 1980. Final harvesting of the

pond was done in the month of May and June this year. Subsequently, the pond was totally dewatered to start new experiment all afresh. In all, a total of 2113 kg of fish was harvested (87.08% carps and rest miscellaneous varieties) giving a production of 2817 kg/ha within a period of about 10 months.

Fresh experiment on composite culture in the same pond has been taken up. Prior to stocking the pond was treated with lime at conventional dose. The stocking of the pond has been completed in the month of September @ 5000/ha with 5 species combination excluding only the grass carp. Routine observations on the physico-chemical parameters and plankton analysis of the pond water are being attended to.

Problem No. 28.2 : Utilization of domestic/kitchen ponds for fish culture.

Personnel : Radheshyam, B.N. Singh, P.L.N. Rao, B. B. Satpathy, J. P. Verma, Kuldeep Kumar, B. R. Dutta and S. K. Sarkar.

Duration : 1980-1983.

Location : KVK/TTC, Kausalyagang, Dist. Puri.

Three kitchen ponds of 0.03 ha, 0.03 ha and 0.02 ha water area, were utilized for rearing fry and fingerlings of cultivable carps. With the fry stocked in 1980, one set of experiment was completed in January, 1981. The rate of recovery of fingerlings in this experiment ranged from 62.85 to 74.57%. The same ponds were subsequently utilized for raining table-size fish by utilizing the same fingerlings. stocked @ 7000/ha. The fish were fed with kitchen wastes as well as locally available supplementary feed. Ponds were harvested in June. 1981 recording production of 2423.33, 1956.66 and 1375.00 kg/ha in 51/2 months time respectively. The same work is being repeated in all the kitchen ponds this year too.

Problem No. 28.3 : Impact of training in KVK/TTC in adopted villages.

Personnel : B. R. Dutta, Kuldeep Kumar, Radheshyam. B.N. Singh and C. S. Purushothaman.

Duration : 1980-1982.

Location : KVK/TTC, Kausalyagang, Distt. Puri.

The survey work has already been initiated in five selected villages, namely, Pomasara, Pubasasan, Kausalyapur, Nakhaurpatna and Pratapsasan.

Project 29 : Fish nutrition and feed technology.

Problem No. 29.1 : Fish feed ingredients survey in India ; preparations of feed composition tables ; formulation of feeds and experimental trials of formulated diets (UNDP/FAO Project)

Personnel : R. Paul Raj (upto 5.9.81), N. K. Thakur, (from 23.11.81), D. N. Swamy, and V. R. P. Sinha

Duration : 1980-1983

Location : FARTC, Dhauli

Proximate composition of 30 locally available feed ingredients were analysed. Based on proximate composition and amino acid profile of feed stuffs. two sets of pelleted feeds were prepared. In the first set with 25% protein level, four combinations were made using groundnut oilcake, rice bran, wheat bran and seasame oilcake and were fortified with vitamins and minerals. Laboratory experiments with rohu fingerlings on the acceptability, intake and effect on growth are being studied.

In the second set with 30% protein level three combination were made using ground nut oilcake, rice bran and sal seed cake, and fortified with vitamins and minerals. Laboratory trials on the acceptability. intake and effect on growth with common carp fry indicated good acceptability when fed at 10% of their body weight.

Problem No. 29.2 : Amino acid requirements of Asiatic carps, catla, rohu, mrigal, silver carp and grass carp.

Personnel : B.N. Singh and P.R. Sen (upto 28.4.81)

Duration : 1980-1984

Location : FARTC, Dhauli

Studies on the efficacy of synthetic balanced diet with an essential amino acid content of 27.44% to 37.33% indicafed better growth in rohu fry with a diet containing 27.44% aminoacid where an increase in weight of 135.9% was recorded in about four weeks' time as against 114.1% in fry fed with the diet containing 37.33% aminoacid content suggesting that probably the essential level of amino acid requirement for rohu fry is about 27.44%.

Problem No. 29.3 : Fortifying conventional feed with available high grade protein as per protein requirement of carps.

Personnel : P. R. Sen (Upto 28.4.1981), B. N. Singh and D.K. Chatterjee

Duration : 1979-1982

Location : FARTC, Dhauli

Seven types of feeds were formulated using local feed stuffs with protein levels at 34.2, 35.1 and 25.1% and their efficiency evaluated by feeding rohu fingerlings. Ground nut oil cake+rice bran fortified with vitamins and minerals ($CaCo_3$+NaCl) gave better results over the conventional feed alone. The conversion ratio was recorded to be 9.6 : 1 at 25-30°C. with fortified feed an increase of 11.0 g in weight was recorded at 15-20°C against nil with conventional feed.

Four different types of feed pellets were also prepared using groundnut oilcake+wheat bran ; oil cake +wheat bran ; groundnut oil cake (expeller)+rice bran and seasame oil cake+groundnut oil cake (expeller) +rice bran and fortified with vitamins, minerals and trace elements keeping the protein level at 25.5%. The first and fourth feed pellets gave better results compared to the other two. The results indicated that 50% of the groundnut oil cake can be substituted by seasame oil cake.

Problem No. 29.4 : Studies on digestive physiology of Indian major carps.

Personnel : D.N. Swamy and V.R.P. Sinha

Duration : 1981-1983

Location : FARTC, Dhauli

In Laboratory experiments, rohu fingerlings fed with four types of pelleted feeds fortified with vitamins and minerals comprising groundnut oil cake+rice bran ; groundnut oil cake+wheat bran ; groundnut oil cake +rice bran+seasame oil cake (protein level 25%) and seasame oil cake + rice bran recorded a total digestibility of 53.45, 56.51, 52.3 and 43.3 percent respectively.

In the second set. three types of feed pellets with 30% protein level comprising ground nut oil cake+ rice bran+sal seed cake and fortified with vitamins and minerals gave 65.5, 71.3 and 64% digestibility when fed to common carp fry. The highest digestibility and growth were obtained with the feed comprising groundnut oil cake+sal seed 50%+rice bran 50%.

Problem No. 29.5	:	On the morpho-histological and and histochemical observations of the digestive system of *Catla catla* and *Labeo* spp. in relation to their food and feeding habits.
Personnel	:	Kuldeep Kumar and S.K. Sarkar
Duration	:	1981-84.
Location	:	KVK/TTC, Kausalyagang, Distt. Puri.

Histological preparations of the samples were made.

Project 31 : Inland Fisheries Resource Assessment

Problem No. 31.2	:	Fisheries resources of the Hooghly System with special referenee to Hilsa
Personnel	:	K.K. Ghosh, P.M. Mitra, D.K. De, S. N. Sar, A. Chowdhury, H. S. Majumder, A.K. Roy, N D. Sakar, N.C. Mondal and A.R. Paul
Duration	:	1981-1985
Location	:	Barrackpore, Calcutta, Lalgola, Kakdwip, Port Canning, Raidighi, Uluberia, Digha and Murshidabad/ Behrampore

During July-December an estimated total of 6045 tonnes of hilsa was caught. This constituted 47% of total fish landings in the zone. The effort in mid-estuary and Rupnarain was more or less of the same order as in previous years but the catch per unit of effort was about three times in Rupnarain in July and August and about two times in Hooghly upto September.

Preliminary estimates of catch of hilsa from the estuary for 4 months period July-October, 1981, showed the yield as 985 tonnes as against the range of 211 to 793 t corresponding period in the six year 72-73 to 77-78.

Problem No. 32.1	:	Use of bio-gas slurry as fish feed.
Personnel	:	M.L. Bhowmik, S.P. Rai and J.G. Chatterjee
Duration	:	1980-81
Location	:	Barrackpore

Bio-gas slurry is a semi-liquid byproduct of bio-gas plants which oozes out continously while producing gas from raw cattle dung. Though the use of biogas slurry as agricultural manure after sun drying or making compost with other wastes was in vougue, its application as pond fertilizer is very recent.

Experiments conducted using bio-gas slurry as one of the feed components also gave very much encouraging results when applied with equal nitrogen basis in case of bottom feeders. Three sets of experiments were conducted using common carp fry and fingerlings and mrigal fingerlings as the experimental materials where growth obtained by feeding the fishes with traditional feed mixture (Rice bran+oil cake), Rice bran+bio-gas slurry and oil cake+rice bran+bio-gas slurry were almost equal.

Problem No. 32.2	:	Tobacco and tea wastes as fish toxicants.
Personnel	:	M.L. Bhowmik, S.P. Rai and J.G. Chatterjee
Duration	:	1980-81
Location	:	Barrackpore

Experiments conducted in the laboratory with Tobacco wastes obtained from North Bengal could not achieve any kill of fish upto 4000 ppm. Subsequently due to the unavailabity of better experimental material

no further work could be carried out. This project has been closed down.

problem No. 32.3 : Biochemical studies on silver carp and grass carp and formulation of compounded feed for intensive culture

Personnel : A. Hajra and S. D. Tripathi

Duration : 1980-81

Location : Barrackpore

The proximate chemical composition of two aquatic weeds, *Spirodela polyrhisa* and *Ceratophyllum demeraum*, and the common land grass, *Cynodon daetylon* which were tried as feed for chinese carp, *Ctenopharyngodon idella*, was determined. The total dry matter digestibility and the apparent nutrient digestibilities of the feeds were estimated. Protein efficiency ratios of aquatic weeds and the land grass were worked out. The aquatic weeds were found to have lesser crude protein and fibre content than the land grass. The ash content was higher in aquatic weeds, highest being in *Ceratophyllum*. *Ceratophyllum* contained lowest amount of crude fat. The calorie content was highest in *Spirodela* followed by *Cynodon* and *Ceratophyllum*. The land grass was less efficiently digested (48.1 percent) than the aquatic weeds (51.0-57.3 percent). The digestion coefficient of crude protein in these feeds ranged from 66.13-78.44 percent. Crude fibre digestion was recorded upto 36.65 percent in *Cynodon* and 38.16-39.17 percent in aquatic weeds indicating abilities of the exotic carp to break down complex polysaccharides of feeds in the digestive system. Digestibilities of dry matter, protein, fat and carbohydrate decreased significantly as the fibre contents in feeds increased from 7.9-23.2 per cent. Among the three feeds tried, *Spirodela* and *Cynodon* were seen to have a better nutritive value as feed for grass carp, whereas *Ceratophyllum* proved to be a nutritionally poor feed. Consumption data showed that palatability of land grass might not be that good as was expected. The digestibility coefficients of nutrients, the consumption data, the proximate chemical composition of food and protein efficiency ratios (P.E.R.) recorded in the experiments are detailed below :

Digestibility coefficient of nutrients

	D. N.	*Protein*	*Fat*	*Fibre*	*Ash*	*NFE*
Cynodon dactylon	48.1	66.13	69.30	36.65	36.41	47.98
Spirodela polyrhiza	57.3	78.44	78.94	39.17	46.23	56.20
Ceratophyllum demersum	51.0	74.86	72.97	38.16	42.64	51.20

Consumption data

	Wet matter consumption	*Moisture %*	*Corresponding dry matter*
Cynodon	125.81	83.15	21.20
Spirodela	303.70	91.90	24.60
Ceratophyllum	341.17	95.75	14.50

Chemical Composition of Feeds

FEED	MOISTURE %	DRY MATTER COMPOSITION					
		Protein	Fat	Fibre	Ash	NFE	Calorific value (Koals/gm.)
Cynodon dactylon	83.15 ± 0.50	14.8 ± 0.10	4.8 ± 0.10	23.2 ± 0.30	9.2 ± 0.10	47.4 —48.6	2.944 ± 0.037
Spirodela polyrhiza	91.90 ± 0.25	13.6 ± 0.10	6.2 ± 0.20	7.9 ± 0.25	20.5 ± 0.20	51.05—52.55	3.174 ± 0.052
Ceratophyllum demersum	95.75 ± 0.20	12.9 ± 0.10	2.6 ± 0.15	9.1 ± 0.20	32.4 ± 0.05	42.50—43.50	2.470 ± 0.037

F. E. R. of Feeds

FEED	Total initial body wt. (gms) n—8	Total final body wt. (gm.) n—8	Total growth (gm.)	Percent growth (growth 100 gm body wt.)	Total moist feed consumed (gm)	Total dry feed consumed (gm)	Total protein consumed (gm)	Convertion ratio (with dry feed)	F. E. R.
Cynodon dactylon	109.08	123.20	14.12	12.94	276.55	46.60	6.89	3.30	2.04
Spirodela polyrhiza	113.52	130.44	16.92	14.90	658.02	53.30	7.24	3.15	2.33
Ceratophyllum demersum	115.44	123.61	8.17	7.07	788.23	33.50	4.32	4.10	1.89

ha/yr and the cost of production worked out to Rs. 3.15 kg.

At Badampudi centre (Andhra Pradesh), the 7th set of experiments on composite fish culture was carried out in 3 ponds. The production ranged from 3553 kg to 2332, 5 kg/ha/11 months.

The 8th set of experiments, designed to assess the performance of freshwater prawn *M. malcolmsonii* in mono and mixed culture was initiated in 3 ponds (0.12 ha each). Of these, one pond was stocked with *M. malcolmsonii* at 10,000 juveniles/ha, the second pond with *M. malcolmsonii* at 10,000 juveniles/ha+grass carp at 1,100 fingerlings/ha and the third pond with *M. malcolmsonii* at 10,000 juveniles/ha+a 5 species combination of Indian and Chinese carps (catla 1.11 : rohu 2.78 : mrigal 2.78 silver carp 1.11 : common carp 2.22) at 4,500 fingerlings/ha. After 5 months the result obtained is given below :

Species	*Monoculture of M. malcolmsonii*		*M. malcolmsonii* +Grass carp		*M. malcolmsonii* 5 spp. of Indian & Chines carps.	
M. malcolmsonii	Total wt. at stocking (kg)	Total wt. harvested (kg)	Total wt. at stocking(kg)	Total wt. harvested(kg)	Total wt. at stocking(kg)	Total wt. harvested(kg)
	0.274	25.0	0.275	8.0	0.275	6.3

Problem No. CFCSP 1.2 : All India Coordinated Research Project on Composite Fish Culture and Seed Production

Personnel : R D. Chakrabarty, V. R. P. Sinha, S. D. Tripathi, H.A. Khan, S.N. Datta, K. K. Sukumaran, H.L. Bhatia, R.L. Thawait, P.C. James. V.R. Khadee, A.S. Purani, S.A. Kadri, N. Mohanty and R. Rath

Duration : 1976-84

Location : Tuticorin, Durg. Godhra

At Tuticorin centre (Tamil Nadu), one pond with 4 species combination has beeen harvested yielding a net production of 3377.8 kg/ha/yr. The experiment in another pond is continuing with six species combination. At Durg centre (Madhya Pradesh) the 4th set of experiment is continuing with 6 species combination, viz., catla, rohu, mrigal, silver carp, common carp and grass carp in the ratio of 1.7 : 2 : 1.5 : 1.8 : 2 : 1 respectively and at the stocking density of 5,000 fingerlings/ha with periodic fertilization of the pond and supplementary feeding to the stock. The experiment was taken up in their ponds—the first pond was supplied with both fertilizers and supplimentary feed, the second pond with fertilizer alone, while the third pond with supplimentary feed alone. At Godhra centre (Gujrat), after the completion of fourteen months rearing, the third experiment on composite fish culture was concluded and net production of 1658.03 kg/ha/yr and 1526.82 kg/ha/yr was obtained.

About 91.254 lakhs of spawn were produced at centrally sponsored centres consisting of 80.450 lakhs of Indian major carps, 7.320 lakhs of silver carp and grass carp and 3.5 lakhs of common carp.

Problem No. CFCSP-II : Biology of silver carp and its performance in composite fish culture.

Personnel : B. K. Sharma.

Duration : 1975-1982.

Location : Krishnagar. (W.B.)

During the year, studies were continued on the morphometry, growth, maturity and fecundity and food and feeding habits.

Problem No. CFCSP-21 : Biology of *Puntius gonionotus* in composite fish culture ponds.

Personnel : M. Sinha & P. K. Saha.

Duration : 1979-82.

Location : Kalyani (W. Bengal).

The investigations on the biology of the species cotinued during the year.

Problem CFCSP-10 : Operational Research Project on composite fish culture and live-stock-cum-fish culture.

Personnel : B.K. Sharma, M.K. Das, S.R. Das, S.P. Rai and D. Naryanswami

Duration : 1973 onwards

Location : Krishnagar

Composite fish culture in large water bodies :

The work on composite fish culture in 3 large ponds owned by the State Fisheries Deptt. with waterspread area of 1.48 ha (R II), 1.93 ha (R III) and 2.15 (R I) was continued during the year under report. Fish yields of 3121.925 kg and 2912.745 kg/ha/yr were achieved from ponds No. R-II and R-III respectively. The pond No. R-I gave a production of only 225 kg due to armed dacoity in the pond in the month of August.

Transfer of technology through demonstrations in farmers' ponds :

Demonstrations of composite fish culture technology were conducted in 12 ponds owned by private farmers, with waterspread area ranging from 0.3 to 0.5 ha. Fish yields ranging from 2849 kg to 4018 kg/ha/yr (average production of 3475 kg/ha/yr) were achieved against the earlier average production of 700 kg/ha/yr before the adoption of the technology.

Integrated fish cum-livestock farming :

Fish-cum-pig farming :- The demonstration of fish-cum-pig farming yielded 672.900 kg of fish from a 0.1 ha pond corresponding to a production rate of 6729 kg/ha/yr, when the excreta of 4 pigs (40 pigs/ha) was recycled in the pond. The cost of fish production worked out to Rs. 1.79 per kg. Additional profit was earned by the farmer on pig raising. No fish feed or fertilizer were used.

Fish-cum-duck farming :—Fish-cum-duck farming was demonostrated in 5 ponds (0.1 to 0.5 ha). Fish yield ranging from 2905 to 3941 kg/ha/yr were achieved without the use of any fertilizer and fish feed, About 200-300 ducks per ha of water area were used for getting the above fish yields. The cost of production of fish worked out to Rs. 1.95 per kg. The expenditure incurred on duck raising was offset through the sale of duck eggs and duck meat.

Problem CFCSP-27 : Hatching, rearing and transport of carp eggs, spawn and fry with the help of low cost indigenous materials suitable for rural set up

Personnel : S.R. Das and B.K. Sharma

Duration : 1981-1984
Location : Krishnagar

A low cost "earthen pot carp hatchery" suited to rural conditions has been developed. The hatchery consists of three round earthen pots (vats) with capacity of 250, 100 and 100 liters respectively. The water from bigger container kept at a higher level is allowed to flow to the middle container placed at a lower level through a rubber tube fitted with aluminium tube closed at the opposite end, having peripheral perforations which helps circulate the water in the second vat. From the second container the water flows to the third container placed at a still lower level through a spout. The eggs are kept in the second container which is covered with a round mesh net frame to avoid the eggs and the egg shells from flowing out. The flow of water is maintained @ 2-3 liters per hour. About 20 liters of eggs (one lakh) can be hatched in one such unit. A single unit costs about Rs. 50/- and can be easily operated by the farmer himself.

Project No. ABF : All India coordinated research project on air-breathing fish culture

Problem No. ABF—1 : All India Coordinated Research Project on Air-breathing Fish Culture.

Personnel : P.V. Dehadrai, P. Das, S.K. Mukhopadhyay, P.K. Mukhopadhyay, B. Venkatesh, S.C. Pathak, M. P. Singh Kohli, D. Kumar, S.K. Munnet, V.K. Murugesan, P. Kumaraiah, N.K. Thakur

Duration : 1971-83

Location : Barrackpore, Patna, Gauhati, Bangalore

New potential seed collection centres for murrels in tanks, reservoirs and rivers have been located in the districts of Bangalore, Mandya, Lasan, Shimoga, Chickmagalur and Kolair and in inundated paddy fields and ditches in the district of South Kanara in Karnataka. It has been observed that Palair reservoir and old Palair river course in Andhra Pradesh form good sites for murrel seed collection throughout the year. In Andhra Pradesh the peak period for seed collection is April to June for *Channa striatus* and late May to July for *Channa marulius*.

Hypophysation of singhi was taken up at Gauhati centre in Assam and apporoximately 2000 nos. of fingerlings were retrieved. Induced spawning of singhi was also taken up in Kalyani centre. The early fry are being reared in nursery ponds.

Magur fingerlings stocked at the rate of 50,000/ha fed with mustard oil cake and rice bran at the rate of 4%—6% body weight yielded 1,500 kg/ha/10 months at the Kalyani centre in West Bengal. An additional production of carp at the rate of 120 kg/ha/ was also obtained from the same pond.

Experiments on culture of air-breathing catfihes, *C. batrachus* and *H. fossilis* alongwith high yielding paddy (IR-36) at Chinsurah Rice Research Station, West Bengal during pre-khariff season with irrigation have shown the possibility of raising a catfish crop in paddy plots. Paddy cultivation involved use of Demicron which did not affect the fish growth apparently.

At Barrackpore, the hybrid produced by crossing *H. fossilis* (male) and *C. batrachus* (female) is being reared in the laboratory for the last 6 months. Studies on feed formulation for *Clarias batrachus* revealed that an animal protein component is essential in the diet for normal growth of the catfish. Growth studies using feed mixtures containing different animal protein sources like fish meal, meat meal and dried silkworm pupae showed that specific growth rate of fish fed with fish

meal was comparable to those fed with silkworm pupae. Fishes fed during the evening hours were found to assimilate feed better than those fed during midnight and morning hours. There was marked reduction in growth of *C. batrachus* under carbofuran treatment at 0.5 ppm level for 50 days. No mortality or any apparent sysmptom of toxicity could be noted. The enhanced activities of acid phosphatase and alkaline phosphatase in serum of experimental fishes indicated hepatocellular damage in metabolism of carbofuran.

Problem No. ABF—3 : Comparative studies on the gonadal development of *Clarias batrachus* and *Heteropneustes jossilis* under induced maturity and natural maturity

Personnel : S.K. Mukhopadhyay, B. Venkatesh, P. V. Dehadrai and Dhirendra Kumar.

Duration : 1980-81

Location : Barrackpore

Fishes were exposed to photoperiodicity of 14 hrs/day. Mature singhi and magur could be obtained in April and may. No significant difference was noticed in the fecundity of induced mature and naturally mature catfishes. Histological observations of the ovary of the induced ones showed no apparent abnormalities. A comparative study on the egg phospholipid pattern of the experimental and control group of the catfishes showed some differences in their relative concentration.

Problem No. ABF—13 : Some aspects of toxicity and metabolism of malathion and carbofuran in the air-breathing catfish *Clarias batrachus* in relation to its culture in paddyfield

Personnel : P.K. Mukhopadhyay, P. Das, A.P. Mukherjee, A. Pakrashi and Alok K. Paul

Duration : 1978-1982

Location ; Barrackpore, Calcutta

Certain physiological and biochemical responses in the catfish *Clarias batrachus* exposed to 0.5 ppm level of carbofuran in ambient water for a period of 30 days were studied. The growth performance of fish was assessed following exposure to 0.5 ppm of carbofuran over a period of 60 days. Marked reduction in growth rate of the fish could be recorded under carbofuran and the effect of the pesticide was apparent only after 15 days. The level of Ca : P was also found to be decreased in blood serum in pesticide treated fish compared to that of control groups.

Exposure to carbofuran resulted in sharp inhibition of brain acetylcholinesterase, which, however, was reactivated rather rapidly after terminating pesticide treatment and maintaining the fishes in clear freshwater. Activities of the enzymes, GOT, GPT, acid phosphatase and alkaline phosphatase were found to be enhanced in blood serum of the fish exposed to carbofuran suggesting hepatocellular damage by the pesticide. The level of ammonia in serum was measured both in control and pesticide treated conditions. Rate of excretion of ammonia was also worked out. It was found that ammonia of detoxification processes were impaired in the fish under carbofuran. ATPase activity in gills and intestine were significantly inhibited by carbofuran showing that carbofuran resulted in the disturbances in the osmoregulatory processes in the fish.

Problem No. ABF—14 : Investigation on the possibilities of NPN utilization by the catfishes *Clarias batrachus* and *Heteropneustes fossilis*.

Personnel : P. V. Dehadrai and P. K. Mukhopadhyay.

Duration : 1978-1981.

Location : Barrackpore.

Substitution of dietary protein with 3-7% non-protein nitrogen in the form of urea in the *C. batrachus* and *H. fossilis* for 60 days resulted in significant increase in growth rate. The activities of aspartate and alanine aminotransferases remained unchanged during the trial period indicating normal amino acid metabolism in liver. Also the specific activity of the enzyme glucose glucose-6-phosphatase showed an increase in urea fed fishes supporting positive gluco-neogenesis. The intestinal urease activity was maximum in fishes fed with 3% urea in diet which did not change with further increase in the level dietary urea. Similarly unaltered activity of alkaline phosphatase supported the undisturbed assimilation process in the intestine. The urea fed specimens showed no aberrations in regard to total protein, essential and non essential amino acids, urea, glucose and total ascorbic acid in serun or in gross contents of protein, fat, moisture and ash in comparison to control. Occurrence of 15 N-urea incorporation in liver and muscle tissues of the fishes were confirmed through tracing the benzamide compounds for both 15 N and 14 N from m/e of 122 and 121 respectively.

Problem No. ABF—18 : Feed formulation for air-breathing cat fishes *Clarias batrachus* and *Heteropneustes fossilis*.

Personnel : B. Venkatesh, P. Das, P. K. Mukhopadhyay and D. Kumar.

Duration : 1980-83.

Location : Barrackpore.

a) Determination of feeding rate : the maximum feeding rate of *C. batrachus* (magur) and *H. fossilis* (singhi) fed once a day at winter tempereture of 20-22°C was found to be 4% and 3% of the body weight respectively. When the feed was given in 2-3 instalments, magur could consume upto 12% and singhi upto 5% of the respective body weights. At higher water temperature of 30-32°C, the maximum consumption rate was 12% of the body weight in magur and 6% of the body weight in singhi. However, when feed was provided in instalments at higher temperature there was no increase in consumption rate in singhi while magur could consume upto 14% of its body weight.

b) Specific feeding time for optimum assimilation : To find out the circadian rhythm of assimilation of feed in *Clarias batrachus* growth rate and conversion efficiency of fishes fed at different hours of the day like 6 A.M. 12 Noon, 6 P.M and 12 midnight studied. The optimum assimilation of feed takes place during evening hours.

c) Feed formulation and growth studies :

Four feed mixtures having equal protein content were formulated using fish meal, meat meal, silkworm pupae and groundnut oilcake as major protein source in combination with rice bran and wheat flour. The proximate composition of the feed mixtures were also estimated. The feed mixtures were fed to *Clarias batrachus* and the growth rate, protein efficiency ratio and conversion ratio was evaluated in comparison to Halver's standard diet. The best growth rate and protein efficiency ratio were recorded with fish fed on standard diet followed by fish fed on fish meal diet, silkworm pupae diet, meat meal diet and oil cake diet in that order. Addition of yeast (1%) was found to improve the conversion ratio of all the practical diets being studied.

In order to study the effect of different dietary proteins on the metabolism of the fish and to evolve some biochemical indices of growth certain physiological parameters like protein synthesis (as incorporation of L-u-14C-Lysine) : intestinal protease activity serum Ca-P ratio, serum protein, RBC count and haemoglobin content were studied.

Protein synthesis rate in liver was found to be maximum in fishes under standard diet followed by

silkworm pupae diet, fish meal diet. meat diet and oilcake diet fed fishes. There was no significant difference in the intestinal protease activity of fish fed on standard diet, silkworm pupae diet and fish meal diet whereas it was significantly lower in fish fed on oil cake diet. No significant differences were discernible in the level on total serum protein, erythrocyte count and haemoglobin content in the blood of different groups of fishes. There was a positive correlation bctween the serum Ca-P ratio and the growth response in different groups of fishes.

Problem No. ABF—19 : Paddy-cum-air-breathing fish culture.

Personnel : P. K. Pandit, P. Das, P. K. Mukhopadhyay, S. K. Datta, P. V. Dehadrai, D. Kumar and B. Venkatesh.

Duration : 1981-1982.

Location : Chinsurah.

During the pre-kharif season, high yielding paddy variety I.R. 36, was planted in 5 plots (8.5 m x 6.5 m) having a shallow canal of 60 cm deep and 60 cm wide along with the length on one side. Water column of 15 cm in the paddy plot and 75 cm in the canal was maintained throughout the cultivation period. Fifteen days after planting the paddy seedlings, magur and singhi were stocked in four plots in the following densities : P_1—singhi @ 15000/ha. P_2—singhi and magur (1 : 2) @ 10,000/ha, P_3—magur and P 4 magur and singhi (1 : 2) @ 10,000/ha. P_5 was kept as control without any fish. Fishes were fed daily with a mixture of fish meal and rice bran @ 3% of the body weight. Estimated production of fishes at the end of 78 days of culture in different plots were—P_1—336 kg/ha, P_2—308.2 kg/ha, P_3—469.80 kg/ha and P_4—324.6 kg. However, fish culture could not be continued beyond this period because of heavy rains resulting in overflowing of water from the plots. Paddy yield in different plots were : P_1—2.443 tons/ha, P_2—1.809 tons/ha, P_3—2.805 tons/ha, P4—2.714 tons/ha and P_5—2.533 tons/ha. Application of Demicron @ 2.5 lit/ha to check the paddy pests had apparently no effect on the growth of fishes.

It is suggsted that for integrating air-breathing fish culture with paddy cultivation during pre-kharif season, the planting should be done during March and the harvesting should be compteted before the onset of monsoon. Otherwise, it becomes essential to provide bamboo matting or wiremesh screen barrier around the plot to prevent the fishes from migrating out of the paddy fields.

Problem No. ABF—20 : Cytogenetics of air-breathing fishes.

Personnel : S. K. Mukhopadhyay, P. V. Dehadrai, P. Das, A. P. Mukherji

Duration : 1981-1984

Location : Kalyani, Barrackpore

Success has been achieved in obtainiug hybrids by crossing *Heteropneustes fossilis* and *Clarias batrachus* by hypophysation and artificial fecundation. However, reciprocal crosses between *C. batrachus*, *H. fossilis* met success only upto hatchling stage. In both the crosses, most of the hybrids died either during the embryonic development or just after hatching. The surviving hybrid produced is being reared in the laboratory for more than 5 months for further biological and genetical study.

Karyotypic study of an albino magur with some black patches collected from Midnapur, West Bengal is being carried out. Chromosomal preparation was done from kidney tissue. The metaphase compliment is comprised less than 50 chromosomes, Further studies is being made to establish chromosome number and chromosomal morphology.

Problem No. R 1 : Ecology and Fisheries of Freshwater Reservoirs.

Personnel : S.D. Tripathi, G.K. Bhatnagar, Ch. Gopalakrishnaiyya, Y. Rama Rao, V.R. Desai, M. Ramakrishniah, A. Mathew, B.P. Gupta, S. Sivakami, B.C. Jha, D.K. Kaushal, N.P. Srivastava, V.K. Sharma, S.N. Singh, M.D. Pisolkar, K K. Agarwal and A.K. Likka.

Duration : Since 1971.

Location : Nagarjunasagar, Bhavanisagar, Rihand, Ranchi and Bilaspur.

The work programme as approved by the *VI* th Workshop at Simla was adopted. The centres at Rihand (U.P.) Getalsud (Bihar), Bhavanisagar (T.N.) and Nagarjunasagar (A.P.) having completed their work programmes, prepared the final reports and carried out investigations on limnology and fishery on limited scale and experimental fishing, depending on facilities by the respective State Governments. The centres at Govindsagar (H P.) and at the two centrally sponsored centres in Ukai, Gujarat and Kangsabati, West Bengal, however, were to carry out full programme of work on ecology and fisheries.

Bhavanisagar Reservoir, Bhavanisagar, TN

The annual catch during 1980-81 was estimated as 210.42 tonnes corresponding to 57 kg/ha. During the year 1981-82 landings were better with much higher catch per unit (50 in gill net-day) of effort for catla with 327 kg against .282 kg in 1979-80, *L. rohita* with ·066 kg against .042 kg the previous year and *M. aor* with .2 ›5 kg against .218 kg the previous year. The total effort was also higher in 1981 with overall CPUE of 1-3 kg/net against 1.02 kg/net in the previous year. During the year about 3 lakh fingerlings, (90% *L. fimbriatus* were stocked.

Experimental fishing with 60-300 mm meshed suface gill nets operated furing Jan-March showed high CPUE of 26 3 kg/day in intermediate sector, 23.6 kg/day in Moyar sector, 15.4 kg/day in lotic and 13.4 kg/day in lentic sectors The species distribution were the same as in earlier years. Lentic sector yielded higher catches in 100 mm mesh *P, dubious* (av. length 416 mm) was more in 100 mm mesh and *M. aor* (av. length 596 mm) dominating the 130 mm mesh. In Moyar sector, 130 mm nets yielded higher catches of *M. aor* (av. length 658 mm), 140 mm catches recorded higher yields of *L. calbasu* (av. length 597 mm), This confirmed work of earlier years.

Pen culture of spawn of *C. catla. C. mrigala* and *L. rohita* (4 : 3 : 3) stocked at 22 lakhs/kg in a pen of 250 m^2 in area located in Pongar Swamp showed a survival of 40% by 15th day. A second rearing 06.8 lakhs/ha faced *Lernea* infection. 12000 fry were treated and restocked which yielded after 3 months only 1510 fingerlings, due to continued infection of *Lernea* (30-40% fishes affected).

Govindsagar Reservoir, Bilaspur (H. P)

The annual catch during 1980-81 was estimated to be 842.39 t corresponding to yield rate of 81 kg/ha. The summer and monsoon of 1981 gave poorer yield of major carps in Lunkhar khad, there by lowering the overall catch during the year to around 800 tonnes as against 953 t in the previous calendar year. The proportionate distribution of catches in all the zones was again observed during 1981. The significant decline was in the catches of Catla from 210 t in 1977-78 to 54 t in 1981. Rohu and mrigal also showed lower yield. The catch of *L. dero*, however, registered an increase to over 200 t, while silver carp yielded around 96 t. The use of small meshed nets landed for the first time 79 t of *C. reba.* Occassionally grass carp and *Salno trutta faro* were also caught.

The principal size groups represented in the catches were found to be 350, 610, 810 and 920 mm for catla, 323, 448, 643 and 739 mm for rohu and 249, 339, 389, 464 and 579 mm for *L. dero*. Cage culture of silver carp was done during the year. The average size attained was 150g/227 mm and the production was 37.5 kg/m²/year.

Nagarjunasagar Reservoir, A. P.

Higher rainfall in 1981 (549 mm) produced higher inflow (46.3 and 6.4 million cusecs) in 1981 as against 4.9 and 7.7 million cusecs in 1980 during July and August respectively. The catch estimation was done for only one landing centre. The total yield during 1980-81 was 124.776 t which was lower than the previous year. *P. pangasius* dominated the catches with 39.5 t of annual yield. *Maor* (19.5 t) *S. childrenii* (14 t) and *M. seenghale* (4.6 t) were the important catfish yeilding sizably. Amongst carps, *L. fimbriatus* yielded 19 t, while catla and *L. calbasu* were of the same order with annual yield about 6 t. During 1981, at Sagar camp, *P. pangasius* was found to contribute 45% of total catches, while *M. aor* was next (25%). The final report of the centre was prepared during the year.

Getalsud Reservoir, Bihar

The investigations in the reservoir were completed and a final report prepared.

The fish landing during 1980-81, were reported to be 5980 kg as compared to 2595 kg in 1979-80. A total of 4800 of gill nets were used, while drag netting was also done. During the year the reservoir was stocked with 2.8 lakhs fingerlings of major carps. The result of continious annual stocking appeared to have significantly, raised the stock abundance as reflected in experimental fishing, with average catch of 3 kg per gill net per day, comprising *L. rohita* 77% and *C. mrigala* 23%. For the first time *L. Calbasu* was found to breed in the reservoir, with 28.6% abundance in reared samples of spawn.

Rihand Reservoir, U. P.

The investigations at Rihand being completed a final report was prepared. The total yield from the reservoir during 1980-81 was 79.5 t (2.64 kg/ha/yr), which was lower than the previous year. The effort in 1980-81 was also lower. The stock abundance in 1980-81 did not appear lower than the previous year with CPUE of .353 kg/net/day in 1980-81 against 0.333 kg/net/day a year earlier. During 1981-82 no fishing took place.

Ukai Reservoir, Gujrat

Ukai reservoir had a lower water level in 1981 compared to 1980. All aspects of ecological work were undertaken. The primary production during the year was lower than in the previous year. As per official records total of 257 t of fish were caught in 1980-81, while the 1981 catch was about 100 t. These appears to be large scale illegal fishing not reported to State Government. Experimental fishing showed high density of major carps, 80-86% of gill net catches being major carps. This was reflected in commercial catches too. Catla stocks appeared to be building up with its percentage contribution increasing to above 45% in 1981 against 33.6% a year earlier. The average catch per net per day in experimental fishing was .57 kg. The reservoir was stocked with 2.72 lakh fingerlings of major carps.

A significant finding of the year was that the hilsa young ones stocked in 1979, appeared to have thrived well and bred also as experimental fishing caught hilsa of average weight 600 g in March '81. Fingerlings were also found in samples, which showed that they had

bred. Commercial catches also reported stray catches of hilsa.

Kangsabati Reservoir, West Bengal

The work at the centre suffered due to non appointment of staff. Plankton sampling towards the end of 1981 showed net plankton abundance from .21-.27 ml/m^3. dominated by phytoplankton, the major constituent being *Microcystis*. Bottom biota dominated by *Chironomus*, *Chaovorus* and univalves, were estimated to be 206/m^2. in lentic, 358/m^2 in intermediate and 449/m^2 in lotic sectors. The total catch during 1981 was 13.4 t only, dominated by *M. aor* (45%), *Catla* (25%), *Mrigal* (12%), *rohu* (8%) and *Calbasu* (5%). This catch corresponded to an yield level of 2 kg/ha/yr against 4 kg/ha/yr in 1979-80. With no stocking in the reservoir since 1977, the stocks have dwindled. The reservoir catchment experienced very low rainfall during 1981, which caused high shrunkage in area and growth of aquatic vegetation.

Research problems completed

The following research problems were completed during 1981.

2.9 Studies of the process of maturation, ovulation and resorption of gonads in Indian major carps.

3.13 Composite fish cultue of Indian and exotic carps in tanks simulating long seasonal irrigation tanks.

3.16 Biology of *Puntius dorsalis* (Jordon).

5.60 Standardization of transport technique of commercially important brackishwater prawn and fish seed.

8.7 Reproductive biology of a few brackishwater fishes.

11.10 Evaluation of existing infrastructural base in relation to institutional finance, marketing and legislation for propagation of aquaculture in West Bengal.

13.16 Breeding and nursery management of schizothoracid fishes.

14.16 Pilot survey to evolve sampling methodology for estimating inland resources and total catch of fish in West Bengal.

14.17 Assessment of wanton distruction of early juveniles of commercial species in upper Hooghly estuary.

18.1.6 Production of carp in mixed culture operation with sewage effluents.

20 11 Environmental pollution in the Hooghly estuary with reference to heavy metals disposed through industrial wastes.

20.13 Effect of supernatent waste water of Calcutta metropolitan city on fisheries of Kulti estuary.

20.14 Aquatic pollution in the Hooghly estuary with reference to Haldia Oil Refinery complex.

22.2 Catfish culture in running water.

22.3 Cage culture of carps in lentic waters.

23.1(b) Bundh breeding of major carps.

32.1 Use of biogas slurry as fish feed.

32.2 Use of tobacco and tea waste as fish toxicants.

32.3 Biochemical and nutritional studies on silver carp and grass carp and formulation of compounded feed for intensive culture.

32.4 Effect of cation and anion exchange capacity, pH and type of clay minerals on fertility of fish ponds.

32.5 Rock phosphate and basic slag in pond fertilisation.

33.1 Formulation of training courses for extension workers.

ABF-3 Comparative studies on the gonadal development of *Clarias batrachus* and *Heteropneustes fossilis* under induced maturity and natural maturity.

ABF-14 Investgations on the possibilities of NPN utilization by the catfishes, *Clarias* and *Heteropneustes*.

Research problems merged

The following research problems were merged during the year 1981 :

1.1.1.1 Rearing of Indian major carp fry to fingererlings for optimum survival and growth

under different stocking densities.
(Merged with Project 1.55)

1.1.2,2 Composite culture of Indian and exotic carps to raise marketable fish.
(Merged with Project 1.54)

1.1.2.3 Culture of Indian carps.
(Merged with Project 1.54)

1.21 Management of carp nursery ponds.
(Merged with Project 1.55)

1.42 Statistical relationship between the inputs and fish production in composite fish culture.
(Merged with Project 1.54)

1.48 Alternative protein source for carp fry and fingerlings.
(Merged with Project 29.2)

1.50 Fortifying conventional feeds as per amino acid requirements of carps.
(Merged with Project 29.3)

2.7 Isolation of fish gonadotropin for hypophysation of carps in large scale.
(Merged with Project 2.17)

2.11 Effect of hormones in hypophysation and vitamins on maturity of carps.
(Merged with Project 2.18)

2.5 Techniques for large scale production of grass carp and silver carp seed.
(Merged with Project 2.18)

2.8 Maturity of grass carp with different feeds.
(Merged with Project 2.18)

5.1 Pen culture and study of ecology and fishery management of a selected beel in Assam.
(Merged with Project 25.3)

1.1 Assessment of (i) Fisheries resources of Ganga river system-Principal channel, (ii) Carp seed resources and potential of Ganga river system (iii) Fisheries resources of Hooghly-Matla estuarine system.
(Merged with Problem No. 31.2)

CFCSP-23 Oxygen requirment of fish biomass in composite fish culture.
(Merged with Project 1.53)

CFCSP-26 Impact of field demonstration in adoption of scientific carp culture technology.
(Merged with Project 33.1)

Research problems kept in abeyance

The following research problems remained suspended during 1981 :

1.33 Studies on detection of digestive enzyme complex of freshwater culturable food fishes.

1.43 Seasonal changes in the fat content in flesh of Indian major carps.

1.45 Culture of *Mystus seenghala* and *Mystus aor*.

1.49 Monoculture of Indian major carps catla, rohu and mrigal.

1.51 Improvement in the harvesting technique in carp culture ponds.

2.15 Biochemical changes associated with gonadal cycle in certain freshwater carps.

6.8 Rearing techniques for the palaemonid prawns.

10.3 Survey of Sunderban Islands for commercial brackishwater fish farming.

15.3 Studies on the microbial activity on treatment of organic manure and subject to feed resources of fish culture ponds.

16.14 Studies on aquatic weed biocoenosis.

17.11 Studies on the ecology of *Rana tigrina* Daud and their behaviour in nature.

17.13 Optimum per hectare production of early frogs, juveniles, and adult frogs of *Rana hexdactyla.*

17.14 Breeding of the commercially important frogs and raising the tadpoles upto frog-let stage to replenish natural popultion.

Research problems contemplated

The following new research problems were initiated for the year 1982.

1.58 Increasing fish production from ponds with aeration.

1.59 Composite fish seed rearing.

1.60 Rearing of carp fry and fingerlings with aeration.

1,61 Increasing fish production in non-drainable ponds by using fertilizers alone.

2.19 Endocrinological studies of Asiatic carps inhabiting running and confined waters.

2.20 Reproductive endocrinology of Indian major carps.

3.20 Biochemical and histological studies of captive carps in tanks in relation to different feeds.

5.74 Culture of fish food organisms.

5.75 Breeding and culture of *Penaeus indicus* and other penaeid species.

5.76 Breeding and culture of *Scylla serrata* and other portunid carbs.

5.77 Culture of grass carp in brackishwater impoundments (bheries).

5.78 Comprehensive study of bheries in 24-Parganas, West Bengal.

5.79 Breeding and larval rearing of *Penaeus monodon* and other penaeid prawns.

6.10 Seed production of freshwater prawns, *Macrobrachium malcolmsonii.*

6.11 Nursery rearing of prawn post larvae to stockable juveniles.

9.14 Production of artificial gynogenetic, androgenetic and polyploid populations in Indian major carps and common carp.

9.15 Short and long-term storage of fish gamates and fertilized ova.

9.16 Sex reversal of fish through hormone treatment.

9.17 Genetic characterisation of *Catla catla, Cyprinus carpio* and *Hilsa ilisha.*

11.15 Bio-economic modelling for optimisation of the economics of carp culture in India.

13.25 Studies on the tolerance of different ecological factors on schizothoracid fry/fingerlings.

13.26 Monoculture of mirror carp in a temperate climate.

15.10 Studies on haematological and histopathological aspects to monitor fish health.

16.17 Use of ammonia in fishery management.

17.15 Culture possibilities of Indian bull frog in paddy fields and study of their predatory role upon insects and insect pests of paddy.

18.1.12 Production of fishes in sewage-fed ponds by multiple stocking and harvesting.

18.1.13 Mixed culture of freshwater and brackishwater prawns along with *Tilapia mossambica* in ponds fertilized with sewage effluents.

18.1.14 Utilization of dometic waste water for algae and beneficial weed culture.

18.2.1 Integration of fish in deep water paddy plots.

18.2.2 Brackishwater paddy-cum-fish culture.

19.12 Impact of Farrakka Barrage on the spawning of *Hilsa ilisha* in the middle stretch of river Ganga.

19.13 Standardisstion of transport techniques of fry and fingerlngs of hilsa and other cultivable species.

20.18 Screening of Hooghly estuarine fishes and prawns to heavy metals and their impact on the ecophysiological conditions.

20.19 Abiotic and biotic character ot Calcutta Corporation's effluent and its pollutional effect on the fisheries of Kulti estuary and adjoining impoundments.

20.20 Studies on acute and chronic toxicity of pesticides (DDT & BHC) to the fish *Tilapia mossambica*.

20.21 Detection and measurement of pesticides in aquatic environment.

21.2 Studies on the oxidation reduction (redox potential) with reference to distribution of nutrients and bottom fauna of 'Mans' in Gandak basin.

21.3 Penculture in 'Mans'.

25.2(a) Hydrobiological studies of a freshwater beel.

25.3 Ecology and fisheries of Dhir beel in Assam.

26.2 Studies on transformations of energy by fishes in recirculatory filtering systems.

29.6 Nutritional bioenergetics of Asiatic carps (rohu, catla, mrigal, silver carp, grass carp and Common carp).

29.7 Evolving efficient feed from non-traditional plant an animal sources for *Hilsa ilisha* and other cultivable species.

29.8 Studies on some important digestive enzymes in the three populations of *Catla catla* at Rihand reservoir.

30.3 Breeding and culture of *Mystus* spp.

32.8 Correction and improvement of acid soils of fish ponds for increased fish production.

33.2 Impact on the subsidy on the growth of aquaculture.

34.1 Selective dissemination of information.

34.2 Constauction of Central Information File.

35.1 Biology, behaviour and control of major representative of Hemiptera associated with carp nurseries.

PUBLICATIONS

The following are the contributions made by the scientists of the Institute during 1981.

1. Banerjee, R. K. & P. Roy, 1980.
Payapranalir jale matsya chasera bivinnya jibanu O rasayanik paderther sackriya bhumika abong tader bigijanvithic niyantran. (*in Bengali*) (The active role of various bacteria and chemical articles which are present in drain water fish culture and their control on scientific line). *In* paribesh dile machhe variey deoya jaya. Chabbish Pargana Fish Producers' Association.

2. Banerji, S. R., M. L. Singh, S. K. Thakur & N. K. Thakur, 1980.
Khulnawa—A special fishing device for minnows in the river Ganga at Patna (Bihar).
J. Bombay nat. Hist. Soc., **77**(2) 351-353.

3. Banerji, S. R. & N. K. Thakur, 1981.
Observations on the spawning behaviour of *Anabas testudineus* (Bloch).
Indian J. Anim. Sci., **51**(6) : 651-654.

4. Bhagat, M. J. & S. N. Dwivedi, 1975.
Sport fishery of Powai Lake, Bombay.
J. Indian Fish Ass., **5**(1 & 2) : 56-60.

5. Bhanot. K. K. 1981.
Collection of brackishwater fish and prawn seed. *In* Seminar on Fishery (Inland) as an Economic Programme for IRD, 28-30 September, 1981, Barrackpore : 10pp.

6. Bhowmick, R. M., 1978.
Glass jar hatchery for Indian major carps and Chinese carps.
Indian J. Fish., **25**(1 & 2) : 171-179.

7. Bhowmick, R M., R. K. Jana, S. D. Gupta, G. V. Kowtal & M. Rout, 1981.
Studies on some aspects of biology and morphometry of the intergeneric hybrid, *Catla catla* Hamilton × *Labeo rohita* Hamilton produced by hypophysation.
Aquaculture, **23**(1-4) : 767-371.

8. Chakrabarti, N. M. 1981.
Fishery and culture possibilities of estuarine prwns in Sundarban, West Bengal.
Seafd. export J., **13**(5) : 17-23.

9. Chakrabarty, R. D., P. R. Sen, N. G. S. Rao, S.R. Ghosh, S. Jena & K. Janakiram, 1980.
Observations on intensive composite fish culture.
Proc. Indo-Pacif. Fish. Comm., **19th Session** (Section *III* : Symposium on the development and management of small-scale fisheries) : 515-525.

10. Chandra, K., 1981.
Pollution from wastes of industries manufacturing nitrogenous fertilizer—A case study from river Ganga near Allahabad.
In Proc. Symp. W.R.C.P.A., Roorkee, 11-13 December 1981 : 141-151.

11. Chattopadhyay, G.N & L.N. Mandal, 1980.
Effect of different levels of water salinity on the decomposition of organic manures in a brackishwater fish pond soil.
Hydrobiologia, **72**(3) : 287-292.

12. Chattopadhyay, G.N. & L.N. Mondal, 1980.
Effect of different water salinity levels and organic matter application on the composition of water soluble and exchangeable bases in a brackishwater fish pond soil.
Hydrobiologia, **74**(1) : 33-37.

13. Chattopadhyay, G.N. & L.N. Mandal, 1980.
Inorganic transformation of applied phosphorus in brackishwater fish pond soil under different water salinity levels.
Hydrobiologia, **71**(1 & 2) : 125-130.

14. Datta, S.N., 1981.
Fish/rice co-existence.
Seafd. export J., **13**(5) : 9-16.

15. David, A.K., V. Rajgopal & K. Gopinathan, 1979.
Breeding of fishes, seasonal abundance of young and forage fishes within the Tungabhadra Reservoir.
Proc. nat. Acad. Sci. India., **49B**(4) : 183-195.

16. Dehadrai, P.V., 1980.
Advances in air-breathing fish culture in India.
Proc. Indo-Pacif Fish. Comm., **19th Session** (Section *III* : symposium on the development of smallscale fisheries) : 508-514.

17. Dehadrai, P.V., 1981.
Collection of natural seed of air breathing fishes. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28-30 September, 1981, Barrackpore : 7 pp.

18. Dehadrai, P.V.. 1981.
Culture of air-breathing fishes for table size production. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28-30 September, 1981, Barrackpore : 10 pp.

19. Dehadrai, P.V., 1980.
Swamp ecology and scope for its utilization for aquaculture in India. *In* Tropical Ecology and Development : Proceedings of the Vth International Sympozium of Tropical Ecology, 16-21 April 1979 Kuala Lumpur, Malaysia, Part 2, *ed.* J. I. Furtado, Kuala Lumpur, The International Society of Tropical Ecology : 823-832.

20. Dehadrai, P.V., 1976.
Swamps of North Bihar.
J. Indian Fish Ass., **6**(1 & 2) : 13-21.

21. Ghosh, Apurba, 1981.
Fish culture integrated with paddy cultivation. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28–30 September, 1981. Barrackpore : 11 pp.

22. Ghosh, Apurba, 1980.
Matsya chase moyla jaler byabohar (*In Bengali*)
(Use of sewage in fish culture)
In Paribesh dile machhe variey deoya jaya, ed, by P. Ghosh, Calcutta, Chabbish Pargana Fish Producers' Association.

23. Ghosh, A & S.K. Saha, 1980.
Scope for paddy-cum-fish culture in India.
In Tropical ecology and development ; Proceedings of the Vth International Symposium of Tropical Ecology, 16-21 April 1979, Kuala Lumpur, Malaysia, Part 2, *ed.* J.I. Furtado, Kuala Lumpur, The International Society of Tropical Ecology : 1009-1016.

24. Ghosh, K.K., 1981.
Collection of spawn of Indian major carps. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28-30 September, 1981, Barrackpore : 10 pp.

25. Ghosh, S.R. & A.N. Mohanty, 1981.
Observations on the effect of aeration on mineralization of organic nitrogen In fish pond soil.
Bemidgeh. **33**(2) : 50-56.

26) Govind, B.V., 1981.
Pen and cage culture in freshwater. *In* Seminar on Fishery (Inland) as an economic progrmme for IRD, 28-30, September, 1981, Barrackpore : 9pp.

27) Halder, D.D., 1981.
Polyculture of fish and prawn in brackishwater ponds/farms. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28-30 September, 1981, Barrackpore : 7 pp.

28) Halder, D.D., 1981.
Prawn culture in brackishwater ponds/farms. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28-30 September, 1981, Barrackpore : 8 pp.

29) Jhingran, A.G., 1980.
Riverine fishery resources of India and their socio-cultural impact.
In Tropical Ecology and Development : Proceedings of the Vth International Symposium of Tropical Ecology, 16-21 April 1979 Kuala Lumpur, Malaysia, Part 2, *ed.* J. I. Furtado, Kuala Lumpur, The International Society of Tropical Ecology : 747-758.

30) Jhingran, V.G., 1973-74.
Recent advances in inland fish culture.
J. Indian Fish. Ass., **3 & 4**(1 & 2) : 23-26.

31) Jhingran, V.G. & B.K. Sharma, 1980.
Integrated livestock-fish farming in India. *In* Integrated Agriculture-Aquaculture Farming Systems ; Proceedings of the ICLARM-SEARCA Conference on Integrated Agriculture-Aquaculture Farming Systems, Manila, Philippines, 6-9 August, 1979, *ed.* Roger S.V. Pullin & Z.H. Shehadeh, Makati, Metro Manila, ICLARM SEARCA : 135-142.

32) Jhingran, V.G. & S.D. Tripathi, 1980.
Reseach and strategy for development of fisheries in inland aquatic ecosystems of India.
In Tropical Ecology and Devolopment : Proceedings of the Vth International Symposium of Tropical Ecology, 16-21 April 1979, Kuala Lumpur, Malaysia Part 2, *ed.* J.I. Furtado, Kuala Lumpur, The tnternational Society of Tropical Ecology, : 1369-1378.

33) Jhingran, V.G., V.R.P. Sinha & M. Sinha, 1980.
Trends in development of present day aquaculture in India and their socio-economic inpact.
In Tropical Ecology and Development : Proceedings of the Vth International-Symposium of Tropical Ecology, 16-21 April 1979, Kuala Lumpur, Malaysia, Part 2, *ed.* J.I. Furtado, Kuala Lumpur, The International Society of Tropical Ecology : 1209-1218.

34) Joshi, C.B., K.L. Sehgal & Shyam Sunder, 1978.
Observations on the fishery resources of the hill streams of Jammu province with special reference to mahseer and other commercially imprortant species.
Indian J. Fish., **25**(1 & 2) : 197-206.

35) Kaliyamurthy, M., G. Ramamohana Rao & A.V.P. Rao, 1977.

Ecological considerations concerning the seed of cultivable fishes of the Pulicat lake.
Indian J. Fish. **24**(1 & 2) : 223-227.

36) Kamal, M.Y., Balbir Singh P. M. Mathew, 1980. Assessment of fish seed potentiality of a stretch of river Ganga in Bihar.
Proc. Indian nat. Sci. Acad., B, **46**(1) : 120-128.

37) Karamchandani, S.J. & D.N. Mishra, 1980. Preliminary observations on the status of silver carp in relation to catla in the culture fishery of Kulgarhi reservoir.
J. Bombay nat. Hist. Soc., **77**(2) : 261-270-

38) Krishnamurthy, K.N. & M. Kaliymurthy, 1978. Studies on the age and growth of sandwhiting *Sillago sihama* (Forskal) from Pulicat Lake with observations on its biology and fishery.
Indian J. Fish., **25**(1 & 2) : 84-97.

39) Mitra, E., 1976. The association of weeds under natural environment.
J. Indian Fish. Ass., **6**(1 & 2) : 98-104.

40) Mukhopadhyay, P.K. & P.V. Dehadrai, 1980. Studies on air-breathing catfish, *Clarias batrachus* (Linn.) under sublethal malathion exposure.
Indian J. Exp. Biol., **18** : 400-404.

41) Mukhopadhyay, P.K. & P.V. Dehadrai, 1980. Biochemical changes in the air-breathing catfish *Clarias batrachus* (Linn.) exposed to malathion.
Environ Pollut., **22**(2) : 149-158.

42) Nandy, A.C., G.V. Kowtal & D.P. Chakraborty, 1980. Preliminary observations on crude culture of fish food organisms.
Proc. nat. Acad. Sci. India B, **50**(4) : 223-228.

43) Natarajan, A.V. 1980. Moyla jale matsya chasera samasya (in Bengali)
(Problem of fish culture in sewage-fed water)
In Paribesh dile machhe variey deaya jaya, *ed* by P. Ghosh, Calcutta, Chabbish Parganas Fish Producers' Association,

44) Natarajan, A.V , 1980. Research and development of Indian reservoir fisheries.
ICLARM Newsletter, **3**(4) : 6-7.

45) Natarajan, A.V. 1981. Ecological considarations in introduction of exotic fishes in inland waters of India. Introduction of the exotic carp, *Hypophthalmichthys molitrix* In Indian rivers and reservoirs-An ecological risk-benefit analysis. *Bull. Cent. Inland Fish. Res. Inst. Barrackpore*, No. 34 : 24 pp.

46) Natarajan, A.V. 1981. Management of reservoir fisheries. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28-30 September 1981, Barrackpore : 7 pp.

47) Pal, R.N 1980. Mechhogherite machher rog o pratikar (in Bengali)
(Fish diseases and its control in bheris)
In Paribesh dile machhe variey deoya jaya. *ed.* P. Ghosh, Calcutta, Chabbish Parganas Fish Producers' Association.

48) Panwar, R. S., R. A. Gupta, H. C. Joshi & D. Kapoor, 1981.
Toxicity of some chlorinated hydrocarbon and organophosphorus insecticides to gastropod *Viviparous bengalensis* (Swainson).
J. Environ Biol., **2**(4).

49) Pathak, S. C., Y. S. Yadava & M. P. Singh Kohli, 1980.
Semi-intensive culture of *Heteropeneustes fossilis* (Bloch) from a small pond at Ulubari fish farm, Gauhati through monoculture experiment.
Proc. Indo-Pacif Fish- Comm. **19th Session** Section III : Symposium on the development and management of small scale fisheries : 539-547.

50) Roy, P., 1980.
Kolkatar nardamar jale machh chasera sambhabona (in Bengali).
(Possibilities of fish culture using sewage of Calcutta).
In Paribesh dile machhe variey deoya jaya, *ed.* P. Ghosh, Calcutta, Chabbish Pargana Fish Producer' Association.

51) Saha, G.N., K.L. Saha & S.C Thakurta, 1981.
Feasibility survey report on utilisation of saline ground water of Gurgaon district for aquaculture.
Bull. Cent. Inland Fish. Res. Inst., Barrackpore, No. **33**, 8pp. *(Mimeo)*

52) Sen, P.R., 1981.
Production of fingerlings of freshwater fish. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28-30 September, 1981 Barrackpore : 4pp.

53) Sen, P.R., 1981.
Production of fry of freshwater fish. *In* Seminar on Fishery (Inland) as and economic programme for IRD, 28-30 September, 1981, Barrackpore : 8 pp.

54) Sharma, B.K., 1981.
Fish Culture integrated with livestock raising. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28–30 September, 1981, Barrackpore : 15 pp.

55) Singh, D.N., R.K. Tyagi R.S. Panwar, 1981.
Toxicity of some organic biocides to a freshwater fish, *Cyprinus carpio* var-*communis* (Linn).
J. Environ Biol., **2**(3) : 41-46.

56) Singh, R.K., 1980.
Physicochemical characteristies of soil and water in relation to fish food production.
J. Indian Soc. Soil Sci., **28**(2) : 227–231.

57) Singh, S.P., J.C. Malhotra, R.N. Seth, K.P. Srivastava & R.K. Chandra, 1980.
Observations on rearing of hatchlings of catfish *Mystus seenghala* (Sykes).
Aquaculture, **26**(1 & 2) : 161-166.

58) Sinha, V.R.P., H.A. Khan, D .P. Chakraborty & M.V. Gupta, 1980.
Preliminary observations on nitrogen balance of some ponds under composite fish culture.
Aquaculture Hungarica, **2** : 105-116.

59) Singha. V.R.P., 1980.
Hydration of female spawners of carps during hypophysation.
Hydrobiologia, **72**(1-2) : 193-196.

60) Sinha, V.R.P., 1981.
Production of table size carps. *In* Seminar on Fishery (Inland) as an economic programme for IRD, 28-30 September, 1981, Barrackpore : 6 pp.

61) Sinha, V.R.P. & M. Ranadhir, 1980.
Potential and constraints of small-scale freshwater fish culture enterprises in India. *Proc. Indo-Pacif. Fish Comm.*, **19th Session** (Section *III* : Symposium on the development and management of small-scale fisheries) : 526-538.

62) Sinha, V.R.P., 1981.
Integrated synergic approach to aquaculture.
Resource Managemet and *Optimisation*, **4** : 333-345.

63) Sinha, V.R.P. & K.H. Ibrahim, 1980
Conservation and utilization of genetic resources of fish in India.
Tigerpaper, 7(1).

64) Shyam Sunder & C.B. Joshi, 1977.
Preliminary observations on the spawning of *Tor putitora* (Hamilton) in Anji stream, Jammu Province, during 1969.
Indian J. Fish., **24**(1 & 2) : 253-258.

65) Tripathi, S.N., 1981.
Spawn production by induced breeding. Seminar of Fishery (Inland) as an economic programme for IRD, 28-30 September, 1981, Barrackpore : 7 pp.

Abstracts

1. Dehadrai, P.V. & P.K. Mukhopadhyay, 1980.
Monitoring of the nitrogen inputs in intensive culture of *Clarias batrachus* (Linn.). *In* Proceedings of the 67th Indian Science Congress, Pt. IV p. 66.

2. Jhingram, A.G., R.C. Dwivedi, K.P. Srivasthava & D.N. Singh, 1981.
An ecological approach towards stocking policy formulation in Gularia, a small irrigation impoundment. *In* Proceedings of the Silver Jubilee Symposium on Tropical Ecology, University of Bhopal, 5-10 October, 1981 : p. 98.

3 Singh, D. N., K. Chandra, R. S. Panwar & R. A. Gupta, 1981.
Effect of effluent on ecology of Rihand reservoir. *Ibid* : p. 242.

4. Dilip Kumar, B.K. Mishra and B. Biswas, 1981.
Observations on the efficiency of carbonic acid as anaesthesia for Indian major carps. *In* All India Seminar on Fish Biology, 26-28 November, 1981. Bihar university, Muzaffapur.

5. Mishra, B.K., Dilip Kumar & R. Mishra, 1981.
Observations on the use of carbonic acid as anaesthesia in fish seed transport. *Ibid.*

6. Singh. B.N. & V.R.P. Sinha, 1981.
Observations on the nutrition of an Indian major carp, *Cirrhina mrigala* (Ham.). *Ibid.*

7. Patnaik, S., 1981.
Evaluation of some aquatic weeds collocted from different sites for their wastes, nitrogen and protein content. *In* Proceedings, Asia-Pacific Weed Science Society, 22-29 November, 1981.

8. Patnaik, S. & K.M. Das, 1981.
Efficacy of paraquat for control of submerged weeds. *Ibid.*

CIFRI PUBLICATIONS

The following publications were brought out by CIFRI during 1981.

Reports :

1. Annual Report for the year 1979.
2. Report, Fifth Workshop, All India Coordinated

Research Project on Composite Fish Culture and Fish Seed Production.

3. Final Report, AICRP on Ecology and Fisheries of Freshwater Reservoirs, Bhavanisagar Reservoir.

4. Report, Fourth Workshop, AICRP on Barackish-water, Fish Farming.

5. Report, Seminar on Fishery (Inland) as an Economic Programme for Integrated Rural Development, CIFRI, 28-30 September, 1981.

Brochures :

6. Progress and Achievements in Aquaculture.

7. Carp culture.

8. Carp Seed Raising.

9. Hatchery for Carp Eggs.

10. Fish-cum-duck Culture and Fish-cum-pig Culture.

11. Development of a Multipurpose Production Technology Based on Recirculatory Filtering System (RFS) as a Hatchery, Seed Production Factory and Commercial Scale Production Unit for Table Size Fish.

12. Massive Effort at Technology Transfer in West Bengal and Orissa Through CIFRI/IDRC Rural Aquaculture Project.

13. Weed Problem in Fishery Waters.

14. Reservoir Fisheries.

15. Brackishwater Fish and Prawn Culture.

16. Giant Freshwater Prawn Culture.

17. Shrimp Culture.

18. Frog Seed Production.

19. Lab to Land Programme at CIFRI.

Bulletins :

20. Feasibility Survey Report on Utilization of Saline Ground Water of Gurgaon District for Aquaculture. (Bulletin No. 33)

21. Ecological Considerations in Introdution of Exotic Fishes in Inland Waters of India. (Bulletin No. 34.)

Serials :

22. Accession List, Nos. 7-12, 1979 ; 1-12, 1980 ; 1-3, 1981.

23. Current Content List, Nos. 1-8, 1980.

24. CIFRI Newsletter, **4** (1-4), 1981.

PERSONNEL

Retirement :

Shri J. C. Malhotra, S-3 and Head, Riverine and Lacustrine Division, CIFRI retired from the services of CIFRI on 31st May, 1981. Shri Malhotra is a recipient of the coveted Rafi Ahmed Kidwai Memorial Prize for the biennium 1978-79 for his outstanding work on hilsa fisheries.

Shri A. N. Ghosh, Scientist and Shri V. Ramachandran, Fishery Scientist retired voluntarily from the services of CIFRI and the Council on 16.6.1981 and 9.7.1981 respectively.

Shri S. C. Banerjee, S-1, A. K. Nath, Sample Sorter, Budhi Bahadur, Supporting Staff Grade III, Chandra Bahadur, Fieldman and Ruba Ram, Peon have retired from their services of CIFRI during the year 1981.

Resignations :

Shri V. K. Bali, S-1 and Shri Mrinal Kanti Bala, Junior Clerk have resigned from the ICAR services during the year 1981.

Dr. R. Paul Raj Left FARTC of CIFRI on 5-9-81 to join the Centre of Advanced Studies in Mariculture at CMFRI, Cochin.

Promotions :

The following members of staff have been promoted to the next higher grade during the year :

Name	*From*	*To*	*Discipline*	*w. e. f.*
Shri S.D. Tripathi	S-2	S-3	Fish & Fishery Science	1.7.1977
Shri P. Das	,,	,,	,,	1.7.1978
Shri K. Raman	,,	,,	,,	,,
Dr. (Mrs.) T Rajyalakshmi	,,	,,	,,	,,
Shri G. V. Kowtal	S-1	S-2	,,	,,
,, S. P. Singh	,,	,,	,,	,,
,, R. D. Prasadam	,,	,,	,,	,,
,, C. Selvaraj	,,	,,	,,	,,
,, S. K. Mukhopadhyay	,,	,,	,,	,,
,, R. K. Jena	,,	,,	,,	,,
Dr. N. K. Thakur	,,	,,	,,	,,

Name	*From*	*To*	*Discipline*	*w. e. f.*
Shri V. R. Desai	S-1	S-2	Fish and Fisheries	1.7.1978
Dr. C. R. Das	,,	,,	,,	,,
Shri M. Sinha	,,	,,	,,	,,
,, A. V. P. Rao	,,	,,	,,	,,
Dr. S. C. Pathak	,,	,,	,,	,,
,, P. U. Verghese	,,	,,	,,	,,
,, K. K. Vass	,,	,,	,,	,,
,, B. N. Singh	,,	,,	,,	,,
Shri K. N. Krishnamurthy	,,	,,	,,	,,
,, R. M. Rao	,,	,,	,,	,,
,, B. K. Sharma	,,	,,	,,	1.7.1977
Dr. K. J. Rana	S	S-1	,,	1.7.1976
Shri D. K. Kaushal	,,	,,	,,	1.7.1978
,, B. K. Banerjee	,,	,,	,,	,,
,, D. R. Kanaujia	,,	,,	,,	,,
,, R. K. Dey	,,	,,	,,	,,
,, M. P. S. Kohli	,,	,,	,,	,,
,, Amitabh Ghosh	,,	,,	,,	,,
,, D. K. De	,,	,,	,,	,,
,, Shree Prakash	,,	,,	,,	,,
,, R. N. Seth	,,	,,	,,	,,
,, S. N. Singh	,,	,,	,,	,,
,, R. K. Dwivedi	,,	,,	,,	,,
,, V. Pathak	,,	,,	Agricultural Chemitry	1.7.1979
Dr. K. Chandra	,,	,,	,,	,,
Shri R. K. Singh	S	S-1	Soil Science	,,
,, H. C. Karmakar	,,	,,	Agri. Statistics	,,
,, R. K. Tyagi	,,	,,	,,	,,
,, P. N. Bhattacharjee	T-4	T-5		,,
,, N. K. Srivastava	T-II-3	T-4		,,
Smt. Sukla Das	,,	,,		,,
Shri H. K. Muduli	T-2	T-II-3		,,
,, T. P. Ghosh	,,	T-I-3		,,
,, S. N. Sadhukhan	,,	T-I-3		,,
,, K. R. Deb	T-1	T-2		,,
,, B. L. Singh	,,	,,		,,
,, J. P. Mishra	,,	,,		,,
,, K. P. Singh	,,	,,		,,
,, Swapan K. Chatterjee	,,	,,		,,

Name	From	To	w. e. f.
Shri Sukumar Saha	T-1	T-2	1.7.1979
,, K. C. Pani	,,	,,	,,
,, B. B. Das	,,	,,	,,
,, M. G. Subramani	,,	,,	,,
,, Kanchan Dutta	,,	,,	,,
,, U. Chatterjee	,,	,,	,,
,, Nirmal Biswas	,,	,,	,,
,, R. L. Balmiki	,,	,,	,,
,, Surja Bahadur	,,	,,	,,
,, B. Majhi	SG-III	IV	2.11.1981
,, Khemchand Balmiki	SG-I	II	,,
,, Dhaneswar Das	,,	,,	,,
,, A. K. Biswas	,,	,,	,,
,, Fakii Parida	,,	,,	,,
,, Giridhari Das	,,	,,	,,
,, Dhirendra Bhujan	,,	,,	,,
,, Khetra Mohan Sahoo	,,	,,	,,
,, Rajkrishore Behera	,,	,,	,,
,, Raghunath Swain	,,	,,	,,
,, Shyama Bhoi	,,	,,	,,
,, S. Parida	,,	,,	,,
,, Lakshmidhar Sahoo	,,	,,	,,
,, Sitaram Bahadhur	,,	,,	,,
,, Surja Bahadur	,,	,,	,,
,, K. Kaliannan	,,	,,	,,
,, M. V. Krishnan	,,	,,	,,
,, A. E. Raju	,,	,,	,,
,, Hiralal Bose	,,	,,	,,
,, Parameswar	,,	,,	,,
,, Jainandan Mallah	,,	,,	,,
,, B. Hazarika	,,	,,	,,
,, Manindra Nath Biswas	,,	,,	,,
,, Shyamlal Dhanuk	,,	,,	,,
,, Kishori Mohan Das	,,	,,	,,
,, Ashok Kumar Biswas	,,	,,	,,
,, Biswanath Mondal	,,	,,	,,
,, Vibhuti Kumar Jena	,,	,,	,,

Grant of Advance Increments :

Name	Designation	No. of increment	w.e.f.
Shri A. K. Ghosh	S-1	2	1.7.1978
,, D. K. Chatterjee	,,	2	1.7.1979
,, S. N. Mohanty	S	2	1.7.1976
,, D. Kapoor	,,	2	,,
,, B. B. Roy	T-1	2	
,, R. L. Balmiki	,,	2	

Appointments :

Name	Designation		Place of posting
Shri A. K. Chattopadhyay	Senior Training Assistant		KVK/Kakdwip
Shri H. K. Banik	Jr. Clerk		Barrackpore
Smt. Anita Chakraborty	,,		,,
Kum. N. T. Sadavaste	,,		Poona
Shri Dhambarudhar Borgogamy	Driver		
Smt. Rupali Chatterjee	SG-I		Barrackpore
Smt. Godhuli Mondal		SG-I	Barrackpore
Shri S. Pari		,,	Madras
Smt. Dhanmaya		,,	Allahabad

Transfers :

Name	Designation	From	To
Shri S. D. Tripathi	S-3	Barrackpore	Dhauli
Dr. C. R. Das	S-2	Cuttack	Bhubaneswar
Dr. N. K. Thakur	,,	TTC, Dhauli	FARTC, Dhauli
Shri M. Sinha	,,	Barrackpore	Kalyani
,, A. V. P. Rao	,,	Kakinada	Madras
,, P. R. Sen	,,	Cuttack	Barrackpore
,, V. V. Sugunan	S-1	Nagarjunasagar	,,
Smt. G. K. Vinci	,,	,,	,,
Dr. H. C. Joshi	,,	Muzaffarpur	,,
,, A. C. Nandy	,,	Barrackpore	Calcutta
,, P. K. Chakraborty	,,	Lalgola	Port Canning

Name	Designation	From	To
Shri J. G. Chatterjee	S-1	Barrackpore	Kakdwip
,, N. A. Reddy	,,	,,	,,
,, S. M. Pillai	,,	,,	,,
,, D. K. Chatterjee	,,	Cuttack	Bhubaneswar
,, M. Rout	,,	,,	,,
,, S. Jena	,,	,,	,,
,, D. Narayanaswamy	,,	Barrackpore	Dhauli
,, P. K. Saha	,,	Kalyani	Rahara
,, D. Kumar	,,	Barrackpore	Patna
,, P. L. N. Rao	,,	Dhauli	Poona
,, M. L. Bhowmick	,,	Barrackpore	Muzaffarpur
,, S. P. Rai	,,	,,	,,
Smt. S. Sivakami	,,	Bhavanisagar	Bangalore
Shri D. S. Murty	JFS	Cuttack	Tadepalligudem
,, N. M. Chakraborty	S	Kakdwip	Khardah
,, S. N. Sar	SRA	Barrackpore	Digha
,, K. S. Banerji	T-II-3	,,	Bilaspur
,, N. C. Guin	T-2	Cuttack	Bhubaneswar
,, K. C. Pani	T-1	,,	,,
,, B. K. Behera	,,	,,	,,
,, K. B. Rajani	Asst. Adm. Officer	Allahabad	Barrackpore
,, R. K. Panda	Jr. Clerk	Cuttack	Bhubaneswar
,, Wilson Guria	,,	Ranchi	,,
,, K. R, Deb	Driver	Kakdwip	Calcutta
,, S. C. Mondal	Supporting Staff	,,	Lalgola
,, B. K. Halder	Messenger	,,	Calcutta
,, J. K. Patra	Peon	,,	,,
,, N. C. Jana	S. S. Gr. II	Lalgola	Kakdwip

The following Scientists rendered their services to the Institute during the year :

DIRECTOR

Dr. A. V. Natarajan

Freshwater Aquaculture Division

Name	Designation	Section	Place
Dr. V. R. P. Sinha	S-3 (special)	Freshwater Aquaculture Research & TrainingCentre	Dhauli
Shri K. K. Sukumaran (On deputation)	S-2	,,	,,
,, H. A. Khan	,,	,,	,,
,, M. Ranadhir	,,	,,	,,
,, R. K. Jena	,,	,,	,,
,, C. Saha	,,	,,	,,
Dr. N. K. Thakur	,,	,,	,,
Dr. C. R. Das	,,	,,	,,
Shri Radha C. Das	S-1	,,	,,
,, B. R. Shirsat	,,	,,	,,
,, George John	,,	,,	,,
,, D. Narayanasamy	,,	,,	,,
,, B. K. Mishra	,,	,,	,,
,, Dilip Kumar	,,	,,	,,
,, K. Suresh	,,	,,	,,
,, R. K. Dey	,,	,,	,,
,, D. K. Chatterjee	,,	,,	,,
,, S. N. Datta	,,	,,	,,
,, S. Jena	,,	,,	,,
,, M. Rout	S-1	,,	,,
Dr. R. Paul Raj	,,	,,	,,
Dr. S. N. Mohanty	,, (on study Leave)	,,	,,
Shri R. D. Chakraborty	S-3	Pond Culture Unit	Cuttack
,, V. Ramachandran	S-2	,,	,,
,, S. Patnaik	,,	,,	,,
,, T. Ramaprabhu	,,	,,	,,
,, N. G. S. Rao	,, (On study leave)	,,	,,

Name	Designation	Section	Place
,, G. V. Kowtal	S-2	Pond Culture Unit	Cuttack
,, M. A. V. Lakshmanan	JFS (on deputation)	,,	,,
,, S. D. Gupta	S-1	,,	,,
,, S. R. Ghosh	,,	,,	,,
,, A. K. Sahoo	,,	,,	,,
,, Apurba Ghosh	S-2	Sewage-fed fish Culture Unit	Rahara
,, Ajoy Kr. Ghosh	S-1	,,	,,
Smt. K. K. Bhanot	,,	,,	,,
Shri A. K. Roy	,,	,,	,,
Dr. G. N. Chattopadhyay	,,	,,	,,
Shri S. K. Saha	,,	,,	,,
,, K. R. Naskar	,,	,,	,,
,, N. M. Chakraborty	S	,,	,,
,, P. K. Saha	,,	,,	,,

Estuarine Division :

Dr. T. Rajyalakshmi	S-3 (on deputation)	Estuarine Section	Barrackpore
Shri K. K. Ghosh	S-2	,,	,,
,, B. B. Ghosh	,,	,,	,,
,, K. K. Bhanot	,,	,,	,,
,, S. B. Saha	S-1	,,	,,
Dr. H. C. Joshi	S-1	,,	,,
Shri M. M. Bagchi	,,	,,	,,
,, P. M. Mitra	,,	,,	,,
,, D. K. De	,,	,,	,,
,, S. K. Mazumdar	S	,,	,,
,, J. N. Pal	,,	,,	,,
,, R. N. Pal	S-2	Calcutta Research Centre	Calcutta
Shri G. N. Saha	S-2	,,	,,
,, P. Ray	JFS	,,	,,
,, S. C. Thakurta	S-1	,,	,,
,, R. K. Banerjee	,,	,,	,,
,, A. C. Nandy	,,	,,	,,
,, Hardial Singh	,,	,,	,,
,, H. C. Karmakar	,,	,,	,,
,, S. C. Banerjee	,,	,,	,,

Name	Designation	Section	Place
" G. C. Laha	S	Calcutta Research Centre	Calcutta
" A. Chaudhuri	SRA	"	"
" A. C. Banerjee	"	"	"
" D. D. Haldar	S-3	Kakdwip Research Centre	Kakdwip
Dr. P. U. Varghese	S-2 (On deputation)	"	"
Shri N. K. Das	S-2	"	"
" R. K. Chakraborty	S-1	"	"
" M. K. Mukhopadhyay	" (On study leave)	"	"
Dr. S. M. Pillai	"	"	"
Shri P. Ravichandran	"	"	"
" N. A. Reddy	"	"	"
" S. K. Mondal	"	"	"
" P. K. Ghosh	S (On study leave)	"	"
" K. Raman	S-3	Madras Research Centre	Madras
" K. V. Ramakrishna	S-2	"	"
" A. V. P. Rao	"	"	"
" R. D. Prasadam	"	"	"
" G. R. M. Rao	S-1	"	"
" S. Radhakrishan	"	"	"
" C. P. Rangaswamy	"	"	"
" M. Kaliyamurthy	"	"	"
" S. Srinivasagam	"	"	"
" K. Gopinathan	"	"	"
Smt. M. Sultana	"	"	"
Shri K. O. Joseph	S	"	"
" P. K. Chakraborty	S-1	Estuarine Division	Port Canning
" S. N. Sar	S	"	Digha

Riverine & Lacustrine Division :

Shri J. C. Malhotra	S-3 (up to 31.5.81)	Allahabad Research Centre	Allahabad
Dr. A. G. Jhingran	"	"	"
Dr. G. N. Mukherjee	S-2	"	"
Shri Ravish Chandra	"	"	"
Dr. R. S. Panwar	"	"	"
Shri S. P. Singh	"	"	"

Name	Designation	Section	Place
Shri S. J. Karamchandani	JFS	Allahabad Research Centre	Allahabad
Dr. M. Peer Mohamed	S-1	,,	,,
Shri M. A. Khan	,,	,,	,,
,, S. K. Wishard	,,	,,	,,
,, K. P. Srivastava	,,	,,	,,
,, R. K. Saxena	,,	,,	,,
,, G. N. Srivastava	,,	,,	,,
,, Balbir Singh	,,	,,	,,
,, S. N. Mehrotra	,,	,,	,,
,, R. A. Gupta	,,	,,	,,
,, D. N. Singh	,,	,,	,,
,, R. N. Seth	,,	,,	,,
,, R. K. Tyagi	,,	,,	,,
,, R. K. Dwivedi	,,	,,	,,
Dr. K. Chandra	,,	,,	,,
Shri D. R. Kanaujia	S-1	Buxar Res. Centre	Buxar
Shri Sree Prakash (On study leave)	,,	,,	,,
Dr. K. K. Vass	S–2	Coldwater Research Unit	Srinagar
Shri Shyam Sunder	S-1	,,	,,
Dr. H. S. Raina	,,	,,	,,
Smt. Usha Moza (On study leave)	,,	,,	,,
Shri V. K. Bali	,, (up to 29.6.81)	,,	,,
,, K. V. Rao	S-1	K. G. Unit	Tadepalligudem
,, K. J. Rao	,,	,,	,,
,, D. S. Murty	JFS	,,	,,
Dr. M. Subrahmanyam	S-2	Prawn Breeding Unit	Kakinada
Shri A. V. P. Rao (up to 5.9.81)	,,	,,	,,
,, L. H. Rao	S-1	,,	,,
Dr. K. J. Ram	,,	,,	,,
Shri A. K. Lal	S-1	Bhagalpur Research Centre	Bhagalpur
,, S. K. Sarkar	S	,,	,,
,, Y. S. Yadava	S-1	Brahmaputra Survey Unit	Gauhati
,, R. K. Singh	,,	,,	,,
,, M. Chaudhury	S	,,	,,
,, V. Kolekar	,,	,,	,,
,, C. B. Joshi	S-1	Coldwater Fisheries Unit	Bilaspur
Dr. M. L. Bhowmick	S-1	Muzaffurpur Research Centre	Muzaffurpur
,, S. P. Rai	,,	,,	,,
Shri V. R. Chitranshi	,,	,,	,,
,, D. Kapoor (On study leave)	,,	,,	,,

Name	Designation	Section	Place
,, B. L. Pandey	S-1	Lalgola Survey Centre	Lalgola
,, B. V. Govind	S-2	Bangalore Research Centre	Bangalore
Smt. S. Sivakami	S-1 (From 3.7.1981)	,,	,,
,, S. Ayyappan	,,	,,	,,
,, P. K. Sukumaran	S	,,	,,

Sections Projects Directly under Director's Control :

Shri P. Das	S-3	Extension Section	Barrackpore
,, U. Bhowmick	S-1	,,	,,
,, B. Roy	,,	,,	,,
,, P. K. Pandit	,,	,,	,,
,, B. K. Banerjee	,,	,,	,,
,, B. N. Saigal	S-2	Library & Documentation Section	,,
,, V. V. Sugunan	S-1	,,	,,
Smt. G. K. Vinci	,,	,,	,,
Dr. V. K. Unnithan	,,	,,	,,
Shri Amitabha Ghosh	,, (On study leave)		,,
Shri M. J. Bhagat	S	,,	,,
,, A. R. Choudhury	,,	,,	,,
Dr. K. L. Sehgal	S-2	Technical Cell	,,
Shri Kuldip Kumar	S-1	,,	,,
,, P. R. Sen	S-2	Hilsa Breeding Unit	,,
,, D. Nath	S-1	,,	,,
,, A. Hajra	S	,,	,,
,, S. Paul	S-1	Economics Section	,,
Dr. Babulal	,,	Radio Tracer Technique	,,
,, V. Pathak	,,	,,	,,
Shri B. K. Sharma	S-2	Operational Research Project	Krishnagar
,, M. K. Das	S-1	,,	,,
,, S. R. Das	,,	,,	,,
Dr. A. K. Mondal	S-2	Frog Culture Unit	Kalyani
Shri R. M. Bhowmick	S-3	KVK/TTC	Dhauli
Dr. B. N. Singh	S-2	,,	,,
Shri C. Selvaraj	,,	,,	,,
,, K. Madhusudana Rao	,, (On deputation)	,,	,,
,, C. S. Purushothaman	S-1	,,	,,
,, J. G. Chatterjee	,,	,,	Kakdwip

Co-ordinated Projects :

Composite Fish Culture and Fish Seed Production

Dr. R. D. Chakraborty	S-3 (upto July 1981)	CFCSP	Dhauli
Shri S. D. Tripathi	,,	,,	,,
Dr. K. G. Rao	S-1	,,	,,
Shri M. Sinha	S-2	,,	Kalyani
,, D. P. Chakraborty	S-1	,,	,,
,; P. C. Mahanta	S	,,	Gauhati
Shri D. N. Mishra	S-1	CFCSP	Jaunpur
Dr. M. Y. Kamal	S-2	,,	Ranchi
Shri A. Mukherjee	S-1	,,	,,
,, P. N. Jaitly	S	,,	,,
,, K. N. Krishnamurthy	S-2	,,	Bhavanisagar
,, P. K. Aravindakshan	S-1	,,	,,
Dr. P. M. Mathew	S-1 (upto 29.5.81)	,,	Pune
Shri P. L. Rao	,,	,,	,,
,, B. K. Singh	S	,,	,,
,, D. V. Pahwa	S-2	,,	Karnal
,, K. L. Shah	S-1	,,	,,
,, B C. Tyagi	,,	,,	,,
,, R. M. Rao	S-2	,,	Badampudi
,, J. B. Rao	S-1	,,	,,

Air-breathing Fish Culture

Dr. P. V. Dehedrai	S-3 (Special)	ABF	Barrackpore
Dr. S. K. Mukhopadhyay	S-2	,,	,,
Shri P. K. Mukhopadhyay	S-1	,,	,,
,, B. Venkatesh	,,	,,	,,
,, R. K. Das	,, (On study leave)	,,	,,
Dr. S. C. Pathak	S-2	,,	Gauhati
Shri M. P. S. Kohli	S-1	,,	,,
Dr. N. K. Thakur	S-2 (upto 4.4.82)	,,	Patna
Shri Dirandra Kumar	S-1	,,	,,
,, S. K. Munnet	,, (On study leave)	,,	,,
Dr. S. P. Ayyar	S-2 (On deputation)	,,	,,
Shri V. K. Murugesan	S-1	,,	Bangalore
,, P. Kumaraiah	,,	,,	,,

Reservoir Fisheries

Shri Ch. Gopalakrishnayya	S-2	Reservoir Fisheries	Nagarjunasagar
,, M. Ramakrishniah	S-1	,,	,,
Shri G. K. Bhatnagar	S-2	,,	Ranchi
Dr. B. P. Gupta	S-1	,,	,,
Shri S. N. Singh	,,	,,	,,
Dr. Y. Rama Rao	S-2	,,	Bilaspur
Shri B. C. Jha	S-1	,,	,,
,, M. D. Pisolkar	,,	,,	,,
,, D. K. Kaushal	,,	,,	,,
,, V. K. Sharma	S	,,	,,
,, V. R. Desai	S-2	,,	Rihand
,, N. P. Srivastava	S	,,	,,
Dr. Mathew Abraham	S-1	,,	Bhavanisagar

The following members of staff (Technical) rendered their services during the year :—

Liaison of Officer

Shri N. K. Tripathi

Senior Training Assistant—T-6

Shri N. C. Basu
Dr. S. K. Sarkar
Shri J. P. Verma
Shri S. L. Kar
,, B. B. Satpathy
,, A. K. Chattapadhyay

Overseer—T-5

Shri P. N. Bhattacherjee

Demonstrator—T-4

Shri B. R. Dutta
,, Radheshyam
Shri Kuldeep Kumar

Senior Artist—T-5

Shri J. Ghosh

Assistant Librarian—T-5

Smt. Anjali De

Technical Assistant—T-4

Shri P. B. Das
,, R. N. De
,, S. L. Raghavan
,, T. S. Ramaraju
,, P. V. G. K. Reddy
,, K. S. Rao
Shri P. R. Das
,, H. S. Mazumdar
,, R. C. Singh
,, D. R. Rao
,, B. K. Saha
,, N. K. Srivastava

Artist Photographer—T-4

Shri A. R. Mazumdar

Senior Library Assistant—T-4

Smt. Sukla Das

Photographic Assistant—T-4

Shri P. K. Ghosh

Estimator—T-4

Shri Chakradhar Sahoo

Draftsman- T 4

Shri M. D. Mantri

Technical Assistant—T-II-3

Shri P. M. Abdul Kadir
,, M. F. Rahaman
,, K. S. Banerjee
,, S P. Ghosh
,, N C. Mondal
,, Aloke Sarkar
,, H. K. Sen
,, P. S. C. Bose
,, Bhaskar Ghosh
,, N. D. Sarkar

Shri K. K. Agarwal
,, N. N. Sarkar
,, A. K. Ekka
,, N. N. Mazumdar
,, A. R. Paul
,, B. D Saroj
,, G. P. Bhattacherjee
,, Ram Chandra
,, A. K. Roy
,, D. N. Srivastava

Technical Assistant—T-I-3

Shri D. P. Verma

Artist—T-I-3

Shri P. Dasgupta

Electrician—T-I-3

Shri B. N. Sadhukan

Mechanic – T-I-3

Shri R. C. Satpathy

Technical Assistant—T-2

Shri S. Krishnan
,, R. K. Langer
,, A. N. Mohanty
,, N. Sarangi
,, Ramji Tiwari
,, B. B. Das
,, Sukumar Saha
,, K. P. Singh

Shri Camil Lakra
,, J. P. Mishra
,, G. C. Sahu
,, M. P, Singh
,, S. Kr. Chatterjee
,, K. C. Pani
,, D. Sanfui

Mechanic—T-2

Shri Donald Singh

Electrician—T-2

Shri S. K. Chatterjee
Shri N. Guin

Senior Gestetner Operator—T-2

Shri S. C. Bhowmick

Senior Binder—T-2

Shri M. M. Das

Driver/Engine Driver/Launch Driver/Mini Bus Driver-T-2

Shri Basmadaya
,, R. S Negi
,, J. C. Saha
,, R. N. Singh
,, Surja Bahadur
,, N. C. Biswas
,, U. K. Chatterjee
,, K. R. Deb
,, K. K. Dutta
,, Badal Lal Singha

Shri S. C. Das
,, R. M. Roy
, B. B. Sothi
,, D. Tarai
,, R. L. Balmiki
,, M. G. Subramani
,, K. L. Das
, Kishen Deo
,, T. P. Ghosh

Carpenter—T-2

Shri S. Bhattacherjee

Pump Man—T-2

Shri N. C. Roy

Laboratory and Field Assistant T-1

Shri M. C. Pal
,, S. C. Mondal
,, R. Tarai

Shri Aloke Kumar Jain
,, Bhai Lal
,, R. K. Halder

Sample Sorter—T-1

Shri A. K. Banerjee
,, S. C. Moitra
,, K. P. Saha
,, R. D. Saha

Shri S. K. Gupta
,, A. K. Nath
,, N. P. Saha

Driver/Engine Driver/Launch Driver/Mini Bus Driver—T-1

Shri Harihar Das
,, Pasupati Lal
,, C. K. Norh

Shri K. Kahall
,, A. K. Mazumdar
,, B. B. Roy

Plumber—T-1

Shri S. K. Deb

Pump Man T-1

Shri C. R. Das

Carpenter—T-1

Shri S. K. Biswas

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

Senior Administrative Officer

Nandy, L. M.

Accounts Officer

Mukherjee, A. N.

Administrative Officer

Sthanpati, P. K.

Assistant Administrative Officer

Roy, K. C.
Rajani, K. B.

Superintendent

Biswas, M. L.
Drs, A. K.
Roy, M. R.
Kanungo, P. C.
Sengupta, A. K.
Saha, S. C.
Datta, B. C.

Assistant

Bhattacherjee, B. C.
Bose, S. K.
Das, T. P.
Dasgupta, S.
Mazumder, Sandhya
Roy, Bani
Baidya, N. H.
Das, C. C.
Choudhury, Nomita
Halim, Abdul
Roy, S. C.
Sarkar, A. C.
Sarkar, N. K.
Shastry, S. P.
Zaidi, F. A.
Mahesh Prasad
Awadh, Sah
Neogi, M. M.
Banerjee, D. K.
Bose, D. C.

Senior Stenographer

G. Lahiri

Stenographer

Banerjee, A. K.
Chakladar, H.
Ghosh, U. K.
Chakraborty, G. M.
Srivastava, R. C.
Sinha, R. C. P.

Junior Stenographer

Bhattacherjee, S.
Chatterjee, T.
Das, P. K.
Jena, P.
Prasad, P.
Roy, T. K.
Saha, A. K.
Sahood, D. C.

Senior Clerk

Acharjee, D. K.
Baidya, D. N.
Banerjee, J. N.
Halder, S. R.
Kodandraman, I. N.
Mukherjee, B. B.
Nath, H. K.
Ghosh, B. K.
Kar, S. K.
Mishra, L. P.

Mitra, N. K.
Rai, Jagdish
Majumdar, T. K.
Bhowmik, S.
Dey Sarkar, D. K.
Patra, J. C.
Pramanick, S. N.
Sarkar, H. L.
Singh, R. C. P.
Subrahamanian, M.
Jagdish Rai

Singh, Kallu
Majumdar, Biplab
Das, Moloy Kr.
Sinha, S. S.
Mukherjee, R. R.
Pramanick, S. K.
Prasad, Keshaw
Sarkar, S. K.
Sreedharan, T. K.
Sutur, H. B.

Junior Clerk

Banerjee, Anita
Behara, A. C.
Behara, R. C.
Bhagirathi, S.
Biswas Manjulal
Bose, Samir Kumar
Chowdhury, Debesh
Das B. K.
Dutta, P. K.
Ghosh, R. K.
Gurish, W.
Kumar, Surendra
Lahiri, P.
Mahato, R. N.
Mandal, S. P.
Mazumdar, Sikha
Mupid. B. S.
Neogi, Anjali
Nath, Baij
Mondal, A. B.
Rao, K. S.
Radhakrishan, K.
Roy, J.
Roy, S. B.
Shan, Biswanath
Bhattacherjee, Mrinalini
Tikadar S. K.

Banerjee, Narayani
Behari, Kunj
Bala, M. K.
Biswas, A. B.
Biswas, P. K.
Chattarjee, Dipankar
Chhotey Lal
Das G. B.
Ghosh, P. K.
Ghosh, Samar Kumar
Kachhap M.
Kundu, N. R.
Lal, Ambika
Mandal, Bulbul
Manjhi, K.
Maranappa, S. K.
Murthy, P. B. V. S.
Panda. R. K.
Naik, N. C.
Sadaverte, N.
Rao, G. S.
Raina, R. L.
Roy, Ramir Kumar
Sarkar, B. K.
Nath, Kalipada
Srivastava, A. K.
Behera, Purnachandra

Supporting Grade IV

Chakraborty, K. L.
Jally, U. N.
Jally, H.
Burman, G. N.
Naik, J.
Das, P. V. N.
Mewalal
Biswas, D. N.
Bhuyan, U.
Sahoo, D.
Bose, J. L.
Dalai, B.
Samood Majhi, B.

Dey, S. K.
Behera, B. N.
Das, K. P.
Dosad, R. B.
Prasad, K.
Samal, B.
Singh, D.
Das, C.
Jena, K. C.
Ramdeo
Biswas, J. N.
Gangaram

Supporting Grade III

Barik, N.
Singh, C.
Varghese, P. V.
Shyamal, B. R.
Panda, Lakshmidhar
Das, S. K.
Pandey, C. K.
Bakshiram
Iruthiraj, M.
Raha, R. N.
Kotaish, S.
Maranappan, S. K.
Mishra, P.
Naik, B.
Kujur, J. M.
Singh, Meher
Chakraborty, S. K.
Burman, M. S.
Barik, Dija
Prakash, B.
Das, Mosa
Bhoi, D.
Mondal, A. K.
Patra, A. M.
Burman, S. N.

Behera, K. B.
Raikwar, Ramlal
Biswas, T. K.
Das, H. K.
Bhuloka, D.
Laluram
Munda, Budhram
Jana, Natabar
Das, Antiram
Gopal, K.
Shyamal, H. K.
Barik, S.
Bahadar, Nar
Sahoo D.
Behera, K. C.
Bahadur, Durga
Paramanik, H. K.
Behera, Alekha
Balmiki, Sitaram
Saha, N. K.
Naik, D.
Jally, Khetrabasi
Das, K. K.
Balmiki, S. C.
Apparao, B.

Biswas, R. C.	Behera, N.
Routh, H. K.	Bose, M. R.
Baldevsing, D. N.	Chand, Mool
Lal, Madan	Mohanty, N. N.
Rao, Ch. Ganeswar	Patnaik, S. R.
Bhuyan, N.	Sethi, P. C.
Behera, Trailokya	Jally, Aghur

Supporting Crade II

Boral, S. K.	Behera, M.
Kishore, Jugal	Jadav, S. P.
Jangli	Barik, D.
Maity, S. S.	Chaki, S. N.
Parbat, L. K.	Chaki, S. N.
Bhanja, B.	Narasapp, B.
Singh, S. S.	Das, B. B.
Narendra, G. C.	Sayalu, P.
Sahoo, D. N.	Appanna, K.
Sahu, D. N.	Behera, K. B.
Burman, S. N.	Bhoi, R. C.
Tair, R. N.	Panda, Jagdish
Das, P. C.	Singh. P.
Behera, Khalia	Bhania, D.
Bahadur, Tek	Burman, S. K.
Pradhan, B.	Behera, Keshab
Singh, Ramdeo	Ram, Japhu
Sahoo, G.	Jally, L.
Ramalingam, M.	Mondal, Biswanath
Singh, C. P.	Balaraman, M.
Jena, N. C.	Manickyam, P.
Mondal, Gokul Chandra	Burman, Balaram
Burman, Niranjan Kumar	Burman, H. S.
Burman, Sudhangshu Sekhar	Burman, Sudhangshu
Chakraborty, Saradandu	Ram, Munshi
Mondal, Subal Chandra	Samulu, L.
Balmiki, Krishanlal	Das, Sitaram
Srinivssan, V. K.	Balmiki, Kartore
Sundar, Ram	Bahadur, Bhim
Manna, L. C.	Das, Gunadhar
Yadav, A. L.	Shaw, Gulab
Saha, P. C.	Bhava, C. K.
Biswas, Jagdish	Burman, H. K.
Santra, Gangadhar	Dhanuk, Badlu
Biswas, S. C.	Nayak, B. K.
Mondal, Niranja Kumar	Das, Nikunjlal
Raju, Kolludharma	Dehuri, Basudeb
Das, Jhantu Ranjan	Lal, Bideshi
Biswas, Hiralal	Sahoo, K. M.
Bose, Hiralal	Biswas, A. K.
Bhoi, Shyama	Bhuyan, Dhirendra
Swain, Raghunath	Bahadur, Sitaram
Bahadur, Surja	Parida, Fakir
Das, Giridhari	Behera, Rajkishore
Kaliannan, K.	Sahoo, Lakshmidhar
Mallah, Jai Nandan	Krishnan, M. V.
Biswas, Manindranath	Mondal, Biswanath
Biswas, Ashoke Kumar	Hazarika, B.
Parida, Sridhar	Jana, Bibhuti Kr.
Balmiki, Khem Chand	Das, Dhaneswar
Raju, A. Eswar	Parameshwar
Dhanuk, Shyamlal	Bhaskar Bhoi

Supporting Grade I

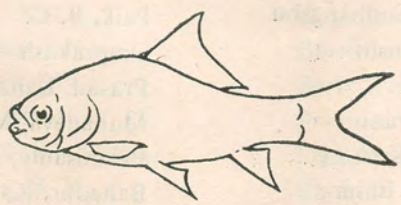
Mondal, Bholanath	Ghosh A. C.
Mani, N.	Bahadur Mina Rani
Mondal, Kalashashi	Ram, Rajendra
Debroy, R. L.	Khalko, Joseph
Saha, Mohna Lal	Bose, Sankar
Saha, Manoranjan	Karmakar Sarbananda
Bain, G. C.	Sethi, P. K.
Pugalendhi B.	Bairagi, Sukla
Behera Chhakei	Ghosh Pasupati
Ali Munsur	Bijali, Amalya
Paik, B. C.	Mallah, Munilal
Omprakash	Kachari, P. C.
Prasad, Lalta	Krishnappa, B. N.
Mahadeva, M.	Rajaratnam, R.
Palanisamy, R.	Uahendran, S.
Bahadur, Karna	Dhir, K. K.
Bahadur, Indra	Naik, G. C.
Bahadur, Asta	Pramanik, G. C.
Rao, G. Santa	Karkatta, Joseph

Muchi, R. U.
Arumugam, P.
Khatua, Jadumani
Subbaiyan, K.
Bhattacherjee, Ashutosh
Kumhar, Kharban
Ghume, T. H.
Naik, Krishna Ch.
Behera, Debahari
Mollick, G. C.
Sita
Yasiah, R.
Ramaswamy, A.
Biswas, Sukh Chand
Prasad, Ram
Singh, Maha
Semanta, Narayan Ch.
Mani, K.
Ningegowda, K.
Lakshmi, Ram
Subramani
Biswas, A.
Bez, P. C.
Gowda, Malige
Gangayya, A.
Bind, M. P.
Mukhia, J.
Dhibar, Gunadhar
Choudusi, Umesh

Saha, P. C.
Ray, Pradupta Kishore
Das, Mukti
Bahadur, Lal
Bahadur, Man
Bhoi, M. S.
Choudhury, Panchulal
Paria, J.
Bhol, R. K.
Parida Satyananda
Govate, S. T.
Seshanna
Sahni, Aghanu
Burman, Shatendra
Raj, Karam
Halder, L. K.
Jally, Burman
Mallah, Rajdhari
Das, B. C.
Dukran
Murugesana, A.
Das, B. C.
Karuppanna, P.
Mariappan, V.
Kemparas, A.
Ram, Paras
Ringh, C. P.
Runadale, G. J.
Satyanarayana

Paramanik, P. C.
Anjanappa, M.
Subramaniam, K.
Prasad, Shitala
Subramani, M.
Mahalick, Antaryami
Das, Rash Bihari
Bendre, S. S.
Das, Jayaram
Jana, Gourhari
Mondal, Kalipada
Samal. Krusnna Chandra
Khan, Rahmat
Das, Sudhakar
Gharami, Phani
Haider, Sital Chandra
Swain, Jatadhari
Naik, Sudarsan
Mohd. Yusuf Dar
Samanta, Pravansu Sekhar
Jena, Panchanan
Balmiki, Jagadish
Jena, N.
Nayak, P. K.
Swain, Pitamber
Behera, Dhanu
Halder, Hemlata
Parida, Y.

Bhuiya, N.
Parida, Golekha
Jally, Kedar Chandra
Singh, Kuldeep
Boro, Bhabalu
Palai, Duryodhan
Betal, Sasadhar
Parida, Judhistir
Barik Basanta Kumar
Behera, Makunda Charan
Rao, Medisethi Chandra
Samal, Chaitanya Charan
Halder, Satyendra Nath
Mondal, Sachindra
Swain, Ramesh Chandra
Das, Parusuram
Bhoi, Bijaya
Das, M. C.
Govindalal
Ram, Kawal Pati
Balmiki, Iswar Ram
Rao, P. Nageswar
Patnaik, B.
Swain, Rajan,
Nayak, Sripati
Shree, Nath
Ali, S. K. Munsur



APPENDIX I

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
(I. C. A. R.)
BARRACKPORE : WEST BENGAL

Office of Central Inland Fisheries Research Institute, Barrackpore, West Bengal, Statement Showing the total number of ICAR servants and the number of schedule caste/tribes amongst then as on 1st January, 1982

Class	Permanent/ Temporary	Total No. of employees	Scheduled Castes	Percentage to total employees	Scheduled Tribes	Percentage to total employees	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Class I	Permanent	119	3	2.52%	—	—	—
	Temporary	93	8	8.60%	—	—	—
Class II	Permanent	35	2	5.71%	—	—	—
	Temporary	21	4	19.05%	1	1%	—
Class III	Permanent	135	33	24.44%	1	1%	—
	Temporary	82	12	15.19%	9	8%	—
Class IV	Permanent	211	49	23.22%	1	10%	—
	Temporary	174	36	20.59%	3	2%	—
Class V	Permanent	14	14	100%	—	—	—
	Temporary (Safaiwala)	5	4	80%	1	20%	—

APPENDIX II

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE (ICAR) : BARRACKPORE : WEST BENGA

Address *List of Research/Survey* Centres

(*As in April 1983*)

	Research/Survey Centre	*Telegram/ Telephone*
1.	Central Inland Fisheries Research Institute, Barrackpore-743 101, West Bengal.	Fishsearch 53-161 53-322
2.	Allahabad Research Centre, Central Inland Fisheries Research Institute, 24, Pannalal Raod, Allahabad-211 002, U.P.	Fishsearch Allahabad 52245
3.	Badampudi Centre on Composite Fish Culture, Central Inland Fisheries Research Institute, Badampudi Fish Farm, P.O. BADAMPUDI, Tadepalligudem Taluq, West Godavari Dist., A. P., Pin : 534 412.	
4.	Bakkhali Research Centre, Central Inland Fisheries Research Institute, BAKKHALI, 24-Parganas Dist , West Bengal.	
5.	Bangalore Research Centre, Central Inland Fisheries Research Institute, 42/1 IV Main Road, MALLESWARAM, Bangalore-560-003, Karnataka.	Fishsearch Bangalore-3 366610
6.	Bhagalpur Research Centre, Central Inland Fisheries Research Institute, Khanjapur, Beatson Road, Bhagalpur-812-001, Bihar.	1385
7.	Bhavanisagar Centre of All India Co-ordinated Project on Composite Fish Culture, CIFRI, P.O. BHAVANISAGAR, (Via) Erode, Pin : 638 451, Tamil Nadu.	
8.	Bilaspur Centre, AICRP on Reservoir Fisheries, CIFRI, Roara Sector, Bilaspur-174 001, Himachal Pradesh.	
9.	Buxar Research Centre, Central Inland Fisheries Research Institute, 1/644, Sidhanathghat, Buxar-802 101, Bihar.	
10.	Calcutta Research Centre, Central Inland Fisheries Research Institute, 47/1, Strand Road, CALCUTTA-700077, West Bengal.	
11.	Cuttack Research Centre, Central Inland Fisheries Research Institute,	Fishsearch Cuttack

	Research/Survey Centre	*Telegram/ Telephone*
	Kanika Road, CUTTACK-753 008, Orissa.	
12.	Digha Survey Centre, Central Inland Fisheries Research Institute, Digha, Midnapur Dist., West Bengal.	
13.	Freshwater Aquaculture Research & Training Centre, Central Inland Fisheries Res. Inst., P.O. Kausalyagang, Dhauli, (Via) Bhubaneswar-751 002, Orissa.	Aquaculture Unit-8 Bhubaneswar 53084
14.	Gauhati Research Centre, Central Inland Fisheries Research Institute, Natun Sarania, Gauhati-781 003, Assam.	23831
15.	Jaunpur Research Centre of AICRP on Composite Fish Culture, CIFRI, House No. 334, Husainabad, Near Collectorate, Jaunpur-222 002, U.P.	
16.	Kakdwip Research Centre, Central Inland Fisheries Research Institute, Kakdwip-743 347, 24-Parganas, West Bengal.	Fishsearch Kakdwip 72
17.	Kakinada Research Centre, Central Inland Fisheries Research Institute, 16-23-1 Sambamurthi Nagar, Kakinada-533 001, A.P.	
18.	Kalyani Research Centre, Central Inland Fisheries Research Institute, P O. Netaji Subhas Sanatorium, Kalyani, Dist. : Nadia, West Bengal. Pin : 741 235.	
19.	Karnal Centre of AICRP on Composite Fish Culture (CIFRI), Govt. Eish Seed Farm, P.O. Saidapura (CSSRI), Karnal-132 001, Haryana.	3382
20.	Krishnagar Operational Research Centre, Central Inland Fisheries Research Institute, Anjana Fish Farm, Shaktinagar, Krishnagar-741 102, Dist : Nadia, W.B.	
21.	Krishi Vigyan Kendra, Central Inland Fisheries Research Institute, P.O. Kakdwip-743 347, Dist : 24-Parganas, W.B.	
22.	Krishi Vigyan Kendra/TTC, (Matsya), Central Inland Fisheries Research Institute, P.O. Kausalyagang, (Via) : Bhubaneswar-751 002, Orissa.	
23.	Lalgola Survey Centre, Central Inland Fisheries Research Institute, Lalgola, Dist : Murshidabad, West Bengal. Pin : 742 148.	
24.	Madras Research Centre, Central Inland Fisheries Research Institute, 1, Karaneeswarar Koil Street, (Near All India Radio), Mylapore, Madras-600 004.	Ulnadmeen Madras 74633
25.	Muzzaffarpur Research Centre, Central Inland Fisheries Research Institute, House No. 113, Ward No. 27, Damnchak, Muzzaffarpur-842 001, Bihar.	
26.	Nagarjunasagar Centre of AICRP on Reservoir Fisheries, CIFRI,	2617

Research/Survey Centre	*Telegram/ Telephone*
P.O. Vijayapuri South, Nagarjunasagar Dam, A. P., Pin : 522 439.	
27. Patna Centre of AICRP on Air-breathing Fish Culture, CIFRI, Mithapur Fish Farm, Patna-800 001, Bihar.	26286
28. Pollachi Centre of AICRP on Reservoir Fisheries, CIFRI, 12. Arumugam Nagar (Opposite to CTC), Mahalingapuram, P.O., Pollachi-642 002, Tamil Nadu.	
29. Port Canning Survey Centre, Central Inland Fisheries Research Institute, Port Canning, 24-Parganas, West Bengal.	
30 Pulicat Survey Centre, Central Inland Fisheries Research Institute, Pulicat, Chinglepet Dist., Tamil Nandu.	
31. Pune Centre of AICRP on Composite Fish Culture, CIFRI, C/O. Asstt. Director of Fisheries, Sadasiv Sadan, 873, Bhandarkar Institute Road, Daccan- Gymkhana, Pune-411 004, Maharashtra.	
32. Puri Research Centre, Central Inland Fisheries Research Institute, Balisahi, (Near Gachakali Temple), Sidha Bakul Lane, Puri-752 001, Orissa.	
33, Ranchi Centre of AICRP on Composite Fish Culture & Reservoir Fisheries, Central Inland Fisheries Research Institute, Doranda Fish Farm, P.O. Hinoo Ranchi-834 002, Bihar.	
34. Rahara Research Centre, Central Inland Fisheries Research Insntitute, 8, Station Road, Khardah, Dist : 24-Parganas, West Bengal, Pin : 743 186.	58-1023
35. Raidighi Survey Centre, Central Inland Fisheries Research Institute, Raidighi, 24-Parganas, West Bengal.	
36. Rihand Centre of AICRP on Reservoir Fisheries, CIFRI, C/O. Asstt. Director of Fisheries, Rihand, P.O. Turra, Dist. Mirzapur, U.P., Pin : 231 221.	
37. Srinagar Research Centre, Central Inland Fisheries Research Institute, Harwan, Srinagar-191 123, Kashmir.	Fishsearch Srinagar
38. Tadepalligudem Research Centre, Central Inland Fisheries Research Institute, 4-11-3, Subbaraopeta, Tadepalligudem, West Godavari Dist., Andhra Pradesh, Pin : 534 107.	
39. Ulubaria Survey Centre, Central Inland Fisheries Research Institute, Ulubaria, Dist. : Howrah, West Bengal.	

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