1982
ANNUAL REPORT

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
BARRACKPORE • WEST BENGAL • INDIA

ne
vater
ieving
modern
y manage-
ale aiming to
ery operations,
term production
r to meet the ever-
r country. This is in
jects that are of conti-
aim is the rapid develop-
areas of the country where
onal water bodies abound.

ANNUAL REPORT

1982

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
BARRACKPORE-743101 WEST BENGAL
INDIA

Credits

Edited and Compiled by : B. N. Saigal
M. J. Bhagat
Amitabha Ghosh
A. R. Choudhury

Assisted by : Anjali De
Sukla Das

Photographs : J Ghosh
A. R. Mazumdar
P. K. Ghosh

Assisted by : R. K Halder

Cover Design : P. Dasgupta

Typing Assistance : Samir Roy
Dipankar Chatterjee
R. C. P. Sinha
Ujjwal Ghosh
Mrinalini Banerjee

Printed by : Roman Printers
37 Andul Road, Howrah 711 109

(Released in December 1983)

Published by :

Dr. A. V. Natarajan, Director. Central Inland Fisheries Research Institute, Barrackpore-743 101, West Bengal.

CONTENTS

.....Contd.

Contents .....

ANNUAL REPORT 1982
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
BARRACKPORE

1. DIRECTOR'S INTRODUCTION

History :

The Central Inland Fisheries Research Institute is the pioneering organisation in the field of inland fisheries research in India whose objective is to promote research with a view to maximising fish output in the country. The Institute was formally established at Calcutta in March 1947 under the Ministry of Food and Agriculture, Government of India and since June 1959 is housed in its own buildings at Barrackpore on the left bank of the river Hooghly in an area covering about 5.2 ha. On the Ist of October, 1967 it came under the administrative fold of the Indian Council of Agricultural Research.

Objectives :

The major objectives of the Institute are :

i) to evolve aquacultural practices suitable to the country ;

ii) acquiring understading of the biology of food fishes and other important culturable organisms of fishery importance ;

iii) conducting investigations on hydrology and ecology of different types of fishery waters ;

iv) performing research on population dynamics of fish in natural capture fishery waters, like those of rivers, lakes, reservoirs, estuaries, etc.

v) integrating fish farming with livestock and agriculture ;

vi) understanding of the digestive enzyme equipment of food fishes and formulating artificial feeds of high conversion values and evolving feeding techniques ;

vii) developing better genetic strains through hybridization ;

viii) evolving techniques to make use of waste waters ;

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

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

Organisational structure :

With a view to achieving the desired objectives the scientific work of the Institute has been organised under three major Divisions *viz*, 1) Freshwater Aquaculture ; 2) Riverine and Lacustrine Fisheries and 3) Estuarine Capture and Culture Fisheries with their Divisional Headquarters at Dhauli (Orissa), Allahabad (U.P) and Calcutta (West Bengal) respectively.

1 Freshwater Aquaculture Division :

The nucleus of this division is at Freshwater Aquaculture Research and Training Centre at Dhauli where a modern fish farm complex with 800 scientifically designed ponds has been established in the recent past. This division is engaged mainly in evolving different freshwater aquaculture techniques, studies on fish nutrition, digestive physiology, fish genetics and hybridisation, problems of induced breeding of fishes, microbiology and ichthyopathology.

2. Riverine and Lacustrine Division :

The division with its Headquarters at Allahabad and Research Centres at Bangalore, Bhagalpur, Buxar, Gauhati, Kakinada, Muzaffarpur, Srinagar and Tadepalligudem is actively engaged in development of riverine and lacustrine fisheries, evolving conservation measures and judicious exploitation, besides large catfish and freshwater prawn culture.

3. Estuarine Division :

The Headquarters of the Division is located at Calcutta with Research Centres at Bakkhali, Barrackpore, Calcutta, Kakdwip, Madras and Puri. The problems pertaining to capture and culture of brackishwater finfish and shellfish, induced breeding of commercially important prawns and fishes etc. are being dealt with by this Division.

4. Coordinated Projects :

There are four Institute-based All India Coordinated Research Projects viz , (i) Composite fish culture and fish seed production with the main centre at Dhauli (ii) Culture of air-breathing fishes (iii) Ecology and fisheries of freshwater reservoirs and (iv) Brackishwater fish farming with their main centres at Barrackpore.

5. Other Centres :

The Operational Research Project at Krishnanagar, Rahara Research Centre, Kalyani Research Centre, the Extension Section, the Documention and Information Section, the Economics and Statistics Section and the Technical Cell located at Barrackore are directly under the cotrol of the Director, CIFRI.

6. KVK/TTC :

Two Krishi Vigyan Kendras, one at Dhauli and the other at Kakdwip and Trainer's Training centre at Dhauli are functioning under the aegies of the Institute. The main obejctives of these Centres are to produce technical manpower, to train extension workers in

aquaculture and to take up inservice training for research scientists and State Government officials to develop a better management infrastructure in the field of aquaculture in the country.

IMPORTANT ACHIEVEMENTS

Paddy-cum-fish farming in brackishwater saline fields :

Coastal saline soils of West Bengal, comprising an area of 0.8 mha, form a major part of the total coastal saline soils in India. Almost the entire area is a monocrop one, paddy being the only crop. During the rest of the year these fields are kept fallow. Recently, efforts are being made to culture euryhaline species of fish and prawns during the post harvest period of the monsoon dependent paddy crop. At Canning, sequential culture of *Penaeus monodon* and *Mugil parsia* was done in two 0.015 ha plots of Central Soil Salinity Research Institute (CSSRI) preceding paddy cultivation during summer months. Average production of 654 kg/ha/86 days could be achieved from the plots. After fish harvesting the salinity was allowed to decline to safer levels since this system of integrated farming involves a possibility of salt accumulation in the soil. During monsoon and post monsoon period paddy varieties *viz.* CSR—1, SR-26B and Assam were transplanted. Fingerlings of rohu, catla and mrigal were stocked in the paddy fields along with juveniles of *Macrobrachium rosenbergii* and a production to the tune of 511.8 kg of fish and prawn/ha/83 days could be obtained.

Seenghala breeds in captivity—a long awaited fillip in catfish farming :

Fry of *Mystus seenghala* collected from river Ganga in April-May, 1980, were reared to an average length of 70 mm in the floating cages in Ganga. Then they were shifted to a 0.05 ha pond at Yusufpur near Allahabad on 18.7.1982. This two year old cage and pond reared stock (av. size 518 mm) bred for the first time in the pond by forming breeding pits in the shallower region (depth range 60-90 cm). Hatchlings (6-15 mm size) were collected from nine breeding pits during 10-4 to 1-5, 1982 and are being reared.

Biogas-slurry—Tomorrow's mainstay in rural aquaculture :

A production of 762 kg of fish in 11 months could be achieved from a 0.15 ha pond treated with biogas-slurry. This is a commendable performance in a pond where no other management measures were adopted either. The pond was stocked @ 7,500/ha and the application of slurry was done depending on the oxygen budget of the pond. Surface feeders—catla and silver carp exhibited excellent growth and attained average growth of 530 and 900 g respectively within six months. Mrigal, common carp and grass carp attained average weights of 500, 600 and 900 g respectively. The performance of rohu, however, was not satisfactory. In another pond, where rock phosphate was also used in addition to biogas slurry, silver carp grew from 1g to 1 kg and catla from 50 g to 930 g in 7 months. Rohu and mrigal attained 370 and 350 g from their initial weights of 50 and 40 g respectively in 8 months. Common carp and grass carp grew to 400 and 1800 g from their initial weights of 5 and 200 g respectively in seven months. These investigations have added a new dimension to biogas-slurry utilisation in pisciculture and will thus serve to meet the ever increasing demand for fertiliser in aquacultural practices in the country.

Artificial breeding of Mahseer :

Dry stripping method for breeding mahseer *(Tor putitora)* at Bhimtal (U.P.) has been successful and 50,000 eggs were obtained. About 40,000 hatchlings (80% survival) are being reared under continuous water flow system. Besides, 3,500 fry obtained from earlier experiments are being reared in plastic pools and fed

with artificial food consisting of soyabeans, barley flour, wheat middlings and mustard oil cake.

A new high in fish production in brackishwater polyculture :

Experiments on polyculture of *Mugil cephalus* and *Chanos chanos* at the Vytilla Centre of the All India Coordinated Research Project on Brackishwater Fish Farming at the Kerala Agricultural University yielded a production of 328.4 kg in 13 months in a 0.15 ha pond. This is equivalent to 2021 kg/ha/yr. Mullet and milk fish were stocked @ 4000/ha in the ratio of 3 : 1. The mullet recorded a final weight of 446 g from an initial average weight of 0 76 g (88.4% survival), while milkfish was 735 g from initial average weight of 4.35 g (96% survival). No supplementary feed was given. Management measures involved were fertilization and periodic replenishment of pond water.

Artificial gynogenesis in rohu, catla & silver carp :

The fish Genetics Laboratory of the Freshwater Aquaculture Research & Training Centre of the Central Inland Fisheries Research Institute, has produced gynogenetic rohu, catla and silver carp for the first time in India.

Polyploidy was induced in rohu eggs fertilised with normal rohu milt and catla eggs fertilised with normal milt. In both cases, the fertilised eggs were treated with temperature shocks and colchicine. In silver carp, gynogenesis was induced through fertilisation of eggs with genetically inactivated sperms.

Rearing of these fry is in progress for cytological studies for screening of polyploidy.

Large scale breeding of Magur :

All India Coordinated Research Project on Air-breathing Fish Culture has achieved success for the first time in large scale breeding of magur, *Clarias batrachus* at North Eastern Council financed Regional Seed Farm, Amargana Gauhati. The breeding trials were conducted in collaboration with the Directorate of Fisheries Assam, in five specially prepared breeding plots each of 0.25 ha. Breeding experiments initiated on 10.6.82 continued till 14.7.82. The plots were provided with earthen cross bars with 25 cm deep and 10 cm wide burrows at a distance of 1 m. These plots were manured with 1000 kg/ha of cowdung and then planted with paddy saplings. After about a fortnight, when the water accumulated in the plot to a level of about 15 cm, 50 sets of pituitary hormone injected male and female brooders in the ratio of 1 femal : 2 males were released in each plot. Small fry of magur were noticed in about a week's time. The fingerlings, expected to be over a lakh, have attained an average size of 55 mm on 28.8.82.

Composite fish culture in Assam :

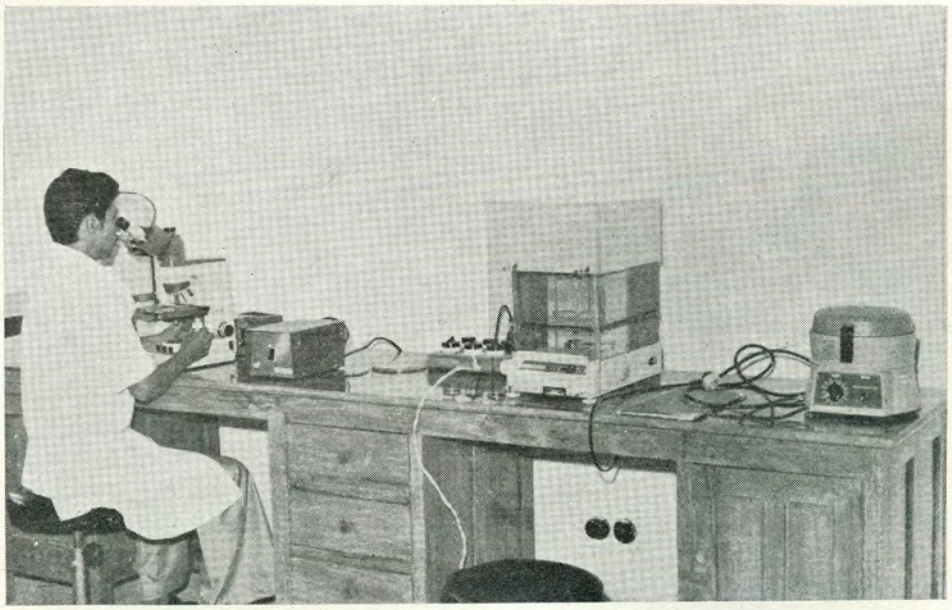
Composite fish culture experiment, conducted by Coordinated Research Project on Composite Fish Culture and Fish Seed Production at its Gauhati Centre, in a 0.25 ha pond yielded production to the tune of 3,454 kg/ha/10.5 months when stocked @ 5,000/ha with 3 species,in the ratio of C4 : R3 : M3. In the second pond stocked with 6 species (C1 : R1.5 : M2 : Sc 3 : Gc 0.5 : Cc2) at the rate of 6,000/ha, the yield was 4,320 kg/ha during the same period. It is worthy to note that the acidic soil of these ponds has responded well in these experiments.

IMPORTANT EVENTS

Sixth workshop on composite fish culture and fish seed production :

The sixth Workshop on composite fish culture and fish seed production was held at the Freshwater Aqua-

A technical session of Workshop on Composite Fish Culture in progress. From left : Dr. V. G. Jhingran, Dr. V. R. P. Sinha, Shri G. N. Mitra, Shri S. D. Tripathi and Shri H. A. Khan.



Microbiology Laboratory at FARTC. Dhauli.

Biochemistry-physiology laboratory at CIFRI, Barrackpore.

culture Research & Training Centre of CIFRI at Dhauli (Orissa) during 1-2 July, 1982 to evaluate the work done so far under the Project and its impact and implications were discussed at length by thirty five participating scientists from different states. Inaugurating the Workshop Dr. R. M. Acharya (DDG, ICAR) suggested that most of the project centres should be transferred to the respective states and the technology of induced breeding for Chinese carps should be properly tested under different agro-climatic conditions. Dr. B. Misra, Vice-Chancellor, Orissa University of Aricultural Technology, who graced the occasion by his presence as the Chief guest, desired that FARTC and OUAT should collaborate in popularising freshwater aquaculture in rural Orissa.

At the instance of Dr. A. V. Natarajan, Director, CIFRI the Workshop in its deliberations considered ;—

1. whether the project has accomplished its objectives,
2. if not, its causes and a new orientation in its programme and
3. closure of some of the Institute-based centres.

Region-wise progress of the work was assessed in the first four of the five sessions. The fifth session dealt with the finalisation of the technical programmes and formulation of the recommendations. Shri S. D. Tripathi, Project Co-ordinator, moved the vote of thanks.

The Workshop appreciated the suggestions made by Dr. Acharya and Dr. Natarajan and recommended that the project has achieved its objectives of maximising fish production in different agro-climatic conditions and demonstrating the technology to extension officers and farmers, the project programme could now be reoriented and consolidated at a few selected regional centres with adequate field facilities in major agro-ecological zones. Adequate attention should be paid to the selection and maintenance of pedigreed brood stock and seed production at each of the new centres, the results of researches at FARTC given field trials and a two-way traffic between basic and applied research established.

Sixth workshop on Air-breathing Fish Culture

The sixth workshop of the All India Coordinated Research Project on Air-breathing Fish Culture was held at Barrackpore during 27-28 December 1982. The workshop was attended by invited scientists, officers of the State Fisheries Departments, ICAR representative, scientists of the centres of the Project and the members of the Midterm Appraisal Committee.

The distinguished participants included Prof. B. I. Sundararaj, Delhi University, Prof. S. K. Moitra, Burdwan University, Prof. N. C. Dutta, Calcutta University, Dr. P. S. B. R. James, Assistant Director General (F), ICAR, Shri G. N. Mitra, Chairman, Midterm Appraisal Committee, Dr. V. D. Singh, Member, Midterm Appraisal Committee, Dr. S. R. Banerjee, Managing Director, S.F.D C., Bihar, Shri Gour Narayan Jt. Director of Fisheries, Bihar, Shri P. C. Chakraborty, Jt. Director of Fisheries, West Bengal, in addition to Dr. A. V. Natarajan, Director, CIFRI and Dr. V. R. P. Sinha, Head, FARTC, Dhauli.

The Workshop discussed in length the work report presented by the different centres. While the success on the mass breeding of magur in simulated conditions and use of some feed items of vegetable origin were highly appreciated, the necessity of further work on standardisation of some aspects of the air-breathing fish culture was felt by some scientists. In the light of discussions, the Workshop finalised the work programme of the project for the next year.

Union Minister visits FARTC

Shri R. V. Swaminathan, Hon'ble Minister of State for Agriculture, visited the Freshwater Aquaculture Research and Training Centre, Dhauli on 6.1.1982. He was accompanied by Smt. Swaminathan and Shri K. Majhi, Hon'ble Minister for Fisheries and Animal

Hasbandry, Orissa, Dr. V.R.P. Sinha, National Project Director and Head, FARTC, welcomed the ministers and took them round the laboratories of FARTC. They held discussions with the scientists regarding ongoing research programmes. The progress made under Lab to Land Programme of the Centre was also discussed. A netting demonstration in a carp culture pond was arranged on the occasion.

U. P. Minister visits FARTC

Shri Bhanu Pratap Singh, Hon'ble Minister for Agriculture, Animal Husbandry and Fisheries, Govt. of U. P. visited FARTC, Dhauli on 29 April, 1982. In the farm and laboratories the scientists apsrised him of the achievements and further plans of the centre. Taking note of the progress made in aquaculture research the Minister desired to introduce programmes like integrated farming in the state of U. P. on a wider scale.

Shri C. S. Singh, M P at FARTC

Shri Chandra Sekhar Singh, Member of Parliament and Member, Governing Body of the ICAR paid a visit to the laboratories and farms of the FARTC, Dhauli on 26th July, 1982. Shri Singh also visited the villages adopted by the centre under its 'Lab to Land' programme. Shri Singh was very happy to see fish farming activities in a Harijan Basti at Uttar Shasan where the womenfolk were engaged in controlled breeding of common carp and nursing the spawn. Shri Singh also met the farmers of Malisahi village who produced about 17 lakhs spawn under the guidance of the scientists of FARTC. These villagers have earned about Rs. 1000/- from the sale of spawn and are expecting about Rs. 5000/- from the sale of fry.

Shri Singh met the KVK/TTC trainees and showed keen interest in their activities. He highly appreciated the work done by the scientists at FARTC and expressed his satisfaction for establishing the Freshwater Aquaculture Research and Training Centre with such a zeal to make it the lead centre on carp farming for all Asian countries.

FAO/UNDP Technical Coordination Committee meeting

Technical Coordination Committee Meeting and Tripartite Review Meeting of the FAO/UNDP Project on Intensification of Freshwater Fish Culture & Training were held at FARTC on 18 and 19 November, 1982 respectively under the Chairmanship of Dr. A. V. Natarajan, Director, CIFRI. Dr. J. G. Rumeau, FAO Representative in India, Dr. P. S. B. R. James. (ADG Fisheries), ICAR, Shri D. R. Malhotra, UNDP Sr. Programme Officer, Mr. A. L. Mendiratta, FAO Senior Programme Officer, Dr. M. D. K. Kuthalingam, Dean, College of Fisheries, Tuticorin, Tamil Nadu, Dr. V. R. P. Sinha, National Project Director, FAO/UNDP and Head, FARTC and Shri S.C. Hota, IAS, Director of Fisheries, Govt. of Orissa participated.

RESEARCH COLLABORATION WITH OTHER INSTITUTES/ORGANISATIONS

At National Level :

Through a network of centres under the All India Coordinated Research Projects operating at the Institute, investigations on composite fish culture and fish seed production, culture of air-breathing fishes, ecology and fisheries of freshwater reservoirs and brackishwater fish farming were continued in collaboration with State Fisheries Departments and Agricultural Universities.

Investigations on selective breeding and hybridisation of selected commercial frog species were conti-

nued in collaboration with the University of Calcutta, West Bengal.

The Rahara Research Centre and Rice Research Institute, Chinsura (Government of West Bengal) continued their joint venture on fish culture in paddy fields.

In order to make an indepth scientific study of brackishwater paddy-cum-fish culture the CIFRI has started a collaborative project with the Central Soil Salinity Research Institute at Canning.

The Institute has established new exchange relationships with the Centre for Rural Development, IIT Madras and Keshavanand Gramothan Vidyapith Mahajan, Bikaner, Rajasthan.

At International Level :

Professors, scientists and teachers from Department of Silviculture, University of Helsinky headed by Dr. L. Olavi who visited this Institute during December 1981 to 23rd January, 1982 were apprised of the research activities of the Institute.

Dr. Charles Gunnerson, Project Officer UNDP recovery project (World Bank), visited CIFRI on 20th September, 1982. Dr. Gunnerson discussed the salient features of the UNDP project on research and development in integrated resource recovery (waste recycling) with the Director and the scientists of the Institute.

Dr. Tibor Farkas, lipid biochemist from Hungarian Academy of Science visited the Institute on 15th January. Dr. Farkas exchanged views on lipid metabolism of air-breathing fishes with Dr A. V. Natarajan, Director and other scientists of the Institute.

The national research staff have been trained by FAO/UNDP consultants, Dr K. W. Chow, in Fish Nutrition and Fish Feed Technology and Dr N. Fijan, in Fish Pathology. The Programme was organised at FARTC.

Dr Jean Clane Ardithi, Deputy Counsellor for Scientific and technical affairs, France Embassy, New Delhi, visited CIFRI on 12th September, 1982. Dr Ardithi discussed with Dr. A. V. Natarajan, Director, various technologies developed by the Institute.

The 2nd RAS/76/003 training programme on Composite Fish Culture for Senior Aquaculturists of Asia and the Pacific Region was organised at FARTC from 23 8.1982 to 31.8.1982. Sixteen participants from Indonesia, Philippines, Socialist Republic of Vietnam, Thailand, Malaysia, Singapore, Srilanka and Nepal attended the programme. The training programme for Mr Doan Van Dau of Vietnam was, however, further extended upto 20.9.82 specially for Integrated Fish Farming.

In order to further strengthening the exchange of research publications, new exchange relationships at international level were established with 3 additional individual/organisations, viz., Fishery expert, Mekong Secretariat, Escape sala Santhithane, Bangkok ; Deutsehe Wissenschatlliche Kommission fiir Meeres foreschung, Bibliothek, Hamburg, West Germany, and Institute fur Binnenfischeri, Berlin, Germany.

HONOURS, AWARDS, ETC.

Dr. A. V. Natarajan, Director has been nominated as an additional collaborator for 'Science & Culture', one of the leading science journals published by the Indian Science News Association, Calcutta

Dr. V. R. P. Sinha, National Project Director FAO/UNDP Project and Head FARTC attended the Second NACA advisory committee meeting as a member and a nominee of the Govt. of India, from 11 to 20 December, 1982 at Bangkok, Thailand.

Shri A. K. Laal. S-1 has been awarded the Ph.D (Sc) degree by the University of Bhagalpur.

Shri G. Ramamohan Rao, S-1 has been awarded the degree of Doctor of Philosophy by the Andhra University.

Shri K. M. Das, S-1 has been awarded Ph.D (Sc) degree by the University of Burdwan.

Shri M. Kaliyamurthy, S-1 has been awarded the Ph.D (Sc) by the University of Magadh.

S/Shri P. K. Mukhopadhyay, S-1 and T. Ramaprabhu, S-2 have been awarded Ph.D (Sc) degree by the University of Calcutta.

Shri M. P. Singh Kolhi, S-1 has been nominated as a Contributing Editor (Hony.) for Bulletin of Pure & Applied Science, Modinagar, U. P.

TRAINING

Seventeen technical staff members of the Institute—S/Shri R. K. Langer, A. N. Nohanti, N. Sarangi, K. C. Pani, M. P. Singh, D. P. Verma, R. Tiwari, D. Sanfui, G. S. Sahoo, C. Lakra, K. P. Singh, S. C. Mondal, S, K. Chatterjee, J. P. Mishra, S. Krishnan, B. Das and Bhai Lal underwent one month inservice training (13th January to 11th February, 1982), conducted by the Extension Section of the Institute. The orientation course comprised objectives of ICAR, personnel policies, personality development through idea generation, interpersonal communication, role of statistics in research and administrative procedures.

Shri R. M. Rao, S-2 underwent training in "Aquaculture" at Philippines under FAO/UNDP from 29.4.81 to 31.3.1982.

Smt. A. Dey, Sr. Librarian and Smt. S. Das, Librarian attended a week long (15-20th February, 1982) "Management course in conservation of Documents" conducted by Indian Association of Special Libraries & Information Centres, Calcutta.

Shri B. B. Satpathy, Senior Training Assistant (T-6) attended a training programme on Scientific dairy management and extension techniques at TTC, NDRI Karnal from 15.3.82 to 15.4.82.

Shri H. K. Maduli, T-II-3 joined a 4 month training programme (II Training Course on Integrated Fish Farming) at Wuxi, China from 12.4.1982 to 5.8.1982.

Shri C. R. Das, T-1 underwent a refresher course for 20 days (1-21st July, 1982) at Tractor Training Centre at Hissar (Haryana).

S/Shri K. N. Krishnamoorti, Kuldip Kumar and Dr. S M. Pillai underwent training on fish nutrition under Dr. K. Chou, FAO Consultant on fish nutrition and feed technology at FARTC, Dhauli during 27 August—21 October, 1982.

Shri T. Rama Prabhu, S-2 was trained in Weed Management at Central Plant Protection Training Institute, Rajendranagar, Hyderabad during 6th-15th December, 1982.

S/Shri K. Raman and D. D. Halder, S-3 attended training programme on Research Management at National Academy of Agricultural Research Management, Hyderabad during 15-24, December, 1982.

VISITORS

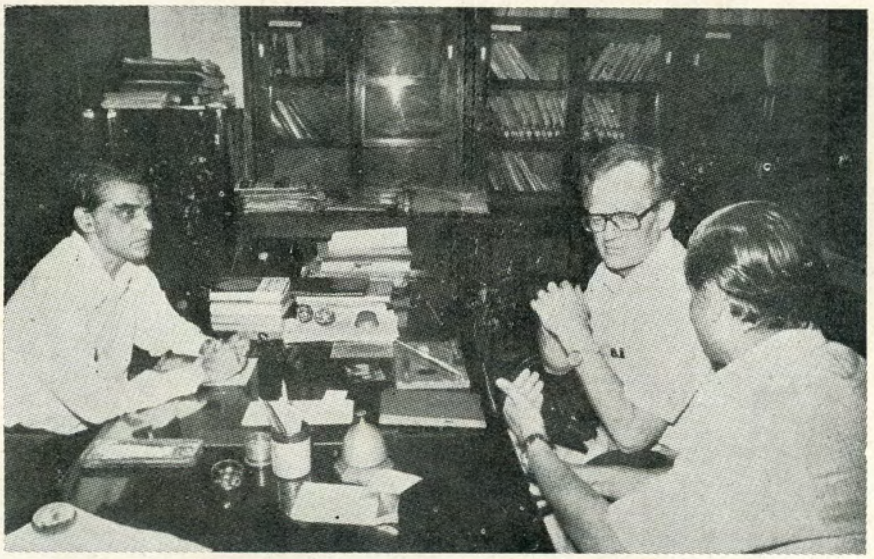
The following distinguished personalities and scientists from different parts of the country and abroad visited the Institute and its regional centres. They were taken round the research laboratories, experimental and demonstration centres to apprise them with the achievements of the Institute.

Acharya, R. M. (Dr.)	Dy. Director General (Animal Sciences), ICAR, New Delhi.
Ahmed, M. Md.	Director of Fisheries, Assam, Gauhati.
Alam, A. (Dr.)	Assistant Director General (Agric. Engg.), ICAR, New Delhi.
Alikunhi, K. H.	Ex-Director, CIFE & Fisheries Adviser, Govt. of Kerala, Kerala.
Anwar, M. M. (Dr.)	Faculty Member, National Academy of Agriculture Research Management.
Arditti, J. C.	DI Science Counsellor, French Embassy, New Delhi.
Ashnah, K. M.	Consultant, National Committee on Rural Training, Planing Commission, Bangladesh.
Banerjii, S. M.	Ex-Dy. Director, Directorate of Fisheries, West Bengal.
Banerji, S. R.	Managing Director, SFDC, Bihar
Barma, S.	Director of Fisheries, West Bengal, Calcutta.
Bora, L. C. (Dr.)	Assistant Director of Ext. Edn. Services, Govt. of Assam Gauhati.
Bora, (Dr.)	Director, Vet. Services, Assam.
Chakraborty, P. C.	Jt. Director of Fisheries, W. B., Calcutta.
Chakraborty, S. K.	Prof. Zool. Cotton, College, Gauhati, Assam.
Dutta, Amal	M. P, Calcutta.

Datta, N. C. (Dr.)	Reader, Dept. of Zoology, Unviversity of Calcutta.
Doyle, Roger N. (Dr.)	Professor of Biology, Dalhousie University Halifax, Canada.
Duara, P. K.	Jt. Director of Fisheries, Assam, Gauhati.
Dwivedi, S. N. (Dr.)	Director, CIFE, Bombay.
Emal, Jafar Md.	FAO Trainee from Kabul University, Kabul.
Farkas, Tibor.	Institute of Biochem., Biological Research Centre, Hungarian Academy of Sciences, Szarvas, Hungary.
Gautam, O. P. (Dr.)	Director-General, ICAR, New Delhi.
Gilman, R. H. (Dr.)	John Hoffikins University, U. S. A.
Gunnerson, Charles	Sr. Project Officer, World Bank, Washington.
Hota, S. C.	Director of Fisheries, Orissa, Bhubaneswar.
Ifesanya, B. O.	FAO Fellow, Federal Ministry of Agriculture Dept. of Fisheries, Victoria Island, Lagos, Nigeria.
Jalil, Md.	Bangladesh.
James, P.S.B.R. (Dr.)	Assistant Director General (Fisheries) ICAR, New Delhi.
Jauncey, K. (Dr.)	University of Sterling, U. K.
Jayram, K. C. Dr.)	Jt. Director Z. S. I, Calcutta.
Jhingran, V. G. (Dr.)	Ex-Director, CIFRI, Dehradun
Junior, J. F. (Dr.)	Technical Director, Agricultural Research Centre for Humid Tropics, Belen, Brazil.
Kalita, K.	Depertment of Fisheries, Assam, Gauhati.

Kamaluddin, A. S. M.	Consultant, National Committee on Rural Training, Planning Commission, Bangladesh.
Lee, Duchsoo.	Chief, Asian Division, The World Bank.
Luukkanen, Olavi (Dr.)	Department of Silviculture, University of Helsinki, Helsinki, Finland.
Majhi, K.	Minister of Fisheries, Orissa.
Mitra, G. N.	Ex-joint Commissioner, Govt. of India, Fisheries Advisor, Govt. of Orissa, Cuttack.
Molla, A. Q.	M. L. A. West Bengal.
Moitra, S. K. (Dr.)	Professor of Zoology, University of Burdwan, Burdwan. West Bengal.
Nanda, Kiranmoy.	Minister of Fisheries, West Bengal.
Narayan, G.	Department of Fisheries, Bihar, Patna
Nascimento, C. (Dr.)	Director, Agricultural Research Centre for Humid Tropies, Belen, Brazil.
Panda, P. B. (Dr.)	Dy. Director of Animal Husbandry, W.B. Calcutta.
Paulraj. R. (Dr.)	CMFRI, Cochin.
Pillay, T. V. R. (Dr.)	Programme Leader, ADCP, FAO, Rome
Prasad, C. S.	Regional Director, National Savings Organization.
Price, Christophar (Dr.)	Fishery Expert, Nimgachi Fish Culture Project, Pabna, Bangladesh.
Priestly, M. J.	UNDP Resident Representative, New Delhi.
Rao, N. K. Ananta (Dr.)	Former Dy. Director-General (Edn), ICAR, New Delhi.
Rao, Panduranga (Dr.)	Director, CIFT, Cochin.

Roy, D. J. (Dr.)	Jonal Coordinator (Zone II), LLP, BCKV, Mohonpur, Kalyani, W.B.
Roy, R.	Dy. Director, Dept. of Fisheries, Govt. of West Bengal, Kalyani.
Rumeau, J. G. (Dr.)	FAO Representative in India, New Delhi.
Saksena, R. K.	Director of Fisheries, U. P., Lucknow.
Sengupta R.	Dy. Director of Fisheries West Bengal, Calcutta.
Shetty, H.P.C. (Prof.)	Director of Instructions, Fisheries College, Mangalore.
Singh, Bhanu Pratap.	Former Union Minister of State, Lucknow.
Singh, Chandra Sekhar.	M. P. & Member of ICAR Governing Body, New Delhi.
Singh, Maharaj (Dr.)	Dy. Director General (Edn.) ICAR, New Delhi.
Singh, V. D. (Dr.)	Dy. Commissioner, Ministry of Agriculture & Irr. (Dept. of Agriculture), Krishi Bhavan, New Delhi.
Spiller, Gary.	Box 618, UNDP, Bangkok.
Sundararaj, B. I. (Prof.)	Head, Dept. of Zoology, Delhi University, Delhi.
Swaminathan, R. V.	Union State Minister for Agriculture, New Delhi.
Tripathi, Y. R. (Dr.)	Ex-Director of Fisheries, U. P., Lucknow.
Wahed, Md.	Bangladesh.
Yan, Cheu Foo.	Coordinator, FAO, Bangkok, Thailand.



Dr. Gunnerson (middle) with Dr. A. V. Natarajan (left), Director and Shri Apurba Ghosh, Scientist.

Visitors from Helsinki are briefed by the Director on the activities of the Institute.

CONFERENCES AND SYMPOSIA

The Scientists of the Institute participated in various Conferences/Symposia/Seminars and Meetings during 1982 wherein they presented their research findings and exchanged views with the delegates. List of scientists who participated and presented papers in such gatherings is furnished below :—

Conferences/Symposia	Place	Title of the paper presented	Authors
Seminar on "Freshwater Fish Seed Production", held on 1st & 2nd February, 1982.	Nari Seva Sadan, Cuttack	Role of hydration in spawning of carps.	V. R. P. Sinha & N. K. Tripathi (Presided by V.R.P. Sinha)
		Fish Seed Production in freshwater ponds.	P.R. Sen
Regional Workshop on 'Education in Food and Nutrition Agriculture", held during 24-26 February, 1982, sponsored by UNICEF, East India Office, Calcutta.	Kapgari, West Bengal	—	Attended by B. K. Banerjee
Symposium on "The diseases of finfish and shell-fish" held during 1-3 March, 1982.	College of Fisheries, Mathsyanagar, Mangalore.	Effect of temperature on the outbreak of diseases of freshwater fishes.	R. N. Pal
		The common parasitic diseases of Indian major carps in West Bengal.	A. K. Ghosh
		Stress mediated columnaris disease in rohu (*Labeo rohita*).	Dilip Kumar *et al.*
Workshop on "Development of Inland Fisheries in Orissa through Institutional Finance" held during 6th-8th March, 1982.	Gandhi Smriti Bhawan, Balasore	Recent advances in freshwater aquaculture.	Inaugurated by V.R.P. Sinha
		Role of soil and water in pond productivity and method of effective pond fertilization for increased fish production.	G. N. Saha

		Nutritional requirements and nature and supplementary food of cultivated fishes with special reference to spawn, fry and fingerlings.	B. N. Singh
		Fisheries extension for rural aquaculture.	Radheshyam & Dilip Kumar
		Bundh breeding in India : a review and discussion.	S.K. Sarkar
		Role of various inducing agents in hypophysation of carps.	V.R.P. Sinha, H.A. Khan & R.C. Das
		Sampling methods packing and shipments of materials for laboratory diagnosis of fish diseases.	R.K. Dey *et. al.*
		Composite culture of Indian and exotic carps.	M. Sinha
		Management techniques of carp nurseries and rearing ponds for carp seed production.	P.R. Sen
		Monitoring of fish health in aquaculture practices.	B.K. Mishra *et al.*
		Concept of community fish farming.	N.K. Tripathi *et al.*
		The role of stress in fish diseases.	K. Suresh *et al.*
		Role of prophylaxis in aquaculture	Dilip Kumar *et al.*
		Utilization of road side borrow pits for rearing of carp fry—a case study.	Radheshyam *et al.*
All India Conference on Limnology held during 3-5th March 1982.	Nagarjuna University, Nagarjunanagar, A. P.	Evaluation of productivity in reservoirs as a function of limnochemical and eco-energetic parameters.	V. Pathak
Seminar on "Increase of productions from Coastal Aquaculture" held during 7-8th March, 1982, organised by MPEDA & Dept. of Fisheries, West Bengal.	Calcutta	—	Attended by P. Das & U. Bhowmik

Seminar on "Transfer of Technology under Lab to Land Programme ', organised by Jute Technological Research Centre on 26th March, 1982.	Vidyanagar, West Bengal	Talk on "Modern Aquaculture"	U. Bhowmik
National Seminar on Fisheries Development in India, held on 9th, 10th & 11th April, 1982, organised by the Indian Institute of Management.	Ahmedabad	Infrastructural base and policy support measures for aquaculture —a case study of West Bengal.	S. Paul & Attended by K.K. Ghosh
Seminar on "Progress of Fish Culture in W. B.—its problems and prospects", held on 24th & 25th April, 1982, organised by the Directorate of Fisheries, West Bengal.	Bekar Hall of Presidency College, Calcutta	—	Participated in discussion by P. Das, U. Bhowmik & B. K. Banerjee
National Workshop on Fisheries, held on 6th May, 1982.	National Co-operative Development Corporation, New Delhi.		Attended by K.K. Ghosh
National Workshop on Lab to Land Programme", held on 14-15th May, 1982	Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur.		Attended by U. Bhowmik
Seminar on "Strategy for Fisheries Research in Karnataka" held on 17th & 18th May, 1982	College of Fisheries, University of Agriculture, Mangalore.	Composite fish culture in manageable larger freshwater tanks in and around Bangalore.	B. V. Govind *et al.*
First National Fisheries Co-operative Congress, held on 26th June, 1982.	Nagpur	Revitalisation of co-operatives for efficient fish marketing in inland sector.	A.V. Natarajan & S. Paul
Symposium on "Environmental Quality and Conservation" held on 27th June, 1982.	S. V. University, Tirupathi	Environmental implications of herbicides in aquatic ecosystems.	T. Ramaprabhu
Third All India Seminar on Icthyology, organised by the Department of Zoology, Gauhati University, during July 26 to 29, 1982.	Dept. of Zoology, Gauhati University, Gauhati.	Breeding of *Clarias batrachus* (Linn.) and *Heteropneustes fossilis* (Bloch).	S. C. Pathak & Y. S. Yadava

		Assessment of carp spawn potential of a stretch of river Brahmaputra in Assam.	A. G. Jhingran *et al.*
		Past and present trends in abundance and catch structure of *Hilsa* ilsha (Hamilton) in the middle stretch of river Ganga	R. A. Gupta & A. G. Jhingran
		Prospects of inland fish culture in North-Eastern region.	K. L. Sehgal
		Studies on the macrobenthic fauna of Dighali beel (Assam).	Y.S. Yadav *et al.*
		Spawning behaviour of freshwater teleost, Singhi, *Heteropneustes fossilis* (Bloch).	M.P. Singh Kohli
6th Workshop of "All India Co-ordinated Research Project on Composite Fish Culture & Fish Seed Production". held on 1st & 2nd July, 1982.	Freshwater Aquaculture Research & Training Centre, Dhauli, Orissa.		Organised by CIFRI
Seminar on "Fishermens' Co-operative Societies 1982", organised by the W. B. State Fishermen's Co-operative Society on 13th September, 1982.	Calcutta		Attended by P. Das as member.
47th Annual Covnention af Indian Society of Soil Science, held during 1st—3rd October, 1982.	Nagpur	Possibilities of brackishwater paddy-cum-fish farming in coastal saline soils of West Bengal.	G. N. Chattopadhyay, Apurba Ghosh & P. K. Chakraborti.
VI Conference of Agricultural Research Statisticians of the ICAR Institutes/Agricultural Univetsities etc., organised by the Indian Agricultural Statistics Research Institute, during 6-8 October, 1982.	IASRI, New Delhi	Current statistical research problems in inland fisheries of India.	K. K. Ghosh
Workshop on "Orientation, communication for subject matter specialists (Training & Information) under T & V system", organised by the Gujarat Agricultural University, Extension Education Institute, during 18th-30th October, 1982.	Anand, Gujarat		Attended by P. K. Pandit & B.K. Banerjee

Society of Biological Chemists' (India) 51st Annual Meeting, Department of Biochemistry, Punjab University, Chandigarh, held during 18-20 November, 1982.	Chandigarh	Effect of feeding methyl testosterone on the growth and metabolism of the catfish *Clarias batrachus* (Linn.)	P.K. Mukhopadhyay, B. Venkatesh & P. Das.
		Effect of photoperiodicity on the egg phospholipid pattern of an air-breathing catfish, *Heteropneustes fossilis* (Bloch).	S. K. Mukhopadhyay, B. Venkatesh & P. Das.
Symposium on "Harvest & Post Harvest" during 24-27 Nov., 1982.	Society of Fisheries Technologists (India) Matsyapuri, Cochin.	Keynote address on Inland fisheries	A.V. Natarajan
		Credibility of communication facets in relation to clientele for adoption of scientific fish culture.	P. Das *et al.* & Attended by U. Bhowmik
		Special fishing devices for catching air-breathing fishes in Bihar.	N. K. Thakur
		Crab fisheries of Pulicat lake with special reference to catches from the Southern Sector.	S. Srinivasagam & K. Raman.
Regional Workshop on "Limnology and Water Resources Management in Developing countries of Asia and the Pacific", organised by the University of Malaya and the International Society for Theoretical and Applied Limnology during 29 November—5 December, 1982.	Kuala Lumpur Malaysia	Ecoenergetics and productivity of freshwater tropical and subtropical impoundments of India.	A.V. Natarajan & V. Pathak
		Recent advances in aquaculture in Asia.	V.R.P. Sinha
		Ecology and management of Kashmir Himalayan lakes.	K.K. Vass
		Some ecological considerations of the Rihand reservoir polluted by industrial wastes of Kanoria Chemicals, Renukoot (U.P.), India.	K. Chandra *et al.*

		Evaluation of limnological characteristics and trophic status of Gulariya reservoir.	S.N. Mehrotra & A.G. Jhingran.
Sixth Workshop All India Co-ordinated Research Project on Air-breathing Fish Culture held on 27-28 December, 1982.	CIFRI, Barrackpore		Organised by CIFRI
First National Environment Congress held during December 28-30, 1982.	IARI, New Delhi	Some observations on bioaccumulation, toxicity, histopathology and haematology of some fishes in relation to heavy metal pollution in the Hooghly estuary between Nabadwip and Kakdwip.	B.B. Ghosh
		Efficacy of penicillin mycelium as a fish pond manure.	R. K. Banerjee & K.V. Srinivasan
		Studies on the ecology and productivity of an outfall zone in a 'Kol' of River Ganga at Bhagalpur in relation to its role in combating pollution and offering prospects for fish culture.	A K. Laal *et al.*
		Studies on the distribution of organochlorine pesticide residues in the Hooghly estuary.	H.C. Joshi & B.B. Ghosh
		Environmental studies on jute-retted waters *Vis-a-vis* their utility in aquaculture.	B.N. Saigal *et al.*
		Impact of some common herbicides on the aquatic environment and its living resources.	S. Patnaik
		The impact of aquatic weeds on the aquatic environment in fish ponds.	T. Ramaprabhu & S R. Ghosh
		Present environmental considerations of Dal Lake, Kashmir.	K.K. Vas
Second NACA Advisory Committee Meeting held during December 11-20, 1982.	Bangkok		Attended by V.R.P. Sinha—as a nominee of Govt. of India.

Annual Workshop of the All India Coordinated Project on National Demonstration of Major Food Crops held during June 10-12, 1981.	University of Agricultural Sciences, Bangalore.	Paddy-cum-fish culture	Apurba Ghosh Kuljeet K. Bhanot & S.K. Saha.

FINANCE

The provision of funds for the financial year April 1982 to March 1983 was as under :-

Non-Plan	Rs.	1,47,10,000
Plan	Rs.	57,79,000
TOTAL	Rs.	2,04,89,000

Against the above provision, the expenditure from 1.4.1982 to 31.12.1982 was as follows :-

Non-Plan	Rs.	1,00,50,563
Plan	Rs.	10,49,429
TOTAL	Rs.	1,10,99,992

EXTENSION AND NATION BUILDING ACTIVITIES

For dissemination of results of researach of practical value, emerging from the research activities of various research centres the extension section of the Institute rendered its services through various extension media, *viz.*, short term training, organising fish farmers days, establishing personal, group and mass contact with fish farmers, by maintaining advisory services etc. Short term training courses, lectures, group discussions etc., were also arranged by various research centres.

Training Programme :

Training imparted at national level :

A short term training programme was organised for 5 fish farmers and one Fishery Officer of Arunachal Pradesh from 7–10 January '82.

A training programme was organised by the Extension section for inservice technical personnel, category-I from 13.1 to 11.2.1982.

A ten days training from 12-21 April '82 was imparted to two veterinary officers of the United Insurance Company Ltd. and New India Assurance Co. Ltd., Calcutta 'On Inland Aquaculture with special reference to hazards generally encountered, with their remedies and economics of operations' aiming at the implementation of newly introduced Fishery Insuarnce Schemes in the country.

A training course on brackishwater seed collection technique was organised by KVK Kakdwip. during 3-8 August, 1982.

Shri Iqbal Ahmed and Kumari Poonar Prakash from Rajendra Agricultural University, Pusa (Samastipur) underwent training on the various aspects of fish culture from 15.7.82 to 13.8.82. Shri R. K. Sharma, Asstt. Director of Fisheries, Himachal Pradesh, aquainted himself with recent advances in Aquaculture at FARTC from 27.7.82 to 13.7.1982. The trainees from the CIFE, Bombay, Barrackpore and Agra and Fisheries College,

Mangalore underwent training on the various aspects of fish culture at FARTC.

Bangalore Research Centre of the Institute organised an intensive training programme including survey of tanks for 44 superintendents of fisheries from various districts of Karnataka State in five batches during 6.9.82 to 14.10.82.

A four day training on stock pond management was organised for 41 fish farmers of 13 villages at Kamarpukur from 17—20 November, 1982.

Training imparted at International level :

A 5 days training on fisheries extension was imparted to two Fisheries Extension Inspectors, S/Shri J. A. Chandrasiri and N. J. W. Nanayakkara of Srilanka from 1st April, 1982.

A one-day training was imparted to Shri B. Chowdhury of Bangladesh on different aspects of scientific fish culture on 15.11.82.

Mr. E. Vendeer Poortam, Mr. W. P. Wilbert and Mr. V. Padmasena, Pisiciculturists from Srilanka were imparted training in pisciculture from 1.4.82 to 30.4.82 at FARTC, Dhauli.

One month training (6.7.82 to 3.8.82) in induced breeding, fish culture and fish diseases was imparted to S/Shri M. C. Balasuriya, L.K.S Balasuriya and I.M.D.E.I. Uukkumbura, fishery & officials from Srilanka at FARTC under ITEC programme, Govt. of India.

Mr. Clifford A. Nbakango, FAO fellow fromNigeria received four months training in different disciplines of freshwater aquaculture from 6.11.1981 to 16.3.82 at FARTC.

Mr. Xaysandasy Thosathith and Mr. K. Vatthanathan from Laos underwent training at Dhauli under FAO/UNDP training programme. They were also imparted training on different aspects of frog farming at Kalyani Research Centre, Kalyani.

The Scientists of Srinagar Research Centre imparted training to a FAO trainee from Afganisthan.

Demonstration :

The technique of controlled breeding of common carp was demonstrated to 15 fish farmers of Aniya village and 7 lakh spawn produced were handed over to the fish farmers.

Demonstrations on fish sampling and supplementary feeding were given to farmers at Kamarpukur centre which were attended by 82 fish farmers.

About 30 lakh spawn of common carp were produced under a demonstration programme at Chanditala for the 'Lab to Land" farmers.

The technology of Induced breeding of carps was demonstrated to 28 trainees in the Ramkrishna Mission ponds at Narendrapur. About 2.5 lakh spawn of Indian major carps were produced.

About 30.5 lakh spawn of Indian major carps and 2.7 lakhs fry of Chinese carps were produced at Chanditala during July-August, 1982.

Ten lakh fry and 70 lakh fingerlings of Indian major carps were produced and handed over to the farmers of Chanditala area.

Demonstration on induced breeding of carps was given to a private fish farmer at Machlandapur.

About 5000 fry of *P. javanicus*, 10,000 fry of Common carp and 3 lakh fry of Indian major carps were produced at Kamarpukur centre.

Talks delivered

The following lectures were delivered by the Scientists of the Extension Section and other research centres during the year :-

'Extension activities of CIFRI' to the trainees of Fisheries Extension Centre, Hyderabad on 7.1.1982.

Two lectures on different aspects of pisciculture to the KP's trainees at Gram Sevak Training Centre, R. K. Mission, Narendrapur on 7.1.1982.

Lectures were delivered to the trainees and fish farmers at Loka Siksha Parisad, R. K. Mission, Narendrapur on 'Magur culture, Fish disease and their control' and "Procurement of fish seed" on 17.1.82.

A talk on 'Air breathing fish culture' at the Seminar organised during 3rd National Agriculture Fair '82, Park Circus, Calcutta on 9.2.82,

A talk on 'Modern Aquaculture' at Vidyanagar, 24-Parganas on 26 3.82.

A talk on 'Composite fish culture' at Mandra, Dist. Hooghly in the training programme organised jointly by Workers Education Centre, Govt. of India and Vivekananda Institute of Community Service, Mandra on 29.3.82.

Two lectures to the FEO trainees on "Cage and Pen Culture" and "Conservation of fisheries" at the Fisheries Training Centre, Kulia, Kalyani on 12.4.82.

Two lectures on 'Fisheries Extension' and 'Air breathing fish culture' to the FEO trainees Dept. of Fisheries, Govt. of W.B. at Freshwater Fisheries Station Kulia, Kalyani on 27.4.82.

A talk on 'Fish breeding and Seed raising' to the trainees at Mandra Unnyan Sanstha on 3.5.82.

Talks on "composite fish culture" and "fish diseases and their control" to the trainees of Mandra Unnayan Sanstha on 3.5. 82.

Talks on different aspects of fish culture to the trainees of Loka Siksha Parisad, Muradpur on 9-10.6.82 and 'Magur culture' on the occasion of Fish Farmers Day at JARI, Nilganj on 11.6.82.

Two lectures on Induced breeding and Composite Fish Culture to 26 trainees, fish farmers at Loka Siksha Parisad, R. K. Mission, Narendrapur on 12.7.82.

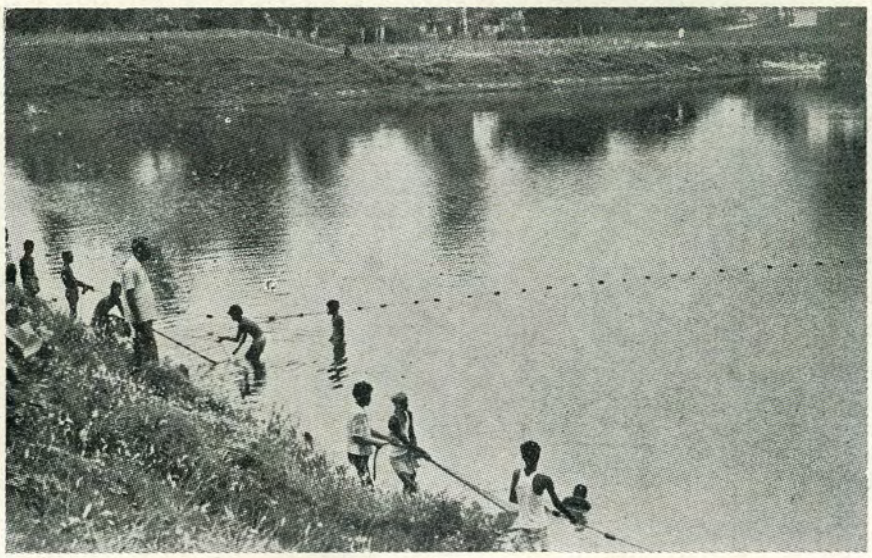
Talks on different aspects of induced breeding, fish and prawn culture, fish disease etc., were delivered to the fish farmers (Narendrapur, R. K, Mission on 2.7.82) ; trainees of AFPRO (KVK, R. K. Mission, Nimpith on 10.8.82), fish farmers (Kamarpukur on 11.9.82) and CADC officials (Calcutta on 19.11.82).

Lectures on different aspects of brackishwater shell and fin fish culture were delivered to the trainees of Namkhana Training Centre, Kakdwip, AFPRO trainees (R. K. Mission, Nimpith) and trainees who participated in the course on "Brackishwater seed collection" KVK, Kakdwip during August, 1982 by the Scientists of the Kakdwip Research Centre.

Advisory Services Provided :

Advisory service on different aspects of Inland Aquaculture, through correspondence and personal contacts, was rendered to over 112 fish farmers, several Government officials, private entrepreneurs and institutions.

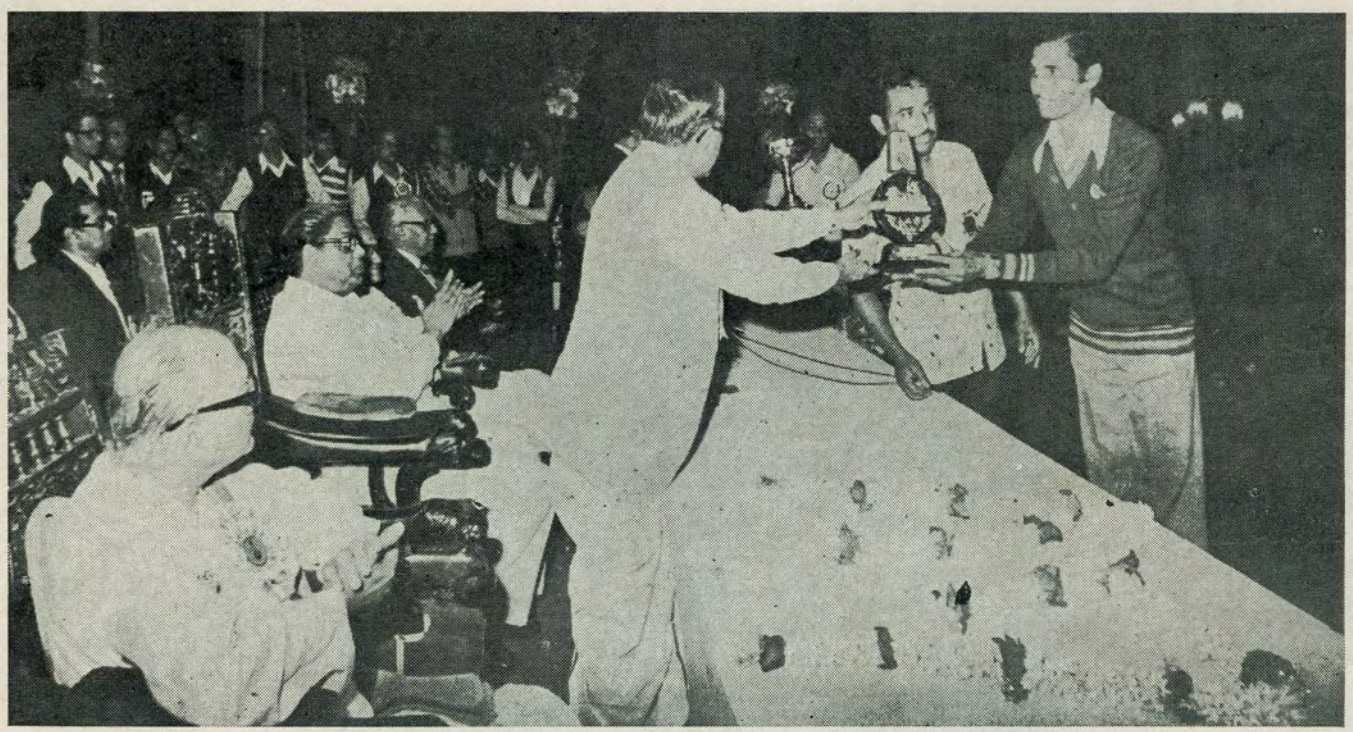
Scientists of the Frog Culture Unit, Kalyani provided information on frog culture, frog breeding, hatchery techniques and biology of commercial frog species to various Central and State Govt. Departments, private agencies and Universities. Different species of frog were supplied to the Zoology Department, Kalyani University and Bidhan Chandra Krishi Visvavidyalaya on their request.



A net operation in Shri S. K. Roy's pond at Harischandrapur.

Application of biogas-slurry in pisciculture.

The CIFRI Pavilion was awarded a special prize in the category of Government of India stall at the 3rd National Agricultural Fair '82 held at Park Circus Maidan, Calcutta. The fair was jointly organised by the Ministry of Agriculture, Government of India and Department of Agriculture, Government of West Bengal from January 23 to February 15, 1982.



Shri P. K. Pandit, Scientist receiving the prize (top) from the Chief Minister of West Bengal.

Radio/TV Programme :

Shri D. N. Singh, Scientist delivered a talk on 'Machli palan ke liye thaiyari' which was broadcast on 15.6.82 by AIR Allahabad.

The film on Induced Breeding was telecast with Bengali commentary from Calcutta Doordarshan Kendra on 25.8.82 in the Pallikatha Programme. This was followed by the comments on achievements and activities of CIFRI pertaining to various technologies developed by the Institute.

Calcutta Doordarshan Kendra telecast film on 'Mach Chaser Katha' on 15 9.82.

Fish Farmers' Days :

The Institute organised/participated in the following fish farmers' days :

—At JARI, Nilganj on 11.6.82.

—At Kamarpukur on 11.9.82.

During these days the scientists of the Institute took part in discussions with the fish farmers on different problems encountered by them. Films on composite fish culture, pond life and pond culture were projected which were witnessed by about 300 participants.

Exhibitions :

The Extension Section participated in the following exhibitions :

—Third National Agriculture Fair at Park Circus, Calautta during 23.1.82-15.2.82.

—Annual exhibition on the Gram Sevak Training Centre, R. K. Mission, Narendrapur from 17th to 20th January, 1982.

—At Vidyanagar, organised by JTRL, during 26.3.82 to 27.3.82.

—At JARI, Nilganj during 10-11.6.82.

—At Kamarpukur on 11.9.82.

Charts and posters were supplied to Department of Fisheries, Govt. of West Bengal for Gramin Mela at Calcutta maidan during December.

LAB TO LAND PROGRAMME

The Lab to Land Programme launched during 1979 in commemoration with ICAR Golden Jubilee, continued during 1982 also. The Institute continued to provide information on different aspects of pisciculture to fish farmers and interested persons. Demonstrations on induced breeding, nursery management, stock pond management, treatment of fish diseases, weed cotrol etc., were arranged.

At Barrackpore :

The 47 ponds under Lab to Land Programme (Phase I) were harvested. The production in these ponds ranged between 1700 and 4764 kg/ha/6 months.

The ponds where magur culture was taken up yielded productions ranging from 2102 to 2445 kg/ha/6 months.

The work under second phase of Lab to Land Programme with 80 farm families covering five villages at Chanditala and 20 farm families covering 5 villages at Kamarpukur and Bally Dewangunj centres have been initiated in June 1982 and the work is in progress.

At Kalyani

Composite fish culture (without grass carp) was demonstrated in the ponds of two fish farmers. The

productions in these ponds were 1298 kg/ha/8 months and 1444 kg/ha/10 months respectively.

At Kakdwip

Ten fish farmer families have been adopted under Lab to Land Programme. Demonstrations on different aspects of brackishwater fish culture were arranged in the farmers ponds. Through polyculture of brackishwater fishes and prawns in the farmers' ponds productions ranging from 117.0 to 2109.6 kg/ha/90 days were obtained.

At Jaunpur

Lab to land programme was concluded in six villages viz, Raniman, Dhobi, Dhandwara, Barra, Khidirpur and Khudauli. Productions of the order of 4,618 kg/ha/9 months, 5,018 kg/ha/9 months, 5,336 kg/ha/7 months, 5,406 kg/ha/9 months, 5,357 kg/ha/8 months and 2223 kg/ha/12 months could be achieved in different ponds.

At Kauslyagang

Under the first phase of Lab to Land programme a pond (1.25 ha) at Nakhapurpatna was stocked with fingerlings of Indian major carps @ 4,000/ha. The production achieved from this pond after six months of culture was 1425 Kg.

Controlled breeding of common carp was demonstrated to fish farmers of different villages. Incidental to different demonstration programmes 24.85 lakhs of common carp seed was produced which yielded a revenue of Rs. 3,342.

Under the Lab to Land programme conducted by TTC 40 fish farmers from three villages have been adopted. At Nuagaon two ponds (total water area 0.8 ha) have been stocked with fingerlings of Indian major carps @ 5000/ha. In Pubasasan village two newly dug ponds are being utilised for demonstration of fish seed rearing and culture technology. Though these ponds were partially affected by flood during August-September sampling have demonstrated good growth of the remaining fishes.

In Gobardhanpur a pond of 0.8 ha is being prepared for stocking of fingerlings. The demonstration programme in this pond will be initiated shortly.

KVK/TTC

Dhauli

Training Programmes : During 1982 a batch of 20 extension staff from Department of Fisheries, Government of Orissa were imparted training on composite fish culture and fish seed production during 1st February to 15th August 1982 at TTC.

The training comprised oncampus as well as offcampus programmes which included lectures, demonstrations, discussions etc.

A fresh batch of 24 trainees deputed by the Orissa Fisheries Department is receiving training in similar aspects from August 16. This training course will be completed in February, 1983. The trainees at TTC produced 5.75 lakhs of common carp spawn in Nakhaurpatna village. In Malisahi and Pubasasan villages 13 lakhs spawn of Indian major carps and 4 lakhs spawn of common carp were produced by the staff of TTC and the trainees.

At KVK 46 trainees were trained on different aspects of fish breeding, nursery management and fish culture, during the year. Under the offcampus training programme two ponds in Sardaipur and one each in Tikkerpada, Joypur, Pratapsasan, Bageswarpur and Pubasasan were taken up. Pond preparation and stocking techniques were demonstrated to the farmers, but due to flood further demonstration programmes had to be abandoned.

Kakdwip

During 1982 the KVK organised 11 oncampus programmes, 8 on agronomy and horticulture and 3 on fish and fisheries. Seventy five trainees received training in agronomy while 28 trainees in fisheries. In addition twenty three offcampus training courses were organised in which 260 trainees were imparted training on different aspects of agronomy & horticulture and fisheries.

LIBRARY AND DOCUMENTATION

During the year under report 230 books, 46 reprints and 57 miscellaneous publications were added to the Library of the Institute. A total of 49 foreign and 52 Indian journals were subscribed during the year. The Library also obtained, either as gift or in exchange, additional 250 Indian and foreign journals. The present library holdings inclusive of the year's arrivals comprise 5165 books, 3883 outside reprints and 2189 miscellaneous publications excluding the stock of journals, pamphlets, maps, departmental publications etc. Besides maintaining old exchange relationships new exchange relationships were established during the year. The Institute library supplied a number of publications to INSDOC, New Delhi ; Zoological Survey of India, Calcutta ; Department of Zoology, Madhav Science College ; Fisheries office, Contai, Govt. of West Bengal, Midnapur ; Jute Agricultural Research Institute ; INSDOC, Regional Centre, Calcutta ; Life Sciences Division, Manipur University, Imphal ; Manipur University of Agricultural Science, College of Fisheries ; Mangalore College of Fisheries and Orissa University of Agriculture and Technology, Bhubaneswar, Orissa on inter-library loan service.

About 100 technical and non-technical queries from India and abroad were attended to by the Library & Documentation Section. In many cases reprints, Departmental publications and Xerox copies were supplied to members of International Organisations.

During the year 38 reports on Progress of research were compiled and sent to ICAR. Sixty four scientific papers on different aspects of inland fisheries by the scientists of the Institute were published. Fiftytwo scientific papers have been presented by the scientists of the Institute at different symposia/seminars/conferences ete.

The following departmental publications were broughtout by CIFRI during the year :-

1) Annual report for the year 1980.
2) Report on 6th Workshop, All India Co-ordinated-Research Project on Composite Fish Culture & Fish Seed Production, 1st and 2nd July, 1982 (Mimeo).
3) Report on 6th Workshop, All India Co-ordinated Research Project on Air-breathing Fish Culture, 27 & 28 December, 1982 (Mimeo).
4) Lecture notes for training on "Fisheries Extension" to the Officials of the Department of Fisheries, Govt. of Srilanka, April 1-15, 1982 by the Extension Division, CIFRI, Barrackpore, West Bengal.
5) Indian Fisheries Abstracts **15** (1-4), 1976, **16** (3-4), 1977 and **17** (1-4), 1978.
6) CIFRI Newsletter, **4** (5-6) September-December, 1981 and **5** (1 & 2) January-April, 1982.
7) Contents list Nos. 9-12, September to December, 1980.
8) Bull. No. 35—Recent advances in studies on acute diseases of fishes.

RESEARCH IN HAND

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

Problem 1.34 : Observations on culture possibilities of Fish in Jute-retted ponds.

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

Duration : Seven years (From 1976).

The jute-retting pond at Khardah (0.07 ha) when harvested after eight months, yielded a production of 210 kg (equivalent to c 3000 kg/ha/yr). The pond was initially stocked @ 9,700/ha with fingerlings of catla, rohu, mrigal and silver carp in the ratio of 5 : 2 : 2 : 1. The management measures involved artificial feeding at a low rate from the fourth month of culture and thinnig of the fish stock during 5th and 6th months. The average final weights of the fishes after 8 months were 460, 340, 310 and 780 g for catla, mrigal, rohu and silver carp respectively.

Problem 1.44 : Studies on ecological changes in newly constructed ponds and their management.

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

Duration : Five years (From 1977)

Studies on ecological changes could be initiated in October after the flood water receeded from the experimental ponds (0.04 ha) which were constructed in 1982. The average depth of water declined from 100 cm to 50 cm in pond A and from 60 cm to 38 cm in pond B during the period. Monthly observations on the changes in water qualities showed an increase in transparency, total alkalinity and conductivity of water from 5.0-15.0 cm, 96-120 ppm and

208-291 micromhos in Pond A and 4-14 cm, 72-100 ppm and 133-208 micromhos in Pond B respectively while dissolved phosphorus (.04-.08 ppm) and nitrogen (.03-.07 ppm) did not record any major change in both the ponds. Plankton density varied irregularly from 350 units to 29 units/l and 259 units to 520 units/l in ponds A and B respectively.

Problem 1.56 : Studies on the ecology of a fresh water swamp and newly constructed ponds.

Personnel : Radheyshyam

Duration : Five years (From April, 1981)

Comparative studies on the limno-biology of the Kausalyagang swamp and newly constructed ponds in the swamp are in progress.

Problem 1.57 : Investigations on enhancing fish production in trench type of ponds in Kolleru area.

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

Duration : Five years (From 1982)

Seven trench type ponds (2.79-3.94 ha) of a private fish farm located at Chanamilli village of Godavari district were stocked with advanced fry of catla, rohu, mrigal, silver carp, grass carp and common carp in different stocking ratios under same stocking density of 5,000/ha. Silver carp and grass carp were stocked only in two out of the seven ponds. Management measures involved manuring the ponds with organic and inorganic fertilisers, supplementary feeding @ 2-3% of body weight and making routine observations on physico-chemical and biological parameters of the ponds. The culture work is in progress.

Problem 1.58 : Increasing fish production from ponds with aeration.

Personnel : V.R.P. Sinha, N.K. Thakur, D.K. Chatterjee, Dilip Kumar, M. Rout and C.D. Sahoo

Duration : Three years (From 1982)

Initial observations made on the culture of Indian major carps under the naturally occurring conditions of 10 non-drainable ponds (0.1 ha each) at FARTC at a uniform stocking density of 5,000 fingerlings/ha revealed the base level production potential of non-drainable ponds to be 117 kg/ha/5½ months. Performance of rohu was found to be better in weed-infested ponds as compared to catla and mrigal, both in terms of survival and growth. Experiments on mixed culture of Indian and exotic major carps have been intiated taking 5 variables *viz.*, (i) with only manual imput, involving no cash-cost input, (ii) with only organic manure, (iii) with inorganic and organic fertilizers together, (iv) with application of feed and fertilizers and (v) with feed, fertilizers and aeration. The work is in progress.

Problem 1.59 : Optimum per hectare production of fry, fingerlings and fish in culture fishery operations.

Personnel : S.N. Dutta, C.R. Das, B.R. Shirsat, B. K. Mishra, K. C. Pani, D. N. Swamy and S D. Tripathi

Duration : Two years (From 1982)

Work could not be undertaken due to loss of fish seed during flood.

Problem 1.60 : Rearing of carp fry and fingerlings with aeration.

Personnel : C.R Das, N.K. Thakur, D.K. Chatterjee, R.K. Jena, S. Jena, R.K. Dey and B.R. Shirsat

Duration : Four years (From 1982)

Aeration in ponds indicated an increase in volume

of plankton biomass from .02 cc (control) to 3.0 cc (in aerated ponds).

The effect of aeration on growth and survival of silver carp (67 mm/.97 g) stocked at .02 million/ha in .02 ha nurseries under three treatments *viz.*, with feed, with organic fertilizers, and with inorganic fertilizers showed the growth to be 58.4 mm/4 g, 56.0 mm/3.9 g, and 54.8 mm/3.1 g as compared to control (without aeration and with the same treatment) as 54.0 mm/2.98 g, 53.1 mm/2.66 g and 52.5 mm/2.35 g respectively in six weeks' rearing.

Problem 1.61 : Increasing fish production in non-drainable ponds by using fertilizers alone.

Personnel : S.R. Ghosh, S. Patnaik, K.M. Das, A.N. Mohanty and H.K. Muduli

Duration : Three years (From January, 1982)

A number of ponds were treated with ammonium sulphate, urea, super phosphate and organic manures viz., cowdung & poultry droppings and the mixture of both inorganic and organic manures on equivalent nutrient basis. In all the treatments the water quality was observed to be more alkaline than the control. Among the treatments the values of dissolved nitrogen and phosphorus were highest in the ponds treated with nitrogenous inorganic fertilizers. Higher phytoplankton population was observed in the pond treated with inorganic nitrogen and phosphorus followed by the pond treated with inorganic phosphorus, nitrogen and organic manures.

Project 2 : *Induced fish breeding physiology of reproduction*

Problem 2.10 : Pituitary-gonad relationship in free-spawning and non-free-spawning carp.

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

Duratiron : Seven years (From January 1977)

Studies on seasonal variations in the pituitary of rohu in relation to gonadal activity have shown that the acidophils predominate during restitution phase of gonads while the cyanophils, especially gonadotrophs, preponderate among different cell types in proximal pars distalis during the spawning season. Gonadotrophs demonstrate marked changes in cellular activity depending on the gonadal activity of fishes Identification of adanohypophyseal cells in rohu and common carp is in progress.

Problem 2.12 : Activities of interrenal and chromaffin tissues during the process of maturation of gonads of Indian major carps from still and running water

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

Duration : Six years (from January, 1978)

Histological observations on interrenal glands of *L. rohita* have shown that the activity of the cells increases as revealed by the enlarged cellular size, nucleus and viscous cytoplasmic contents during gonadal maturation whereas their activity reduces considerably during the resting phase of the gonadal cycle. The work is in progress.

Problem 2.14 : Studies on interrelation between thyroid and gonads of the major indegenous carps

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

Duration : Five years (From January, 1979

Histological techniques for staining thyroid follicles in *L. rohita* from the pharyngeal region as well as from the head kidney have been standardized. Their cellular activities were also studied in relation to gonadal

maturity. In one experiment thyroid inhibitor (thiourea) was injected intramuscularly @ .03% to see its effect on gonads. A considerable decline in the weight of the gonads treated with thiourea compared to control suggested that there could be some direct or indirect correlation between gonads and thyroid. Histological studies of thyroid of treated fishes are in prograss.

Problem 2.17	:	Quantitative analysis of gonadotropin in common carp pituitary at different sexual stages for induced breeding.
Personnel	:	H.A. Khan, D.K. Chatterjee, R.C. Das, George John and B.R. Shirsat
Duration	:	Four years (From January, 1981)

With a view to obtain mature fishes for gonadotropin analysis common carp fingerlings have been stocked at 5000/ha in a prepared pond for rearing The previous culture experiment was vitiated by flood.

Problem 2.18	:	Environment and nutrition of brood stock.
Personnel	:	S.D. Gupta, R.C Das, K.K. Sukumaran, A.K. Sahu, R.K. Dey, P.V. G.K. Reddy M.Rout, G.C. Sahoo, D.N. Swamy, S.R. Ghosh and H.K. Muduli
Duration	:	Four years (From 1981)

Brood stock of rohu and silver carp (2-3 years) weighing 1.5 kg to 2 kg were stocked at a stocking density of 1500 kg/ha in 0.1 ha rearing ponds in January 1982. They were fed daily, one group with the conventional feed (i.e. groundnut oilcake and rice bran at 1 : 1 ratio, at 3 to 5% of the body weight), the other with a prepared pelleted diet made of rice bran, groundnut oil cake, wheat bran and fish meal fortified with vitamins and minerals. The diet had 30% protein content. The results indicated better development of gonads in fishes fed with pelleted diets containg higher percentage of protein.

The best spawning response (63%) was recorded for rohu fed with high protein pelleted diet compared to 52% of the fish fed with conventional feed. Fertilization was 75 and 65% respectively.

Similar results were obtained for silver carp with 55% of brooders spawning as compared to 47% of the other group fed with conventional diet. Fertilization was 45 and 40% respectively.

A total quantity of 3,992 million hatchling comprising 3.615 million rohu, 0.34 million silver carp and 0.037 million catla-rohu hybrid were produced at Dhauli. At Cuttack about 2.3 million spawn comprising catla 0.22 million, mrigal 0.545 million, rohu 1.25 million, silver carp 0.1175 millon and grass carp 0.175 million were obtained.

Problem 2.19	:	Endocrinological studies of Asiatic carps inhabiting running and confined waters
Personnel	:	H.A. Khan, V.R.P. Sinha, A.K. Sahu, R.C. Das, S.K. Sarkar, B.R. Datta and G.C. Sahoo
Duration	:	Four years (From January, 1982)

Staining techniques have been standardized. Histological studies on the pineal organ of rohu and gonads of silver carp have been initiated.

Problem 2.20	:	Reproductive endocrinology of Indian major carps.
Personnel	:	P.K. Mukhopadhyay, B. Venkatesh (upto 17. 6. '82) and A.P. Mukherji (upto 11. 3. '82)

Duration : Two years (From January, 1982)

Total protein level in blood serum of *Cirrhinus mrigala*, before and after breeding, were estimated. The total protein level in serum before breeding was estimated as 80 mg/ml. The level of protein came down to 60 mg/ml in the fish after breeding.

Due to non-availability of purified gonadotropin and antibodies for preforming radioimmunoassays, the level of gonodotropin in fish blood could not be measured.

Project 3 : *Reservoir Fisheries*

Problem 3.8 : Fisheries of Peninsular tanks—introduction of less commonly known culturable species.

Personnel : B.V. Govid, M.F. Rahaman, S.L. Raghaban and P.K. Sukumaran

Duration : Five years (From September, 1979)

Cirrhinus cirrhosa, *Labeo fimbriatus* and *Pangasius pangasius* stocked in ASC tank in 1979 registered net increments of 318 mm/536.0 g, 327 mm/606.3 g and 119 mm/229.0 g respectively in a culture period from September 1979 to December 1982. A total of 105.75 kg of fish comprising *Cirrhinus cirrhosa* and *Labeo fimbriatus* were harvested dring the period. Fingerlings of *Puntius pulchellus* have been stocked in the ASC tank and Departmental Fish Farm, Bhadra reservoir project.

Problem 3.15 : Ecology and fisheries of peninsular tanks.

Personnel : B.V. Govind, S. Sivakami (Smt.), S.L. Raghavan, S. Ayyapan and P.K. Sukumaran.

Duration : Three years and four months (From November, 1981)

Turugumnur tank near Mandya (Mysore district) was selected for investigating its ecological nature and fish culture potential. The soil texture of the tank varied from silt to sandy with alkaline nature. Higher values of primary production were recorded during March, April and September. Phytoplankton dominated initially and zooplankton in the later part of the year. Benthic and littoral fauna were represented by fish, molluscs, prawns and insects. Trial netting conducted in the tank during April and October, 1982, yielded a total catch of 544.875 kg of fish comprising *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio* var. *communis*, *Puntius sarana*, *P. dorsalis*, *Cirrhinus reba*, *Labeo bata*, *Mastacembelus armatus*, *Mystus cavasius*, *Notopterus notopterus* and *Glossogobius giuris*.

7000 fry of catla and 2000 fry of silver carp (average length/weight : 18.6 mm/41.0 mg) which are being reared in an adjacent nursery since July 1982 will be stocked in the tank shortly.

Prablem 3.15.1 : Investigations on the nutrient cycles and microbial activity influencing productivity in an aquatic ecosystem.

Personnel : S. Ayyapan, B. V. Govind, P. K. Sukumaran, S. L. Raghavan and S. Sivakami (Smt.)

Duration : Three years (From May, 1981)

Hydrobiological investigations were taken up in the perennial Sankey tank. The water was in the alkaline range with low-concentrations of nutrient. The primary production was observed to be higher in the surface water, with gross droduction values reaching upto 268.41 mg $C/m^3/hr$. Plankton concentration in the tank decreased during the latter months of the year. Periphyton comprised mainly diatoms. Littoral fauna was mainly constituted by insects, molluscs and fish fry, Soil was clayey and slightly alkaline with moderate nutrient value. About 56 bacterial isolates have been

enumerated so far. Gram positive bacteria formed larger part of the isolates (as many as 48-rods, rods in chains, rods with spores, coccobacilli and cocci). As regards total counts, station 1 in gereral gave higher counts in surface, subsurface and soil samples. Surface counts were usually higher as compared to subsurface.

Problem 3.17 : *Culture of fish in cages in peninsular tanks*

Personnel : B. V. Govind, S. L. Raghaban, S. Ayyapan and M. F. Rahaman

Duration : One year (From December, 1981)

Cage culture for raising fingerlings of common carp to table size was conducted for a period of 6 months. Two cages, the experimental and control, were stocked with 400 fingerlings (141 mm/40.0 g) of common carp in each (stocking density 3.79 lakhs/ha). After a period of 6 months the fish grew to 275 mm/350 g and the yield was 140 kg (132.58 tonnes per ha). Fish in the experimental cage were fed with artificial feed comprising dried silkwarm pupae powder (30 0%), rice bran (50.0%.) and groundnut oil cake (20.0%) at about 10% of body weight daily.

The second experiment for rearing silver carp fry to fingerling stage was started in July,1982. Stocking was done @ 118 nos sq.m. or 11.8 lakhs/ha in the experimental and control cages. The fish (60.3mm/2.32 g) showed an average growth of 162.13 mm/12.6 g in the experimental and 151.25 mm/10.45 g. in the control cage in a culture period of 4 months. The increments in growth were 101.83 mm/10.28 g in the experimental and 90.95 mm/8.13 g. in the control cages. Artificial feeding was resorted to in the experimental cage, the feed comprising rice bran and groundnut oil cake in equal proportions, given at the rate of 20% of the body weight daily.

Problem 3.18 : Ecology and fishery development of a small reservoir (Bachhra).

Personnel : A. G. Jhingran (upto Sept., '82), K. P. Srivastava, S. N. Mehrotra, D. N. Singh and R. K. Dwivedi

Duration : Five years (from 1981)

Hydrology :

Physico-chemical conditions during the year indicated that water temperature varied from 19.5 to 33°C with maximum in May and minimum in January. Transparency ranged between 16.5 and 108 cm, pH between 7.4 and 8.4, alkalinity between 94-170 ppm whereas hardness varied between 30 and 75 ppm. Calcium ions were fairly rich in the reservoir (19-25 ppm). Dissolved oxygen, nitrate, phosphate and silicate varied between 6.0 and 8.8 ppm ; 0.09-0.2 ppm ; 0.06 and 0.26 ppm and 7.0 and 12.6 ppm respectively. Specific conductivity values (238-384 micromhos/cm) were indicative of high ionisation. Gross and net productions were observed to range between 62.5-100 and 50-87.5 mg $C/m^3/hr$ respectively while respiration remained at 13.5 mg $C/m^3/hr$.

Soil :

The soil is sandy, the percentage of sand ranging between 68–72 while clay and silt constitutents fluctuated between 12-14% and 16-18%. pH ranged between 7.2-7.4, organic carbon ·56-·78% and calcium carbonate 2.0-2.5%. Conductivity values ranged as 780-800 micromho/cm.

Plankton :

Phytoplankton forming 73% of the plankton population, invariably dominated over the zooplankton (27%). Amongst the phytoplankters Myxophyceae (38.2%) dominated over Bacillariophyceae (24.65%) and Chlorophyceae (10.2%). Zooplankton was represented by copepods, rotifers and cladocerans in order of abundance.

Macrobenthic fauna :

Bottom fauna of the reservoir fluctuated between 380 u/m² (August) to 684 u/m² (July) and was dominated by insect larvae (52.1%), annelids (36.6%) and molluscs (12.2%). The benthic population showed an increase as campared to the previous year.

Stocking :

11,500 fingerlings and yearlings of major carps were stocked in the reservoir out of which about 800 were tagged by anchor tags.

Problem 3.19	:	Studies on the limnology and productivity of Mcpherson lake.
Personnel	:	D. N. Singh, K. Chandra and B. D. Saroj
Duration	:	Four years (From 1981)

Limnological studies of this lake revealed that water temperature ranged between 17°C in the month of November to 31°C in June. Transparency ranged from 48 cm to 286 cm, DO 2.2 to 4.9 mg/1, total alkalinity 136 to 280 mg/1, hardness 62 to 72 mg/1 and silicates 8.65 to 12.5 mg/1. Phosphates and nitrates ranged between 0.95 and 0.12 mg/1 and 0.016 to 0.19 mg/l respectively. Gross production ranged between 68 & 112 mg C/m³/hr and net-production between 54 & 92 mg C/m³/hr. Respiration was 14 to 34 mg C/m³/hr. Water temperature was observed to be lowest at 06 hr and highest at 12 hour. pH and Dissolved oxygen showed higher values at 12 hr while the lowest at 24 hr. Alkalinity values were lowest at 06 hr and highest at 24 hr.

Zooplankton constituted 63.2% of the total plankton biomass and mainly comprised rotifers and microcrustaceans. Chlorophyceae, Bacillariophyceae and Myxophyceae were the phytoplanktonic groups in order of abundance. Periphyton biomass productivity ranged between 24 mg/m²/day in April to 42 mg/m²/day in November with peak values during winter months. A definite relationship was observed between the population density and dry matter production of periphyton. Bacillariophyceae dominated in terms of species in periphyton collection, Benthic population ranged between 57 & 190 nos/m² and was dominated by molluscs. The lake was observed to be chocked with aquatic weeds like *Hydrilla, Ceratophyllum, Azolla, Spirodella, Chara* etc.

Problem 3.20	:	Biochemical and histological studies of captive carps in relation to different feeds
Personnel	:	S. Sivakami (Smt.), B. V. Govind, S. Ayyappan and M. F. Rahman
Duration	:	Three years (From January, 1982)

Two cages (6.25 m²), experimental and control, were stocked with advanced fry (66.48 mm/3.43 g) of silver carp (175 nos/6.25 sq.m.). Artificial feeding with wheat bran (40.0%), maida (40.0% , Soyabean powder (10.0·%) and groundnut oil cake (10.0·%) was done. The fish registered an increment of 184.72 mm/173.80 g and 78.34 mm/31.87 g in experimental and control cages respectively in 8 months.

Conversion ratio of the feed was studied under field conditions. The values ranged from 3.67 to 4.0 during the period from April to June 1982. During this period, the increase in body weight was from 4.83 g to 61.0 g. In September the conversion ratio was 6.79 and the increment in growth from August to September was from 88.82 g to 134.40 g. During October and November, the values increased upto 19.70 and 18.80 respectively.

The feed mixture comprised protein, fat and carbohydrate of 20.13, 11.32 and 51.82% respectively. Biochemical analysis revealed that in the experimental fish, moisture content decreased from 82.36% in March to 76.31% in November. Fat and carbohydrate contents increased from 2.12 to 5.02 and from 0.53 to 0.65% respectively. In the control cage, moisture content decreased from 83.36 to 80.39% Fat and carbohydrate

contents in the control cage ranged from 2.12 to 4.63% and from 0.53 to 0.57% respectively.

Histological observations of the alimentary canal revealed that buccal floor is provided with profuse mucous glands and taste buds, their number decreasing posteriorly. Mucous folds of the intestinal bulb and intestine proper bear large number of goblet cells. The mucous folds of the latter region are branched and closely arranged. Rectum has thick muscular layer with mucous folds bearing conspicous mucous glands.

Project 4 : *Riverine Carp Spawn Prospecting and Collection Techniques*

Problem 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, R. K. Saxena, R. Chandra, R. K. Dwivedi, R. K. Tyagi and N. K. Srivastava

Duration : Continuing (From June, 1972)

Due to scanty rains spawn yield at Madhauka was poor as compared to previous year. Four spurts of floods and two vacillation phases were observed. A total of 3750 ml of spawn (18,75,000 hatchlings) was collected by five standard spawn collection nets. Spurts I to IV constituted 650 ml (17.33%), 90 ml (2.40%), 87 ml (2.32%) and 2923 ml (77.93%) respectively. Major carps constituted 37.9% while minor carps and 'others' constituted 37.0% and 25.1% respectively. The percentage of desirable spawn in different spurts i.e., from 1st to fourth was estimated at 27.3, 12.7, 63.7 and 48.1 respectively. Seasonal indices of quantity and quality were estimated at 790 ml and 48.2% respectively. Nursery and plastic pool rearing denoted the percentage of major carps to be 48.2. *C. mrigala*, *C. catla* and *L. rohita* constituting 20.1, 12.6 and 15.5% respectively and the minor carps represented by *L. bata* and *C. reba* etc. contributing 51.8%.

Laboratory experiments on feeding of hatchlings demonstrated best survival of 64 to 71% with feed comprising Soyabean+rice polish + Groundnut oil cake and plankton.

Experiments on segregation of spawn revealed the percentage of desirable spawn retained in different mesh-size sieve is directly proportional to the mesh-size of the sieve.

Project 5 : *Brackishwater Fish Farming*

Problem 5.18 : Oyster Cum fish Culture

Personnel : K.V. Ramakrishna, R.D. Prasadam, M. Kalyamurthy, M. Sultana (Smt), K.O. Joseph and S. Krishnan.

Duration : Four Years (From January, 1979)

Five of the FRP tanks (2.7 x 0.85 x 0.75 m) provided with partitions designed for vertical circulation of water and 100 numbers wooden trays (75 x 50 x 10cm) have been procured. One of these tanks with 20 wooden trays was stocked with oysters @ 50/ tray. *Etroplus suratensis* and *Siganus oramin* @ 50 of each species and 25 specimens of *Scylla serrata* were also stocked in the tank. *P. indicus* were stocked in another tank. The experiment was visiated due to failure of solar water pump after cyclone in October, 1982. The experiment is being reset.

Problem 5.38 : Culture of *Lates calcarifer*

Personnel : D. D. Halder, S. K. Mondal & D. Sanfui

Duration : Five years (From Junuary, 1978)

Lates calcarifer fingerlings (128-182 mm/33.0-45.5 g) stocked @2070/ha in 0.1 ha canal, attained 140-200 mm/35.0-50.0 g after 90 days rearing. Another canal

of 0.15 ha was stocked @ 450/ha with *L. calcarifer* (325.0 mm/612.5 g) and the fingerlings reared in 0.1 ha canal making the combined stocking density of 1000/ha. The stock were fed with miscellaneus fishes and prawns drawn in along with tidal waters. At the end of one year the fishes attained an av. size of 245.60 mm/198 g (group I) and 410 mm/1031 g (group II) respectively. The salinity, DO, total alkalinity and pH of the canal water ranged from 11.0-15.5% ; 4.4—8.8 ppm ; 90-136 ppm and 8.4-9.0 respectively.

Problem 5.40 : Mullet Culture

Personnel : N. K. Das, R. K. Chakraborty & S. K. Mondal

Duration : Seven years (From 1976)

Liza tade fingerlings (135.5 mm/35.7 g) were stocked @ 8,000 an 5,000/ha in two ponds of 0.06 ha respectively. *L. parsia* fingerlings were stocked @50,000/ha in the same ponds after one month. In the smaller pond *L. tade* attained an av. weight of 151 g and the total yield was estimated to be 990 kg/ha/13 months. The poor yield was due to very poor survival of *L. parsia*. In the other pond *L. tade* registered a final growth of 230 mm/132 g with 66.65% survival leading to an estimated yield of 921.7 kg/ha/13 months. *L. parsia* recovery was only 5.38 kg. The low production in these ponds could be attributed to the entry of *Lates calcarifer* through small tunnels from the adjoing canal.

Problem 5.47 : Utilisation of Municipal, Agricultural and Industrial wastes in Agriculture

Personnel : R. K. Bannerjee, A. C. Nandy, H.C. Karmaker, N. N. Majumder and S. K. Chatterjee.

Duration : Six years (From January, 1977)

Five different feed combinations comprising cowdung+cotton seed extract ; cowdung+poultry droppings ; cotton seed waste+poultry droppings ; distillary waste+poultry droppings+cow-dung and mycellium of Penicillium+cotton seed waste+poultry droppings in the ratio of 1 : 1 : 1 enriched with maggot (crude protein level 12.0—22.8% depending upon maggot population) did not demonstrate any significant difference in growth of the test fishes-catla, rohu and mrigal, when compared to control (with conventional feed).

Problem 5.51 : Ecology of brackishwater impoundments

Personnel : S. C. Thakruta, G. N. Saha, S. C. Bannerjee, N. N. Majumder, S. P. Ghosh, B. B. Das and A. C. Nandy.

Duration : Four years (From January, 1980)

The average pH (8.2) of the three bheries viz., Haroa, Nazat and Taldi did not indicate any marked variation. Total alkalinity in the three bheries were recorded to be 125.5, 109.5 and 97.6 ppm respectively. The salinity was observed to be maximum (30.7‰) at Taldi in May and minimum (9.9‰) at Haroa. Nitrate and phosphate ranged as 0.15-0.35 and 0.05-0.16 ppm respectively in the three bheries. Studies on other chemical parameters and plankton biomass revealed Nazat to be the most productive amongst the three bheries studied.

Problem 5.52 : Studies on characteristics of brackishwater aquaculture soils and their response to fertilization

Personnel : G.N. Saha, H. Singh, A. C. Nandy, S.P. Ghosh and B.B. Das.

Duration : Continuing (From January, 1978)

Earthen tub experiments with brackishwater soils having pH 7.7, available N 19.69 mg/100 g, organic carbon 0.38%, available P 0.36 mg/100g and EC 4.2 m mhos/cm treated with 1) dried cow-dung; 2) wet cow-

dung; 3) dried cow-dung+N; 4) dried cow-dung+P; 5) wet cow-dung+N; 6) wet cow-dung+PP and 7) control (Salinity of the water media adjusted to 8-12‰) indicated that total alkalinity (185.25 ppm) and ingorganic N (0.80 ppm) were higher in dried cow-dung treatment than that of wet cow-dung, but for phosphate it was just the reverse. Attempt of rearing *Penaeus monodon* post-larvae (50/tub) could not meet with success due to rise of temperature in the culture media.

Problem 5.57 : Induced Breeding of Penaed Prawns

Personnel : D. D. Halder, P. Ravichandran (upto 5.5.82), S. M. Pillai (upto 5.5. 82), R.K. Chakraborti, P. K. Ghosh (From 19.10.82) and S. R. Das.

Duration : Five years (From 1978)

The investigations could not be carried out due to non-availability of spawners.

Problem 5.58 (a) : Intensive culture of brine shrimp, *Artemia salina* each for small scale hatchery use and pilot survey of salterns in and around coastal areas of West Bengal and Orissa

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

Duration ; Three years (From May, 1981)

Seed production of *Artemia salina* was tested under different stocking densities of 100, 150, 200, 300, 750 and 1000/l. Studies indicated that addition of Fe in the form of $FeCl_3$, $FeSO_4$ and EDTA enhanced seed production. Maximum cyst of *Artemia* (642) could be produced at 1.0 ppm of iron against 88 nos in control without iron.

A pilot survey is being conducted to locate the source of *Artemia*. Nauplii and adults of *Artemia* have been collected from the sedimentation tank of salt pan near Bansalghat in Contai, West Bengal.

Problem 5.62 : Multiple Cropping of *Penaeus monodon* and mullets in low saline ponds at Bakkhali

Personnel : S.R. Das, S.K. Mondol, D.D. Halder and R.K. Chakraborti

Duration : Three years (From 1979)

The culture experiment was visiated due to cyclone. A production to the tune of 173.2 kg/ha was achieved when *Liza parsia,* stocked @ 20,000/ha in a 0.25 ha pond, was harvested after 8 months.

Problem 5.63 : Culture of *Penaeus monodon*

Personnel : P. Ravichandran (upto 5.5.82), R.K. Chakraborti, S. K. Mondal, S. M. Pillai (upto 5.5.82), D. Sanfui and P. K. Ghosh (From 19.10.82).

Duration : Five years (From January, 1979)

Survival of 10.9—28.7% of *P. monodon* larvae could be achieved when they were reared in nursery ponds (0.02 ha) at a stocking density of 75,000—2,00,000/ha.

In another experiment a production of 10.7 kg of *P. monodon* was obtained in about 4 months time when the post-larvae of the prawn (2000 nos.) were stocked in a 0.02 ha pond.

To estimate the standing crop by adopting single marking method by rising one eye with aluminium foil, no estimate could be made beyond one month. In the multiple marking experiment estimate could be made by recapture method.

To find out the sampling efficiency, three locally available bamboo traps were tried of which Chhataka a

triangular type trap, was found to be efficient with 9 nos of catch per effort.

Problem 5.65 : Induced breeding of brackishwater fishes in Madras region

Personnel : K.V. Ramakrishna, S. Radhakrishnan, A. V. P. Rao, G. R. M. Rao, M. Kaliamurthy, K. O. Joseph and S. Krishnan

Duration : Six years (From January, 1979)

At Ennore, where brood fish of *Liza macrolepis* of both sexes are available, induced breeding experiments were conducted using homoplastic pituitary glands and carp pituitary glands+HCG. It was found that the later gave better results with free oozing of eggs and milt on slight pressure. Development upto morula stage could be achieved. The females (206–270 mm/110-200 g) were given two doses of 3.5 and 8 to 12 mg/kg of body weight with an interval of 5 to 6 hours and the males (155-192 mm/50-70 g) a single dose of 4 mg/kg of body weight synchronizing with the 2nd injection to the emales.

Sillago sihama also were given a combination of carp pituitary extract and HCG but ovulation was not satisfactory, though males were in prime condition.

Problem 5.66 : Studies on nutrition of the penaeid prawn, *Penaeus monodon*

Personnel : S.M. Pillai (upto 5th May '82), N.A. Reddy (upto 5th May '82), P. Ravichandran (upto 5th May '82), S.K. Mondal, D.D. Halder and D. Sanfui

Duration : Four years (From April, 1979)

Project was kept suspended due to technical difficulties.

Problem 5.67 : Cultivation of *Derris* plant for increasing rotenone content

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

Duration : Four years (From January, 1980)

Suppression of aerial vegetative growth and acceleration of root growth of *Derris trifoliata* var *uliginosa* was achieved by foliar application of cycocel, a growth retardant hormone. The rotenone content of the treated plants increased by 1.3% at 100 ppm application rate. Maleic hydrozide though increased the rotenone content by 3.1%. The result achieved was not much conclusive. Defloration of plants for concecutive twelve months also led to an increase in rotenone content by 3.75%.

Problem 5.68 : Pen and cage culture of fishes and prawns in the shallow areas of Pulicat lake

Personnel : R. D. Prasadam, G. R. M. Rao, M. Kaliyamurthy, K. V. Ramakrishna, K. Raman, K. Gopinathan, P.M.A. Kader and S. Krishnan

Duration : Three years (From January, 1980)

The third experiment was initiated in the month of February and 1500 *P. indicus* (av. 67.1 mm/1.43 g), 100 *P. monodon* (av. 72.6 mm/3.84 g), 125 *M. cephalus* (av. 74.0 mm/5.0 g) and 500 *L. macrolepis* (av. 66.6 mm/3.64 g) were stocked in a 0.05 ha pen at a combined stocking rate of 44,500/ha. No supplementary feed was given during the course of the experiment. Before the planned harvesting programme, the pen was damaged due to cyclone and the entire stock escaped. Sampling made in the 7th month of the experiment indicated that *M. cephalus* and *L. macrolepis* have grown to 235.00 mm/155.56 g. and 156.59 mm/45.45 g showing an increment of 161.00 mm/150.56 g and 90.00 mm/41.81 g, respectively. The prawns were not encountred in the samples after the 4th month of rearing. A total production of 860.12 kg was estimated

in the third experiment. The work on the project is temporarily suspended.

Two hundred fingerlings of *Chanos* (70 mm/1.7g) were stocked in a nylon cage (50 m) during August 1981 and the experiment was completed in April 1982. From these, a total of 70 chanos weighing 5.00kg could be harvested. The production worked out to be 1000 kg/ha/8 months.

Another 50 m^2 cage has been fixed in the lake during January 1982 and 450 *Chanos* fingerlings (average : 85 mm/4.7 g) were stocked (90,000/ha). They have attained an average size of 202 mm/76.4 g in 6 months. Heavy mortality of *Chanos* was encountered on two occasions from this cage and the remaining were transferred to the pen where mixed culture of chanos, mullets and prawns is being done. From this cage, a total of 16 *Chanos* (217 mm/100 g – average) weighing 1.6 kg and prawns (420 nos. of which 359 were *P. indicus*) were harvested. The total production amounted to 520 kg/ha/7 months (*Chanos* 320 kg and prawns, 200 kg).

A pen of 0.1 ha, made of velon screen was stocked with *Chanos chanos*, *Liza macrolepis* and *Penaeus indicus* in a ratio 1 : 10 : 20 at an overall density of 93,000/ha. The initial and final average sizes after 80 days of rearing were : *Chanos chanos* 82.5-260.6 mm, *L. macrolepis* 42.4-68.7 mm and *P. indicus* 67-116 mm. Before the final harvest could be done, the experiment was vitiated by cyclone.

Problem 5.70	:	Controlled breeding and development of hatchery techniques for commercially important brackishwater fishes.
Personnel	:	G. V. Kowtal, B. Venkatesh and N. A. Reddy.
Duration	:	Four years (From December, 1980)

Survey was undertaken to locate *Lates calcarifer* brooders. Only mature males (3.5 to 8.5 kg) were encountered at Talchua fish landing centre. No fully mature females were available in the catches.

Induced breeding trials of *Mugil cephalus* conducted at Chilka Lake mouth met with successful ovulation and fertilization but the eggs did not hatch. Induced breedin of *Sparus datria* could be achieved successfully and the resultant larvae were transported to Puri under oxygen packing for further rearing.

Problem 5.71	:	Influence of salinity on the growth and survival of Penaeid prawns in brackishwater environments.
Personnel	:	Hardial Singh, S.C. Thakurta, S.K. Chatterjee and B.S. Das.
Duration	:	Four years (From February, 1982).

Studies were conducted at Haroa, Nazat and Sandeshkhali where the water salinity ranged as 3.4-16.7, 8.3-25.2 and 12.16-27.0‰ respectively. Temperature in these water bodies ranged between 20° and 40°C.

Primary production at Haroa, Nazat and Sandeshkhali was of the order of 110-240, 165-320 and 188-370 $mgC/m^3/hr$ respectively. Best growth (325 g/yr) and survival was obtained at Sandeshkhli.

Problem 5.72	:	Fertilizer-soil-water interaction in brackishwater impoundments.
Personnel	:	R. K. Chakraborti and D. Sanfui.
Duration	:	Two years (January, 1981)

Superphosphate @ 250 kg/ha/yr in monthly doses when applied at 5.4, 9.2, 14.5 and 18.67 ppt water salinity levels, higher amount of P-was available upto 21 days at 5.4 and 9.2 lavels and upto 10 days at 14.5 and 18.67 ppt.

Different doses of superphosphate @ 200, 250 and 300 kg/ha/yr when applied in monthly instalment at 7.3

ppt salinity, availability of P was significantly higher at 300 kg/ha application. Primary productivity was also higher with 300 kg urea and single superphosphate each and 1000 kg of poultry manure.

Problem 5.73 : Studies on the metabolism of *Penaeus monodon* in relation to moulting cycle and environmental factors.

Personnel : N.A. Reddy (upto May '82), P. Ravichandran (upto May '82), R.K. Chakraborti and P.K. Mukhopadhyay.

Duration : Three years.

The project was kept suspended due to technical difficulties.

Problem 5.74 : Culture of fish food organisms.

Personnel : S. Radhakrishnan, G.R.M. Rao, M. Kaliyamurthy and S. Srinivasagam.

Duration : Five years (From January, 1982).

Laboratory culture using enriched seawater with Schrieber/Miquel solution gave fairly high densities of diatoms such as *Amphora* sp., *Chaetoceros* sp , & *Navicula* sp., etc. Seawater with *Skeletonema* cells (100 u/ml) when treated with modified Miquel solution yielded 1900 to 7100 u/ml, of which *Skeletonema* formed about 67.4%. The density of *Skeletonema* showed a remarkable increase (10,100 to 41,000 u/ml) when glycine and EDTA were added along with Miquel solution. Continuous culture of marine diatoms was maintained with periodical exchange of seawater and addition of nutrients. About 54 liters of laboratory cultured green water was supplied for rearing the larvae of *P. indicus*. Early post-larvae of *P. indicus* (7-8 mm) when reared with cultured live diatoms showed an average increase in length of 18.5 mm in 30 days.

Culture of *Chlorella* sp. was made in glass aquaria using enriched fresh and saline water (15 ppt) for feeding rotifers. The percentage hatching of *Artemia* cysts was poor in spite of adopting decapsulation techniques. This might be due to the reason that the cysts were very old. Fresh samples of *Artemia* cysts with 60 to 80% hatching were obtained and experiment on the culture of *Lrtemia* is in progress.

Problem 5.75 : Breeding and culture of *Penaeus indicus* and other penaeid species.

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

Duration : Four years (From January, 1982).

Mature breeders of *Penaeus indicus* collected from trawler catches, were kept in well aerated sea-water. One specimen (151 mm) spawned in a plastic pool and the larvae were reared through all stages upto the juvenile stage. Development to post-larvae took 12 days. Mixed phytoplankton and prawn/squilla squash were used as feed at different stages. A total of 188 post-larvae could be produced.

Two field experiments in 0.05 ha pond recently excavated at Pulicat, 23 experiments in nylon *hapas* (7.5 m) and one experiment in a 70 m nylon cage were carried out. Out of these, 1 field experiment and 1 hapa experiment gave good results. In the field experiment, *P. indicus* (71.3 mm/1.2 g) were stocked @ 1,00,000/ha and reared without artificial feed. At the end of 69 days they registered an average growth increment of 19.8 mm/3.36 g and a total weight of 10.27 kg was harvested (equivalent to 205.4 kg/ha/69 days). The survival was 45.6%. In the second experiment with the same species (53.1 mm/1.29 g) and at lower stocking densily (25,000/ha), and fed artificially (rice bran, G.O.C. & prawn powder : 1 : 1 : 1) at 10% body weight gave a growth increment of 14.3 mm/1.04 g at the end of a fortnight.

In two 7.5 m² hapas, *P. monodon* juveniles (75.6 mm/4.5 g) stocked @ 60,000/ha registared a growth increment of 39,2 mm/14.6 g giving a total production of 1.856 kg (equivalent to 1237 kg/ha/37 days) without artificial feeding.

P. indicus (53.4 mm/.09 g) stocked @ 50,000/ha in a 70 m² cage resulted an average growth increment of 4.7 mm/0.3 g in a fortnight without artificial feeding.

Problem 5.76 : Breeding and culture of *Scylla serrata* and other portunid crabs.

Personnel : K. Raman, S Srinivasagam, Munawar Sultana and S. Krishnan.

Duration : Four years (From January, 1982)

Eggs from an oviperous specimens of *Scylla serrata* (93 × 60 mm), kept in a plastic pool with well aerated sea water, hatched out into prezoeal and post-zoeal stages after an incubation period of 8 days. They were reared in glass jars and plastic trays with provision of freeze-dried diatoms *Coscinodiscus*, *Navicula* and *Nitzschia*) as food. At second zoeal stage when they were fed with slightly lager diatoms (*Amphipleura*), there was no further moulting and the larvae perished due to ciliate attack.

The eye-ablated specimens of *S. serrata* (100 mm & 105 mm) maintained in plastic pools released the eggs prematurely.

Eggs of oviperous specimens of *Portunus pelagicus* (140 mm) and *P. sanguinolentus* (135 mm) hatched out into pre-zoeal nnd first-zoeal stages in plastic pools. They could be reared upto second zoeal stage after which the larvae died due to ciliate attack.

Four short term (35-55 days) experiments on rearing of carabs, *Scylla serrata* (25 to 75 mm), conducted in nylon hapas (6m²) fixed in the lake, with varying stocking densities (16,666-23,333/ha) and fed on trash fish meat, showed varying monthly growth increments between 7.37 mm and 8.67 mm (carapace width) and 9.82 g and 21.2 g (weight), with 50 to 60% survival.

Under laboratory conditions mating of *P. pelagicus* was observed to last for about 2½ hr.

Problem 5.77 : Culture of grass carp (*Ctenopharyngodon idella)* in low saline impoundments.

Personnel : Hardial Singh and S.K. Chatterjee.

Duration : Four years (From Janury, 1982).

Two hundred grss carp fingerlings (Av. wt. 40 g) when stocked in two rain-fed ponds of 0.15 ha each at Dwarirjungle and fed with weeds regularly, registered a growth increment of 675 g (average) in 165 days. Salinity in these ponds increased slowly from 1.8 to 3.4 ppt during the course of culture.

Laboratory experiments revealed that grass carp fingerlings could tolerate salinity levels upto 8 ppt but further increase of salinity affected their normal behaviour. 12 ppt salinity was observed to be lethal to grass carp fingerlings.

Problem 5.78 : Comprehensive study of bheries in 24-Parganas, West Bengal.

Pesronnel : H. C. Karmakar, R. N. Pal, S. C. Thakurta, A. C. Bannerjee, A. C. Nandi, G. C. Laha, P. B. Das, N. N. Majumder, S. K. Chatterjee and B. B. Das.

Duration : Five years (From Januar, 1982).

Bheri to bheri survey in seven police stations has been completed and the work in other places is in progress. Out of the bheries surveyed 66.4% were found to be utilised for seasonal paddy-cum-fish culture and the rest were perinnial. Physico-chemical and biologcial parameters are being studied.

Problem 5.79 : Breeding and larval rearing of *Penaeus monodon* and other penaeid prawns.

Personnel : P. Ravichandran, S. M. Pillai, N.A. Reddy and G.V. Kowtal,

Duration : Five years (From March, 1982).

Unilateral and bilateral ablation were tried with male and female prawns but no success could be achieved. Out of the prawns tried two reached II stage of maturity and one marine prawn attained III stage.

Project 6 : *Freshwater Prawn Culture.*

Problem 6.2 : Breeding and culture of *Macrobrachium malcolmsonii.*

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

Duration : Eight years (From November, 1974)

Mixed culture of *M. malcolmsonii* and carps i.e., *Catla catla*, *Labeo rohita* and *Ctenopharyngodon idella* was taken up in three ponds (*c* 0.1 ha each) at Badampudi Fish Farm (A.P.). Stocking was done @ 5,000/ha of carps while *M. malcolmsonii* was stocked @1,00,000 75,000 and 50,000/ha in pond I,II and III respectively. Management practices involved manuring with cattle dung @ 10,000 kg/ha, periodical liming @ 100 kg/ha and supplimentary feeding with rice bran and groundnut oil cake @ 2% body weight of the fish and 10% body weight of prawn. Grass carp, stocked only in pond III, was fed with *Hydrilla*. After one year the fish yield from pond I, stocked with catla 1 : rohu 2 was 2060.10 kg/ha, while from pond II (catla 1 : rohu 2) and III (catla 1.5 : rohu 3.0 : grass carp 5.5) 2393.4 and 2709.3 kg/ha respectively. Prawn production was badly affected due to mass mortality and only 4.64 kg, 9.30 kg and 19.85 kg of prawns could be harvested from pond I, II and III respectively.

Problem 6 5 : Breeding and rearing of *Macrobrachium birmanicum choprai* under laboratory condition & survey of seed resources of *M. birmanicum choprai* in River Ganga and to study the growth pattern in ponds and plastic tanks.

Personnel : D. R. Kanaujia.

Duration : Six years (From January, 1977)

Adult *choprai* (70-150 mm) stocked in two ponds of 0.04 ha each in September, 1981 did not show significant growth when sampled in May, 1982. Gonads were found in developing stage, Total mortality was observed in one pond while in the other some beried females were encountered during September. These females hatched successfully, but the larvae survied only upto 15 days.

In another culture trial 2000 juveniles (30-40mm) collected from River Ganga around Buxar, were stocked in a pond (0.04 ha) during September, 1981, which registered a growth of 10-15 mm in 8 months rearing. Though berried specimens were noticed, no larvae or juveniles were encountered when sampled in the last week of April, 1982.

Two sets of female *choprai* were bred successfully in tapwater medium. The eggs hatched after 9-12 days and larvae survived for 12-15 days in tap water.

Problem 6.6 : Seed production of the giant freshwater prawn *Nacrobrachium rosentbergii.*

Personnel : M. Subrahmanyam.

Duration : Four years (From January, 1979).

Rearing trials were continued in 4 plastic pools with reduced power and reduced labour hours. Based

on operation costs, the production cost of 1,000 seed has been calculated as Rs. 31-90 in average.

Problem 6.7	:	Development of artificial feeds for rearing of the larvae of commercially important palaemonid prawns
Personnel	:	K. J. Ram and P. S. C. Bose.
Duration	:	Seven years (From January, 1976)

Postlarvae of *Macrobrachium rosenbergii* were produced employing soft slaughter house products in plastic pools (500 l). The larval rearing were carried out using *Acetes indicus* tissue suspension as food. A total of 132 post-larvae were produced. *A. indicus* is having some advantages as larval food being easily acceptable by prawn larvae and commonly available throughout the costal areas.

Problem 6.9	:	Culture of commercially important fishes and freshwater prawn in pens and cages in Kolleru lake (A.P.).
Personnel	:	K.V. Rao, K.J. Rao, D. S. Murty, T.S.R. Raju and K. S. Rao.
Duration	:	Six years (from 1981)

A pen of 0.01 ha made of bamboo split matting stocked with rohu, silver carp and grass carp @40,000/ha in the ratio of 3:1:2 during December, 1980. An estimated production of 7.1 tones/ha was obtained in 13 months with survival of 5.5 to 37.5%.

Problem 6.10	:	Seed production of freshwater prawn *Macrobrachium malcolmsonii*
Personnel	:	L. Hanumantha Rao.
Duration	:	Three years six months (From June, 1982)

The zoeae of *M. malcolmsonii* could be reared upto 9-11th stage in filtered brackishwater and by employing cut pieces of tubificed worms and nauplii of *Artemia* spp.

Porblem 6.11	:	Nursery rearing of prawn post larvae to stockable juveniles.
Personnel	:	L. H. Rao, M. Subramanyam, K. J. Ram and P.S.C. Bose.
Duration	:	Three years 9 months (From March, 1982)

Post larvae of prawns were produced in pots and plastic pools and were stocked in 4′×2′ plastic pools after acclamatisation to freshwater conditions. The post larvae were fed with flesh of blood clam *(Anadara granesa)* and broken rice and reared for a period of 6-8 weeks under laboratory coditions.

The postlarvae of average size 1.0 cm grew to 3.6 to 5.4 cm in different experiments.

Project 8	:	*Estuarine and brackishwater lake fisheries.*
Problem 8.1	:	Brackishwater fish and prawn seed prospecting of the Hooghly-Matlah estuarine system.
Personnel	:	K. K Bhanot, R. N. De and H. S. Mazumdar.
Duration	:	Continuing (from 1968).

Hilsa ilisha fry (15-35 mm) was collected from the Hooghly estuary at Barrackpore during February to June. The fry was available in poor numbers and was found to be highest during May (30 nos./day). Other fishes collected by dragnet were *Rhinomugil corsula* (20-35 mm), *Sillago panijus* (15-25 mm) and *Setipinna phasa* (10-30 mm). Shooting net collections comprised commercially important species of prawns and among fishes *Liza parsia* (20-35 mm) and *Eleutheronema tetradactylum* (15-40 mm).

The Hilsa fry collected by drag net was treated with different chemicals *e.g.*, Amylalcohol, Ethylalcohol,

chloral hydrate, sodium chloride and valium (a trade name medicine used as a sleeping pill). Treatment with different chemicals did not prove to be fruitful for transportation and most of the fry died with in 3-4 hours.

Problem 8.11 : Studies on prawn seed catch in West Bengal.
Personnel : G. C. Laha, H. C. Karmakar, P B. Das and B. B. Das.
Duration : Four years 3 months (From April, 1978).

The assembly centres at Nazat and Daharani, and 10 other fishing centres covering a stretch of 461 km were surveyed for *Penaeus monodon* seed. The estimated landing of *P. monodon* seed in West Bengal during the year was 621 millions. Two assembly centres at Nazat and Daharani contributed to 79.59% of the total collection. Maximum catch of the species was obtained in April.

Two fishing centres at Ghatal and Andharmanik contributed 27.97 and 38.92 kg of *Macrobrachium rosendergii* during the year.

Project 9 : Fish Genetics and Hybridisation

Problem 9.4 : Fish chromosome investigations of Indian major carps studies on cytogenctical features of Indian major carps hybrids.
Personnel : R. K. Jana and V. R. P. Sinha.
Duration : Seven years (From August, 1977).

A total of 0.37 lakhs of catla-rohu hybrids have been produced and the fry are being reared in two nursery ponds for further studies.

Chromosome slides have been prepared from kidney tissue of *L. rohita* following the Colchicine-Air-drying technique.

Photomicrographs of embryonic developmental stages of the F, catla×rohu hybrid have been made.

Problem 9.7.1 : Studies of 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 : Continuing (From 1980)

Detailed studies on the morphology of the hybrid between grass carp female and silver carp male and that with the parent species are being made. Karyological studies are in progress. In case of silver carp there are five pairs of metacentric, nine pairs of submetacentric and ten pairs of telocentric chromosomes, while in grass carp the number of metacentric chromosome pairs is six, submetacentric pairs ten and that of telocentric pairs eight. The hybrid also proved to be diploid with $2n=48$.

Problem 9.11 : Artificial gynogenesis and hormonal sex reversal of silver carp and grass carp. Intraspecific hybridisation 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 : Three years (From 1981).

Artificial gynogenesis in silver carp has been achieved for the first time in India. Induction of gynogenesis was through fertilisation of eggs with genetically inactivated sperms by using U.V. rays. Homozygocity of eggs has been restored by cold and heat shocks. Different temperatures ranging from 4°C to 14°C have been tried and it has been found that cold shock treatment at 12°C has given good result. Percentages of hatching varied from 2 to 5. Rearing of the gynogenetic silver carp fry is in progress in laboratory as well as in nursery pond.

Problem 9.14 : Production of artificial gynogenetic, androgenetic and polyploid populations in Indian major carps and common carp.

Personnel : George John, S.D. Gupta and P.V. G.K. Reddy.

Duration : Three years (From 1981),

For the first time gynogenetic catla have been produced. Artificial gynogenesis in catla was achieved using irradiated rohu milt for fertilisation of catla eggs. As in the case of rohu, diploidy in these eggs could be restored on exposure to temperature shocks. The gynogenetic offsprings, bearing only the maternal characters, are being reared in plastic pools. A few fingerlings released into a 0.02 ha pond have shown good growth.

The appearance of a few albine coloured catla among the gynogenetic fry show the presence of this recessive gene in the haterozygous condition in certain catla populations. This indicates that artificial gynogenesis can be used for locating genes in populations.

Attempts were made to induce polyploidy in rohu and the catla-rohu hybrid by subjecting fertilised eggs to cold/shock/colohicine treatments. The progeny thus produced are being reared in ponds to screen them for ploidy-level.

Problem 9.15 : Short and long term storage of fish sperms and fertilised ova.

Personnel : S.D. Tripathi and R.K. Jana.

Duration : Two years and six months (From May, 1982)

Work could not be intiated due to technical difficulties.

Problem 9.16 : Sex reversal of fish through hormone treatment.

Personnel : B. Venkatesh, Apurba Ghosh, S. K. Mukhopadhyay and P. K. Mukhopadhyay.

Duration : Two years (From January, 1982).

Work could not be initiated due to technical difficulties.

Problem 9.17 : Genetic characterization of *Catla catla, Hilsa ilisha* & *Cyprinus carpio.*

Personnel : S. K. Mukhopadhyay and A. P. Mukherjee.

Duration : Three years (From January, 1982).

In order to characterise the three intraspecific populations of *Catla catla* of Rihand reservoir, polyacrylamidegel electrophoretic study on muscle protein of the populations was initiated.

The electrophoretic pattern of the muscle protein of P(M) population extracted at different pH (10,7.6 and 6) showed some difference in the number of bands. The Rd value and the staining intensity of the bands also differed appreciably.

Project 11 : *Economics in Fishery Investigations.*

Problem 11.11 : Economic analysis of experimental, pilot scale and large-scale freshwater aquaculture operations in India.

Personnel : M. Ranadhir, B. R. Shrisat, N. K. Tripathi and M. Rout.

Duration : Four year (From February, 1980).

The economics of experimental and pilot scale operations have been worked out for different levels of inputs. Data relating to large scale operations are being collected and analysed. The empirical input-output relations are being tried to determine optimum rates of feeding and stocking.

Problem 11.12 : Economic feasibility study of a well laid out fish farm with dependable

water supply and determination of minimum economic size of farm.

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

Duration : Four year (From March, 1980).

Data collected on Institute-based case studies are being analysed. Data on input costs, price realisation at different points of marketing are being collected.

Problem 11.13 : Economics of the use of different sources of water in undrainable ponds

Personnel : M. Rout, C. Saha, M. Ranadhir, B.R. Shrisat and C.D. Sahu.

Duration : Three years (From July, 1980).

Local surveys on the use of different sources of water indicated that the cost per hectare meter of water was minimum when drawn from irrigation canals followed by electric pumps, diesel pumps, bamboo tube wells and dug wells. The cost varied from Rs. 890/- to Rs. 2250/- per hectare meter. A solar photovoltaic powered pump was observed to discharge water at an average rate of 50-60 cubic meter (0.004 ha meter) approximately per day depending on the local condition.

Problem 11.14 : Cost price structure of Aquacalture in Eastern Region of India.

Personnel : S. Paul and H. K. Sen.

Duration : Three years (From 1980).

No significant progress could be made due to non-availability of time series data from concerned organisations.

Problem 11.15 : Bio-economic modelling for optimization of the economics of carp culture in India.

Personnel : M. Ranadhir, M. Rout and N. K. Tripathi.

Duration : Four years (February, 1982).

Based on data on existing case studies, estimation of biological parameters such as maximum growth coefficient for individual species, half saturation constants and food suitability coefficients have been initiated through interactive process.

Project 13 : *Coldwater Fish Culture*

Problem 13.20 : Standardisation of rearing techniques of brown and rainbow trouts from fry to yearling.

Personnel : *For brown Trout* :
K. K. Vass, H. B. Singh and Bashir Ahmed (State Fisheries)
For rainbow Trout :
G.N. Bhat, G.N. Gazi (State Fisheries) and R. K. Langer (Central Unit)

Duration : Four years (From March, 1978).

The project work was completed on March 1982 and the final report is under processing.

Problem 13.21 : Induced breeding and raising of stocking material of *Tor putitora*

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

Duration : Two years (from January, 1981).

During August ripe spawners of *T. putitora* were obtained from Bhimtal lake, egg taken were fertilised by 'dry method'. The ripe fish in spawning run ranged as 370-450 mm in length and 365-800 g in weight. 47 females produced 1, 13, 620 eggs of which 20% were non-viable till water hardening process. The number of eggs was 4208/kg body weight. The percentage of fertilization ranged from 80-100. Hatching was 52.8% in running water trays against 71.1% in floating cages anchored in the lake. The incubation period was observed to range between 56-192 hrs at 16. 0-25.0°C against 30-70 hrs at 23.0-27.0°C. The cumulative survival at swim-up fry was 21.8%. The maximum loss of eggs was due to fungal (*Saprolegnia*) attack.

Rearing of early fry for 30 days in plastic pools and 1/50" mesh net nylon floating cages (1.5 x 1.0 x1.5m) anchored in the lake showed survival rate ranging from 74.0-76.0% in plastic pools against 80-90% in cages. Yolk of hen's egg was used as initial feed and then changed to formulated mash after 15 days.

Induced breeding of the species was attempted by administering carp pituitary extract @ 3-4 mg/kg initially followed by two other doses of 6-8 mg/kg, did not meet with success.

Problem 13.24 : Ecology and Energy flow studies in a Sar (Kashmir)

Personnel : K. K. Vas, H. B. Singh and R. K. Langer (Shyam Sunder on study leave from April 1982).

Duration : Two years (From March, 1981).

a) *Physico-Chemical features of the Sar*

Central Site : Light transmission ranged between 1.5-4.5 m. Water temperature, dissolved oxygen and pH ranged from 5.0-32.0°C, 5-31°C, 5-29°C, 5-28.5°C, 5-26.5°C & 5.0-24°C ; 6.8-14 ppm, 6.5-13.6 ppm, 6.8-13.6ppm, 3.6-13.6 ppm, 1.5-12.4 ppm. & 0.7-13.2 ppm ; 7.8-8.5 units, 7.8-8.4 units, 7.8-8.2 units, 7.6-8.0 units, 7.4-8.0 units & 7.2-8.0 units, at surface, 1m, 2m, 3m, 4m & 5m depth zones, respectively. Total alkalinity ranged from 79-180, 84-172 & 92-330 ppm at surface, middle and bottom zones, respectively. Specific conductivity ranged between 288-470, 229-421, 317-638/μ/25°C at the three zones, respectively. The range of other factors in the whole column was 24-84 ppm (dissolved organic matter); 8-16 ppm (Chloride) ; 36-60 ppm (Calcium) ; 1.8-13.4 ppm (Magnesium) ; 0.147-0.98 ppm (Nitrate) ; traces-0.120 ppm (Phosphate). While hydrogen sulphide was recorded in some months at the bottom zone and ranged between nil and 14.4 ppm.

Littoral site I : Transparency ranged between 1.5-2.0 c m. Water temperature, dissolved oxygen and pH ranged between 17-32°C, 17-31°C, 17-30°C, 17-30°C; 7.3-11 ppm, 7.2-11.2 ppm, 7.1-11.5 ppm, 7.1.10 ppm ; 8.0-8.4 (at surface to 2 m) and 8.0-8.2 (at 3 m), at surface, 1m, 2m, and 3m depth zones, respectively.

While other parameters analysed at surface and bottom ranged between 86-168 ppm, (total alkalinity); 290- 61, 290-485/μ/25°C (Specific conductivity). The dissolved organic matter ranged between 20-58 ppm ; Chloride between 9.6-14 ppm ; Calcium between 40 and 57 ppm ; Magnesium 1.4-5.6 ppm ; Nitrate between traces and 1.86 ppm ; and phosphate between traces and 0.189 ppm.

Littoral site II : Transparency ranged from 1-2m. water temperature, dissolved oxygen and pH ranged from 17-33°C, 17-31.5°C, 17-28.5°C ; 7-11.5 ppm, 7.8-9.3 ppm, 6.4-9.2 ppm ; 8.1-8.4, 8.1-8.2. 7.4-8.2, at surface, 1 and 2 m depth zones, respectively. Total alkalinity ranged from 72-160 ppm, 98-164 ppm, while specific conductivity between 277 and 397, 304 and 482/μ/25°C, at surface and bottom zones, respectively. The dissolved organic matter ranged between 20 and 58 ppm ; Chloride between 9.6 and 14 ppm ; Calcium 40 and 58 ppm ; Magnesium 1.8 and 5.6 ppm ; nitrate between traces and 0.54 ppm and phosphate between 0·007 and 0.074 ppm.

b) *Biological features*

i) *Zooplankton* :

Four groups namely Protozoa. Rotifera, Cladooara and Copepoda were dominant at all the stations even in column profiles.

ii) *Phytoplankton* :

Among phytoplankton population the main groups recorded from column profiles and stations were Myxophyceae, Chlorophyceae and Bacillariophyceae while Euglenophyceae was encountered occasionally. Out of the total phytoplankton density the contribution of Myxophyceae ranged between 59 and 66% ; Chlorophyceae 8-11% and Bacillariophyceae 26-30%.

iii) *Benthic fauna* :

The main groups encountered were Oligochaetes (2-100%), Mollusca (nil-100%), Diptera (5-100%) and others (nil-27%).

iv) *Fish & Fisheries* :

The Sar abounds mainly exotic carp (*Cyprinus carpio*) and endemic carp (Schizothoracids). The catch per man/day by rod and line ranged between 500 and 1000 g exotic carp comparising more than 75% of the total catches.

v) *Macrophytes* :

The dominant submerged forms encountered in the Sar were *Myriophyllum spicatum* and *Ceratophyllum demursum* covering most of the pelagic zone. Towards the shore mostly *Potamogeton natans*, *P. crispus* and *Nymphoides paltatupa* were dominant. The total biomass increment in terms of dry weight of dominant froms ranged between 135 g/m²/month recorded in winter months and maximum of 844 g/m²/month in June-July, while in remaining months the increment ranged between 410-500 g/m²/month.

c) *Primary production*

The gross phytoplankton production at central site ranged between 15-53, 9-37, 6-61, 12.5-44 and nil-40 mg C/m³/hr at surface, 1m, 2m, 3m, and 4m depth zones respectively. The productivity at littoral site-I ranged between 6-62, 6-62, 9-31 mg C/m³/hr at surface, 1 m and 2 m depth zones respectively. At littoral site-II, the production ranged between 6 and 69, 12.5 and 60 and 9 and 50 mg C/m³/hr at surface, 1m & 2 m depth zones respectively. So littoral zones in this Sar usually do not fix more carbon than pelagic site.

The production of macrophytes in terms of carbon is estimated at 6.4 g C/m²/ day which is a significant contribution as compared to phytoplankton production.

d) *Photosynthetic behaviour by insitu experiments*

Different plankton populations were exposed at constant light of 1 m depth zone. Results reveal that if bottom population of 4 m depth zones are given enough light they will photosynthesize at a quicker rate. This in-situ study shows that in Sar the photosynthetic behaviour is primarily controlled by light/temperature apart from population density.

e) *Photosynthetic efficiency and energy flow*

The data revealed that on yearly average basis, carbon production of photoplankton alone amounts to 145 g C/m²/yr, with daily production range of 150 mg C/m²/d-850 mg C/m²/d.

With regard to energy flow it is estimated that about 23×10^6 calories/m²/y are fixed by primary producers, zooplankton fix about 127000 cal/m²/y and fish harvest comes to only 4800 calories/m²/y. Thus the conversion efficiency between phytoplankton photosynthesis to fish is 0.048%, total photosynthesis to fish is 0.002% and light energy to fish is 0.00054%.

Problem 13.25 : Studies on the tolerance of different ecological factors on Schizothoracid fry/fingerlings.

Persennel : H. B. Singh, K. K. Vass and R. K. Langer.

Duration : One year (from April, 1982)

A series of experiments on the response of Schizothoracid young-ones to different ecological factors were carried out in laboratory and field. The results are summarised below :

It was observed that *Schizothorax niger* and *Schizothoraichthys esocinus* (25-40 mm) could withstand the temperature range between 25-30°C. When the temperature was raised between 30-37°C, *Schizothorax niger* showed distress within 15-20 minutes and died within 1-1.30 hrs. While fry of *Schizothoraichthys esocinus* was under distress and subsequently died within 1 hour at a temperature range of 32-35°C.

The fry of *Schizothorax niger* and *Schizothoraichthys esocinus* were found to tolerate pH range

between 5.5-8.5 without any ill effects. Both the species showed stress condition in the lower pH range of 4.5-5.0 and in the upper range of 8.5-8.8 and scumbed after somtime.

The fry of *Schizothorax niger* were found to be in distress at oxygen level of 3 ppm, while *Schizothoraichthys esocinus* fry was observed to withstand 3 ppm oxygen level for quite sometime. The oxygen levels above 15 ppm were well tolerated by both species during six hours of observations. The carbon dioxide level above 18 ppm was harmful for *Schizothorax niger* while it was above 22 ppm level for *Schizothoraichthys esocinus.*

Field Conditions :

The field studies were conducted in a thermally stratified lake by incubating the young-ones at different depths in specially fabricated containers.

Water temperature :

The fry of *Schizothorax niger* and *Schizothoraichthys esocinus* were tested at different temperature ranges of 12-20°C ; 23-25°C ; 25-28°C ; 28-32°C and 32-34°C at various depth zones.

The young ones of both *S. niger* and *S. esocinus* were observed to withstand a temperature level upto 30°C without any apparent effect. While a temperature range above 32°C was found lethal for both the species.

pH

Under field conditions, two ranges were tried, one between 7.2-8.0 and other between 8.0-8.5. But both species in both the ranges did not show any distress.

Dissolved oxygen & Carbon dioxide :

Youngones of both the species died immediately at an oxygen level of 2 ppm. In 3 ppm the fishes died within 1-2 hours. Oxygen levels between 4 and 14 ppm were found congenial. It was also observed that carbon dioxide concentration between 18-20 ppm was harmful and 20 ppm was lethal to the fishes studied.

Problem 13.26	:	Monoculture of mirror carp in a temperature climate.
Personnel	:	K. K. Vass, H. B. Singh and R. K. Langer.
Duration	:	Two years (From March, 1982)

In the last week of April, about 400 fingerlings (70-150 mm/22-44 g) of *Cyprinus carpio* were stocked in a rural pond. A pelleted dry feed comprising wheat bran 50%, maize flour 30% and soyabean 20% was given as supplementry feed @ 1-2% of body weight at weekly intervals and there was abundant natural food in the pond. After 200 days of rearing, the fishes grew to an average weight of 500 g (300-700 g range). This amounts to a gross production of about 3,000 kg/ha in 210 days. Phytoplankton encountered in the pond water were *Oscillatoria*, *Frustulia*, *Navicula* and *Euglena*. *Daphina pulex* was the principal zooplankton encountered.

Project 14 : *Riverine Fish Catch Statistics*

Problem	: 14.1	Reverine fish catch statistics of the middle and lower stretches of the Ganga River System.
Personnel	:	S. Karamchandani (upto 31.3.82), A. G. Jhingran, Balbir Singh, R. A. Gupta, R. K. Tyagi, D. N. Srivastava, B. D. Saroj, J. P. Mihsra, Bhailal, D. R. Kanujia, A. K. Laal, R. C. Singh, A. Sarkar, B. L. Pandey and P. K. Chakraborty.
Duration	:	Continuing

The total fish catches estimated at Sadiapur, Daraganj Rasulbad, Bhagalpur and Lalgola were 125.28 t, 37.79 t, 31.60 t, 110.22 t and 37.35 t respectively. The fish catch at Sadiapur, Daraganj, Bhagalpur and Lalgola showed marginal decline by 4%, 25%, 15.12% and 19.41% respectively, when compared to the fish catch during the preceding year. This was largely due to low

landing of miscelaneous fishes. Rasulbad centre was started towards the end of last year therefore, no comparison could be made.

At Lalgola, landings of hilsa was maximum during July to November and catfishes during June to November. Major carps were encountered only during June and July. Landings of prawn were higher during June and July.

The annual mean lengths of various species of fish showed very little variation when compared to that of the previous years.

Scale studies revealed that *L. calbasu* attains 207,311, 401, 489 and 557 mm respectively at ages between 1 to 5 years. The Von Bertalanffy's equation was calculated as

$$Lt = 1075 \left[1 - e^{0.129\ (t+0.647)} \right]$$

The annual catch of various species is given in Table-1.

The inventory survey of nearly 58 fishing villages on either banks of river Ganga and Yamuna revealed that though the fisherman population has increased the number of active fishermen have gone down. It has been observed that cotton thread has completely been replaced by nylon thread and the operation of drug nets have also been replaced by long lines resulting in the increase in catfish catches in this area.

TABLE 1. Centre-wise annual catch of various species during 1982

Species	Sadiapur		Daraganj		Rasulabad		Bhagalpur		Lalgola	
	Wt (t)	%	Wt (t)	%	Wt (t)	%	Wt (t)	%	Wt (t)	%
C. mrigala	8.85	7.1	2.22	5.9	1.59	5.0	1.56	1.42	0.24	0.64
C. catla	5.71	4.6	0.32	0.8	0.24	0.8	3.71	3.36	0.56	1.50
L. rohita	2.46	2.0	0.50	1.4	0.91	2.9	2.04	1.85	0.81	2.17
L. calbasu	32.73	26.0	2.20	5.8	0.99	3.1	0.48	0.44	0.01	0 03
Total	49.75	39.7	5.24	13.9	3.73	11.8	7.79	7.07	1.62	4.34
M. aor	10.65	8.5	2.13	5.6	3.37	10.7	7.46	6.77	1.50	4.01
M. seenghala	6.83	5.4	6.85	18.2	6.61	20.9	4.35	3.95	0.31	0.83
W. attu	3.70	3.0	3.78	10.0	5.48	17.3	15.68	14.22	0.30	0.80
Total	21.18	16.9	12.76	33.8	15.46	48.9	27.49	24.94	2.11	5.64
Hilsa	0.46	0.4	0.01	—	0.10	0.3	2.18	1.98	15.98	42.77
Misc.	53.89	43.0	19.78	52.3	12.31	39.0	72.76	66.01	17.65	47.25
Grand Total	125.28		37.79		31.60		110.22		37.35	

Problem : 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 : Continuning (From January, 1979)

Hydro-biological investigations were conducted at Hanumanghat on river Ganga and Sirighat "Kol".

Hanumanghat on river Ganga :

Air and water temperature ranged from 15.0 to 31.0 and 19.0 to 31.0°C respectively. Transparancy ranged from 5.0 to 44.0 cm, free CO_2 : *nil*—11.44 ppm,

iii) *Benthic fauna* :

The main groups encountered were Oligochaetes (2-100%), Mollusca (nil-100%), Diptera (5-100%) and others (nil-27%).

iv) *Fish & Fisheries* :

The Sar abounds mainly exotic carp (*Cyprinus carpio*) and endemic carp (Schizothoracids). The catch per man/day by rod and line ranged between 500 and 1000 g exotic carp comparising more than 75% of the total catches.

v) *Macrophytes* :

The dominant submerged forms encountered in the Sar were *Myriophyllum spicatum* and *Ceratophyllum demursum* covering most of the pelagic zone. Towards the shore mostly *Potamogeton natans*, *P. crispus* and *Nymphoides paltatupa* were dominant. The total biomass increment in terms of dry weight of dominant froms ranged between 135 g/m²/month recorded in winter months and maximum of 844 g/m²/month in June-July, while in remaining months the increment ranged between 410-500 g/m²/month.

c) *Primary production*

The gross phytoplankton production at central site ranged between 15-53, 9-37, 6-61, 12.5-44 and nil-40 mg C/m³/hr at surface, 1m, 2m, 3m, and 4m depth zones respectively. The productivity at littoral site-I ranged between 6-62, 6-62, 9-31 mg C/m³/hr at surface, 1 m and 2 m depth zones respectively. At littoral site-II, the production ranged between 6 and 69, 12.5 and 60 and 9 and 50 mg C/m³/hr at surface, 1m & 2 m depth zones respectively. So littoral zones in this Sar usually do not fix more carbon than pelagic site.

The production of macrophytes in terms of carbon is estimated at 6.4 g C/m²/ day which is a significant contribution as compared to phytoplankton production.

d) *Photosynthetic behaviour by insitu experiments*

Different plankton populations were exposed at constant light of 1 m depth zone. Results reveal that if bottom population of 4 m depth zones are given enough light they will photosynthesize at a quicker rate. This in-situ study shows that in Sar the photosynthetic behaviour is primarily controlled by light/temperature apart from population density.

e) *Photosynthetic efficiency and energy flow*

The data revealed that on yearly average basis, carbon production of photoplankton alone amounts to 145 g C/m²/yr, with daily production range of 150 mg C/m²/d-850 mg C/m²/d.

With regard to energy flow it is estimated that about 23×10^6 calories/m²/y are fixed by primary producers, zooplankton fix about 127000 cal/m²/y and fish harvest comes to only 4800 calories/m²/y. Thus the conversion efficiency between phytoplankton photosynthesis to fish is 0.048%, total photosynthesis to fish is 0.002% and light energy to fish is 0.00054%.

Problem 13.25 : Studies on the tolerance of different ecological factors on Schizothoracid fry/fingerlings.

Persennel : H. B. Singh, K. K. Vass and R. K. Langer.

Duration : One year (from April, 1982)

A series of experiments on the response of Schizothoracid young-ones to different ecological factors were carried out in laboratory and field. The results are summarised below :

It was observed that *Schizothorax niger* and *Schizothoraichthys esocinus* (25-40 mm) could withstand the temperature range between 25-30°C. When the temperature was raised between 30-37°C, *Schizothorax niger* showed distress within 15-20 minutes and died within 1-1.30 hrs. While fry of *Schizothoraichthys esocinus* was under distress and subsequently died within 1 hour at a temperature range of 32-35°C.

The fry of *Schizothorax niger* and *Schizothoraichthys esocinus* were found to tolerate pH range

between 5.5-8.5 without any ill effects. Both the species showed stress condition in the lower pH range of 4.5-5.0 and in the upper range of 8.5-8.8 and scumbed after somtime.

The fry of *Schizothorax niger* were found to be in distress at oxygen level of 3 ppm, while *Schizothoraichthys esocinus* fry was observed to withstand 3 ppm oxygen level for quite sometime. The oxygen levels above 15 ppm were well tolerated by both species during six hours of observations. The carbon dioxide level above 18 ppm was harmful for *Schizothorax niger* while it was above 22 ppm level for *Schizothoraichthys esocinus.*

Field Conditions :

The field studies were conducted in a thermally stratified lake by incubating the young-ones at different depths in specially fabricated containers.

Water temperature :

The fry of *Schizothorax niger* and *Schizothoraichthys esocinus* were tested at different temperature ranges of 12-20°C ; 23-25°C ; 25-28°C ; 28-32°C and 32-34°C at various depth zones.

The young ones of both *S. niger* and *S. esocinus* were observed to withstand a temperature level upto 30°C without any apparent effect. While a temperature range above 32°C was found lethal for both the species.

pH

Under field conditions, two ranges were tried, one between 7.2-8.0 and other between 8.0-8.5. But both species in both the ranges did not show any distress.

Dissolved oxygen & Carbon dioxide :

Youngones of both the species died immediately at an oxygen level of 2 ppm. In 3 ppm the fishes died within 1-2 hours. Oxygen levels between 4 and 14 ppm were found congenial. It was also observed that carbon dioxide concentration between 18-20 ppm was harmful and 20 ppm was lethal to the fishes studied.

Problem 13.26	:	Monoculture of mirror carp in a temperature climate.
Personnel	:	K. K. Vass, H. B. Singh and R. K. Langer.
Duration	:	Two years (From March, 1982)

In the last week of April, about 400 fingerlings (70-150 mm/22-44 g) of *Cyprinus carpio* were stocked in a rural pond. A pelleted dry feed comprising wheat bran 50%, maize flour 30% and soyabean 20% was given as supplementry feed @ 1-2% of body weight at weekly intervals and there was abundant natural food in the pond. After 200 days of rearing, the fishes grew to an average weight of 500 g (300-700 g range). This amounts to a gross production of about 3,000 kg/ha in 210 days. Phytoplankton encountered in the pond water were *Oscillatoria, Frustulia, Navicula* and *Euglena. Daphina pulex* was the principal zooplankton encountered.

Project 14 : *Riverine Fish Catch Statistics*

Problem	: 14.1	Reverine fish catch statistics of the middle and lower stretches of the Ganga River System.
Personnel	:	S. Karamchandani (upto 31.3.82), A. G. Jhingran, Balbir Singh, R. A. Gupta, R. K. Tyagi, D. N. Srivastava, B. D. Saroj, J. P. Mihsra, Bhailal, D. R. Kanujia, A. K. Laal, R. C. Singh, A. Sarkar, B. L. Pandey and P. K. Chakraborty.
Duration	:	Continuing

The total fish catches estimated at Sadiapur, Daraganj Rasulbad, Bhagalpur and Lalgola were 125.28 t, 37.79 t, 31.60 t, 110.22 t and 37.35 t respectively. The fish catch at Sadiapur, Daraganj, Bhagalpur and Lalgola showed marginal decline by 4%, 25%, 15.12% and 19.41% respectively, when compared to the fish catch during the preceding year. This was largely due to low

landing of miscelaneous fishes. Rasulbad centre was started towards the end of last year therefore, no comparison could be made.

At Lalgola, landings of hilsa was maximum during July to November and catfishes during June to November. Major carps were encountered only during June and July. Landings of prawn were higher during June and July.

The annual mean lengths of various species of fish showed very little variation when compared to that of the previous years.

Scale studies revealed that *L. calbasu* attains 207,311, 401, 489 and 557 mm respectively at ages between 1 to 5 years. The Von Bertalanffy's equation was calculated as

$$Lt = 1075 \left[1 - e^{0.129\ (t+0.647)} \right]$$

The annual catch of various species is given in Table-1.

The inventory survey of nearly 58 fishing villages on either banks of river Ganga and Yamuna revealed that though the fisherman population has increased the number of active fishermen have gone down. It has been observed that cotton thread has completely been replaced by nylon thread and the operation of drug nets have also been replaced by long lines resulting in the increase in catfish catches in this area.

TABLE 1. Centre-wise annual catch of various species during 1982

Species	Sadiapur		Daraganj		Rasulabad		Bhagalpur		Lalgola	
	Wt (t)	%	Wt (t)	%	Wt (t)	%	Wt (t)	%	Wt (t)	%
C. mrigala	8.85	7.1	2.22	5.9	1.59	5.0	1.56	1.42	0.24	0.64
C. catla	5.71	4.6	0.32	0.8	0.24	0.8	3.71	3.36	0.56	1.50
L. rohita	2.46	2.0	0.50	1.4	0.91	2.9	2.04	1.85	0.81	2.17
L. calbasu	32.73	26.0	2.20	5.8	0.99	3.1	0.48	0.44	0.01	0 03
Total	49.75	39.7	5.24	13.9	3.73	11.8	7.79	7.07	1.62	4.34
M. aor	10.65	8.5	2.13	5.6	3.37	10.7	7.46	6.77	1.50	4.01
M. seenghala	6.83	5.4	6.85	18.2	6.61	20.9	4.35	3.95	0.31	0.83
W. attu	3.70	3.0	3.78	10.0	5.48	17.3	15.68	14.22	0.30	0.80
Total	21.18	16.9	12.76	33.8	15.46	48.9	27.49	24.94	2.11	5.64
Hilsa	0.46	0.4	0.01	—	0.10	0.3	2.18	1.98	15.98	42.77
Misc.	53.89	43.0	19.78	52.3	12.31	39.0	72.76	66.01	17.65	47.25
Grand Total	125.28		37.79		31.60		110.22		37.35	

Problem : 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 : Continuning (From January, 1979)

Hydro-biological investigations were conducted at Hanumanghat on river Ganga and Sirighat "Kol".

Hanumanghat on river Ganga :

Air and water temperature ranged from 15.0 to 31.0 and 19.0 to 31.0°C respectively. Transparancy ranged from 5.0 to 44.0 cm, free CO_2 : *nil*—11.44 ppm,

dissolved oxygen : 2 84 to 8.23 ppm; pH : 6 3 to 8.45, carbonate alkalinity : *nil* to 52.0 ppm; bi-carbonate alkalinity : 90.0 to 184.0 ppm ; phosphate : 0.012 to 0.058 ppm ; nitrate : 0.016 to 0.166 ppm ; silicate : 2.5 to 20.0 ppm ; iron (ic) : 0.013 to 0.113 ppm ; dissolved organic matter : 2.4 to 10.40 ppm ; choloride : 26.16 (Dec.) to 74 88 ppm (Mar.) and specific conductivity : $10^2 \times$ 1.83 (Aug,) to $10^2 \times 4.66$ micro-mhos/cm_2 at 25°C (Feb.) respectively.

Gross and net primary production were in the range of 16 63 to 278.44 mg C/m^3/hr and 5.28 to 240.00 mg C/m^3/hr respectively. Community respiration ranged from 7.5 to 82.00 mg C/m^3/hr.

The phytoplankton density ranged from 48 u/l (July) to 1294 u/l (May). Phytoplankton population was very poor during July.

Zooplankton population ranged from 6 u/l (July) to 336 u/l (Feb.) and comprised *Keratella* sp., *Anura* sp., *Brachionus-calyciflorus*, *Bosmina* sp. and *Diaphnosoma* sp.

Sirighat 'kol'

At Adampurghat (below out fall) on Sirighat 'KOL' air and water temperature ranged from 16.0 (Dec.) to 31.5 (May) and 17.5 (Dec.) to 30.7°C (July) respectively. Transparency ranged from 2.8 (June) to 25.75 cm (Nov.) ; free CO_2 : *nil* (Aprl., May, Oct to Dec.) to 36.96 ppm (Jan.) ; dissolved oxygen : 1.27 (Feb.) to 7.62 ppm (Oct.), pH : 6.3 (Sept.) to 8.55 (May) ; carbonate alkalinity : *nil* (Jan., June, Aug. & Sept.) to 124.04 ppm (Apr.) ; bi-carbonate alkalinity : 86.0 (June) to 698.0 ppm (Mar.) ; phosphate : 0.028 (Oct.) to 0.7145 ppm (May) ; nitrate : 0.0434 (May) to 1.459 ppm (Apr.) ; silicate : 5.0 (Apr. & May) to 16.7 ppm (Oct.) ; iron (ic) : 0.013 (Sept.) to 0.8577 ppm (Feb.) ; dissolved organic matter : 2.2 (Dec.) to 35.58 ppm (Mar.) ; chloride : 22. 58 (June) to 249.34 ppm (Mar.) and specific conductivity : $10^2 \times 1.36$ (June) to $10^3 \times 2$ 013 micro-mhos/cm^2 at 25°C (Apr.) respectively.

Gross and net primary production ranged from 20.314 (June) to 493.37 (May) and 0.91 (Aug.) to 376.25 mg C/m^3/hr (May) respectively. Community respiration ranged from 17.81 (Dec.) to 147.37 mg C/m^3/hr (May).

Phytoplankton ranged from 32 u/l (June) to 5873 u/l (Apr.). Dominance of *Closterium* sp. in January *Euglena* sp. in February-March, *Chlamydomonas* sp. in April ; *Aphanocapsa* sp. in May and *Oscillatoria* sp. in July were noticed.

Zooplankton population ranged from 12 u/l (Aug.) to 589 u/l (Feb.) and was dominated by *Brachionus* sp. except in the month of April when *Moina* dominated

At Maniksarkarghat confluence (out fall) on Sirighat 'Kol' air and water temperatures ranged from 15.0 (Dec.) to 32.5 (May) and 17.5 (Dec.) to 28.0°C (May) respectively. Transparency ranged from 15.0 (Mar.) to 21.0 cm (Apr. & Dec.) ; D.O. 0.94 (Feb.) to 8.29 ppm (Apr.) ; pH : 8.0 througout the period of observation except in April when it was 8.4 ; free CO_2 : *nil* (Apr., May. Nov. & Dec.) to 45.76 ppm (Jan.) ; carbonate alkalinity : *nil* (Jan to Mar.) to 133.12 ppm (Apr.) ; bi-carbonate alkalinity : 172.0 (Dec.) to 590.72 ppm (May) ; phosphate : 0.037 (Jan.) to 0.76 ppm (May) ; nitrate : 0.032 (Feb.) to 2.2594 ppm (Mar.) ; silicate ; 4.0 (Jan.) to 17.4 ppm (Nov.) iron (ic) : 0.013 (Nov.) to 0.825 ppm (Apr.) ; dissolved organic matter : 1.8 (Dec.) to 40.0 ppm (Feb) ; chloride : 27.73 (Nov.) to 246.50 ppm (Apr.) and specific conductivity : $10^2 \times 3.63$ (Dec.) to $10^3 \times 2.16$ micro-mhos/cm^2 at 25°C (May) respectively.

Gross and net primary production ranged from 44.53 (Dec.) to 702.50 (May) and 14.84 (Dec.) to 603.13 (May) mg C/m^2/hr respectively. Community respiration ranged from 35.63 (Dec.) to 143.25 (Apr.) mg C/m^3/hr. Phytoplankton population ranged from 394 u/l (Feb.) to 4050 u/l (Mar.)

Zooplankton population ranged from 49 u/l (Feb.) to 3150 u/l (March). *Brachionus* dominated amongst zooplankton.

At Manikasarkarghat main sewage (above out fall) on Sirighat 'Kol' air and water temperature ranged from 15.0 (Dec.) to 28.0°C (Apr.) and 15.5 (Dec.) to 25.5°C (Apr.) ' D. 0. : 0.6 (Mar.) to 5.13 ppm (Dec.) free CO_2 : *nil* (Apr., Nov. & Dec.) to 42.24 ppm (Mar) ; pH : 7.6 (Nov.) to 8.0 (in rest of the months) carbonates alkalinity : *nil* (Jan. to Mar.) to 79.04 ppm (Apr.) ; bi-carbonate alkalinity : 400.0 (Nov.) to 574.0 ppm (Feb.), phosphate : 0.069 (Jan) to 1.633 ppm (Dec.) ; nitrate : 0.023 (Feb.) to 2.686 ppm (Jan.) ; silicate : 4.0 (Jan. & Apr.) to 20.0 ppm (Dec.) iron (ic) ; 0.066 (Mar.) to 0.306 ppm (Feb.) ; dissolved organic matter : 6 6 (Apr.) to 31.6 ppm (Feb.) , chloride : 95.42 (Dec.) to 165.42 ppm (Feb.) and specific conductivity : $10^2 \times 9.05$ (Nov.) to $10^3 \times 1.55$ (Mar.) micro-mhos/cm^3 at 25°C respectively.

Phytoplankton population ranged from 138 u/l (Feb.) to 208 u/l (Apr.) while Zooplankton ranged from 66 u/l (Feb.) to 139 u/l (March)

Problem 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	:	Five years 6 months (From June, 1981)

Total fish landing from the lake during the year was estimated to be 1754. 728 t of which Akividu, Eluru and Bhimavaram Centres contributed 998.981 ; 311.679 and 374 068 t respectively. Highest landing was recorded during April and lowest during July. The per hactare yield was estimated to be 70.19 kg. Perches and prawns formed the major constituent of the fishery contributing 27.33 and 27.08% respectively. Other constituents of the fishery were cat fishes 21.35%, murrels 15.18%, carps 5.65% and mullets 0.8%. Amongst perches *Anabas testudineus* and amongst prawns *Metapenaeus monoceros* were the prime contributors. The cat fish fishery was constituted chiefly by *Heteropneustes fossilis* followed by *Wallago attu, Mystus gulio* and *Clarias batrachus*. Due to heavy weed infestation netting operation in the lake is reduced and major part of the lake "Gidasa vala" a stake net was found to be the principal gear operated for fishing.

Project 15 *Ichthyopathology and Fish Health Protection*

Problem 15.5	:	Diseases of fishes in bheries of sewage-fed Kulti estuary.
Personnel	:	R. N. Pal and N. Sarengi (1.7.82 to 31.12.82)
Duration	:	Five years

Bacteria *viz.. Satphylococcus* and *Pseudomonas* have been isolated from the circulatory systems of *Tilapia mossambica* and *Penaeus monodon* respectively. Antibiotics were found effective in controlling the diseases.

Problem 15.6	:	Investigation on diseases of Indian major carps caused by parasites and malnutrition
Personnel	:	B. K. Mishra and R. K. Dey
Duration	:	Three years

Major parasitic diseases and two nutrition defficiency diseases of Indian major carps, reared around Kausalyagang, were identified. Myxosporidiasis was observed to be enzootic in this area. Several drugs and chemicals which may control the disease were screened.

Problem 15.8	:	Development of primary cell cultures and fish cell lines from Indian major carps for virological studies.
Personnel	:	Dilip Kumar and K. Suresh
Duration	:	Three years

Special procedures for washing and sterilization of glasswares and other items as well as the preparation of fish for taking of tissues aseptically are routinely used. Monolayer stage of primary cultures initiated from explant tissues have been achieved several times and various parameters affecting the successful culture are being

standardised. Cultures have been sub-cultured and maintained.

Efforts are being made to isolate and identify pathogenic viruses from primary cultures.

Problem 15.9 : Investigations on the bacterial diseases of major carps and their treatment

Personnel : K. Suresh, R. K. Dey and Dilip Kumar

Duration : Three years (From January, 1981)

Of the several diseases of bacterial origin causing wide spread mortality in major carps, the occurrance of columnaris disease in rohu has found to be the most important. Tne pathogen *Flexibacter columnaris* has been isolated in pure culture. Several other gram negative as well as gram positive pathogenic bacteria have been isolated and experimental inoculation of the diseases has been attempted.

Problem 15.10 : Studies on haematological and histopathological aspects to monitor fish health

Personnel : R. K. Dey, B. K. Mishra and Dilip Kumar

Duration : Six years (From January 1982)

Two sporozoan parasites *viz.*, *Myxosporidia* and *Microsporidia* have been identified by histopathological examination of the kidney sections of diseased Indian major carps. In the myxosporidia infected rohu (*L. rohita*), the kideny sections have revealed the presence of parasitic cysts having spores inside with the effect that most of the kidney tubules are degenerated, showing necrotic changes. In the microsporidian infected rohu almost all the renal tubules were having microsporidian parasites inside the tubular epithelial cells causing extensive damage and necrotic changes. Myxosporidian cysts have also been identified in the gill section of diseased catla where secondary lamellae were having parasitic cysts which damaged the gill lamellae causing mortality.

Occurrence of haemosiderosis has been recorded by histopathological studies on the liver and ovary of catla using Prussian blue stain. The study is in progress. Morphometric studies on the blood of healthy and diseased specimens of Indian major carps are also being made.

Problem 15.11 : Haematological assessment of apparently healthy and diseased indigenous and exotic carps, cultured in bheris and sewage fed ponds.

Personnel : A. K. Dutta (upto June 1982), R. N. Pal and N. Sarengi

Duration : Five years

Haematological studies of healthy Indian major carp fingerlings from freshwater indicated an average haemoglobin value of 8.9, 8.1 and 9.3 9% for rohu, mrigal and catla respectively. Length and breadth of the erythrocyte of these species have been measured to be 9.5 μ × 6.9 μ, 9.7 μ, x 7.1 μ and 12.1 μ x 7.3 μ respectively. The test fishes examined for ecto – and endoparasites did not indicate any sort of infection.

Project 16 : *Weed control*

Problem 16.3 : Screening of new herbicide formulations for control of aquatic weeds.

Personnel : S. Patnaik, Rama Prabhu and K.M. Das.

Duration : Continuing (From January, 1980)

2-4 D Ethyl ester granules (4% a.i.) at 20 kg a i/ha resulted uprooting of 10% of *Hydrilla* and *Nechamandra* plants and inhibited the further propagation in a nursery pond. *Nelumbo nucifera* infestations could be controlled by spraying 2-4D Sodium salt formulation (80% a.i.) at 10 kg a.i./ha. 2-2 dichloropropionic acid (74% a.i.) could control *Nelumbo* infestation at 50% level. Adding 0.2% wetting agent and

applied at 10 kg a.i./ha growth of *Panicum* sp. and at 15 kg a.i./ha growth of *Cyperus* sp. could be checked. Diuron (dimethyl urea) in 80% commercial formulation controlled submerged weeds (*Hydrilla* and *Nechamandra*) in 2 nursery ponds when applied at 1 ppm a.i. in 4-6 weeks interval.

Problem 16.15 : Studies of the toxic effect of algicides on fish and consequences of their periodic application on fish pond ecology.

Personnel : S. Patnaik, S. R. Ghosh & K. M. Das.

Duration : Three years (From January, 1981)

A bloom of *Microcystis* could be cleared in 18 days by the application of diuron. The DO gradually reduced from 8.6 to 1.4 ppm. The associated phytoplankton disappeared along with the bloom but reappeared after 26 days of treatment. The zooplankron were not affected. The fish were in distress during 5th to 7th day of treatment but no mortality occurred. The pond under observation was free of bloom for 8 months.

A *Microcystis* bloom treated with 0.7 ppm copper sulphate showed 50% clearance of the bloom in 16 days. The fish and fish food organisms were not affected by the treatment. The bloom however, reappeared after two months.

Problem 16.16 : Effects of aquatic weed infestation on loss of water in different aquatic ecosystems and their interference with storage and flow conditions.

Personnel : S. Patnaik, T. Rama Prabhu, M. Rout and K.M. Das.

Duration : Three years and 8 months (From April, 1981).

In nursery ponds with *Eichhornia*, *Pistia* and *Salvinia*, water loss was found to be greater than from open water surface. The rate of water loss in a 8 week observation period from March-May ranged from 0.56-2.35, 0.64-0.87, 0.57-1.74 cm/day for *Pistia*, *Eichhornia* and *Salvinia* respectively as compared to 0.07-1.80 cm/day from open water surface.

Problem 16.17 : Use of ammonia in fishery management.

Personnel : T. Rama Prabhu, S. D. Tripathi, S.R. Ghosh, K.M. Das, C.R. Das, D.K. Chatterjee ane S. Jena.

Duration : Two years 8 months (from April, 1982).

Ammonia was tried as a fish toxicant in six nursery ponds of 0.023 to 0.036 ha and with 250 to 360 cm water column to clear unwanted fish and other predators. Murrels, minnows, crabs, eels etc. were killed by ammonia application and the toxicity disappeared after about 4 weeks. The rate of application varied from 15-35 ppm of ammonia calculated on water volume basis in ponds, which however was much higher than the actual concentration ranging from 5-10 ppm estimated in each pond due to loss of ammonia, temperature factors and other variables.

Project No. 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 : Continuing (From 1974)

A production of about 2.5 million pre-hatching stages and hatchlings of the Indian bullfrog and *Rana crassa* was achieved by utilising the frog hatchery technique evolved by this Research Centre. Majority of the seeds produced was 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 : Continuing (From 1974)

Out of 2.5 million pre-hatching stages and hatchlings of *R. tigrina* and *R. crassa* produced, about 0.5 million hatchlings were utilised for nursery rearing and other experiments and the rest were released in the nature.

In field rearing experiments of three weeks duration conducted in four hapas, 4-day old tadpoles of *R. tigrina* stocked at 1.5 million/ha and regularly fed with silkworm pupae powder, in adition to their natural food, gave an average survival of 79.1% early frogs. The same experiment conducted in the pond yielded excellent growth of tadpoles recorded precocious metamorphosis due to feeding with silkworm pupae, perhaps due to the high quality protein and ecdysone present in it. It was, noted that early frogs raised from silkworm pupae fed tadpoles were always bigger in size than those obtained from zooplankton, tubifex or frog meat-fed tadpoles.

Problem No. 17.9 (a) : Mono-culiure of *Rana hexadactyla*

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

Duration : Continuing (From 1974)

The breeding of blue bottle and house fly was continued and excellent growth of their maggots was obtained in a medium containing raw cowdung, mustard oil cake, bone meal, single superphosphate and urea. Preliminary observations revealed their good acceptability by the early frogs of *R. tigrina*. Growth of frogs was also found to be good.

Mono-culture of *Rana hexadactyla* could not be taken up due to technical difficulties.

Problem 17.10 (a) : Studies on the digestive enzymes ot *Rana hexadactyla* from Bengal.

Personnel : A. K. Mondal and J. J. Ghosh (Prof. of University of Calcutta)

Duration : Three years (From October 1980)

The work could not be carried out due to technical difficulties.

Problem 17.11 (a) : Selective breeding and hybridization between frog species ot commercial importance,

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

Duration : Five years (From March, 1980)

Induced hybridization among *Rana tigrina*, *R. crassa* and *R. limnocharis* was successfully carried out and their hybrids were produced.

The hybrids resulting from crosses between *R. tigrina* ♀ and *R. crassa* ♂ showed good performance of growth over those resulting from the reciprocal crosses.

Crosses between *R. limnocharis* and *R. tigrina* did not meet with success. Cellular disorganisation, developmental anamoly and deformity of the resultant hatchlings were observed.

Problem 17.15 : Paddy cum-frog culture

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

Duration : Five years (From March, 1982)

The work could not be undertaken for lack of scientific staff and establishment of our own frog farm at Kalyani.

Project 18 : *Sewage fed fisheries*

Problem 18.1 : Fish culture in sewage-fed ponds

Sub-problem 18.1.10 : Etiology and control of common parasitic diseases in fishes reared in sewage fed ponds.

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

Duration : Five years

Mapping out the bacterial load to indicate the danger level for the outbreak of fish disease in sewage-fed ponds could be standardised. Bacteriological investigation in

the newly excavated experimental ponds at Patulia filled with sewage effluent and provided with or without artificial feed and in the freshwater nursery ponds manured with cow dung were continued.

The bacterial lead count ranged between 1×10^{-3} and 19×10^{-6} / ml in different sewage fed ponds. In freshwater nurseries the bacterial count was observed to be $0-2\times10^{-2}$ and $0-3\times10^{-2}$ / ml before and after the application of organic manure respectively.

Multiple-tube fermentation technique for members of the Coliform group of bacteria, prevalent in sewage water, has also been initiated.

Sub-problem 18.1.12 : Production of fishes in sewage-fed ponds by multiple stocking and harvesting.

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

Duration : Three years (From June, 1981)

A sewage treatment pond (0.17 ha) was treated with sewage effluent in the ratio of sewage 1 : water 2 and with lime @ 200 kg/ha. The pond was stocked on 16.7.81 with carp fingerlings @ 10,000/ha keeping the species ratio as silver carp 1 : catla 2 : rohu 3 : mrigal 2.5 : common carp 1.5. The gross production achieved was 4,658 kg/ha/7 months (i. e. 7,985.5 kg/ha/yr).

During March 1982, the pond was again treated with sewage effluents in the ratio of sewage 1 : water 1 and with lime @ 200 kg/ha. After stabilization the pond was stocked in April with carp fingerlings @ 18,000/ha and with species ratio of Sc 1 : C 2 : R 3 : M 2.5 : Cc 1.5. The management measures included application of sewage periodically and supplementary feeding with mustard oil cake @ 0.05% of biomass.

Under the programme of multiple stocking and harvesting, about 419.375 kg of fish was partially harvested till the 1st week of December, 1982. To maintain the stocking density and the species ratio constant, replenishment against the harvest was done.

The plankton percentage ranged between 45.08% (October and 99.60% (August) and 0.4% (August) and 55.88% (February) respectively for phyto and zooplankton. The density of plankton during the period under report varied between 131.00 u/l (October) – 2883.40 u/l (March), while the same showed a sudden peak in the month of August (5192.0 u/l). The gross and net primary productions and respiration in the sewage-fed pond (0.17 ha) ranged as 83.3 to 364.4 mgC/M^3/hr ; 41.6 to 250.0 mgC/M^3/hr and 41.6 to 270.8 mgC/M^3/hr respectively.

Physico-chemical parameters of the Titagarh Municipal sewage effluent during 1982 ranged as under :

	Pond water	*Sewage effluent*
D.O. (ppm) at 7.30 hrs	3.2-12.0	Nil
BOD (ppm)	10.0-17.0	350-600
Free CO_2 (ppm)	0-6.0	5-80
pH	7.8-8.4	7.4-7.9
Total alkalinity (ppm)	250-420	450-650
Chloride (ppm)	70-140	100-130
NH_4-N (ppm)	0.65-3.2	25.0-75.0
NO_3-N (ppm)	Traces-0.09	0.09-0.15
PO_4 as Phosphorus (ppm)	0.12-1.8	2.8-6.0

	Soil
pH	7.4-7.9
Organic carbon (%)	1,2-1.62
Available N (mg/100 g soil)	18.0-25.2
Available P (mg/100 g soil)	2.0-3.12
Alkaline earth carbonate (%)	2.0-3.0

Cage culture

A Cage (2.37×0.9×0.75 m^3 made of split bamboo was installed into the pond and *T. mossambica* (av. 85.6 mm/10.5 g) fingerlings were stocked on 2.9.82 @ 50 nos./m^2 in the sex ratio of 3 males : 1 female. No

supplementary feeding was done excepting regular treatment with sewage effluents. During December the fish attained 128.05 mm/41.25 g. No breeding in the cage was observed and the percentage survival was 71.96.

Length-weight relationship and condition factor

The length weight relationship Log W = Log a + b Log L and co-efficient of condition (k) of the cultivable species in sewage condition were found to be—

Species	*b*	*Log a*	*k*
Hypophthalmichthgs molitrix	2.44 to 3.37	-3.63 to -5.91	1.05 to 1.18
Catla catla	2.09 to 3.82	-2.58 to -6.90	1.27 to 1.46
Labeo rohita	2.75 to 3.28	-4.45 to -5.61	1.12 to 1.30
Cirrhinus mrigala	2.4 to 3.29	-3.46 to -5.74	1.01 to 1.34
Cyprinus carpio	2.98 to 3.53	-4.73 to -5.98	1.49 to 2.02

Estimation of population catch-haul relationship and catch-density relationship

To ascertain the standing crop and to estimate population number of a pond at any time 5-10% of the stocked fishes were fin elipped (left pelvic) irrespective of size.

No significant veriation was observed between marked and unmarked samples of all species. The estimated population for silver carp, *C, catla, L. rohita* and common carp were 183,754,1215 and 220 respectively.

For complete harvesting, the treatment of the pond with a heavy dose of sewage effluent was found to be essential and economical particularly for bottom dwelling species both in nursery pond (0.076 ha) and rearing pond (0.17 ha).

The % catch increases with the increase of density of silver carp, *C. catla, L. rohita* individually and in 5 species combination whereas reverse trend was observed in case of mrigal and common carp.

Catches (No./haul) under uniform effort at successive hauls did not decline in regular fashion indicating a marked variation in observed and expected catches of all cultivated species of carps tried in the experiment.

Sub-Problem 1 .1.13

Mixed culture of freshwater and brackishwater prawns along with *T. mossambica* and pond fertilized with sewage effluents.

Personnel : Apurba Ghosh, G. N. Chattopadhyay, A. K. Roy, N. M. Chakraborty and B. K. Saha.

Duration : Three years.

A pond (0.076 ha) treated with sewage effluents in the ratio of sewage : water (1 : 1) was allowed to stabilise after liming. The pond was stocked with *T. mossambica* (80.9 mm/8 g) in the sex ratio of 1 male : 4 female and @ 50,000/ha. The fish was found to breed from the second month onwards after its introduction in the pond. A production of 48.22 kg was obtained besides 300 small fry were transported to Allahabad Centre for bioassay experiments. Prawn seed could not be stocked due to scanty rain during the year. Plankton density varied between 1 and 3 ml/50 l (113.80 u/l to 309 u/l). Among phytoplanters *Microcysts* sp., *Chlorella* sp. and *Scenedesmus* sp. were the dominated group and among zooplankters *Diaptomus* sp., *Cyclops* sp., *Brachionus* sp., and nauplii of copepods dominated.

Sub-Problem 18.1.14 : Utilization of domestic waste water for algae and beneficial weed culture.

Personnel : K. R. Naskar, (Smt) K. K. Bhanot, P.K. Saha and B Ghosh

Duration : Three years

Five cemented cisterns (0.018 ha each) were treated with varying doses of cow dung (1250-20000 kg/ha)

and were inocculated with 1 kg of *Wolffia arrhiza* in each. From three cisterns treated with cow dung @ 20000, 10000, and 5000 kg/ha the production of weed was 130, 95 and 8 t/ha/yr respectively. In others the weed did not grow. The pH in these cisterns ranged between 7.2 and 8.5, total alkalinity from 80 to 320 ppm ; chloride from 40 to 70 ppm, available phosphorus 0.12 to 2.4 ppm and inorganic N from 0.1 to 8.0 ppm.

Studies on autecology of duck weeds were also made. Three glass jars were filled with 15 liter of water, enriched with water hyacinth compost @ 500 g/jar and innoculated separately with *Wolffia arrhiza*, *Lemna perpusilla* and *Spirodela polyrhisa* @ 10 g weeds/jar, after seven days were kept for 45 days to study various phases of development of the weeds. Likewise, a set of 3 conical flasks was filled with drain water and another set of 3 with tap water @ 1 liter of water/flask. In each set a flask was charged with each kind of these 3 weeds @ 2 g weeds/flask and kept for 30 days to study the growth pattern. The harvests of *Wolffia* sp,, *Lemna* sp., and *Spirodela* were 250, 192 and 170 g in 45 days from the jars, 12, 14 and 10 g in 30 days from the flasks with drain water and 4, 6 and 3 g in 30 days from the flasks with tap water respectively.

It was also observed that *W. arrhiza* preferred monospecific condition. It was found that the reproduction and growth mostly took place from the ventral budding pouches in 20-25 days to complete growth from the budding pouches to the adult matured fronds. At maturity the fronds gradually turned purplish to yellowish. Finally, decayed weed settled to the bottom of the water.

Unlike *Wolffia* sp., *Lemna perpusilla* preferred to grow on the water surface in single layer only. At full maturity or at the decaying phase the plant was found to float just below the surface with some parts of the fronds exposed to the air.

Problem No. 18.2 : Paddy-cum fish-culture.

Sub-problem 18.2.1 : Freshwater paddy-cum-fish culture.

Personnel : (Smt.) K. K. Bhanot, A. K. Roy P.K. Saha, G.P. Bhattacharya, one collaborator from Rice Research Station (Govt. of West Bengal), Chinsurah.

Duration : Two and a halt years

Five 0.1 ha paddy polts at Chinsurah Rice Research Station, was stocked with catla. rohu and mirgal fry (18-23 mm) @ 13,500 54,000 ; 9,450-37,800 ; 4,050-16,200/ha respectively. Water depth in these plots varied from 15-24 cm. By October, the plots dried up and mass mortality of fish occurred.

In another deep water paddy plot (0.25 ha), fry of rohu mrigal and *Puntius javanicus* were stocked @ 1,000 ; 1,000 and 800/ha respectively on 23.9.82 and 25.9.82. Supplementary feeding with rice bran and mustard oil cake (1 : 1) was done. The fishes were harvested on 10.12.82 and the retrieval at harvest was 66.8, 36.0 and 17.0% respectively. At the time of harvest rohu attained 157.7 mm/41 g, mrigal 137.5 mm/26 g and *P. javanicus* 155 mm/58.8 g.

Sub-problem 18.2.2 : Brackiswater paddy-cum-fish culture.

Persannel : G.N. Chattopadhyay, P.K. Chakrabarti, B.K. Saha, R.N. Dey, A.K. Bandopadhyay (collaborator from CSSRI) and C.R. Biswas (collaborator from CSSRI).

Duration : Three years.

Two monocropping paddy plots (0.015 ha each) with saline water drawn from river Matlah (salinity 12.5 to 40.0 m mhos/cm) at Canning were taken up for brackishwater paddy-cum-fish culture. The plots were stocked with *P. monodon* post-larvae (13.4 mm),

L. parsia fry (69.3 mm/3 1 g) @ 35,000 and 40,000/ha respectively during April to June and an average production of 654 kg/ha in 86 days were obtained from sequential brackishwater farming during summer fallow months. During monsoon and post-monsoon period, simultaneously culture of carps and freshwater prawn *M. rosenbergii* were taken up alongwith paddy cultivation. The salinity levels of the paddy plots were lowered through frequent run off and leaching due to rain water. Fry (2.7-16.6 g) of catla, rohu, mrigal, silver carp and *M. rosenbergii* juveniles (3.4 g) were stocked @ 1,400, 1,400, 2,800, 2 600 and 15,300/ha respectively and in 83 days culture an average production of 511.8 kg fish and prawn per hectare was obtained. Besides usual production of 3062 kg/ha of paddy, two aquaculture crops yielded an average 1165.8 kg/ha/169 days (fish & prawn). About 33% of the produce from aquaculture was *P. monodon* and *M. rosenbergii.* Application of insecticide and fungicide on paddy did not affect the fish and likewise brackishwater farming in summer months did not affect paddy cultivation during kharif season. For paddy cultivation urea was applied @ 40 kg/ha and no separate fertilization schedule was made for fish culture.

Physico-chemical parameters of water and soil of the paddy plots varied as under during the experimental phase.

Soil	
Salinity (ppt)	2.4-15.4
pH	7.2-8.2
Available nitrogen (mg/100g)	26.6-84.0
Available phosphorus („ „)	5.6-8.8
Organic carbon (%)	0.27-0.63
Water	
Salinity (ppt)	1.3-26.3
pH	7.4-8.4
Dissolved oxygen (ppm)	2.8-13.6
Total alkalinity (ppm)	40-400
Total inorganic nitrogen (ppm)	1.1-2.9
Total dissolved phosphorus (ppm)	0.2-0.6

Project 19 : *Hilsa fisheries.*

Problem 19.10 : Research and development of technology of commercial scale production of *Hilsa ilisha* seed.

Personnel : P. R. Sen, D. K. De, D. Nath and K. K. Bhanot.

Duration : Five years.

During February to April and June to October breeding of *Hilsa ilisha* was attempted by stripping. Brooders were procured from Farakka, Dhulian, Nimtita, Jangipur in the lower stretch of the Ganga river system ; Nawabganj, Kuntighat, Sandel char and Balagarh in the upper stretches of the Hooghly estuary and Kolaghat along the Rupnarayan estuary.

Out of 4 sets tried at Nimtita—Dhulian stretch ovulation and fertilization occured in two sets but fertilised eggs failed to develop beyond blastula stage. The percentage of fertilisation ranged between 20 and 30.

Problem 19.11 : Culture of *Hilsa ilisha* of the Hooghly estuary in freshwater ponds.

Personnel : K. K. Bhanot, D. K. De and V. Pathak.

Duration : Four years.

A pond of 0.1 ha situated at the CIFRI campus was stocked with 400 hilsa fry (18-35 mm) during the period February to May. The fry were collected from Hooghly estuary in Monirampore area with the help at nylon drag net. The pond where the culture practice is in progress was already having a stock of hilsa (300 to 350 mm) introduced during 1980 to 1982. At the end of 1982 the second stock has attained a growth of 120 to 180 mm/150 to 180 g. Studies on the gut content revealed *Melosira* to be the principal food item of the pond grown hilsa followed by *Keratalla, Brachionus* ; *Eudorina* and *Englena.*

Problem 19.12 : Impact of Farrakka barrage on the spawning of *Hilsa ilisha* in the middle Stretch of river Ganga.

Personnel : R. Chandra, R. K. Saxena, M. A. Khan, B. D. Saroj and R. Tiwari.

Duration : Three years (From 1982)

The project was initiated in September, 1982. Fortnightly observations were made at Kaduka (river Yamuna) and Sirsa and Manda (river Ganga) by operating 1/16″ mesh size "Midnapore type" standard shooting nets as well as 1/2 metre diameter and 1½ meter long tow nets. September collections did not show any hilsa hatchlings while October collections from the river Ganga and November collections from the river Yamuna demonstrated the presence of hilsa hatchlings. In the Ganga the number ranged between 2-32 but in Yamuna only 1 hatchling was found in the collections. Young ones of hilsa were also observed in the commercial drag net catch at Madhauka.

580 72 kg of hilsa was landed at the three landing centres located in the vicinity of Allahabad.

Presence of hilsa hatchlings in the catches is indicative of slow revival of the fishery.

Problem 19.13 I : Standerdisation of transport techniques of fry and fingerlings of hilsa and other cultivable species.

II : Use of different fish toxicants in fish culture operation.

Personnel : D. K. De, P. R. Sen and D. Nath.

Duration : Two years four months.

I Fibre glass open containers, without any provision for aeration, were found to be better for transporting hilsa fry compared to closed oxygen packed plastic bags. When hilsa fry transported in open containers with a density of 800 fry/200 l of water the survival percentage obtained was 60 to 75 involving 6 hours transporting time.

II Toxicity of eight different plant materials was evaluated using different test fishes The results obtained from laboratory and yard trials revealed the tea seed cake and latex from the stem of Akanda and Rangchita to be effective as fish toxicant. Tea seed cake at a doze of 50 to 100 ppm was found sufficient in killing predatory fishes like *Channa punctatus*, *Anabas testudineus* and *Heteropneustes fossilis*. *Tilapia mossambica*, fingerlings of major carps and common carps were also found to be susceptable. The toxicity of tea seed cake persisted for 10 to 12 days.

Project 20 : *Water Pollution Investigations*

Problem 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 : Eight years (From January, 1976).

Bio-assay :

Carbaryl (Sevin). 1-Napthol and Y BHC were screend for their toxicity using selected fish and fish food organisms as test animals. LC50 values of carbryl and its metabolite 1 Napthol, for 24, 48, 72 and 96 hours, using *Cyprinus carpio* fry and fingerlings as test animals were toxic than its parent compound, Carbaryl and the fry of the test fish was found to be more succeptable than the fingerlings. Sevin, when applied at a dose of 15 mg/l, was found to be lethal to *Tilapia mossambica* fingerlings bringing about 100% mortality in 96 hours.

LC50 values of 1-Naphthol and Carbaryl with chironomid larvae were calculated at 0.9 mg/l and 2.1 mg/l in tap water and 0.74 mg/l and 1.95 mg/l in lake water (Mcpherson) at 19 to 21°C water temperature for 24 hrs exposure period whereas with Sevin (W.P.) it was found to be 17 mg/l at 30±1°C temperature in tap water. LC50 of 1-Naphthol and Carbaryl with *Daphnia carinata* was found to be 0.88 mg/l and 1.84 mg/l respectively at 20±1°C temperature in tap water.

Safe concentration level :

The safe concentration levels of Carbaryl and 1-Naphthol with respect to fry of *Cyprinus carpio* were calculated at 6.55×10^{-2} mg/l and 2.13×10^{-2} mg/l respectively and with fingerlings 9.48×10^{-2} mg/l and 3.16×10^{-2} mg/l respectively.

Histopathology :

Sub-lethal concentration (1 mg/l) of Carbaryl increased glycogen content in liver of treated fish while in muscles it decreased.

Effect Y-BHC (0.1 mg/l) and Carbaryl (1 mg/l) on different organs of *Mystus vitattus* e.g liver, kidney, intestine etc under 60 days exposure were observed. Vacuolation of hepatic cells and destruction of haemopoitic cells were the main lessions in treated fish. Liver was more severely damaged than kidney whereas in major carps (earlier experiments), kidney was found to be more affected.

Problem 20.9 : The impact of pesticides on respiratory metabolism and energy utilization in aquatic animals.

Personnel : M. Peer Mahamed, M. A. Khan, S.N. Mehrotra, R.A. Gupta, R.N. Seth and P.K. Mukhapadhyay.

Duration : Six years (From January, 1977)

Experiments were conducted to study the short-term and long-term effects of sublethal DDT on *Ceriodophina* sp. The LC50 value for 3 hr duration was estimated as 0.0021 ppm. Two concentrations—0 0002 m and 0.0004 ppm DDT, tried for 25 days, and three concentrations—0.0006, 0.0008 and 0.001 ppm lasting for 15 days indicated a decrease of 27 and 50% in population in the first set while in the second set, a decrease of 27, 83 and 95% respectively was observed when compared to control. The temperature of the medium ranged between 17 and 25°C.

Ceriodaphnia sp., when exposed to zinc at 20°C, showed 100% mortality in 15 ppm and 30 to 50% mortality in 9 to 12 ppm within 8 hours. In lower concentrations (1.0-3 0 ppm) reproduction took place and the animals propagated profusely.

Effects of metals (mercury and zinc) on chironomid larvae at 5, 10, 20 and 30 ppm zinc and 0.01 to 3.0 ppm mercury (water temperature $30° \pm 1°C$) revealed 30 ppm zinc and 3 ppm mercury to be lethal and 50% mortality occurred within 12 hours. The results indicated that mercury was 10 times toxic than zinc to chironomid larvae.

When the gastropod, *Viviparus bengalensis* (av. wt. 2.5 g) were exposed to 0.1 and 0.5 ppm mercury, the percentage of mortality was 10 and 60 respectively during 25 hours. At 1.0 and 1.2 ppm 100% mortality occured within 72 and 48 hours respectively. The calculated LC50 values for *V. bengalensis* were 0.385, 0.295, 0.261, and 0.225 ppm of mercury for 24, 48, 72 96 hours respectively.

With sublethal conentration of murcery (0.02 ppm) an upward shift in the metabolic rate was observed in *C. carpio*. The routine metabolic rate of *Tilapia mossambica* was observed to be 65 mg/kg/hr at 30°C and 73 mg/kg/hr at 35°C.

Problem 20.10 : Pollutional effect of industrial wastes on aquatic ecosystem.

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

Duration : Five years 6 months (From May, 1977).

The Waste released into Rihand reservioir by Kanoria Chemicals Ltd., manufacturing caustic soda, bleaching powder and gammexane, were observed to be acidic to alkaline (pH : 5.8 to 8 8) in nature. Free chlorine ranged from 86.2 mg/l to 2269.4 mg/l, followed by high concentation of chloride (1500 to 3000 mg/l). Specific conductance ranged as 3340 to 11780 micro-mhos/cm and sodium 700 to 1650 mg/l while the samples at the

outfall (Stan.1) showed pH, free chlorine, chlorides, specific conductance and sodium ranging from 6.5 to 7.8, 46.09 to 125.8 mg/l, 200 to 1000 mg/l, 240 to 2750 micro-mhos/cm and 180 to 502 mg/l respectively. Transparency ranged between 11.5 and 15 cm. Free chlorine was estimated at 3.6 to 7.09 mg/l at Station No. 2 (20 m from the outfall) during pre-monsoon period and 12.4 to 21.27 mg/l during post-monsoon period whereas it was not found in monsoon months. At Station NO_3 (50 m) free chlorine was estimated at 2.02 mg/l during pre-monsoon whereas during post-monsoon it was found in the range of 4.2 to 8.86 mg/l.

pH of the soil at the outfall ranged from 7.0 to 8.0 and chloride content between 55 and 72.4 mg/100 g soil. The carbon content ranged between 0.08 and 0.092%.

The toxicity of combined effluent was reflected by total absence of the planktonic and benthic communities upto Station No. 2 during pre-monsoon period. Phytoplanktonic population was found to be nil at Station No. 1 and zoo-plankton population was present at Station 2 and 3 during monsoon period and during postmonsoon. Station No. 2 (outfall) was marked by the presence of both zoo and phytoplankton which indicated a much reduced effect without any fish mortality. A total of 1386, 3208 and 344 u/l of plankton were recorded during premonsoon, monsoon and postmonsoon months respectively. Zooplankton dominated during the entire period being 76.3%, 86% and 58% respectively. The most dominating species emong zooplankton was rotifer *(Brachionus, Keratella, Lecane* and *Polyarthra)* while phytoplankton was dominated by *Microcystis.*

Laboratory experiments conducted with 0 12% combined effluent showed 100% mortality of *Daphnia* sp. and chironomid larvae. LC50 value of the combined effluent with respect to *C. carpio* was calculated at 0.072 at $30\pm1°C$ for 96 hr.

Problem 20.15 : Studies on the pollution in Buckingham canal and its effect on the confluent estuarine system.

Personnel : K.O. Joseph, K. Raman, S. Radhakrishnan, S. Srinivasagam, K. Gopinathan and P.M. Abdul Kader.

Duration ; Six years

Hydrobiological observations were made at eight stations of the Buckingham canal and three stations along the Cooum river. Studies were also taken up at the dfferent channels of the Petro-Chemical Complex at Manali.

Three centres each along the Buckingham canal and Cooum river were selected for studying the bacterial load. In the former the total colonies/ml and MPN5 of coliform bacteria/100 ml, ranged between $3+10^2$ and 11×10^5 & 49 and 1609 respectively and in the latter ecosystem they were 50×10^2 & 11×10^5 and 110 and 1609 respectively.

Studies on heavy metal concentration in water revealed that Zn had a range of 1.1 to 2.9μg/ml with maximum value at Manali (outfall area of Madras Refinaries Ltd.). Distribution of Cr also showed maximum value (0.72 μg/ml) at Manali, while Cu and Hg were more concentrated in the Cooum river and Ennore estuary respectively.

Fishes having a long food chain such as *Mystus gulio* and *Tachysurus* sp., collected from the Ennore Estuary, had heavy accumulation of Zn, Pb, Cr/Hg and Cu as compared to those from Pulicat lake.

Problem 20.16 : Impact of fertilizer factory wastes from IFFCO Complpx (Phulpur), Allahabad on hydrobiology of river Ganga.

Personnel : K. Chandra, M. Peer Mohamed, B. Singh, G. N. Srivastava and R. N. Seth.

Duration : Four years and 9 months (From March, 1976).

Investigations revealed that the composite effluents released @ 5,500 cubic meter/day into river Ganga by IFFCO Complex, Allahabad, manufacturing urea and ammonium sulphate, was characterised by high free amonia 6.5 to 75.40 mg/l, whereas temperature, pH, chloride, alkalinity, specific conductance, hardness, and oil ranged between 26 and 39.0°C, 8.2 and 8.4, 123.0 and 153.0 mg/l, 130 and 460 mg/l, 918.68 and 1924 micromhos/cm, 90 and 120 mg/l and traces respectively.

Plankton biomass ranged between 2400 u/l (outfall) to 6316 u/l (500 m from the outfall). Zooplankton (59.7%) dominated over phytoplankton (40.3%). Amongst phytoplankton Chlorophyceae, Bacillariophyceae and Myxophyceae dominated while amongst zooplankton rotifers were the most dominant. Studies made during 1982 revealed that the bottom biota was gradually reappearing. Bioassay experiments with IFECO effluent were conducted with gastropods *(V. bengalensis)* and chironomid larvae as test animals, showed 100% mortality after 28 and 72 hr exposure respectively. Laboratory experiments conducted with 14% combined effluent showed 100% mortality of fingerlings of *L. rohita* in 24 hrs exposure.

The general effects of wastes discharged into the river Ganga was noticed upto 500 m. Significant improvement in the effluent of IFFCO Complex were observed during the year where ammonia content were found to decrease gradually and nitrate nitrogen was also estimated to be nil. Fish mortality were also found to be negligible in the year 1982 as compared to heavy fish mortality recorded in preceding years.

Problem 20.17 : Impact of thermal wastes on the ecology of Rihand reservoir.

Personnel : K. Chandra, R. S. Panwar, M. Peer Mohamed, D. N. Singh and R. A. Gupta.

Duration : Three years 8 months (From April 1981)

Characterization of the thermal wastes were done. The wastes of Renusagar Power Co. and one unit of National Thermal Power Corporation, Kota, producing electricity showed a temperature of 46 to 52°C and 3? to 38°C respectively, whereas pH, specific conductance, alkalinity' chlorides and hardness of Renusagar Power Company ranged from 6.2 to 6 30, 316 to 460 micromhos/cm, 21 to 26 mg/l, 66.30 to 69.40 mg/l, and 48 to 52 mg/l, respectively as against 7.60 to 7.65, 90.6 to 99.0 micromhos/cm. 21 to 30 mg/l, 45.40 to 56.50 mg/l, 42 to 48 mg/l, respectively showed by NTPC (Kota) wastes.

The plankton ranged as 626 u/l and 436 u/l at the outfall from Renusagar Power Co. during pre-and post-monsoon periods. Amongst zooplankton Rotifera (*Ceratella, Brachionus, Asplanchna*), Copepods (*Cyclops, Diaptomus*) were the main groups. Amongst phytoplankton *Oscillatoria, Anabaena* and *Microcystis* were recorded. Phytoplankton (62 8%) dominated over zooplankton (37.2%) at this centre. NTPC, Kota Centre showed very poor plankton population during premonsoon (78 u/l) but rich during monsoon (388 u/l) at the outfall. Significant improvement in the quantity of the plankton after 1000 m from the outfall was observed as compared to outfall region. Benthic population was absent at all the centres. At Renusagar Power Co. heavy ash deposits were noticed upto 500 m from the outfall which was devoid of any bottom fauna.

Experiment was conducted to find out upper temperature tolerance limit with fishes, *Cirrhinus mrigala* and *Cyprinus carpio*. It was found that *C. mrigala* (av. wt. 5.2 g) can tolerate upto 37.6°C and *C. carpio* (av. wt. 1.1 g) upto 37.2°C.

The impact of thermal wastes were noticed upto 500 m from the outfall region which devoid of any bottom fauna. No fish mortality was recorded at both the centres.

Problem 20.18 : Screening of Hooghly estuarine fishes and prawns to heavy metals and their

impact on the eco-physiological conditions.

Personnel : B. B. Ghosh, M. M. Bagchi, M. K. Mukhopadhya

Duration : Five years (From January, 1982)

Fishes (Juvenile & mature) and prawns collected from Hooghly estuary indicated bioaccumulation of Zn (Tr-295.1 ppm) in *Pama pama, H. ilisha, R. corsula, M. gulio, P. paradisous, Rita rita,* and *Macrobrachium* sp., Cr (35.3-70.5 ppm) in *Rita rita* and Cu (Tr-148.5 ppm) in *P. pama, R. corsula* and *Macrobrachium* sp. Among the fishes studied *R. rita* showed maximum Zn (295.1 ppm) and Cr 70.6 while *P. pama* showed maximum Cu (148.5 ppm) accumulation. Accumulation of Zn was noted in flesh, kidney and liver of both juvenile and mature fishes and also in the gonod (113.4 ppm) of mature ones indicating higher trend of accumulation in the kideny while liver and kidney were found to be the chief site for Cr and Cu accumulation respectively.

Metal accumulation (Zn, Cu, Cr) was more in the fishes collected from zone II (between Nawabgunj and Batanagar) compared to zone I (upper stretch adjoining Nabadwip) and zone III (between Nurpur and Kakdwip).

Zn (9.6 ppm) was present in bottom sediments but neither Zn nor Cu or Cr could be detected in the water samples.

Zn was present in the effluents of sulphite and paper mill. Decreasing trend in hardness was observed in upper stretch of the estuary. Plankton population was lowest in zone II. Benthos were very poorly represented in the marginal stretches.

Necrosis in hepatic tissue containing both Zn and Cr and damage to nephrons in the kidney associated with high Zn contamination in *Rita rita* and enlargement of liver due to Zn accumulation under natural estuarine condition were recorded. Bioassay experiment conducted with Zn as zine sulphate and Cr (as potassium chromate) on *M. gulio* indicated pronounced Zn toxicity at 29-31°C with marked reduction in RBC, Hb and PCV level in the fish blood and decline in the opercular movement during 96 hrs exposure. Zn toxicity to *Cyclops* was about 40 and 10 times more compared to *M. gulio* and *Tubifex* respectively, while the toxicity to tubifex is about 4 times more compared to *M. gulio, P. Pangasins, M. gulio* under the same estuarine condition showed marked variation in RBC level. Long-term exposure to see the level of Zn accumulation and its histopathological and haematological effects on *M. gulio* have been initiated and the experiment is in progress

Problem 20.19 : Abiotic and biotic character of Calcutta corporation's effluent and its pollutional effect on the fisheries of Kulty estuary and adjoining impoundments.

Personnel : R. K. Bannerjee, R. N. Pal, A. C. Nandy, A. C. Karmakar, N. N. Majumder and S. K. Chatterjee

Duration : Five years (From January, 1982)

A flow sheet of the sewage system of Calcutta has been procured and postal zone-wise demarcation is being made. A thorough survey of factories in postal zones 3, 4, 5 is underway.

Problem 20.20 : Studies on acute and chronic toxicity of pesticides (DDT and BHC) to the fish *Tilapia mossambica*

Personnel : H. C. Joshi, P. K. Mukhopadhyay, M. K. Mukhopadhyay and B. Venkatesh

Duration : Two years (From 1982)

LC 50 (168 hours) values of BHC to *T. mossambica* was found to be 7.5 ppm. Under static conditions behaviuoral changes particularly loss of balance were more pronounced in concentrations above 6.5 ppm. Histopathological studies revealed that liver was badly

affected with vacuolation and degeneration of parenchymal cells when exposed to 8.7 ppm. Haematological parameters e. g. RBC, Hb and PVC% did not show appreciable change upto 7.5 ppm but at 8.7 ppm the values declined sharply. At the end of three months exposure the condition factor for the fish was found to be 0.5475 and 0.5483 at 0.075 and 0.15 ppm exposure of BHC as against 0.6144 for control. Maturity indices of male and female fishes were found to be lower than control. The growth of the fish was observed to be lowest at 0.15 ppm exposure, so also the blood parameters. Bioaccumulation of BHC was highest in liver in both the concentrations. The concentration factor was found to be 200.4 and 144.5 for 0.075 and 0.15 ppm respectively.

Problem 20.21 : Detection and measurement of pesticide residues in aquatic environment.

Personnel : H. C. Joshi, B. B. Ghosh and M. K. Mukhopadhyay

Duration : Three years (From February, 1982)

Residues of DDT and BHC were detected in the soil sediment samples collected between Farakka and Namkhana. About 80% of the samples collected between Tribeni and Gardenreach demonstrated the presence of pesticide residues. No pesticide could be detected from water samples. Suspended particles collected as sediments from the adjacent brickfields near Barrackpore indicated the presence of DDT and of BHC upto 87 and 112 ppb. Fish, prawn, molluscs etc. collected from different places also indicated residues of the pesticides (DDT, BHC, Dieldrins. malathion etc.) in the muscle. Residues were also detected in the soil and water samples of most of the fish ponds in the Sundarbans region.

Project 21 : *Fisheries of river basins*

Problem 21.1 : Ecology and development of Mans in Gandak basin.

Personnel : V. R. Chitranshi, M. L. Bhowmick S.P. Rai.

Duration : Four years (From October, 1978)

Brahmaputra man : The water temperature, pH, total alkalinity, DO and primary production ranged as 20°—33°C, 7.1—8.8, 230—250 ppm, 3.96—7.6 ppm and 100—170 mg C/m^3/hr respectively. The specific conductivity (in micro mhos) for the bottom ranged as 800—1013 and 900—1083 with higher values in summer. The bottom soil of the man was observed to be loamy with high organic carbon (3.5—3.94%) and very poor available phosphorus.

The man was found to be rich in plankton. The plankton density ranged as 1200 (July) to 178,000 (March) units/l. The plankton biomass indicated bimodal peaks, one dominated by *Ceratium* (March) and the other by *Microcystis* (August).

The fisheries of the man is constituted by Indian major carps contributing 12%, air-breathing fishes 24.0% and miscellaneous species 62%. Amongst major carps *Labeo rohita* contributed the highest (11.31%). Amongst other fishes, *Heteropneustes fossilis* (7.7%) and *Puntius* spp (19.72%) were the prime contributors.

Manika man :

The water temperature at surface and bottom ranged between 15 and 33°C and 18 & 30°C respectively. Total alkalinity, pH, DO and primary productivity ranged as 80-130 ppm, 7.3-9.4, 6.0-12.0 ppm and 16-125 mg C/m^3/hr respectively. Specific conductivity ranged from 370-584 m/cm. The bottom soil was found to be clay with poor organic carbon (0.35%) and almost without any available phosphorus.

The plankton volume fluctuated erratically. Two peaks have been observed during February (2400 u/l) and July (4600 u/l).

The fishery of the man is constituted by major carps (5.32%), air breathing fishes (36.2%) and miscellaneous species (58.68%). Prawns formed a major fishery contributing 19.4%.

Problem 21.2 : Studies on oxidation-reduction (redox) potential with reference to distribution ot nutrients and bottom fauna of Mans in Gandak Basin.

Personnel : S. P. Rai, M.L. Bhowmik and V.R. Chitranshi.

Duration : Four years (From 1982).

The redox potential of bottom mud of the deepest zone (3.5-5.25 m) of Manika, Kanti and Bhrahmaputra Man were– 145 mv,—78 mv and—306 mv respectively with corresponding values of organic carbon (0.39%, 2.1% and 3.94%). Eh varies with the depth of the Man showing reducing condition in deeper zone. Beyond the active layer (3-5 cm) the value of the redox potential was observed to be constant. Eh values for Kanti, Brahmapura and Manika Man were+28 mv, +109 mv and + 72 mv with corresponding values of D.O.—6.0 ppm, 5.5 ppm and 9.5 ppm and dissolved organic carbon 0.21, 0.24 and 0.20 ppm in December. Both nitrogen and phosphorus were in traces in water phase. Chlorophyl concentration was very low (0.01 g/litre) in Kanti and Manika Man with little more (0.015 g/littre) in Brahmaputra Man. Kanti Man bottom soil was found to be moderately rich in macro-benthos (119 to 422 organism /m^2 upto 3 metre depth). Immediately after the installation of pen, bottom fauna inside the pen showed a decline which however, picked up during early October.

The Manika Man is dominated by submerged aquatic weeds. The average density of *Hydrilla* sp and *Najas* sp, were found to be 2.89 (Nov) to 4.42 (Dec) Kg/m^2 and 0.90 to 4.13 (Oct) Kg/m^2 respectively.

Problem 21.3 : Pen Culture in Mans.

Personnel : M.L. Bhowmik, S.P. Rai and V.R. Chitranshi.

Duration : Three years (From February, 1982).

During September a Pen (100 m^2 water area) made of bamboo chick was installed in Kanti Man. The average depth of water in the pen was 1.5 m. The pen was stocked with *Catla catla*, *Labeo rohita* and *Cirrhinns mrigala* @ 16 fingerlings/m^2 and in the ratio of 2.5 : 6.5 : 1, The fishes were fed with a mixture of mustard oil cake and rice bran (1 : 1) at 10% of body weight. *Saprolegnia* infection in rohu and mrigal affected the production. From their initial average weights of 94.3 mm/8.5 g, 123.0 mm/20.0 g and 86.5 mm/8.0 g rohu, catla and mrigal attained average size of 127.2 mm/26 g ; 144.6 mm/40 g ; and 120.0 mm/14.5 g respectively in 92, 49 and 49 days of culture.

Project 23 : *Bundh Breeding.*

Problem 23.1(a) : Breeding of major carps through canal breeding technique.

Personnel : G.N. Mukherji, R. Chandra, R.N. Srivastava and K. Chandra.

Duration : Five years and 6 months (From May, 1977)

Canal breeding experiments were repeated with success at Beniganj in the district Chhatarpur of Madhya Pradesh. The investigations were conducted in the existing 'breeding chamber' in which water was drawn from the adjacent canal. In all 69 major carp (*L. rohita* and *C. mrigala*) brooders were tried in instalments in July, 1982 when cloudy and favourable weather was recorded.

Breeding did not occur so long drought conditions prevailed during the first three weeks of July. Breeding was first noticed in the evening of 28ih July, which was a rainy day and when the air and water temperature were 26°C. About 3 lakhs eggs were collected (fertilization 90%). During the experiments, liming @ 250 kg/hactare resulted in abrupt rise in pH, alkalinity, chloride and specific conductance values from 7.10-7.30 ; 102-114 mg/l, 15-19 mg/l and 95 to 150 micromhos/cm respectively, which, when coupled with lowering of water temperature to 26°C and transparency from 12.50 to 7.50 cm, appeared to have favoured successful spawning in the major carps.

Project 24 : *Freshwater Aquaculture in Urban Areas.*

Project 24.1 : Intensive rearing of fin and shell fish in recirculatory filtering system.

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

Duration : Four years (From December, 1978).

Mixed rearing of advanced fingerlings of silver carp, rohu and common carp for 32 days in RFS pond at a stocking density of 15000 fingerlings has given encouraging results. The fish was fed @ 3-5% of body weight on a formulated semi-dried agglomerates containing 30% rice bran, 30% mustard-oil cake, 30% soyabean powder and 10% wheat flour as a binder, fortified with commercial poultry vitamin-mineral pre-mix Nuvimin at the rate of 5 gm/kg feed. In 32 days rearing silver carp attained an average weight of 638 g from initial 346 g, rohu 340 g from initial 245 g and common carp 245 g from initial 111 g. The pond was circulated for two hours daily and survival percentage was 100.

The hydrological conditions of the recirculatory pond were : water temperature 20.2-34.5°C ; pH 7.2-8.3 ; dissolved oxygen 4.0-12.8 ppm, total alkalinity 120-218 ppm, free carbon dioxide 1.8-14.0 ppm, phosphates 0.04-0.2 ppm ; nitrogen 0.05-1.9 ppm ; silicates 1.5-7.0 ppm; chlorides 23,0-34.0 ppm, BOD 5.2-9.0 ppm, and specific conductivity 480-860 micro mhos.

Problem 24.4 : Induced breeding of Indian and exotic fishes in RFS ponds.

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

Duration : Two years 6 months (From June, 1980).

With administration of pituitary extract and 4 hours of circulation of water after final injection (@ 9 mg/kg) 75% females of silver carp responded to ovulation and dry stripping. The percentage of fertilization ranged as 60-80. Due to extremely high water temperature at the time of hatching (34.0-35.5°C) mass mortality of egg/hatchlings occurred. This was eventually the first attempt of breeding silver carp in RFS ponds,

Problem 25.2 : Ecology and fisheries of beel.

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

Duration : Four years (From April, 1980).

Hydrobiological studies :

The basin soil of Kulia beel was near neutral and rich both in phosphorus and nitrogen. Water was alkaline with pH range 7.6-8.7. Gross primary production was 10.49 $gC/m^3/day$. Biological productivity was higher compared to last year when macrophytes were removed. Average annual plankton count for phyto and zooplankton were 13270/l and 421/l respectively.

A pen (0.01 ha) made of bamboo matting was fixed in the beel and stocked @ 5,000/ha with catla 15 : rohu 15 : mrigal 10 : silver carp 10. Due to draught condition the experiment had to be abandoned.

A three fold increase in fish production was achieved (1,070 kg/ha/yr) compared to 1981 with almost similar stocking rate. This may be attributed to the removal of macrophytes which resulted in higher production of plankton.

Problem 25.2 (a) : Hydrobiological studies of a freshwater beel,

Personnel : Kuldip Kumar and V. Pathak

Duration : Two years (From January. 1982)

Hydrobiological observations of Kalyani *beel*, situated adjacent to the West Bengal Fisheries Research Station, Kalyani were initiated during February, 1982. The beel is perennial with a water spread of 10 hectares and average depth of 0.7-2.1 m.

The water of the beel was slightly acidic and nitrogen, phosphorus and organic carbon were quite high. Dissolved oxygen values showed sharp fluctuations during the day and were as low as 1.0 ppm during morning hours. The average values of total alkalinity, nitrate and phosphate were 65.0, 0.15 and 0.08 ppm respectively.

Phytoplankton was Principally represented by Myxophyceae, Chlorophyceae, Dinphyceae and Bacillariophyceae Rotiferas, Copepoda, Cladocera and Protozoa constituted the zooplankton. The maximum and minimum of plankton were 684 and 64 u/l during June and November respectively. *Microcystis* was the most dominant phytoplankton while *Keratella* dominated amongst zooplankton. The major hydrophytes in the beel were the species of *Eichhornea*, *Hydrilla*, *Certaphyllum*, *Lemna minor*, *Spirodela* and *Wolffia*. The dry weight biomass of the hydrophytes ranged between 1.2 and 3.8 kg/m^2. The fauna inhabiting these vegetation consisted of molluses, oligochaetes and insects with respective percentage of 72.3, 4.3 and 23.4. The beel is rich in periphyton the maximum abundance of which was observed during October-November (230 u/slide) and minimum during July (13 u/slide). The seasonal abundance of periphyton showed one major peak during September to November. The benthic fauna fluctuated between 213-552/m^2 with peaks during August and February. Gastropods (89%) was observed to be the principal contributor amongst benthos.

The analysis of the gut contents of the major beel fishes indicated that detritus formed 38.0-78.3% of the food of these fishes followed by algae and plankton.

Problem 25.3 : Ecology and fishery of Dhir beel in Assam.

Personnel : Y. S. Yadava, M. Choudhury and V. Kolekar.

Duration : Three years (From September, 1981)

Catch statistics

During 1982 a total of 110.6 *t* of fish was caught from Dhir beel. *Gudusia chapra* (28.93% dominated the catch followed by major carps (25.67%), miscellaneous fishes (22%) and catfishes (11.38%).

Species wise landing :

Species	*Wt. (kg)*	*Species*	*Wt. (kg)*
L. rohita	20,714	*E. vacha*	893
L. gonius	326	*H. ilisha*	716
L. calbasu	527	*G. chapra*	31,972
L. bata	276	*N. notopterus*	1,108
C. catla	5,011	*N. chitala*	2,935
C. mrigala	2,117	Miscellaneous	24,325
C. reba	530	Live fishes	7,396
W. attu	10,311		
M. seenghala	1,079		
M. aor	294		
R. rita	006		

Plankton :

The average monthly plankton at the surface was of the order of 1030 u/l of which 499 u/l was phytoplankton. At the bottom the average monthly occurrence was 8526 u/l of which 6842 u/l was phytoplankton. Amongst the surface phytoplankters Chlorophyceae was the most dominant form while at the bottom Bacillariophyceae dominated. Amongst zooplankters protozoans were the most dominant group.

Macrobenthos :

The average occurrence of bottom organisms was 870/m^2, Gastropods dominated (384/m^2) the benthos followed by Pelecypoda (155/m^2), Oligochaeta (155/m^2) and Diptera (150/m^2).

The hydrophytic bio-mass in the beel ranged from 0.735 to 1.315 kg/m^2.

Physico-chemical characteristics of water :

Parameters	Range
Water temperature (°C)	20.0-31.5
Transparency (cm)	48.0-106.0
pH	6.6-7.2
DO (ppm) Surface	7.1-10.0
bottom	10.0-11.0
CO_2 (ppm)	6.0-7.3
Dissolved organic matter (ppm)	7.4-12.9
Electrical Conductivity (u mhos/cm)	34.9-73.1
Primary productivity Gross	55.56-340.30
(mgC/m³/hr) Net	Nil-253.47
Respiration (mgC/m³/hr)	16.66-124.99

Pen Culture :

An experiment on pen culture has been initiated during November 1982. Two pens of 0.15 ha each have been installed in Sector III and stocked with fingerlings of Indian major carps. The experiment is in progress.

Inventory of fishermen population, crafts and gears :

A survey was taken up during April-May, in three villages *viz.*, Mowatary, Santipur and Satyapur. The fishermen in these villages have formed the Dhir beel Fishermen Cooperative Society. Active fishermen population in these villages were 50, 43 and 118 respectively. Locally made country boats were found to be the only carft employed in fishing. Net fishing was found to be restricted to gill- and cast nets. The principal gears operated in the beel were "Katals", ' Khora jal" (Dip nets) and hooks and lines.

Project 26 : *Energy flow in aquatic ecosystems*

Problem 26.1 : Studies on the energy flow in different aquaculture ecosystems.

Personnel : A.V. Natarajan and V. Pathak

Duration : Three years (From January, 1980)

Studies were conducted in two ponds (receiving organic fertilization) and one beel. The ponds received radiant energy of 196×10^4 cal/m²/day but its rate of transformation ranged between 28,680 and 53,400 cal/m²/day in one pond and in the second the range was 44,604 -76,308 cal/m²/day. The beel received 171 to 238×10^4 cal/m²/day of radiant energy and its transformation was 38,050 to 1,94,460 cal/m²/day.

The chlorophyll in the two ponds ranged from 32 to 96 mg/m² equal to 1600 to 4800 mg C/m² of phytoplankton carbon or 18 240 to 54,720 cal/m² of phytoplankton energy. While the chlorophyll concentration in the beel was high ranging from 34.0 to 216.2 mg/m² equal to 1,700 to 10,810 mg/m² of phytoplankton carbon or 19,380 to 1,23,234 cal/m² of phytoplankton energy.

The total biomass of macrophytes in the beel ranged from 20.08 to 37.47×10^5 cal/m² in 1981. The bottom organic deposites amounted to 335 to 432.5 g /m² equivalent to 334 to 435 k cal/m² or 40.44×10^5 k cal/ha of detritus energy. The transformation of energy from light to fish in the beel ecosystem was 0.015% and the flow was mainly through detritus chain.

Problem 26.2 : Transformation of energy by fishes in recirculatory filtering system.

Personnel : A. V. Natarajan, V. Pathak and K. L. Sehgal

Duration : Three years (From January, 1981)

Energy values of the different ingredients of the feed given to fishes (calories 18) in the recirculatory system were : starch 1944, fish meal 613, rice bran 1781, mustard oil cake 1817, soyabean 1900 and combined feed 1596 cal/g respectively. Studies on the various combination of the above ingredients and the efficiency of transformation of food energy (C) to fish energy (P) are in progress.

Project 27 : *Radio—tracer technique in aquaculture*

Problem 27.1 : Estimation of primary productivity of freshwater reservoirs, ponds and swamps using C-14 technique.

Personnel : Babu Lal

Duration : Two years & six months (From May, 1979)

Net organic production rate using C-14 technique was observed to be 85.55 to 102.25; 100.00 to 111.65; 77.75 to 148 85; 88.28 to 159.25; 155.65 to 168.25 and 145.25 to 160.75 mg C/m^3/hr in six different fish ponds in Hooghly District, West Bengal.

A newly constructed pond (May, 1981) at Rishra demonostrated comparatively higher rate of primary production (159.00 to 175.25 mg C/m^3/hr).

A comparative study of chlorophyll pigments showed positive correlation with the rate of primary production almost in all the fish ponds. Average concentration of chlorophyll-a and chlorophyll-b was estimated to be about 0.89 to 2 67 and 0.00 to 0.65 mg/l respectively.

Problem 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 : Three years (From January, 1980)

Laboratory experiments using ^{15}N-labelled urea were carried out to determine the rate of fertilizer-N and lts effect on various forms of soil-N in six different types of soils i.e., three each of alluvial and laterite nature. Results revealed that about 50 to 80% of added 200 ppm ^{15}N Urea was hydrolysed within 24 hours. Maximum NH_4+-N was noted in urea treated soils during first three days. After three days in some cases it increased while in others decreased.

Nitrite-N was detected primarily in ^{15}N-Urea treated light textured soils generally upto first ten days. Concentration of NO_2-N was generally higher in urea treated than untreated in light textured than heavy textured, and in nonsaline than saline soils. Changes in NO_3-N concentration with increasing incubation period was less in untreated than treated, and in heavy textured than in light textured soils.

Organic-N content decreased during the first three days after application and rate of decrease was more in soils treated with urea than untreated. With further incubation, a decrease in the organic-N content was noted in all the soils. After 30 days organic-N in different soils was either converted to other forms of soils-N or lost to the atmosphere. Immobilization of urea-N or mineralized soil-N in urea treated soil was also noted.

The distribution of fertilizer-N in plankton-soil-water system was measured after attaining the peak of primary production in different soils. The result indicated that fertilizer-N recovered in the plankton ranged from 61.80 to 74.64 ppm depending on the methods of application. Recovery of fertilizer-N in the water column ranged from 35.4 to 48.4 ppm. A considerable portion of fertilizer-N *i. e.*, 48.4 to 54.2 ppm remained in the soil at the end of experiments.

Total recovery of 200 ppm labelled fertilizer-N in the soil-plankton-water system ranged from 146.6 to 177.2 ppm-N in the different soil types.

Project 28 : *Adaptive research in fish culture.*

Problem 28.1 : Lowcost fish culture in the village ponds.

Personnel : C. Selvaraj, S. L. Kar, Radhey Shyam, S. K. Sarkar, B. R. Datta, C. S. Purushothaman, Kuldeep Kumar and J. P. Verma.

Duration : Four years (From 1980).

During September, 1981, the pond (0.75 ha) at Nakhaurapatna was stocked with fingerlings of catla,

rohu, mrigal, silver carp and common carp @ 5,000/ha. The pond was manured with cowdung and inorganic fertilizers. The estimated standing crop was 2,000 kg/ha in April, 1982 at the end of a period of seven months. However, due to flood in August/September '82 the experiment got vitiated.

Problem 28.2 : Utilization of the domestic nursery ponds for fish culture.

Personnel : Radheyashyam, B. N. Singh, B. B. Satpathy, J. P. Verma, Kuldeep Kumar and B. R. Datta and S. K. Sarkar.

Duration : Four years (From 1980).

Two ponds of 0.03 ha each were stocked with catla. rohu mrigal and silver carp @ 7,000 fingerlings/ha. No artificial feeding was done except with kitchen wastes. After 5 months of rearing the fishes were harvested from both the ponds and the rate of production obtained wrs 947.9 kg/ha and 1311.67 kg/ha respectively.

Problem 28.3 : Impact of training in scientific fish culture by the KVK/TTC in adopted villages.

Personnel : B.R. Datta, Radheyshyam, Kuldeep Kumar, B.N. Singh and C.S. Purushothaman.

Duration : Four years (From March, 1983).

Two villages (Pubasasan and Khairi) were adopted for taking up study under this Project. Some farmers of these villages had received training in freshwater fish culture at KVK. A survey made in these villages revealed that there were two ponds of 0.75 ha and 2.0ha which were lying fallow. The trained farmers took up fish culture programme in these ponds utilising the nominal inputs they had at their disposal. Within one year of culture these farmers were able to got a production of 750 kg and 800 kg/ha/yr respectively.

Project 29 : *Fish nutrition and feed technology*

Problem 29.1 : Screening of fish feed ingredients, preparation of feed composition table, formulation of feeds and experimental trials of the formulated diets.

Personnel : N. K. Thakur, D. N. Swamy and V.R.P. Sinha.

Duration : Five years (From 1980).

Proximate composition of 11 feed stuffs was analysed. Two test diets were prepared using sal seed cake (a forest by-product) in order to examine its efficiency as a substitute for rice bran. The prepared diets when tested on common carp and rohu fry indicated the suitability of sal seed cake as a substitute for rice bran, when substituted by only 50%.

Problem 29.2 : Nutritional requirements

ii) Fortifying conventional feeds with available high grade protein and other nutrients as per nutritional requirements of Asiatic carps.

Personnel : B.N. Singh, K. Kumar and D. K. Chatterjee.

Duration : Six years and six months (From 1980).

Protein requirement of mrigal fry was studied using synthetic diets with 4 levels of casein (28-56%). The test diets were fortified with vitamins and trace minerals and the experiments were continued for a period of 64 days in aerated tanks in the laboratory. Maximum protein requirements of mrigal fry was observed to be about 45% of the dry diet. Balanced diets having plant and animal protein sources (crude protein content about 35%) fortified with vitamins, minerals and trace minerals have also been formulated for brood fishes and

spawn of cultivable Asiatic carps. The experimental diet prepared for spawn gave a very high rate of survival (over 95%) in laboratory condition during 21-28 days of rearing. The results are being analysed for its performance in terms of growth, resistance, diseases and other effects. Evaluation of nutritional efficiency of pelleted cattle feed with about 15% crude protein content revealed this feed to be inefficient even in meeting the maintenance energy requirements of rohu fingerlings. Fry, fingerlings and adults of Indian major carps and exotic carps were observed to suffer from malnutrition diseases if vitamin C is not provided in enough quantity during the early stages of life.

Problem 29.4 : Studies on digestive physiology of Indian major carps.

Personnel : D.N. Swamy and V.R P. Sinha.

Duration : Three years (From 1981).

Three combinations of pelleted feeds (Protein level 30% and with mineral and vitamin) : 1) GOC+RB, 2) GOC+RB 50% + Sal Seed 50% and 3) GOC+RB 25% + Sal 75% were tested against rohu fry for a period of nearly three months. The maximum growth was recorded with GOC + RB 50% + Sal Seed 50% from 14.5 gm to 32.7 gm (10 nos fish) follwed by GOC +RB 25% Sal Seed 75% from 14.25 gm to 31.15 gm and GOC+RB from 15.55 to 29.00 gm. The total digestibility recorded using aboye pelleted feeds was (1) GOC + RB = 63.34%, (2) GOC+RB 50%+Sal Seed Cake 50%=64.2% and (3) GOC + RB 25% Sal Seed 75%=53.5%. The net protein utilization of the feeds were calculated as GOC + RB 50% + Sal Seed 50%=19.1%, (2) GOC + RB 25% + Sal Seed 75%= 18.3% and (3) GOC + RB=17.91 gm.

Problem 29.5 : On the morpho-histological and histochemical observations of the digestive system of *Catla catla* and *Labeo rohita* in relation to different feeds.

Personnel : Kuldeep Kumar, S. K. Sarkar and B. N. Singh.

Duration : Four years.

Different parts of the digestive system of *C. catla* and *L. rohita* have been collected and fixed for histochemistry, cytochemistry and enzymology using various fixatives. Gut content analysis and morphometric measurements of gut are also being recorded simultaneously. Gut content analysis indicates that the food spectrum of *Labeo rohita* in order of their abundance, consists of filamentous algae, copepods, diatoms, rotifers, dinoflagellates and zooflagellates. In addition to these, unidentified contents and sand particles were also recorded. The food spectrum of *Catla catla* in order of their abundance comprises copepods, diatoms, filamentous algae cladocerans, rotifers, flagellates chlorophyceae and unidentified items. Zooplankton dominated over phytoplankton (56.85% respectively) in the food items of *Catla catla*.

Problem 29.6 : Nutritional bioenergetics of Asiatic carps (rohu, catla, mrigal, silver carp, grass carp and common carp).

Personnel : B.N. Singh, S.D. Tripathi, K. Kumar and N.K. Tripathi.

Duration : Five years (From February, 1982).

In order to determine part of the maintenance energy requirements, weight loss due to catabolism during fasting was studied in common carp fingerlings of 3 weight groups (1.5 g, 4.0 g and 12.0 g). It was observed that the weight loss (about 35%) and mortality was higher in fingerlings of low weight groups and lowest (9.8% weight loss) in higher weight groups. This indicates that the metabolic energy requirement of common carp decreases with advancement of age.

Problem 29.7 : To evolve efficient feed from non traditional plant and animal sources for *Hilsa ilisha* and cultivabale species.

Personnel : A. Hazra, P.R. Sen, D. K. De and D. Nath.

Duration : Two years 6 months (From July, 1982).

A variety of non traditional feed ingredients of plant origin viz., maize powder, mustard oil cake, green gram dust, red gram dust and lentil waste were procured from the market and tried as feed in different combinations. These feeds were tested against a convensional feed preparation compounded from groundnut oil cake and rice bran (protein level 25%) added with suitable premix for fortification of vitamins and minerals. The details of the convensional and the four experimental feeds are presented in table...

Table : Composition of formulated feeds.

Feed Ingredients	Convensional Feed g	Exp. Feed g E1	E2	E3	E4
Groundnut oilcake	583.3	461.2	302	287.7	251.3
Rice bran	416.7	134.7	31.3	141.5	82
Maize powder	—	134.7	—	—	—
Mustard oil-cake	—	—	302	141.6	—
Linseed ,,	—	—	—	287.7	251.3
Bengal gram waste	—	134.7	302	—	251.3
Green gram dust	—	—	31.3	—	—
Green gram waste	—	—	—	141.5	—
Lentil waste	—	134.7	—	—	82
Red gram dust	—	—	31.3	—	82
Premix (NaCl : 12g, $Ca_3(PO_4)_2$: 6 g, Vitamin and mineral mix : 2g)	20	20	20	20	20
Expected protein level	25%	25%	25%	25%	25%
Actual Protein level	24.9%	25%	24.9%	25%	25.0%
Energy (kcal/g)	3 84	3.81	.82	3.80	3.77
Cost in Rs/kg	1.82	2.08	2.08	2.18	2.25

In each case groundnut oilcake and rice bran were partially replaced by other ingredients. No chemical binder was for any of these feeds. Bioassays were conducted with three of the formulated feeds and the growth performance of *Labeo bata* after 28 days trial was observed to be better with all the three feeds(E_1, E_2, E_3) compared to the control with convensional feed. The fishes fed with E_1, E_2 and E_3 registered 12.76, 12.00 and 11.14% gain respectively over the initial weight while with the convensional feed the weight gain was 10.64%.

In another trial with *C. mrigala* as the test animal, only E_1 and E_2 were observed to be effective in enhancing growth while with E_3 the growth rate was observed to be lesser than that of the control.

Problem 29.8 : Studies on some important digestive enzymes in the three populations of *Catla catla* at Rihand reservoir.

Personnel : K.M. Das and P.K. Mukhopadhyay

Duration : Two years (From January, 1982).

Amylase, maltase, invertase, protease and lipase activities could be detected in the extracts from the digestive organs of both 'PM' and 'PS' varieties of *Catla catla*. The extracts did not demonstrate the presence of cellulose and lactase. Acetone dried powdered preparations demonstrated higher activities of amylase, lipase and protease than fresh tissue extracts. This might be due to removal of lipid, which might interfere the enzyme activity in acetone preparations. Storage of the extract at 0°C in 0.2M phosphate buffer (pH 7.0) did not affect the enzyme activity over a period of 5 days and thereafter a gradual loss of potency was observed. The enzymation in acetone dried powder was found to be stable for 15 days when kept under similar conditions.

Proteolytic enzymes (endopeptidase) were found to be inactivated at pH values below 6.0 when assayed using casein and bovine serum albumin as substrates in both 'PM' and 'PS' varieties indicating thereby the

presence of a trypsin-like enzyme and absence of pepsin.

The hepatopancreas was found to be the chief site of amylase, maltase, invertase, protease and lipase. It was observed that the pH in the intestinal bulb and anterior intestine was moderately alkaline while posterior intestine and the gall bladder bile had neutral to slightly alkaline pH in both the varieties of catla.

Project 30 : *Catfish culture.*

Problem 30.1 : Culture of *Pangasius pangasius* and *Mystus seenghala.*

Personnel : B. N. Saigal, V. V. Sugunan, V. K. Unnithan, M. J. Bhagat and A. R. Chowdhury.

Duration : Four years (From January, 1982).

The work could not be initiated.

Problem 30.2 : Breeding of *Pangasius pangasius.*

Personnel : Apurba Ghosh, P. K. Chakraborty, P. K. Saha and G. P. Bhattacharya.

Duration : Three years (From February, 1982).

Survey was conducted at two landing centres, *viz.*, Shekalipur and Mahaldarpara on the river Padma during July-August. Mostly spent fishes were available in the catches. At Shekhalipur some males were available while at Mahaldarpara mostly females were available. Attempt to induce breeding with two pairs of fish did not meet with success.

Problem 30.3 : Breeding and culture of *Mystus* spp.

Personnel : S. P. Singh, A. G. Jhingran, R. N. Seth and N. K. Srivastava.

Duration : Three years (From January, 1982).

Mystus seenghala fingerlings (av. size : 70 mm) stocked in July, 1980 in a 0.05 ha pond, attained an average size of 559 mm (size range 530-620 mm ; av. wt. 776 g). No supplementary feed was provided during the culture period except trash fishes, viz , *Amblypharyngodon mola* *Puntius ticto*, *P. sophore* and *Ambassis ranga*, the fry of which had been released in the pond to serve as food. The fishes were observed to attain maturity. Formation of breeding pits in the shallow areas of the pond were noticed. The breeding in the pond was first noticed on 10.4.82. The depth in the pond was maintained between 0.60 and 0.90 by filling water from tube well as and when required in order to provide suitable breeding ground.

Profuse breeding of *M. seenghala* was observed during April to June 1982. when a total of 23 breeding pits were located. After the monsoon rains in July no breeding pits were encountered. The number of hatchlings per pit ranged between 300 and 400. The breeding pits encountered upto 1.5 m depth in river Yamuna were found to be of *M. seenghala*. The breeding pits formed by *M. aor* appear to be in deeper waters where wading through water to locate the pits was not possible.

Different feed comprising (a) Plankton + mosquito larvae, (b) Gelatin with arrowroot weed and maize powder (1 : 1), (c) chironomid egg-mass with maize powder and arrowroot (1 : 1) and (d) chironomid egg-mass were tried on fry, Except for chironomid egg-mass no other feed was accepted by the fry.

Fish meal and rice bran (1 : 1) soaked in semi-boiled fish solution ; fish meal and G. O. C.+R B. (1 : 1 : 1) soaked in semi-boiled fish solution and semi-boiled trash fish were tried as feed for fingerlings of *M. seenghala* in plastic pool. It was observed that except for semi-boiled trash fish no other feed was acceptable.

Project 31 : *Inland Fisheries Resource Assessment*

Problem 31.2 : Fisheries resources of the Hooghly system with special reference to *Hilsa.*

Personnel : K.K. Ghosh, P.M. Mitra, D.K. De, S.B Saha, M.M. Bagchi, Hukum Singh (CIFE, Barrackpore), A. Choudhuri, S.N. Sar, H.S. Mazumder, A. R. Paul, A. K. Ray, S. P. Ghosh, N. C. Mondal, R. N. De and N.D. Sarkar.

Duration : Four years (From April, 1981).

During the 12 months period from November, 1981 to October 1982 the Hilsa landing from Hooghly estuary was estimated to be 6886 t which contributed to 30.8% of the total fish landing from the estuary. This landing of Hilsa was 3-5 times the catch recorded in corresponding period during 1972-77. During the monsoon run of Hilsa (July to October) an estimated 1184.0 t comprising 54% of total landing, was landed from the estuary against the range of 211.9 to 793.3 t in the corresponding period during 72-73 to 1981. The fish abundance was observed to be higher in the monsoon of 1982 as reflected by CPUE. CPUE in the mid estuary was observed to be 70% more compared to 1981. The effort was 2 times higher in Rupnarayana compared to 1981 and the CPUE was 50% more. In the upper stretch the effort of different gears were more or less similar to that of 1981 but CPUE increased by 50, 30 and 10% for purse, set gills and drift gill nets respectively. Compared to 1973-76 the effort in the freshwater zone was 4-5 times higher in 1982 resulting in 3.2 and 1.5 times increase in CPUE for purse, set gill and drift gill nets. The catch of hilsa at Farakka was 142.2 t during November 1981—October 1982 as against 17.8 to 47.1 t during 1972-76.

Higher size group (av. 44 cm) dominated the catches of hilsa during 1982.

The inventory on fishermen actively engaged in fishing in Hooghly system and their holdings in terms of boats, gears etc. indicated a major change during last 5 years with nylon replacing cotton almost completely, bagnets increasing in number in middle but going down in upper estuary and a rise in market price of gears employed in hilsa fishing.

In the zones II (Barrackpore to Diamond Harbour) and IV (Rupnarayana Estuary), for which inventory has been completed the structural change in gear inventory was very significant. A marked decline in seines, purse (or clap) nets and long lines in both the zones was observed Set gills in zone IV, operated earlier, have seized to exist, giving way to set-barriers The most marked increase has been in hilsa gill nets. Drift gills in zone II increased from 42563 in 1956-58 to 54594 and in zone IV from 36966 to 98049. Bag nets too showed increase from the 1956-58 level of inventory. The decline in purse nets, lift nets, large seines and such low catch per unit effort (CPUE) gears in favour of high CPUE gears, is reflective of economic factor of income from fishing.

Ecological investigations showed that freshwater zone of the estuary extended upto the confluence of river Rupnarayana with Hooghly (at Nurpur, Salinty : 346-2383 ppm). Specific conductivity, hardness and other chemical parameters showed similar trends. Net primary production was around 21-62 mgC/m^3/hr in upper reaches, upstream of Nabadwip at Farakka and Jangipur. Lower in the Industrial belt and a little down stream (31-35mgC/m^3/hr) from Medgachi in Nurpur and higher (34-197 mgC/m^3/hr) at marine zone Digha, Kakdwip and Port Canning (on Matla). Plankton density was found to be lower in the upper reaches and marine zone at port Canning and Digha.

Growth study on young hilsa showed 33 mm growth in the first 25-27 mm in the second and 20-24 & 19-21 mm in the third and fourth months respectively.

Project 32 : *Rural aquaculture*

Problem 32.8 : Correction and improvement of acid soils of fish ponds for increased fish production.

Personnel : G. N. Saha, S. C. Thakurta, S. P. Ghosh and B. B. Das.

Duration : Two years (From January, 1982).

Analyses of soil samples collected from fish ponds at Harishchandrapur, Malda, West Bengal showed that pH ranged between 5.2 and 6.5 ; available P 28.0-44.0 (P_2O_5 mg/100 g) and available N 11.20-44.24 mg/100 g. The water of the ponds was also observed to be acidic (pH 6.0-6.8) with low alkalinity (24.9-56.9 ppm). After liming the pH and total alkalinity increased to 6.7-7.5 and 54.6-92.8 ppm respectively. The ponds stocked with fingerlings of Indian major carps @ 5,000-6,000/ha with provision of fertilisation and feeding @ 1% of body weight yielded productions ranging from 1,500-2000 kg/ha/yr. In one of these ponds catla registered a net weight gain of 1 kg within five months.

Project 34 : *Inland Fisheries Information Service.*

Problem 34.1 : Selective dissemination of information (SDI) and its evaluation as a tool to assess the relevance of the information input and its proper utilization.

Personnel : B. N. Saigal, V. V. Sugunan, G. K. Vinci, A. R. Chowdhury, M. J. Bhagat, V. K. Unnithan, Anjali De and Sukla Das.

Duration : Two years (From 1982).

Preparation of Scientists profiles pertaining to 250 scientific and technical personnel at CIFRI has been completed as scheduled. In order to facilitate the preparation of scientists and document profiles, a 'microthoughts' containing about 300 key notes was prepared. This key word index will form the nucleus for the proposed thesaurus of inland fisheries.

Problem 34.2 : Construction of central information file.

Personnel : B. N. Saigal, V. V. Sugunan, G. K. Vinci, V. K. Unnithan, M.J. Bhagat, A. R. Chowdhury, Anjali De and Sukla Das.

Duration : Continuing (From 1982).

Location : Barrackpore.

Preparation of cards for central information file is in progress. More than 600 cards have been prepared on articles appeared in different journals.

Project 35 : *Studies on Aquatic Insects*

Problem 35.1 : Biology, behaviour and control of major group of Hemiptera in carp nursery.

Personnel : Krishna Mitra (Mrs)

Duration : Four years (From 1982),

Observations on the recirculatory filtering ponds and another small pond at CIFRI campus at Barrackpore, showed the presence of *Notonectids* and *Gerris* in the latter pond. Other insects encountered in the pond belonged to Ephemeroptera, Zygoptera, Coleoptera, Diptera and Lepidoptera. No insect population could be observed in the recirculatory filtering ponds during February to May. The work is in progress.

COORDINATED PROJECTS

All India Coordinated Research Project on Composits Fish Culture and Fish Seed Production.

Problem CFCSP 1.1 : Composite fish culture and fish seed production (at Institute based centres).

Personnel : V. R. P. Sinha (upto 11.1.82), S. D. Tripathi (From 12.1.82),

S.N. Datta, D.V. Pahwa, M.Y. Kamal, R M. Rao, K.N. Krishnamurthy, M. Sinha, P. M. Mathew, J. B. Rao, D. N. Mishra, B.C. Tyagi, P.K. Aravindakhsan, A. Mukherjee, D. P. Chakraborty, P.K. Saha, B. K. Singh, P. C. Mahanta and P.N. Jaitly.

Duration : Fourteen years (From January, 1971).

Investigations to intensify scientific fish farming through composite fish culture technology under varied agroclimatic conditions of the eountry are being conducted.

At Karnal, three ponds (two of 0.08 ha and the third of 0.1 ha) when stocked with fingerlings of Indian major carps and exotic carps @ 4,000/ha for the first two and @ 4,500 for the third one, gave production to the tune of 8208 kg and 5624 kg/ha/8 months in the first and the 3rd ponds and 4534 kg/ha/7 months for the second pond.

At Jaunpur three ponds (0.07 ha each) stocked with a 5-species combination of catla 3 : rohu 3 : mrigal 1.5 : common carp 1.5 and *Tor tor* 1.0 at 5000 fingerlings/ha gave a production of 3088-3426 kg/ha in 9 months. *Tor tor* tried for the first time as a new component in composite fish culture, recorded an extremely poor growth.

In the other two ponds (0.1 ha each), the usual 6 species combination was tried at 5000 fingerlings/ha in the proportion of catla 10, rohu 10, mrigal 10, silver carp 30, grass carp 20 and common carp 20. While one pond received only nitrogenous fertiltzers, the other was treated with phosphatic fertilizers alone giving a production of 3985 kg and 3333 kg/ha respectively in 9 months. This ts the highest production achieved so far with the use of fertilizers alone and would go a long way in developing a low-input technology.

A production of 5570 kg/ha/yr was obtained from a 0.25 ha pond using small sized yearlings at 6000/ha (catla 10, rohu 10, mrigal 15, silver carp 30, grass carp 10 and common carp 25) with a view to raising a brood stock within an year.

At Ranchi a production to the tune of 2115 kg/ha/yr was obtained in experiment No. 1 of the sixth set from a 0.1 ha pond stocked at 6000 fingerlings/ha in the ratio of catla 12.5 : rohu 12.5 : mrigal 17.0 : silver carp 25.0 : grass carp 8.0 : common carp 25.0. The seventh set of experiment has been initiated in two 0.1 ha ponds at a density of 5000 fingerlings/ha with 6 species combination.

At Kalyani the experiment on monoculture of common carp had to be concluded after 5 months with a very poor level of production (553 kg/ha) on account of prevailing low water levels.

The fifth set experiment undertaken in two 0.25 ha ponds at Gauhati was concluded after 10½ months. A production of 3454 kg/ha was achieved from one of the ponds stocked at 5000 fingerlings /ha with a 3 species combination of Indian major carps, catla 4 : rohu 3 : mrigal 3. The cost of production was found to be Rs. 3.48/kg. From the other pond stocked with the 6 species combination at 6000 fingerlings/ha (C 1 : R 1.5 : M 2 : Sc 3 : Gc 5 : Cc 2) a production of 4,320 kg/ha/10½ months was obtained at a production cost of Rs. 3.81/kg of fish. High rate of production (10,483 kg and 9034 kg/ha/yr) was obtained from two 0.31 ha ponds at Pune. The production cost was Rs. 3.70 and Rs. 3.86/kg respectively. The ponds were stocked at 10,000 fingerlings/ha in the proportion of (i) catla 5, rohu 15, mrigal 20, silver carp 20, grass carp 10 and common carp 30 and (ii) catla 2, rohu 15, mrigal 25, *Labeo fimbriatus* 6, silver carp 22, and common carp 30 respectively. At a stocking density of 600/ha along with the other 5 species.

L. fimbriatus a species of local importance, registered an average growth of 700 g/year.

Six species culture in a 0.12 ha pond at Badampudi yielded a production of 3581 kg/ha/yr when stocked @ 5,000 fingerlings/ha. Severe drought resulted in low production of 3048 and 2374 kg/ha/yr from two 0.375 ha ponds at Bhavanisagar.

Incidental to various induced breeding experiments 11.77, 71.30, 88.48, 58.75, 2.09 & 1.56 lakhs of spawn of catla, rohu, mrigal, common carp, silver carp and grass carp respectively were produced at various centres. At Bhavanisagar only 2.30 lakhs mrigal and common carp spawn was produced.

Problem : CFCSP 1.2 : Composite Fish Culture & Fish Seed Production at Centrally Sponsored Centres

Personnel : V.R.P. Sinha (upto 11.1.82), S.D. Tripathi (From 12.1.82), S. N. Datta, H.L. Bhatia, R.L. Thawit, R. C. James, V. R. Khodse and N. Sukumaran

An experiment on polyculture was initiated in November, 1982 in two 0.5 ha ponds with catla 20, rohu 30 and mrigal 40 at 5000 fingerlings/ha at Lingda, Gujarat.

At tuticorin a production of 5013 kg/ha in 216 days and 2949 kg/ha in 200 days was recorded from two 0.1 and 0.15 ha ponds respectively stocked at 5250 and 5000 fingerlings/ha with catla, rohu, mrigal, silver carp, grass carp common carp and milk fish. An inadvertent entry of tilapia in the 0.1 ha pond was controlled by stocking some murrel fingerlings. Milk fish registered an average growth of over 500 g in about 7 months and appears to be a suitable fish for stocking in coastal freshwaters. Silver carp was bred for the first time though only 500 hatchlings could be obtained. In addition 3.0, 4.0 and 3.25 lakhs of catla, mrigal and common carp spawn were also produced.

At Kausalyagang a total of 84.0 lakhs of spawn comprising catla (2.0), rohu (25.25), mrigal (12.0), calbasu (0.5) and common carp (44.25) were produced.

Problem CFCSP 10 : Operational Research on Composite Fish Culture and Integrated Live stock-cum-Fish Farming.

Personnel : B. K. Sharma, M. K. Das, D. Naryanaswami and V. Pathak

Demonstration of composite fish culture :

Step by step demonstrations of composite fish culture were arranged in 10 fish farmer's ponds. The ponds were stocked with 5 or 6 species of Indian and exotic carps at stocking densities ranging from 5000-6000 fingerlings/ha. Fish yield ranging from 1628 to 2151 kg/ha were obtained from these ponds. The fish yield from the reported demonstration ponds were, however, less as compared to previous years because of lower water levels in almost all the ponds.

Demonstrations on integrated fish cum livestock farming :

Demonstrations of fish-cum-pig farming and fish-cum-duck farming were conducted in 6 ponds owned by fish farmers.

Fish-cum-pig farming :

A pond (0.5 ha) was stocked with six species of Indian and exotic carps at a stocking density of 8500 fingerlings/ha. No feeding or fertilization was resorted to. The excreta of 14 piglets of landrace variety, which were raised under 'Intensive raising system' in the pig-sties constructed on the pond embankment, was recycled in the pond. The yield from the pond was 2752 kg of fish (corresponding to 5504 kg/ha/yr). The cost of fish production was worked out as Rs. 2.50/kg. Additional profit was earned by the farmer through the sale of pig meat.

Fish-cum-duck farming :

Five demonstrations on fish-cum-duck farming were arranged in ponds ranging from 0.1 to 0.5 ha. The ponds were stocked with 5 or 6 species of Indian and exotic carps at stocking densities ranging from 5,000-6,000 fingerlings/ha. No fish feed or fertilizers were used.

Indigenous ducks @ 300 ducks/ha were also raised along with fish culture. The ducks were given a free range over the pond surface during the day. The excreta of the ducks got recycled in the pond. During night the ducks were kept in improvised duck houses constructed on the pond embankment. The excreta of the ducks was collected every morning and applied to the pond. Fish yield from these ponds ranged as 2321-3150 kg/ha/yr. The cost of fish production worked out to be Rs. 3.05 per kg. Additional profit was earned through the sale of duck eggs and duck meat.

The fish production in all these ponds however, was adversally affected due to drou ht condition.

Problem CFCSP-27 : Earthen Carp Hatchery
Personnel : B.K. Sharma & M.K. Das
Duration : Three years 6 months (From June, 1981)

Work could not be taken up due to drought condition during the year.

Project : *All India Coordinated Research Project on Air-breathing Fish Culture.*

Problem ABF—1 : Air-breathing fish culture.
Personnel : P. Das, S.K. Mukhopadhyay, P.K. Mukhopadhyay, B. Venkatesh. (upto '82), S.C. Pathak, M.P. Singh Kohli, D. Kumar, V.K. Murugesan and P. Kumariah.
Duration : Eleven years and Nine months (From June, 1971).

Seed collection and transportation :

A technique for murrel seed collection from nature and their transportation has been standardised at Palair Centre in Andhra Pradesh. A murrel seed calender in relation to its availability has been prepared. *Channa marulius* is available in abundance from late May to December and *C. striatus* from April to October. Murrel seed could be transported in open containers to a distance of 200 km without any oxygen packing.

Various beels in Goalpara and Kamrup districts in Assam have been surveyed for the availabilily of air breathing fish seed.

Contour and topography of Chhotanapur district has been found to be ideal place for magur breeding.

Low input culture :

A production ranging from 2,380–5,200 kg/ha/4-6 months was obtained when magur fingerlings stocked @ 4,000 to 7,000 in a farm pond of Kalyani Centre and also in farmer's pond (0.04-0.1 ha).

Fish meal was replaced by meat meal to reduce operational cost on feed.

Monoculture of singhi :

A production of 1642 kg/7 months was obtained when singhi was stocked in a pond (0.04 ha) at Kalyani Centre at the rate of 60,000/ha.

A production of 4330/kg/ha/4 months could be achieved in monoculture of singhi stocked at the rate of 1,40,000/ha in a 0.02 ha pond. The cost of production was Rs. 4.50/kg. A production of 2.4 kg/m^2/7 months with a survival rate of 81.4% was achieved when culture of *H. fossilis* was taken up in a kitchen garden pond of 30 m^2 area with a stocking density of 60 fingerlings/m^2.

Monoculture of koi :

A production of 1800 kg/ha/170 days was obtained when *Anabos testudineus* finerlings were stocked @ 60,000 fingerlings/ha in a 0.003 ha pond at Kalyani. At Darbhanga (Bihar), koi stocked at the rate of 80,000 fry in a 0.3 ha derelict pond gave a production of 125 kg/ha/5 months.

Murrel culture :

A production of 4041 kg/ha/year was obtained with 200% return over the cost of inputs when *C. marulius* was cultured in Karnataka swamps and fed with trash fish.

Cage culture :

The cage culture experiments conducted at Gauhati Centre have yielded gross production of *C. punctatus*, *H. fossilis* and *A. testudineus* @ 5.175 kg/m²/200 days, 4.832 kg/m²/90 days respectively. *C. batrachus* gave a total production 9.9-12.0 kg/sq.m/90 days at Karnataka Centre. In cage culture experiments at Bangalore Centre magur stocked @ 200 fingerlings/cage gave a production of 9.9 to 12.0 kg/m²/annum.

Intensive culture of singhi :

A production of 7.3 tonnes/ha was obtained with singhi fingerlings stocked @ 4.33 lakhs/ha in a 0.3 ha pond at Kalyani. At Gauhati Centre singhi fingerlings stocked @ 3 lakhs/ha in a 0.15 ha pond gave a production to the tune of 6946.6 kg/ha in 5 months.

Experiments in plastic pools :

A production of 6,712 kg/3 months was obtained when *C. batrachus* stocked @ 250/plastic pool (250 L) at Bangalore with 98.3% of survival.

Problem ABF-13 : Some aspects of toxicity and metabolism of malathion and carbofuran in the air-breathing catfish *Clarias batrachus* in relation to its culture.

Personnel : P. K. Mukhopadhyay and P. Das

Duration : Five years (From January, 1978)

The annual reproductive cycle of *C batrachus* was categorised into four arbitrary phases *viz.*, preparatory, pre-spawning, spawning and post-spawning phases. In the spawning phase the fish was exposed to 0.5 ppm carbofuran in ambient water for 30 days. Gonodosomatic index (ovary) was determined in the fish both under normal and under carbofuran treatment. No significant differences could be observed.

Analysis of residues of carbofuran in testicular tissue of the fish indicated slight accumulation of the compound in the tissue, Histological studies revealed necrosis in the testicular structure with disintegration of the walls of seminiferous tubules.

Problem ABF-18 : Feed formulation for air-breathing catfishes *C. batrachus* and *H. fossilis*.

Personnel : B. Venkatesh, P. Das and P. K. Mukhopadhyay

Duration : Three years and Ten months (From March, 1980

Four feed mixtures were compounded using locally available different inexpensive ingredients viz., meat meal, soyabean, rice bran, poultry droppings, compost cowdung and slaughter house wastes. Vitamins and mineral mixtures (SUPRADIN-ROCHE Preparation) were included @ 0.5% in all the four feed mixtures for fortification. The feed mixtures were as follows :—

Feed No. 1 Mixture of sun-dried powdered poultry droppings, rice bran and dried soyabean powder in 1 : 1 :1 ratio.

Feed No. 2 Mixture of sun-dried powdered poultry droppings, rice bran and meat meal in 1 : 1 : 1.

Feed No. 3 Mixture of powdered slaughter house wastes, rice bran and powdered groundnut oil cake in 1 : 1 : 1.

Feed No. 4 Mixture of meat meal, composed cowdung and rice bran in 1 : 1 : 1.

The compounded feed mixtures were analysed for protien, fat, ash and N. F. E. Crude protein (N x 6.25) content of the feeds were was follows : –

Feed No. 1—20.51% ; Feed No. 2—26.61% ;
Feed No. 3—30.40% and Feed No. 4—30.62%.

The feed mixtures were fed *ad libitum* to fingerlings of *H. fossilis* (av. wt. 12.0 g) for 105 days and growth rate monitored and recorded. The percentage of weight gain over initial weight was found to be maximum (79.8%) in groups of fish fed with feed mixture No. 3 followed by feed No. 4 (65.38%), feed No. 2 (38.97%) and feed No. 1 (32.60%).

Problem ABF-19 : Paddy-cum-Air-breathing Fish Culture
Personnel : P. K. Pandit, P. Das and P. K. Mukhopadhyay
Duration : Two years (From 1981)

Radhunipagal (scented) variety of paddy was transplanted in 3 plots (6m x 28m) having 75 cm wide perimeter canal. Water coloum of 8-10 cm in the paddy plots were maintained through the cultivation period. Magur and singhi (1 : 1 ratio) fingerlings were stocked in two plots @ 1 fish/sq. m. The third plot served as control without any fish. Fishes in first plot were fed with mixture of fish meal and rice bran (1 : 2) mixed with cow dung @ 5% of total body weight. Fishes in the other plot were not provided with any food. Fishes were harvested much before stipulated date because of unprecedented drought.

A production of fish @ 375.0 kg/ha in 30 days was obtained from the plot where supplementary feed was given. In addition to fish paddy @ 1877.97 kg/ha and straw @ 4047.61 kg/ha in 60 days where obtained. A production of fish @ 199.1 kg/ha in 30 days was obtained from the other plot where supplementary feed was not provided. In addition to fish, paddy @ 1839.28 kg/ha and straw @ 3928.57 kg/ha in 60 days were obtained from the same plot.

The control plot yielded paddy @ 1794.64 kg/ha and straw @ 4345,25 kg/ha.

Problem ABF-20 : Cytogenetics of Air-breathing Fishes
Personnel : S.K. Mukhopadhyay and P. Das
Duration : Four years (From January 1981

Diploid chromosome number of 56 was observed in majority of cells. when kidney preparations of males and females of *C. batractus* was examined.

Hybridisation using *H. fossilis* ($\overset{\uparrow}{O}$) and *C. batrachus* ($\underset{+}{O}$) resulted in a very low percentage of successful hatching The eggs were adhesive, demersal, round and yellowish brown measuring approximately 1.82 mm. Absorption of yolk took place after 4-5 days. While incubating the eggs and rearing the resulting spawn, there was considerable mortality. In case of *C. batrachus* ($\overset{\uparrow}{O}$) H. fossills ($\underset{+}{O}$) the fertilized eggs were adhesive and demersal but greenish in colour, measuring approximately 0.95 mm. Incubation period was 18-20 hrs. which is less in comparison to *H. fossilis* ($\overset{\uparrow}{O}$) *C. batrachus* ($\underset{+}{O}$) hybrid. The newely hatched larva measured approximately 1.64 mm. *H. fossilis* ($\overset{\uparrow}{O}$) and *C. batrachus* ($\underset{+}{O}$) hybrid could be reared for 8 months in the laboratory.

Project : *All India Coordinated Research Project On Ecology and Fisheries of Freshwater Reservoirs.*

Problem R-1 : Ecology and Fisheries of Freshwater Reservoirs.

Personnel : A.V. Natarajan, K.K. Ghosh, G.K. Bhatnagar, Ch. Gopalakrishnaya, Y. Rama Rao, V.R. Desai, M. Ramakrishnaiah, A. Mathew, B.P. Gupta, S. Sivakami (smt.), B.C. Jha, D.K. Kaushal, N. P. Srivastava, V. K. Sharma, S. N. Singh, M.D. Pisolkar, K.K. Agarwal, and A.K. Ekka

Duration : Contuning (From 1971)

The work pogramme at Rihand (U.P.). Getalsud (Bihar), Bhavanisagar (Tamil Nadu) and Nagarjunasagar (A P.) have been completed and final reports prepared. The centre at Govindsagar (A P.), and two centrally sponsord centres at Ukai (Gujrat, and Kangsabati (W.B.) carried out their work programme during the year. A new centre at Pollachi (Aliyar), has been established.

GOVINDASGAR (Himachal Pradesh)

The total landing from the reservoir showed a declining trend compared to 1980-81. The annual landing duting the year 81-82 was estimated to be 653.821 t (62.87 kg/ha). Such low yield may be attributed to poor landing of major carps *Labeo rohita* and *Cirrhinus mrigala* contributing to 4.90 and 2.01% of the total catch. *Cyprinus carpio* also showed a declining trend constituting 17.55% as against 31.39% of landing during 1980-81. *Labeo dero* was the prime contributor in the landings (37.5%) while *Cirrhinus reba* also contributed substantially (12.09%) for the first time. The silver carp fishery which started in 1977-78 with merley 555 kg has picked up to about 100 t/year in 1880-81 and 81-82. The establishment of silver carp with a good leval of autostocking promises a higher leval of yield under higher effort since its CPUE has been increasing from .065 kg in 1978-79 to 0.37 kg in 80-81 and 81-82.

During 1981-82 Lathiani Centre (catches from Lunkhar Khad) contributed only 26.78% unlike in the previous years, Lentic sector (Bhakra centre) yielded 55.20% and lotic (Bilaspur) 17.88% of the catches. The occurrance of *Ctenopharyngodon idella* and *Salmo trutta fario* was observed occasionally in the commercial landings.

Aliyar Reservoir (Pollachi)

The work in the Aliyar reservoir has been initiated during September, 1982. The reservoirs (10°15'—10°30'N and 76°50'-77°10'E) is situated in Aliyar Nagar in the Coimbatore district of Tamil Nadu.

Studies on the plankton revealed that lotic sector had maximum concentration (9.12 ml/m^3) followed by the intermediate and lenthic sectors. *Microcystis* sp. dominated amongst the phytoplankton, whereas, *Keratella* and *Brachionus* were the dominant zooplanktonic forms.

Qualitatively, bottom fauna did not show much variation in the three sectors, *Chaoborus* and *Chironomus* larvae being the principal fauna encountered.

The total fish landings from the reservoir during September to December was 1,784.75 kg, *C. mrigala* being the principal contributor (34.31%) followed by *C. carpio* (24.01%).

Research completed

Problem 3.13 : Composite fish culture of Indian and exotic major carps in tanks simulating long seasonal irrigational tanks.

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

Duration : 1980-1982.

Under the 'high-input technology' experiment with six species combination was tried in the ASC tank (1.25 ha) with a stocking density of 6,700 fingerlings/ha and four species (Catla, Rohu, Mrigal and Common carp) combination was tried in ITI tank (0.33 ha) at a stocking density of 9 000 fingerlings/ha. Manuring (cowdung+poultry manure+mahua oil cake) and supplimentary feeding (rice bran, groundnut oil cake and silkworm pupae powder) were resorted to. The fish yield was 1592 and 4250 kg/ha/yr and the cost of production was Rs. 2. 2/kg and Rs. 2.49/kg in ASC and ITI tanks respectively.

In the two experiments conducted for 'medium input technology' at ASC tank, the stocking rates were 5200/ha and 3000/ha with four species (catla, rohu, mrigal and common carp) and five species (catla, rohu, mrigal and common carp) respectiuely. The production in these experiments ranged between 1940 kg/ha/15 months and 2030 kg/ha/20 months, with the cost of production ranging from Rs. 0.75/kg to Rs. 1.59/kg.

Under the 'low input technology' experiments, six species were stocked in the ASC tank at a density of 4880/ha and five species (catla, rohu, mrigal, grass carp and common carp) were stocked in the ITI tank at the rate of 3000/ha. The fish production was 1606 kg/ha/10 months in ASC tank and 1099 kg/ha/yr in the ITI tank, the cost of production being Rs. 0.51/kg and Rs. 0.34/kg respectively.

Problem 18.1 : Fish Culture in Sewage-fed Ponds.

Sub-problem 18.1.11 : Paddy-cum-fish culture.

Personnel : Apurba Ghosh, K. K. Bhanot (Smt.), S.K. Dutta (Collaborator from Rice Research Station, Chinsura), P.N. Bhattacharjee (1977 only), A. B. Mukherjee ('upto 1979), S.K. Saha (upto 1980), K. R. Naskar (from 1980), B.K. Saha (from 1980), G. N. Chattopadhyay (from 1981), P.K. Chakraborti (from 1981), A.K. Roy (from 1981), N.M. Chakraborti (from 1981) and B. Ghosh (from 1981).

Duration : Four years five months (From December, 1977).

Culture of fish in renovated paddy plots and horticulture on the dykes were taken up by the Institute at Patulia Farm and integration on fish culture with paddy cultivation was tried at the farm of Rice Research Station (Goverment of West Bengal), Chinsurah.

At Rahara a plot with 0.25 ha perimeter dyke. 0.27 ha perimeter canal (3.6-6.0 m X 294.8 m X 1.2 m deep) and the paddy field of 0.75 ha was brought under integrated farming during 1977-81. Carps were grown along with Kharif and Rabi paddy. During dry season fishes remained to the canal while during monsoon months, they spread all over the field and canal (i.e. over 1.02 ha area). Four sets of experiments were conducted and the details of production of fishes are presented in the table over leaf :—

Exp. No.	Period of culture	Species ratio	Stocking Density @	Yield
1	1977-78	Catla 4 : rohu 3.5. : mrigal 2.5	6,000/ha	700 kg/ha/yr
2	1978-79	Catla 3.5 : rohu 2.5 : mrigal 4	3,000/ha	Flood water washed off the stock
		Catla 3.5 : rohu 2.5 : mrigal 4 (Restocked in November 1978)	2,000/ha	104.4 kg/ha/6 months
3	1979-80	Catla 1.5 : rohu 4 : mrigal 3 Silver carp 0.3 : magur 0.7 : Prawn 0.5	3,000/ha	259.7 kg/ha yr ★
4	1980-81	Catla 2.2: rohu 2.8 : mrigal 2.6 : Silver carp 0.8 : common carp 1.6+2,000 post-larvae of *M. rosenbergii*	5,000/ha	832.6 kg/ha in 18 months □

★ Harvesting was done after application of 480 kg of Mahua oil cake.

□ Due to excessive water-logging for heavy rains no paddy could be cultivated and as such, the aquaculture had to be prolonged till the normal condition restored.

Along with fishes the yields of paddy were 5,000 kg/ha (1,200 kg Kharif + 3,800 kg Rabi) in 1977-76; 3.733 kg/ha (400 kg Kharif + 3,333 kg Rabi) in 1978-79; 3,334 kg ha (422.6 kg Kharif + 2,912 kg Rabi) in 1979-80; and nil in 1980-81 (due to complete submergance of the plot under rain water).

Physico-chemical characteristics of the perimeter canal water for different parameters during the period under report varied as :—

Temperature : 16.3-31.0°C ; pH 7.7-8.4 ; DO 1.9-5.4 ppm ; CO_2 : 0-14 ppm ; NH_3N : 0.01-0.892 ppm ; NO_2 : O-Traces ; $NO\bar{3}N$: Trace-0.03 ppm ; Phosphate : 0.09-0.918 ppm ; Chloride : 42.6-123 ppm ; Alkalinity : 110-324 ppm ; Bicarbonate : 110-310 ppm ; and COD : 3.1-21.6 ppm.

Plankton studies revealed that the perimeter canal which was initially poor in plankton, became rich from the 2nd year onwards. The density of plankton during 1978-79 was 4,146-6,000 u/l (phytoplankters) and 1,456 u/l (zooplanktons).

At Chinsura 3 pairs of plots (0.01 ha each) at Rice Research Station (Government of West Bengal), were also taken up during 1981, one pair for paddy-cum-fish culture with supplementary feeding, the other without supplementary feeding and the third pair for cultivation of paddy alone to compare the productivity of different sets.

Four plots were stocked @ 16,200 fingerlings/ha each at the uniform ratio of catla 4 : rohu 4 : mrigal 4 : commoncarp 1. In two of these plots supplementary feeding was done with mustard oil cake and rice bran (1:1) @ 5% body weight. In the other plots fish culture was conducted without feeding. Average gross yields of fish in 2 months were 3.763 kg/plot (with feed) and 1.654 kg/plot (without feed), i. e. 376.3 and 165.4 kg/ha respectively. Patnai variety of paddy was transplanted in all these plots during mid-August 981 and the yields were satisfactory. Average depth of water in these plots ranged between 30 and 50 cm. Plankton density ranged as 190.5-1664.4 u/l (in plots with feeding), 135.0-1592.2 u/l (in plots without feeding) and 219.4-2759 u/l (in plots without fish). *Oscillatoria* sp.,

Spirogyra sp., *Closterium* sp. and diatoms dominated amongst phytoplankters while *Cyclops* sp., nauplii of copepods, *Brachionus* sp., *Moina* sp., amongst zooplankters.

Bottom biota comprised *Vivipara* sp. (shell only) 25-50 u/m² and dipteran larvae 25 u/m² among macrofauna while among microfauna *Lyngbya* sp. (4.2-5 lakh u/l) dominated.

Another paddy plot (0.015 ha) at Rice Research Station, Chinsura, was stocked in November 1981 @ 12, 000/ha in the species ratio of catla 1 : rohu 2 : mrigal 2.5 : common carp 3.5. Supplementary feeding @ 5% of the body weight was restorted to. The fish was harvested in the 3rd week of March 1982 and a production of 26.741 kg (i.e. 1783 kg/ha) was obtained.

The second part of activities (composting water-hyacinth) was initiated in December, 1979. Water hyacinth was found to possess high capacity for absorbing nutrients from the ambient water, especially when grown in sewage-fed water. Two sets of trials in pits and earthen vats were conducted to compare nutrient status of compost of water hyacinth. The pits were filled with semi-dried chopped *Eichhornia* sp. alone and in combination with other ingredients, e.g. cow dung, sewage sludge etc.

The first 5 pits were kept under aerobic condition and the last one under anaerobic condition for 120 days.

The organic carbon (%), available p (mg/100g), available N (mg/100g), total N (%), C/N of these compost ranged between 9.0 and 28.51 ; 57.20 and 68.72 ; 140 & 260 ; 0.70 and 3.90 and 5.7 and 20.0.

The second set of trials, conducted in earthen vats under aerobic condition, by treating *Eichhornia* plants with 5% & 10% cow dung and 10% sewage sludge in three vats respectively against suitable control (with *Eichhornia* plants alone) and kept for 100 days to obtain ideal C/N ration between 10 and 30 in compost. During the period of composting the humidity was very high and the temperature as well as pH of these composts varied as 31-35°C and 7.2-8.5 respectively.

Notrogen (%), phosphorus (%), potash (%), calcium (%) and C/N ranged as 2.1 & 2.8 ; 1.08 and 2.0 ; 4.0 & 4.3 ; 4.0 & 4.3 : and 13.0 and 13 5 respectively.

Chemical properties of composts with different treatments were more or less alike but the process of composting was faster as compared to control.

Duriug 1981, studies on the ecosystem of soil and soil-water interphase in low lying coastal soils fed by tidal water were taken up for ultimate assessment of the feasibility of growing paddy along with euryhaline prawn and fish species. Physico-chemical properties, specially the extent of salinization and biological properties of the ecosystem were studied in farmer's paddy-cum-fish culture plots in Kulti region (low saline), Basirhat region (moderately saline) and Taldi-Canning region (high saline). Some important physico-chemical characteristics of the paddy fields in three zones were as follows :

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	204-90
Phosphorus(ppm)	2.1-1.5	1.8-traces	1.2-0.8
Nitrogen (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 (ppt)	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 were as follows :—

	Low Saline	*Moderately Saline*	*Highly Saline*
Plankton (thousand u/l)	0.37-5.18	0.17-36.77	0.76-81.82
Bottom biota (lakh u/m^2)	0.39-17.26	0.11—11630.40	1.62-30.34

Among plankters Cladophora sp., (in highly saline region), *Gyrosigma* sp., *Cladophora* sp., *Pinnularia* sp., *Oocystis* sp., *Chlorella* sp., *Nostoc* sp., *Difflugia* sp., *Clostarium* sp., *Lyngbya* sp., (in moderataly saline) and at low saline region *Cladophora* sp. dominated. Dominent species among benthos were *Lyngbya* sp., *Cladophora* sp. and *Vivipara* sp. at highly saline region ; *Rhizoolonium* sp., *Cladophora* sp., *Spirogyra* sp., *Pinnularia* sp., *Anabaena* sp., *Navicula* sp,, and *Nostoc* sp., at moderately saline region ; and *Cladophora* sp., *Pinnularia* sp. and *Navicula* sp. at low saline region.

Problem 33.2 : Evaluation of the role of subsidy as motivating assistance for adoption of scientific aquaculture by the fish farmers.

Personnel : P. Das, U. Bhowmick, P. K. Pandit & B.K. Banerjee

Duration : One year (1982)

The study was undertaken in two C. D. Blocks in Chanditala I and II in Hooghly district covering 15 villages. A total of 61 fish farmers were selected at random from total sample of 200. Out of 61 fish farmers, 93% adopted scientific fish culture while the rest are continuing fish culture in traditional way and 52.5% of the adopted fish farmers received subsidy. It is evident that though subsidy played a great role in adoption of scientific fish culture (56.1%) other sources like Lab to Land Programme, Cooperative Society, mass media, extension literature, extension personnel, neighbours etc., also contributed much in the adoption process. 83.6% of the fish farmers whose primary occupation was traditional fish farming, adopted scientific fish culture as a result of the above efforts. This indicates that the extension personnel should concentrate more to convert the traditional farmers to adopt scientific fish farming.

The study also reveals the preference in receiving subsidy (44% towards kinds, 29% towards cash and 27% towards inputs at subsidised rate).

87% of the fish farmers desired to continue the practice of modern aquaculture even without getting further subsidy. 62% of the farmers are in favour of receiving loans for meeting the expensive involved in the culture operation.

Research Contemplated

1.	Problem	FA/A/16	Genetic improvement of stock through selection of shootcarp.
2.	,,	FA/A/7	Qualitative segregation and rearing of spawn from river Yamuna.
3.	,,	BF/B/5	Digestive physiology of brackishwater fishes.
4.	,,	BF/A/12	Adaptive research in fish culture in high saline brackishwater paddy-plots.
5.	,,	AN/B/4	Study of the sedimentation charcteristics of the suspended silt load in the brackishwater operation of the water gate.
6.	,,	FC/A/6	Economics of fishing in reservoirs. A case study of selected reservoirs.
7.	,,	AN/B/7	Microbial aspects of pollution in relation to different types of loads in various aquatic ecosystems.
8.	,,	AN/B/8	Development of an economical design of biological filter for efiective filteration of wastewater in recirculatory filtering system of fish culture.
9.	,,	AN/B/9	Devising effecient methods of aeration for raising level of dissolved oxygen in sewage-fed fish farm.
10,	,,	AN/A/1	Training needs of fish farmers.
11.	,,	AN/A/3	Use of different fish toxicants in fish culture operations.
12.	,,	AN/A/5	Culture of *Artemia salina*
13.	,,	FA/B/2	Ecology of sewage-fed fish farms

Research Projects Merged during 1982

1.52 Economic methods of increasing yield of carps in ponds (Merged with 1.58).

1.53 Effect of water-level on fish-production (Merged with 1.58).

1.54 Investigation on increasing fish production particularly in non-drainable ponds (Merged with 1.59).

1 55 Nursing of fry and fingerlings (Merged with 1.60).

2.13 Studies on the fartors responsible for multiple spawning of carps (Merged with 2.19).

2.16 Seasonal changes on the hypothalamohypophyseal complex in relation to reproduction in some freshwater Indian major carps and exotic carps (Merged with 2.19).

9.10 Production of polyploid and androgenetic fish populations in Indian major carps and common carp (Merged with 9.14).

9.12 To develop practical methods of artificial gynogenesis and hormonal sex reversal of common carp (Merged with 9.14)

9.13 Artificial gynogenesis in Indian major carps (Merged with 9.14).

15.2 Investigations on the parameters of fish blood to monitor fish health in culture fishery operations (Merged with 15.10)

15.7 Investigations on histopathological changes in the kidney and liver of Indian major carps and its relation to diseases (Merged with 15.10).

22.6 Nutritional and bio-chemical studies on captive carp (Merged with 3.20).

29.3 Fortifying conventional feeds with available high grade protein as per protein requirement of carps (Merged with 29.6).

5.17 Brackisewater shell fish breeding and culture in Madras region (Merged with Project 5.75 and 5.76).

5.58 Intensive culture of fish food organisms ; Techniques for preserving algae and zooplankters for culture and feed Development and viability testing of fish feeds based on cultured natural food organisms in experimental ponds (Merged with 5.74).

18 1.11 Paddy-cum-fish culture in freshwater by renovating paddy plot (Merged with Project 18.2.1 and 18 2.2).

Research Project suspended during 1982

2.8 Induced fish breeding of important cultivated fishes (other than carps).

19.8 Culture of *Hilsa ilisha* (Ham.) in confined freshwater.

32 6 Effect of split application of biogas slurry on fish growth.

32.7 Studies on lyophobic and lyophilic colloids in relation to fish production.

PUBLICATIONS

The following Papers were published by the staff of the Institute during the year 1982.

Banerji, S. R., M. L. Singh & N. K. Thakur (1981.)
Observations on natural breeding and larval development of the common mud eel *Amphipnous cuchia* (Ham.) *Hydrobiologia*, **79** (2) : 147-155

Barrackpore, Central Inland Fisheries Research Institute, 1979.
Annual Report, 1979, 132 pp.

Barrackpore, Central Inland Fisheries Research Institute, 1980.
Annual Report, 1980, 108 pp.

Barrackpore, Central Inland Fisheries Research Institute, 1976-1978
Indian Fisheries Abstracts. **15** (1-4), 1976, **16** (3-4), 1977, **17** (1-2), 1978, **17** (3-4), 1978.

Barrackpore, Central Inland Fisheries Research Institute, 1981 & 1982.
CIFRI News-Letter **4** (5 & 6), September-December 1981, **5** (1 & 2), January-April, 1982.

Barrackpore, Central Inland Fisheries Research Institute, 1981.
Summer Institute on Farming System Integrating Agriculture, Livestock and Fish Culture (July 6-August 4, 1981), (Mimeo).

Barrackpore, Central Inland Fisheries Research Institute, 1982.
6th Workshop All India Coordinated Research on Composite Fish Culture and Fish Seed Production, 1st and 2nd July, 1982 (*Mimeo*).

Barrackpore, Central Inland Fisheries Research Institute, 1982.
6th Workshop All India Coordinated Research Project on Air Breathing Fish Culture, 27 & 28 December, 1982 (*Mimeo*)

Chakraborti, R. K., D. K. De and M. Subramanyam (1982.)
Observations on the availabilty of Bagda, *Penaeus monodon* (Fabricius) and Chapra, *P. indicus* (H. Milne Edwards) seed in the Hooghly estuary around Nurpur and Uluberia, West Bengal. *Sci* and *Cult.*, **48** (4) : 142-143.

Chattopadhyay, G. N. and L. N. Mandal (1980.)
Distribution of different inorganic forms of phosphorus in some brackishwater fish pond soils of West Bengal. J. *Inland Fivh. Soc. India*, **12** (1) : 25-29.

Chattopadhyay, G. N. and L. N. Mandal 1980.
Distribution of different forms of nitrogen in brackishwater fish pond soils of West Bengal. *Indian* J. *Fsh.* 27 (1 and 2) : 140-144.

Chattopadhyay and L. N. Mandal (1982.)
Concept of fertilising brackishwater fish ponds. *Fertiliser News*, **57** (11) : 15-19.

Chaudhury, M., R. Chandra, H. P. Singh and V. Kolekar (1980)
On the trend and seasonal indices of fish catch statistics at Uzanbazar (Gauhati) landing centre. J. *Inland Fish. Soc. India*, **12** (1) : 92-99.

Das, P. (1982)
History and present status of inland fishery extension in India. *Fisheries Journal*, **3** : 9-12.

Das, P., D. Kumar, A. K. Ghosh, D. P. Chakraborty and U. Bhowmick (1980)
High yield of Indian major carps against encountered hazards in a demonstration pond. J *Inland Fish. Soc. India*, **12** (1) : 70-78.

De, D. K. (1980).
Maturity, fecundity and spawning of post-monsoon run of Hilsa, *Hilsa ilisha* (Hamilton) in the upper stretches of the Hooghly estuarine system. J. *Inland Fish. Soc. India*, **12** (1) : 54-63.

De, D. K. and P. M. Mitra (1981)
Studies on the fecundity of *Setipinna taty* (Valenciennes) and *Trichiurus panuhui* Gupta of the Hooghly estuarine system. *Indian J. Fish.* **28** (1 & 2) : 272-274.

Dehadrai, P. V. (1982)
Prospects and problems of air breathing fish culture in India. *Taranga*, Annual Number 1981-82 : 9-12.

Dey, R. K., Dilip Kumar, B. K Mishra and K. Suresh (1982.)
Sampling methods, packing and shipments of materials for laboratory diagnosis of fish diseases. *Workshop on Development of Inland Fisheries in Orissa through Institutionol Finance, 6th 7th and 8th March 1982 at Gandhi Smruti Bhawan. Balasore* : 43-48.

Ghosh A. N. & P. K. Pandit (1979.)
On the rearing of fry of Bhetki *Lates calcarifer* (Bloch) in brackishwater ponds. *Matsya*, **5** : 50-55.

Jana, R. K. & A. K. Mondal 1981
On the hybridization of *Rana tigrina* Daud and *Rana erassa* Jerdon. *Proc nat. Acad. Sci. India*, **51** (1) : 1-32

Jhingran, V. G. 1980.
Recent advances in inland aquaculture in India (*Chandra Kala Hora Memorial Medal Lecture* 1980 : 1-4) Published by Indian National Science Academy, New Delhi)

Joseph, K. O , K. Raman, P. M. A. Kadir & S. Radhakrishnan (1981.)
Role of trace elements in brackishwater aquaculture. *Proc. nat. Acad. Sci. India*, B, **51** (3) : 221-226.

Kaliyamurthy, M. (1981).
Spawning biology of *Mystus gulio* in Lake Pulicate, India. *Indian J. Fish.* **28** (1 & 2) : 36-40.

Kamal, M. Yusuf, P. N. Jaitly & A. Mukherjee (1982.)
An unusual case of spawning of a chinese carp, *Hypophthalmichthys molitrix* (C & V). *Sci & Cult.*, **48** (1) : 42-43

Kaushal, D. K , M. D, Pisolkar & Y. Rama Rao (1980)
A note on the food habits of silver carp *Hypophthalmichthys molitrix* (Valenceinnes) from Gobindsagar reservoir (Himachal Pradesh). *J. Inland Fish. Soc. India*, **12** (1) : 129-130.

Kaushal, D. K., M. D. Piloskar & Y. Rama Rao 1980
Observations on the food habits of *Tor putitora* (Hamilton) from Gobindsagar reservoir, Himachal Pradesh. *J. Inland Fish. Soc. India*, **12** (1) : 138-139.

Kumaraiah, P. and G. Gnanaeela (1981)
An air-breathing fish a day keeps the doctor away. *Fishing Chimes*, **1** (8) : 25-27.

Dilip Kumar, B. K. Mishra, K. Suresh & R. K. Dey (1980)
Role of prophylaxis in aquaculture. *Workshop on Development of Inland Fisheries in Orissa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balasore* : 7-12.

Kuldip Kumar, (1980)
Laboratory studies on the intake of formulated feed by *Labeo rohita* and *Clarias batrachus*. *J Inland Fish. Soc. India*, **12** (1) : 118-120.

Malhotra, J. C. 1982
Artificial propagation of *Hilsa ilisha* (Hamilton) *Taranga*, Annual Number 1981-82 : 37-40.

Mishra, B. K , Dilip Kumar, R. K. Dey & K. Suresh (1982.)
Monitoring of fish health in aquaculture practices. *Workshop on Development of Inland Fisherie. in Orssa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balasore :* 27-30.

Mukhopadhyay, P. K., A. P. Mukherji & P. V. Dehadrai (1982.)
Certain biochemical responses in the air breathing catfish *Clarias batrachus* exposed to sublethal carbofuran. *Toxicology*, **23** : 337-45.

Mukhopadhyay, S. K., C. R. Sahoo & A. K. Bose (1981.)
Analysis of egg protein in five carps. *Hydrobiologia*, **77** (2) : 97-102.

Natarajan, A. V., K. L. Sehgal & Kulpip Kumar (1981.)
A semi-closed system for aquaculture incorporating use of reconditioned water in recirculatory filtering system. *Annual, Industrial Fisheries Association*, 1981 : 36-44.

Natarajan, A. V. & S. Paul (1982.)
Revitalisation of cooperatives for efficient fish marketing in inland sector. In Souvenir : First National Fisheries Cooperative Congrers 26.6.1982, Nagpur : 69-73.

Natarajan, A. V. & V. Pathak (1980.)
Bioenergetic approach to the productivity of man-made lakes. *J. Inland Fish. Soc. India,* **12** (1) : 1-13.

Panwar, R. S., R. A. Gupta, H. C. Joshi & D. Kapoor (1982.)
Toxicity of some chlorinated hydrocarbon and organophosphorus insecticides to gastropod *Viviparus bengalensis* Swainson. *J. Environ. Bio.,* **3** (1) : 31-36.

Parameswaran, S. & V. K. Murugesan (1976.)
Observations on the hypophysation of murrels (Ophicephalidae). *Hydrobiologia,* **50** (1) : 81-87.

Pathak, S, C., Y. S. Yadav, D. N. Singh & P. V. Dehadrai (1980.)
Observations on the mixed culture experiment on air breathing fishes conducted in derelict and freshwater ponds in Gauhati (Assam). *J. Inland Fish. Soc. India,* **12** (1) : 112-115.

Pathak, V. & V. V. Sugunan (1980.)
Effect of solar eclipes on the photosynthetic processes and behaviour ef biotic communities in Nagarjunasagar aquatic ecosystem. *J. Inland Fish. Soc. India,* **12** (1) : 121-126,

Patnaik, S. (1980)
Toxicity of organic copper compound (cutrine) on some algae and fish *J. Inland Fish. Soc. India,* **12** (1) : 116-137.

Radheshyam, B. B. Satpathy & C. Selvaraj (1982.)
Utilization of road side pits for rearing of carp fry-a case study. *Workshop on Development of Inland Fisheries in Orissa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balasore;* 3-6.

Radheshyam & Dilip Kumar 1982.
Fisheries extension for rural aquaculture. *Workshop on Development of Inland Fisherier in Orissa through Institutional Finance, 6th 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balaeore :* 99-104.

Rao, K. Gopal & P. C. Mahanta (1981.)
On the early maturation and induced spawaning of silver carp, *Hypophthalmichthys molitrix* (C & V) and grass carps, *Ctenopharyngodon idella* (Vol.) at Gauhati (Assam). *Proc. nat. Acad Sci. India,* **B, 51** (3) : 255-262.

Rao, Y. Rama, D. K. Kaushal, M. D. Pisolkar & V. K. Sharma (1980.)
On the occurrence of silver carp, *Hypophthalmichthys molitrix* (Valenceinnes) in Gobindsagar reservois, Himachal Pradesh. *J. Inland Fish. Soc. India,* **12** (1) : 134-135.

Saha, G. N. (1982.)
Role of soil and water in pond productivity and method of effective pond fertilization for increased fish production. *Workshop on Development of Inland Fisheries in Orissa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balasore* : 151-156.

Sarkar, S. K. (1982.)
Bundh breeding in India : a review and discussion. *Workshop on Development of Inland Fishries in Orissa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balaiore* : 77-86.

Sen, P. R. (1982).
Fish seed production in fresh water ponds. *Souvenir : Seminar on Freshwater Fish Seed Production 1982, Supplement* 1 : 1-10.

Sen, P. R. (1982.)
Management techniques of carp nurseries and rearing ponds for carp seed production. *Workshop on Development of Inland Fisheries in Orissa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balasore* : 31-37.

Sen, P. R. & D. K. Chatterjee, (1979.)
Increased Production of major Indian carp fry by addition of growth promoting substance. In finfish nutrition and fish feed technology, ed. by John E. Halver 4 K Tieas, Berlin, Heenemann Verlog-sgesells chaft mb H, 1979, V.1 : 189-195. *Proc. World Symp. on Finfish Nutrution and Fish seed Technology, Hamburg 20-23 June 1978 Berlin. V. I.* : 189-195.

Sen, P. R., N. G. S. Rao & A. N. Mohanty (1980.)
Relationship between rate of feeding, growth and conversion in major Indian carps. *Indian J. Fish.*, **27**(1& 2) : 201-208.

Sharma, V. K. (1979)
On a rare glyptosternoid fish from Kangra Valley of H. P. *J. Zool. Soc. India*, **31** (1 & 2) : 91.

Sharma, V. K. (1980)
A peculiar case of abnormality of caudal fin in *Carassius auratus* (Linn). *J. Inland Fish. Soc. India*, **12** (1) : 127-128.

Singh, B. N. (1982)
Nutritional requirements and natural and supplementary food of cultivated fishes with special reference to spawn, fry and fingerlings. *Workshop on Development of Inland Fisheries in Orissa through Institutional Finance 6th. 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balasore* : 121-134.

Singh, B. N., V. R. P. Sinha & D. P. Chakraborty (1979).
Effects of protein quality and temperature on the growth of fingerlings of rohu, *Labeo rohita* (Hamilton). *In* Finfish nutrition and fish feed technology, ed. by John E. Halver & K. Tieas, Berlin, Heenemann Verlogesells chaft mb H, 1979, V. II : 303-311) *Proc. World Symp. an Finfish Nutrition and Fish feed Technology, Hamberg 20 23 June, Berlin 1978.* V. II : 303-311.

Singh, B. N., V. R. P. Sinha & D. P. Chakraborty (1980).
Feed intake, absorption, conversion and growth of fry and fingerlings of rohu *Labeo rohita* (Hamilton). *Indian J. Fish*, **27** (1 & 2) : 193-200.

Singh, R. K., N. P. Shrivastava & V. R. Desai (1980).
Seasonal and diurnal variations in physico-chemical conditions of water and plankton in lotic sector of Rihand reservoir (Uttar Pradesh). *J. Inland Fish. Soc. India*, **12** (1) : 100-111.

Singh, S. B., S. R. Ghosh, P. V. G. K. Reddy, R. K. Dey & B. K. Mishra (1980).
Effect of aeration on feed utilization by common carp fingerlings. *J. Inland Fish. Soc. India*, **12** (1) : 64-69.

Sinha, Maniranjan (1982)
Composite culture of Indian and exotic carps. *Workshop on Development of Inland in Orissa through Instiutional Finance 6th, 7th & 5th March 1982 at Gandhi Smruti Bhawan, Balasore :* 39-42.

Sinha, V. R. P. (1979).
Contribution of supplementary feed in increasing fish production through composite fish culture in India. (*In* Finfish nutrition and fish feed technology, ed by John E. Halver & K Tieaz, Berlin, Heenemann Verlogsgesellschaft mb H. 1979, V. I : 565-574) *Proc. World Symp. on Finfish Nutrition and fish feed Tecnology, Hamberg 20-23 June, Berlin 1978.* V. I : 565-574.

Sinha, V. R. P. (1982)
Induced spawning of Asiatic carps. *Taranga*, Annual Number 1981-82 : 13-17.

Sinha, V. R. P. (1982)
Recent advances in fresh water aquaculture. *Workshop on Development of Inland Fisheries in Orissa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan Balasore :* 163-170.

Sinha, V. R. P., H. A. Khan & Radha C. Das (1982)
Role of various inducing agents in hypophysation of carps. *Workshop on development of Inland Fisheries in Orissa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan Balasore :* 73-76.

Sinha V. R. P. & N. K. Tripathy (1982)
Role of hydration in spawning of carps. *Souvenir : Seminar on Freshwater Fish Seed Production 1982,* Section II : 1-4.

Sugunan, V. V. (1980)
Seasonal fluctuations of plankton of Nagarjunasagar reservoir A P., India. *J. Inland Fish. Soc. India,* **12**(1) : 79-91.

Shyam Sunder, H. S. Raina & K. K. Vass (1980)
An incubator designed for Schizothoracid fish seed production. *J. Inland Fish, Soc. India* **12** (1) : 131-133.

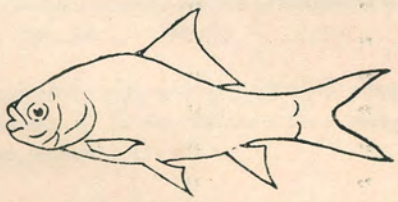
Suresh, K., Dilip Kumar, R. K. Dey & B K. Mishra (1982)
The role of stress in fish diseases. *Workshop on Development of Inland Fisheries in Orissa thrvugh Institutional Finance, 6th, 7th & 8th 1982 at Gandhi Smruti Bhawan, Balasore :* 13-14.

Thakur, Nirmal K. (1980).
Notes on the embryonic and larval development of an air-breathing catfish *Clarias Batrachus* (Linn). *J. Inland Fish. Soc. India,* **12** (1) : 30-43.

Thakur, Nirmal K. & S. K. Munnet (1982)
Occurrence of teratological manifestations in the air-breathing catfish *Heteropmenstes fossils* (Bloch) *Sci & Cutt.*, **48** (3) : 104-105.

Tripathy, N. K., Dilip Kumar & Kuldip Kumar (1982)
Concept of commun ty fish farming. *Workshop on Development of Inland Fisheries in Orissa through Institutional Finance, 6th, 7th & 8th March 1982 at Gandhi Smruti Bhawan, Balasore :* 23-26.

Zutshi, D. P. & K. Vass (1982)
Limnological studies on Dal lake, Srinagar III. Biological features. *Proce. Indian nat. Sci. Acad.* **48** (2) : 234-241.



PERSONNEL

Retirement :

Shri P. Ray, S-2 at Calcutta Research Centre and Shri S. J. Karamchandani, JFS at Allahabad Research Centre retired from the services of CIFRI on 31.3.1982.

Shri P. K. Sthanapathi Assistant Administrative officer, retired from service with effect from the afternoon of 30.11.1982 on attaining the age of superannuation.

Shri S. K. Chakraborty, Fieldman retired from the services of CIFRI on 31.3.1982.

Resignations :

Shri K. Suresh, S-1 at FARTC, Dhauli resigned in September, 1982.

Shri A. P. Mukherjee, Research Scholar resigned with effect from 12.3.1982.

Shri P. K. Karuppanna resigned from service on 15.8.82.

Promotions :

The following staff members have been promoted to the next higher grade during the year :-

Scientific

Name	*From*	*To*	*Discipline*	*w. e. f.*
Shri P. Ray	S-1	S-2	Agri. Chem.	25.2.1982
Dr. Peer Mohammed	,,	,,	Fish & Fisheries	1.7.1979
Shri S. K. Sarkar	S	S-1	,,	,,
,, M. J. Bhagat	,,	,,	,,	,,
,, P. V. G. K. Reddy	,,	,,	,,	,,
,, H. S. Mazumder	,,	,,	,,	,,
,, P. K. Ghosh	,,	,,	,,	,,
,, N. M. Chakraborty	,,	,,	,,	,,
,, S. K. Mazumder	,,	,,	,,	,,
,, P. K. Sukumaran	,,	,,	,,	,,
,, A. R. Choudhury	,,	,,	,,	,,
,, S. L. Kar	,,	,,	,,	,,

Technical

Name	*From*	*To*	*Name*	*From*	*To*
Shri B R. Dutta	T-4	T-5	,, A. C. Banerjee	T-4	T-5
,, Ashish Chowdhury	,,	,,	,, A. R. Mazumder	,,	,,

Technical

Name	*From*	*To*	*Name*	*From*	*To*
,, K. S. Rao	,,	,,	,, A. N. Mohanty	T-2	T-I-3
,, S. L. Raghavan	,,	,,	,, N. Sarengi	,,	,,
,, D. R. Rao	,,	,,	,, Camil Lakra	,,	,,
,, T. S. Ramaraju	,,	,,	,, R. N Singh	,,	,,
,, R. C. Singh	,,	,,	,, D. Tarai	,,	,,
,, P. B. Das	,,	,,	,, R. S. Negi	,,	,,
,, B. K. Saha	,,	,,	,, Kishnan Deo	,,	,,
,, R. N. Dey	,,	,,	,, J. C. Saha	,,	,,
,, Ramji Tiwari	T-2	T-I-3	, S. C. Das	,,	,,
,, Donald Singh	,,	,,	,, Basmadhyay	,,	,,
,, S. Krishnan	,,	,,	,, R. M. Roy	,,	,,
,, R. K. Langer	,,	,,	,, H. Das	T-1	T-2
,, M. P. Singh	,,	,,			

Grant of Advance increments :-

1.	Shri A. K. Ghosh	S-1	3 Increments
2.	Shri N. P. Srivastava	S	3 Increments

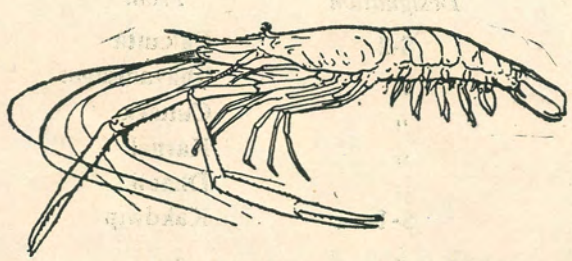
Appoinments :

Name	*Designation*	*Place of posting*
Shri Apurba Ghosh	S-3 (Project Coordinator Brackish-water Fish Farming)	Barrackpore
Shri N. Sarangi	T-4	Dhauli
,, Sukumar Saha	T-4	Kakdwip
Kumari Jayashri Das	Jr. Clerk	Barrackpore
Shri Lakshmi Ram	Watchman	Karnal

Transfers :

Name	*Designation*	*From*	*To*
Shri R. N. Pal	S-2	Calcutta	Barrackpore
,, K. N. Krishnamurti	,,	Bhavanisagar	Madras
,, G. V. Kowtal	,,	Cuttack	Puri
,, D. V. Pahwa	,,	Karnal	Dhauli
,, C. Selvaraj	,,	Dhauli	Pollachi
,, P. Ravichandran	S-1	Kakdwip	Puri
,, S. M. Pillai	,,	,,	,,

Name	*Designation*	*From*	*To*
,, B. Venkatesh	S-1	Barrackpore	Puri
,, N. A. Reddy	,,	Kakdwip	,,
Smt. K. K. Bhanot	,,	Rahara	Barrackpore
Shri S. R. Das	,,	Krishnagar	Kakdwip
,, M. K. Mukhopadhyay	,,	Kakdwip	Barrackpore
,, K. Gopinathan	,,	Madras	Pollachi
Dr. A. Mathew	,,	Bhavanisagar	,,
Shri Y. S. Yadava	,,	Gauhati	Bongaigaon
,, A. K. Dutta	,,	Barrackpore	Rahara
,, M. Chowdhury	,,	Gauhati	Bongaigaon
,, S. K. Wishard	,,	Allahabad	Kalyani
,, N. Sarangi	T-4	Cuttack	Barrackpore
,, R. C. Satpaty	T-I-3	Bhubaneswar	Barrackpore
,, B. Kahali	Driver	,,	Dhauli
,, M. Kachup	Jr. Clerk	Ranchi	Barrackpore
,, H. C. Banik	,,	Muzaffarpur	,,
,, S. K. Naranappan	,,	Bhavanisagar	Pollachi
,, Kunja Behari	Jr. Clerk	Dhauli	Allahabad
,, A. K. Srivastava	,,	Rihand	Dhauli
,, K. Kaliyannan	Fisherman	Bhavanisagar	Pollachi
,, S. K. Venkatachalam	,,	Bhavanisagar	,,
,, M. V. Krishnan	,,	,,	,,
,, Subrahamanyan	,,	,,	,,
,, H. C. Haldar	,,	Digha	Barrackpore
,, N. K. Das	Watchman	Barrackpore	Digha



Staff :

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 Gr.) Head and Project Director FARTC	FARTC	Dhauli
Shri H. A. Khan	S-2	,,	,,
,, M. Ranadhir	,,	,,	,,
,, C. Saha (on study leave)	,,	,,	,,
,, K. K. Sukumaran (From 30.3.82)	,,	,,	,,
,, D. V. Pahwa (From 26.6.82)	,,	,,	,,
,, D. K. Chatterjee	,,	,,	,,
,, M. Rout.	,,	,,	,,
,, R. K. Jana	,,	,,	,,
,, R. C. Das	S-1	,,	,,
,, George John	,,	,,	,,
,, D. Narayanaswami	,,	,,	,,
,, B. K. Mishra	,,	,,	,,
,, Dilip Kumar	,,	,,	,,
,, K. Suresh	,,	,,	,,
,, R. K. Dey	,,	,,	,,
,, A. K. Sahoo (From 25.9.82)	,,	,,	,,
,, S. N. Mohanty (From 4.10.82)	,,	,,	,,
,, S. N. Datta	,,	,,	,,
,, S. Jena	,,	,,	,,
,, P. V. G. K. Reddy	,,	,,	,,
,, B. R. Sirsat	,,	,,	,,
,, S. Patnaik	S-2	Pond Culture Unit	Cuttack
Dr. T. Ramaprabhu	,,	,,	,,
Dr. C. R. Das	,,	,,	,,
Shri N. G. S. Rao (On study leave)	S-2	Pond culture unit	Cuttack
,, S. D. Gupta	S-1	,,	,,
,, S. R. Ghosh	,,	,,	,,
,, Apurba Ghosh (upto 10.11.'82	S-2	Sewage-fed Fish Culture	Rahara

Name	*Designation*	*Section*	*Place*
Dr. S. K. Mukhopadhyay (From 9.10.82)	S-2	Sewage-fed Fish Culture	Rahara
Shri Ajoy Kumar Ghosh	S-1	,,	,,
Dr. G. N. Chattopadhyay	,,	,,	,,
Shri A. K. Roy	,,	,,	,,
,, A. K. Dutta	,,	,,	,,
,, S K. Saha (On deputation)	,,	,,	,,
Smt. K. K. Bhanot	,,	,,	,,
Shri K. R. Naskar	S-1	,,	,,
,, N. M. Chakraborty	,,	,,	,,
,, P. K. Saha	,,	,,	,,
,, P. K. Chakraborty (Posted at Canning)	,,	,,	,,

Estuarine division :

Name	*Designation*	*Section*	*Place*
Dr. T. Rajyalakshmi (on deputation)	S-3	Estuarine Section	Barrackpore
Shri K. K. Ghosh	S-2	,,	,,
,, B. B. Ghosh	,,	,,	,,
,, R. N. Pal	,,	,,	,,
,, K. K. Bhanot	,,	,,	,,
,, S. B. Saha	S-1	,,	,,
Dr. H. C. Joshi	,,	,,	,,
Shri M. M. Bagchi	,,	,,	,,
,, P. M. Mitra	,,	,,	,,
,, M. K Mukhopadhyay	,,	,,	,,
,, D. K. De	,,	,,	,,
,, S K. Mazumdar	,,	,,	,,
,, J. N. Pal	,,	,,	,,
,, G. N. Saha	S-2	Calcutta Research Centre	Calcutta
,, P. Ray (Upto 31.3.1982)	,,	,,	,,
,, S. C. Thakurta	S-1	,,	,,
,, R. K. Banerjee	,,	,,	,,
,, A. C. Nandy	,,	,,	,,
,, Hardial Singh	,,	,,	,,
,, H. C. Karmakar	,,	,,	,,
,, S. C. Banerjee	,,	,,	,,
,, G. C. Laha	,,	,,	,,
,, A. Chaudhuri	SRA	,,	,,
,, A. C. Banerjee	,,	,,	,,
,, D. D. Haldar	S-3	Kakdwip Research Centre	Kakdwip

Name	*Designation*	*Section*	*place*
Dr. P. U. Varghese (on deputation)	S-2	Kakdeep Research Centre	Kakdeep
Shri N. K. Das	S-1	,,	,,
,; R. K. Chakraborty	,,	,,	,,
,, S. R. Das	,,	,,	,,
Dr. S. M. Pillai (Upto May, 1982)	,,	,,	,,
Shri P. Ravichandran (do)	,,	,,	,,
,, N. A. Reddy (do)	,,	,,	,,
,, S. K. Mondal	,,	,,	,,
,, P. K. Ghosh	,,	,,	,,
,, G. V. Kowtal	S-2	Puri Research Centre	Puri
,, P. Ravichandran	S-1	,,	,,
,, B. Venkatesh	,,	,,	,,
Dr. S. M. Pillai	,,	,,	,,
Shri N. A. Reddy	,,	,,	,,
Shri K. Raman	S 3	Madras Research Centre	Madras
,, K. V. Ramakrishna	S-2	,,	,,
,, A. V. P. Rao (on deputation)	,,	,,	,,
,, R. D. Prasadam	,,	,,	,,
,, M. A. V. Lakshmanan	F. S.	,,	,,
,, G. R. M. Rao	S-1	,,	,,
,, S. Radhakrishnan	,,	,,	,,
,, C. P. Rangaswami	,,	,,	,,
,, M. Kaliyamurthy	,,	,,	,,
,, S Srinivasagam	,,	,,	,,
,, K. Gopinathan	,,	,,	,,
Smt. M. Sultana	,,	,,	,,
Shri K. O. Joseph	S	,,	,,
,, S. N. Sar	,,	Digha Survey Centre	Digha

Riverine & Lacustrine Division

Name	*Designation*	*Section*	*Place*
Dr. A. G. Jhingran (Upto)	S-3	Allahabad Res. Centre	Allahabad
,, G M. Mukherjee	S-2	,,	,,
Shri Ravish Chandra	,,	,,	,,
Dr. R. S. Panwar	,,	,,	,,
Shri S. P. Singh	,,	,,	,,
Dr. M. Peer Mohamed	,,	,,	,,
Shri M. A. Khan	S-1	,,	,,
,, S. K. Wishard	,,	,,	,,
,, R. K. Saxena	,,	,,	,,
,, K. P. Srivastava	,,	,,	,,

Name	*Designation*	*Section*	*Place*
Shri G. N. Srivastava	S-1	Allahabad Res. Centre	Allahabad
,, Balbir Singh	,,	,,	,,
,, S. N. Mehrotra	,,	,,	,,
,, R. A Gupta	,,	,,	,,
,, D. N. Singh	,,	,,	,,
,, R. N. Seth	,,	,,	,,
,, R. K. Tyagi	,,	,,	,,
,, R. K. Dwivedi	,,	,,	,,
Dr. K. Chandra	,,	,,	,,
Shri S. J. Karamchandani (Upto 31.3.82)	JFS	,,	,,
Shri D. R. Kanujia	S-1	R. L. Division	Buxar
,, Shri Prakash	,,	,,	,,
Dr. A. K. Laal	,,	,,	Bhagalpur Res. Centre
Shri S. K. Sarkar	,,	,,	,,
Dr. M. L. Bhowmick	,,	,,	Muzaffurpur Res. Centre
Dr. S. P. Rai	,,	,,	,,
Shri V. R. Chitranshi	,,	,,	,,
,, D. Kapoor (On study leave)	,,	,,	,,
,, B. V. Govind	S-2	,,	Bangalore Res. Centre
Dr. S. P. Ayyar	,,	,,	,,
Shri V. K. Murugesan	S-1	,,	,,
,, P. Kumararah	,,	,,	,,
Dr. (Smt.) S. Sivakami	,,	,,	,,
Shri S. Ayyappan	,,	,,	,,
,, P. K. Sukumaran (Upto 17.7.82)	,,	,,	,,
,, K. V. Rao	,,	,,	Tadepalligudem Res. Cen. (K.G. Unit)
,, K. J. Rao	,,		
,, D. S. Murty	JFS	,,	,,
Dr. M. Subramanyam	S-2	,,	Kakinada Res. Centre
,, L. H. Rao	S-1		
,, K. J. Ram			
,, S. C. Pathak	S-2	,,	Gauhati Res. Centre
Shri Y. S. Yadav	S-1	,,	,,
,, M. P. Singh Kohli	,,		
,, R. K. Singh (n study leave)	,,		
,, M. Chaudhuri	,,		
,, S. K. Munnet	,,		
,, V. Kolekar	S		,,
,, B. L. Pandey	S-1		Lalgola Surv. Centre
Dr. K. K. Vass	S-2	Coldwater Res. Unit	Buxar
Shri Shyam Sunder	S-1	,,	,,

Name	*Designation*	*Section*	*Place*
Dr. H. S. Raina	S-1	Coldwater Research Unit	Srinagar
Smt. Usha Moza	"	,,	,,
Shri C. B. Joshi	"	Coldwater Fisheries Unit	Bilaspur

Sections/Projects Directly under Director's Control :

Shri P. Das	S-3	Extension Section	Barrackpore
" U. Bhowmick	S-1	,,	,,
" P. K. Pandit	"	,,	,,
" B. K. Banerjee	"	,,	,,
" B. N. Saigal	S-2	Library & Documentation Section	,,
" V. V. Sugunan	S-1	,,	,,
Smt. G. K. Vinci	"	,,	,,
Shri Amitabha Ghosh (on study leave)	"	,,	,,
Dr. V. K. Unnithan	"	,,	,,
Shri M. J. Bhagat	"	,,	,,
" A. R. Choudhury	"	,,	,,
Dr. K. L. Sehgal	S-2	Technical Cell	,,
Shri Kuldip Kumar	S-1	,,	,,
Dr. (Mrs) K. Mitra	S-1	,,	,,
Shri 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	,,
Dr. V. Pathak	"	,,	,,
Shri B. K. Sharma	S-2	Operational Research Project	Krishnagar
" M. K. Das	S-1	,,	,,
Dr. A. K. Mondal	S-2	Frog Culture Unit	Kalyani
Dr. B. N. Singh	"	KVK/TTC	Dhauli
Dr. N. K. Thakur	"	,,	,,
Shri C. Selvaraj	"	,,	,,
" C. S. Purushothaman	S-1	,,	,,
" J. G. Chatterjee	"	,,	Kakdwip

Co-ordinated Projects :

Composite Fish Culture and Fish Seed Production

Shri S. D. Tripathi	S-3	CFCSP	Dhauli
Dr. K. G. Rao	S-1	,,	,,
Shri M. Sinha	S-2	,,	Kalyani

Name	*Designation*	*Section*	*Place*
Shri D. P. Chakraborty	S-1	CFCSP	Dhauli
,, P. C. Mahanta (Upto 30.6.82)	S	,,	Gauhati
,, D. N. Mishra	S-1	,,	Jaunpur
Dr. M. Y. Kamal	S-2	,,	Ranchi
Shri A. Mukherjee	S-1	,,	,,
,, P. N. Jaitly	S	,,	,,
,, M. Kaliyamurthy	S-1	,,	Bhavanisagar
,, P. K. Aravindakshan	,,	,,	,,
,, P. L. Rao	,,	,,	Pune
,, B. K. Singh	S	,,	,,
,, D. V. Pahwa (Upto 14.6.82)	S-2	,,	Karnal
,, K. L. Shah	S-1	,,	,,
,, B. C. Tyagi	S-1	,,	,,
,, R. M. Rao (From 19.4.82)	S-2	,,	Badampudi
,, J. B. Rao	S-1	,,	,,

Air-breathing Fish Culture

Dr. S. K. Mukhopadhyay	S-2	ABF	Barrackpore
Shri P K. Mukhopadhyay	S-1	,,	,,
,, R. K. Das	,,	,,	,,
Dr. S. C. Pathak	S-2	,,	Gauhati
Shri M. P. S. Kohli (Upto 6.7.82)	S-1	,,	,,
Dr. N. K. Thakur (Upto 4.4.82)	S-2	,,	Patna
Shri Dirandra Kumar	S-1	,,	,,
Dr. S. P. Ayyar (On deputation)	S-2	,,	,,
Shri V. K. Murugesan	S-1	ABF	Bangalore
,, P. Kumaraiah	S-1	,,	,,

Reservoir Fisheries

Shri Ch. Gopalakrishnayya	S-2	Reservoir Fisheries	Nagarjunasagar
,, M. Ramakrishniah	S-1	,,	,,
,, G. K. Bhatnagar	S-2	,,	Ranchi
Dr. B. P. Gupta	S-1	,,	,,
Shri S. N. Singh	,,	,,	,,
Dr. Y. Rama Rao	S-2	,,	Bilaspur
Shri S. C. Jha	S-1	,,	,,
,, M. D. Pisolkar	,,	,,	,,
,, D. K. Kaushal	,,	,,	,,
,, V. K. Sharma	,,	,,	,,

Name	*Designation*	*Section*	*Place*
Shri V. R. Desai	S-2	Reservoir Fisheries	Rihand
,, N. P. Srivastava	S-1	,,	,,
Dr. Mathew Ab aham	,,	,,	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
,, S. L. Kar
,, B. B. Satpathy
,, A. K. Chattopadhyay

Overseer—T-5
Shri P. N. Bhattacharjee

Senior Artist—T-5
Shri J. Ghosh

Assistant Librarian —T-5
Smt. Anjali De

Demonstrator—T-4
Shai B. R. Dutta
,, Kuldeep Kumar
" Radheshyam

Technical Assistant—T—4

Shri P. B. Das	Shri K. S. Rao
" R. N. De	" R. C. Singh
" S. L. Raghavan	" D R. Rao
" T. S. Ramaraju	" B K. Saha

Shri 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	Shri K. K. Agarwal
" M. F. Rahman	" N. N. Sarkar
" K. S. Banerjee	" A. K. Ekka
" S. P. Ghosh	" N. N. Mazumdar
" N. C. Mondal	" A. R. Paul
" Aloke Sarkar	" B. D. Saroj
" H. K. Sen	" G. P. Bhattacharjee
" P. S. C. Bose	" Ram Chandra
" Bhaskar Ghosh	" A. K. Roy
" N. D. Sarkar	" 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	Shri Camil Lakra
" R. K. Langer	,, J. P. Mishra
" A. N Mohanty	" G. C. Sahu
" N. Sarangi	" M. P. Singh
" Ramji Tiwari	" S. K. Chatterjee
" B. B. Das	" K. C. Pani
" Sukumar Saha	" D. Sanfui
" K. P. Singh	

Mechanic—T-2
Shri Donald Singh

Electrician

Shri S. K. Chatterjce — Shri N. Guin

Senior Gestetner Operator—T-2

Shri S. C. Bhowmick

Senior Binder—T-2

Shri M. M. Das

Driver/Engine/Launch/Mini Bus—T-2

Shri Surja Bahadur
" N. C. Biswas
" U. K. Chatterjee
" K. R. Deb
" K. K. Dutta
" Badal Lal Singh
" Basmadaya
" R. S. Nogi
" J. C. Saha
" R. N. Singh
" Ranjit Singh

Shri B. B. Sethi
" M. G. Subramani
" K. L. Das
" T. P. Ghosh
" S. C. Das
" R. M. Roy
" D. Tarai
" R. L. Balmiki
" Kishen Deo
" Harihar Das

Pump Man—T-2

Shri N. C. Roy

Driver/Engine/Launch/Mini Bus—T-1

Shri K. Ganeshan
" A. K. Majumder
" M. C. Pal
" D. Borgoyary
" Ch. S. Rao
" C. K. Nath

Shri P. Lall
" B. B. Roy
" B. K. Bahura
" R. Tarai
" B. Kahali

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
" R. D. Saha

Shri S. K. Gupta
" K. P Saha
" N. P. Saha

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

Shri L. M. Nandy

Accounts Officer

Shri A. N. Mukherjee

Administrative Officer

Shri P. K. Sthanpati

Assistant Administrative Officer

Shri K. C. Roy — Shri K. B.Rajani

Superintendent

Shri M. L. Biswas
Shri A. K. Das
Shri M. R. Roy

Shri P. C Kanungo
Shri A. K. Sengupta
Shri S. C. Saha
Shri B. C. Dutta

Assistant

Bhattacherjee, B. C.
Bose, S. K.
Des, T. P.
Dasgupta, S.
Mazumder, Sandhya
Roy, Bani
Baidya, N. H.
Das, C. C.
Choudhury, Namita
Halim, Abdul

Roy, S. C.
Sarkar, A. C.
Sarkar, N. K.
Shastry, S. P
Zaidi, F. A.
Mahesh Prasad
Awedh, Sah
Neogi, M. M.
Banerjee, D. K.
Bose, D. C.

Senior Stenographer

G. Lahiri

Stenographer

Banerjee, A. K.
Chakladar, H.
Chakraborty, G. M.

Ghosh, U. K.
Sihha, R. C. P.
Srivastava, R. C.

Junior Stenographer

Bhattacherjee, S.
Chatterjee, T.
Das, P. K.
Jena, P.

Prasad, P.
Roy, T. K.
Saha, A. K.
Sahood, D.C.

Senior Clerk

Baidya, D. N.
Banerjee, J. N.
Bhowmik. S.
Das, Moloy Kr.
Dey Sarkar, D. K.
Ghosh, B K.
Halder, S. R.
Kar, S. K.
Kodandraman, I. N.
Majumdar, Biplab
Majumdar, T K.
Mishra, L. P.
Mitra, N. K.
Mukherjee, B. B.
Mukherjee, R. R.
Nath. H. K.
Patra, J. C.
Pramanick, S. K.
Pramanick, S. N.
Prasad, Keshau
Rai, Jagdish
Sarkar, H. L.
Sarkar, S. K.
Singh, Kallu
Singh, R. C. P.
Sinha, S. S.
Sreedharan T. K.
Subrahamanian, M.
Sutur, H. B.

Junior Clerk

Banerjee, Anita
Banerjee, Narayani
Banerjee, Mrinalini
Behara, A. C.
Behari, Kunj
Behara, Purnachandra
Chakraborty, Amita
Chhotey Lal
Das, B. K.
Das, Jayashree
Ghosh, P. K.
Ghosh, Samar Kumar
Kachhap, M.
Kundu, N. R.
Lal, Ambika
Mandal, Bulbul
Manju, K.
Mazumder, Sikha
Mupid, B. S.
Naik, N. C.
Nath, Baij
Panda, R. K.
Rao, K. S.
Raina, R. L.
Roy, S. B.
Behara, R. C.
Bhagirathi S.
Biswas, A. B.
Biswas, Manjulal
Biswas, P. K.
Bose, Samir Kumar
Chatterjee, Dipankar
Chowdhury, Debesh
Das, G. B.
Dutta, P. K.
Ghosh, R. K.
Gurish, W.
Kumar Surendra
Lahiri, P.
Mahato R. N.
Mandal S. P.
Maranappa S. K.
Mondal, A. B.
Murthy, P. B. V. S.
Neogi Anjali
Nath, Kalipada
Rao, G. S.
Radhakrishnan, K.
Roy, J.
Roy Samir Kumar
Sadaverte, N.
Srivastava, A. K.
Shan, Biswanath
Tikadar, S. K.

Supporting Grade IV

Behera, B. N.
Bhuyan, U.
Biswas, D. N.
Biswas, J. N.
Bose, J. L.
Burman, G. N.
Chakraborty, K. L.
Dalai, B.
Das, C.
Das, P. V. N.
Das, K. P.
Dey, S. K.
Dosad, R. B.
Gangaram
Jally, H.
Jally, U. N.
Jana, K. C.
Mewalal
Naik, J.
Prasad, K.
Ramdeo
Sahood, D.
Samal, B.
Samood Majhi, B.
Singh, D.

Supporting Grade III

Apparao, B.
Bahadur, Nar
Bahadur, Durga
Barik, N.
Barik, Dijia
Barik, S.
Balmiki, Sitaran
Balmiki, S. C.
Baldevsing, D. N.
Bakshiram
Behera, K. B.
Behera, K. C.
Behera, Alekha
Behera, Trailokya
Behera, N.
Bhoi, D.
Bhuloka, D.
Bhuyan, N.
Biswas, T. K.
Kotaish, S.
Kujur, J. M.
Lajuram
Lal, Madan
Maranappan, S. K.
Burman, M. S.
Burmau, S. N.
Bose, N. R.
Chakraboty, S. K.
Chand, Mool
Das, S. K.
Das, Mosa
Das, H K.
Das, Antiram
Das K. K.
Gopal, K.
Iruthiraj, M.
Jana, Natabar
Jally. Khetrabasi
Jally, Aghur
Raha, R. N.
Raikwar, Ramlal
Routh, H. K,
Rao, Ch. Ganeswar
Singh, C.

Mishra, P.
Mondal, A. K.
Muuda, Budhram
Mohanty, N. N.
Naik, B.
Naik, D.
Panda, Lakshmidhar
Pandey, C. K.
Patra, A. M.
Paramanik, H. K.
Patnaik, S. R.
Prakash, B.
Shyamal, B. R.
Singh, Meher
Shyamal, H. K.
Sahoo, D.
Saha, N. K.
Sethi, P. C.
Varghese, P. V.

Supporting Grade II

Apponna, K.
Bahadur, Bhim
Bahadur, Surja
Bahadur, Tek
Balmiki, Khem Chand
Bahadur, Sitaram
Boral, S. K.
Bhoi, Shyama
Barik D.
Bhanja, B.
Burman, S. N.
Behera, Khalia
Burman, Niranjan Kr.
Burman, Sudhangshu
Balmiki, Krishanlal
Biswas, Jagdish
Biswas, S. C.
Biswas, Hiralal
Bose, Hiralal
Biswas, Manindranath
Biswas, Ashoke Kr.
Burman, M. K.
Biswas, A. K.
Bhuyan, Dhirendra
Behera, Rajkishore
Bhaskar Bhoi
Chakraborty, Saradandu
Chaki, S. N.
Das, P. C.
Behera M.
Behera, K. B.
Bhoi, R. C.
Bhania, D.
Burman, S. K.
Behera, Keshab
Balaraman, M.
Burman, Balaram
Burman, H. S.
Burman, Sudhangshu
Balmiki, Kattore
Bhava, C. K.
Lal, Bideshi
Maity, S. S.
Mondal, Gokul Chandra
Mondal, Subal Chandra
Manna, L. C.
Mondal, Biswanath
Maniekyam, P.
Mondal, Niranja Kr.
Malleh, Jai Nandan
Mondal, Biswanath
Narendra, G. C.
Narasapp, B.
Parbat, L. K.
Pradhan, B.
Panda, Jadish
Parida, Sridhar
Parida, Fakir
Das, B. S.
Das, Sitaram
Das, Jhantu Ranjan
Das, Giridhari
Das, Nikunjalal
Das, Dhaneswar
Dhanuk, Shyamalal
Dehuri, Basudeb
Jangli
Jena, N. C.
Jadav, S. P.
Jally, L.
Jana, Bibhuti Kr.
Kishore, Jugal
Kaliannan, K.
Krishnan, M. V.
Hazarika, B.
Sayalu, P.
Samulu, L.
Swain, Raghunath
Sahoo, Lakshmidhar
Das, Gunadhar
Tair, R. N.
Parameshwar
Ramalingam, M.
Ram, Japhu
Ram, Munshi
Reju, Kolludharma
Raju, A. Eswar
Singh, S. S.
Sahoo, D. N.
Sahu, D. N.
Singh, Ramdeo
Sahoo, G.
Singh, C. P.
Srinivanan, V. K.
Sundar, Ram.
Saha, P. C.
Singh, P.
Shaw, Gulab
Sahoo, K. M.
Yadov, A. L.

Supporting Grade I

Anjanappa, M.
Ali, Munsur
Arumugam, P.
Ali, S. K. Munsur
Bain, G. C.
Behera, Chhakei
Bahadur, Karna
Bahadur, Indra
Bahadur, Asta
Bahadur, Mina Rani
Bose, Sankar
Bairagi, Suklal
Bijali, Amalya
Bhattacherjee, Ashutosh
Behera, Debahari
Biswas, Suk Chand
Biswas, A.
Bez, P. C.
Choudhury, Panchulal
Chatterjee, Rupali
Dhan, Maya
Dutta, Anjali Rani
Debroy, R. L.
Dhir, K. K.
Dhibar, Gunadhar
Das, Mukti
Das, B. C.
Dukran
Das. B. C.
Das, Rash Bihari
Das, Nayaram
Das, Sudhakar
Das, Parusuram
Das, M. C.
Ghosh, A. C.
Ghosh, Pasupati
Gowda, Malige
Ghume, T. H.
Choudhsi, Umesh

Bind, M. P.
Bahadur, Lal
Bahadur, Man
Bhoi, M. S.
Bhol, R. K.
Burman, Shatendra
Bendre, S. S.
Balmiki Jagadish
Behera, Dhanu
Bhuiya, N.
Boro, Bhabalu
Betal, Sasadhar
Barik, Basanta Kr.
Behera, Makunda Charan
Bhoi, Bijaya
Balmiki, Iswar Ram
Krishnapada B. N.
Karkatta, Joseph
Khatua, Jadumani
Kumar, Kharban
Karuppanna, P.
Kemparas, P.
Kemparas, A.
Khan, Rahmat
Lakshmi, Ram
Mondal, Bholanath
Mani, N.
Mondal, Kalashashi
Mahadeva, M.
Mondal, Godhli
Gangayya, A.
Govata, S. T.
Gharami, Phani
Govindalal
Haldar, L. K.
Halder, Sital Chandra
Halder, Hemlata
Halder, Satyendra Nath
Jally Burman
Jena, Gourhari
Jena, Panchanan
Jena, N.
Jelly, Kedar Chandra
Khalko, Joseph
Karmakar, Sarbananda
Kachari. P. C.
Pugalendhi, B.
Paik, B. C.
Prasad, Laita
Palanisamy, R.
Pramanik, G. C.
Prasad, Ram
Paria J.
Parida, Satyananda
Paramanik, P. C.
Prasad, Shitala
Parida, Y.
Parida, Golekha
Palai, Duryodhan
Mallah, Munilal
Muchi, R. U.
Mollick, G. C.
Mani, K.
Mukhia, J.
Mallah, Rajdhari
Murugesena, A.
Mariappan, V.
Mahalick, Antaryami
Mondal, Kalipada
Mohd. Yusuf Dar
Mondal, Sachindra
Naik, G. C.
Naik, Krishna Ch.
Ningegowda, K.
Naik, Sudarsan
Nayak, P. K.
Nayak, Sripati
Omprakash
Subramani
Samal, Krusnna Chandra
Seshanna
Sahni, Aghanu
Subramaniam, K.
Singh, C. P.
Samanta, Pr. Sekhar
Singh, Kuldeep
Swain, Ramesh Chandra
Shree, Nath
Yasiah, R.
Parida, Judhistir
Patnaik, B.
Rao, G. Santa
Ram, Rajendra
Rajaratnam, R.
Ramaswamy, A.
Roy, Pradupta Kishore
Raj, Karam
Ram, Paras
Runadala, G. J.
Rao, Medisethi Chandra
Ram Kawal Pati
Rao, P. Nageswar
Saha, Mohan Lal
Saha, Manoranjan
Sethi, P. K.
Samanta, Narayan Ch.
Sita
Singh, Maha
Saha, P. C.
Subbaiyan, K.
Sahni, Aghanu
Satyanarayan
Subramani, M.
Swain, Jatadhari
Swain, Pitamber
Samal, Chaitanya Charan
Swain, Ranjan
Uahendran, S.

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, 1983.*

Class	Permanent/ Temporary	Total No. of employes	Scheduled Castes	Percentage to total employees	Scheduled Tribes	Percentage to total employees	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Class I	Permanent	124	3	2.40	—	—	—
	Temporary	88	8	9.00	—	—	—
Class II	Permanent	37	2	3.40	—	—	—
	Temporary	21	4	19.50	1	1.00	—
Class III	Permanent	139	33	23.70	4	2.90	—
	Temporary	83	12	14.80	6	7.00	—
Class IV	Permanent	216	49	22.69	1	6.46	—
	Temporary	170	37	21.80	3	1.80	—
Class IV	Permanent	14	14	100.00	—	—	—
	Temporary (Safaiwala)	5	4	80.00	1	20.00	—

APPENDIX II

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE (ICAR) : BARRACKPORE : WEST BENGAL

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,	

Research/Survey Centre	*Telegram/ Telephone*
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, Kanika Road, CUTTACK-753 008, Orissa.	Fishsearch Cuttack
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,	

Research/Survey Centre	*Telegram/ Telephone*
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, P.O. Vijayapuri South, Nagarjunasagar Dam, A. P., Pin : 522 439.	2617
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.	

Research/Survey Centre	*Telegram/ Telephone*
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.	

ORGANISATION CHART OF
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
BARRACKPORE-743101 WEST BENGAL
1982

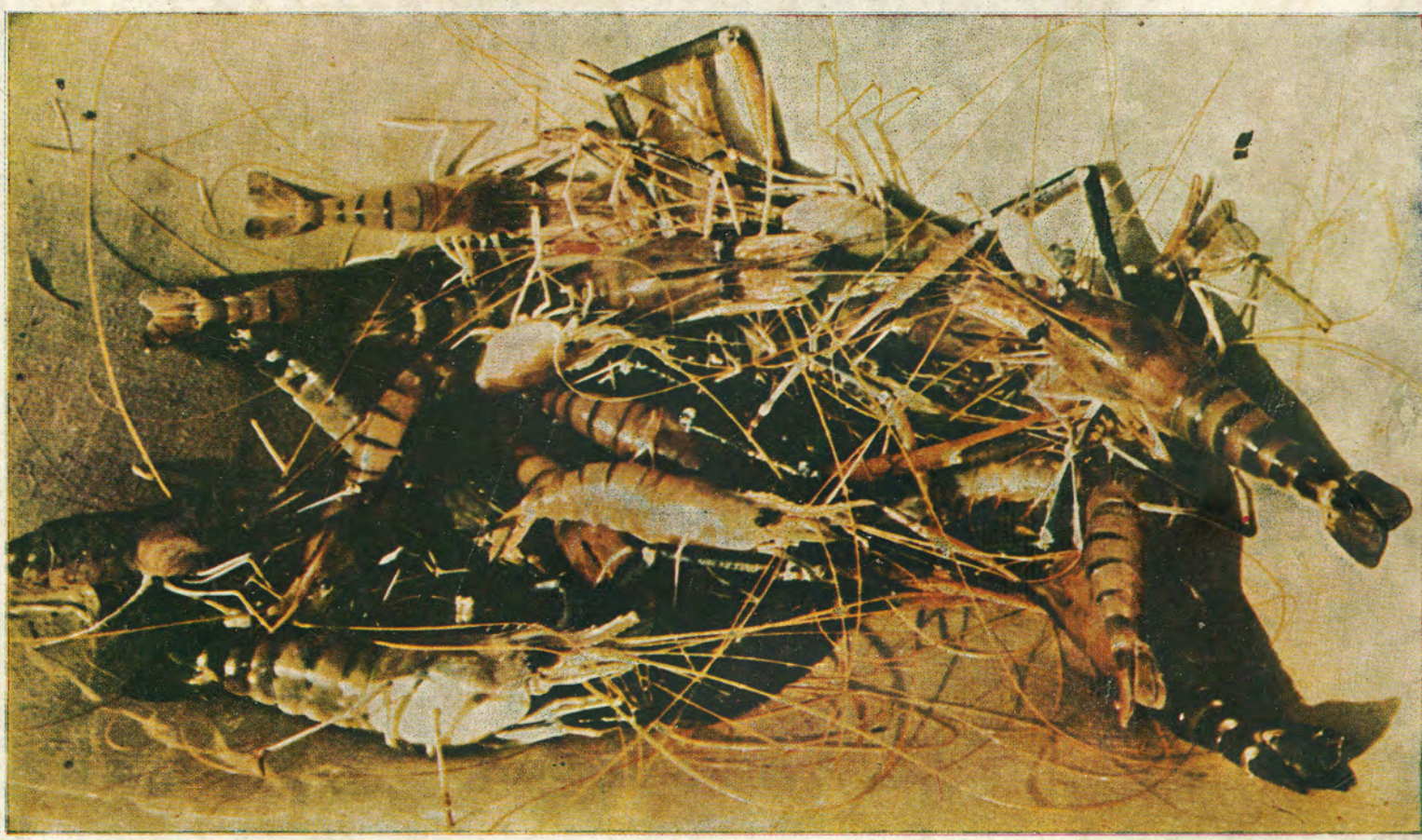
DIRECTOR

- **FRESHWATER AQUACULTURE DIVISION**
  Dhauli P. O. Kausalyagang
  (Via) Bhubaneswar, Orissa
  - Pond Culture
  - Exotic Fish Culture
  - Weed Control
  - Soil Chemistry
  - Frog Culture
  - Fish Farm Engineering
  - Fish Nutrition
  - Fish Pathology
  - Fish Hybridisation & Genetics
  - **FRESHWATER AQUACULTURE RESEARCH & TRAINING CENTRE** (Dhauli)
    - Krishi Vigyan Kendra (Matsya)
    - Cuttack Research Centre
    - Trainers' Training Centre (Fisheries)
- **ESTUARINE FISHERIES DIVISION**
  - Esturaine Fisheries
  - Hilsa Fisheries
  - Water Pollution
  - Statistics
  - Plankton Culture
  - **CALCUTTA RESEARCH CENTRE**
    - Bakkhali Research Centre
    - Kakdwip Research Centre
    - Puri Research Centre
    - Barrackpore Research Centre
      - Digha Survey Centre
    - Madras Research Centre
- **RIVERINE & LACUSTRINE FISHERIES DIVISION**
  24, Pannalal Road,
  Allahabad 2 (U. P.)
  - Riverine Fisheries
  - Hilsa Fisheries
  - Reservoir Fisheries
  - Statistics
  - Water Pollution
  - **ALLAHABAD RESEARCH CENTRE**
    - Srinagar Research Centre
    - Tadepalligudem Research Centre
    - Kakinda Research Centre
    - Buxar Research Centre
    - Bangalore Research Centre
    - Bhagalpur Research Centre
    - Gauhati Research Centre
    - Mans Research Centre, Muzzaffarpur

ALL INDIA COORDINATED

- **COMPOSITE FISH CULTURE AND FISH SEED PRODUCTION**
  Dhauli P. O. Kausalyagang
  (Via) Bhubaneswar, Orissa
  - Subcentres
    - Kalyani (West Bengal)
    - Vadampudi (Andhara Pradesh)
    - Bhavanisagar (Tamil Nadu)
    - Jaunpur (Uttar Pradesh)
    - Karnal (Haryana)
    - Pune (Maharashtra)
    - Ranchi (Bihar)
    - Gauhati (Assam)
    - *Godhra (Gujarat)
    - *Tuticorin (Tamil Nadu)
    - *Kausalyagang (Orissa)
    - *Durg (Madhya Pradesh)
- **AIR-BREATHING FISH CULTURE IN SWAMPS**
  Barrackpore (W. B.)
  - Subcentres
    - Gauhati (Assam)
    - Patna (Bihar)
    - Bangalore (Karnataka)
    - *Palair (Andhra Pradesh)
    - *Kalyani (West Bengal)

ANNUAL REPORT



CIFRI