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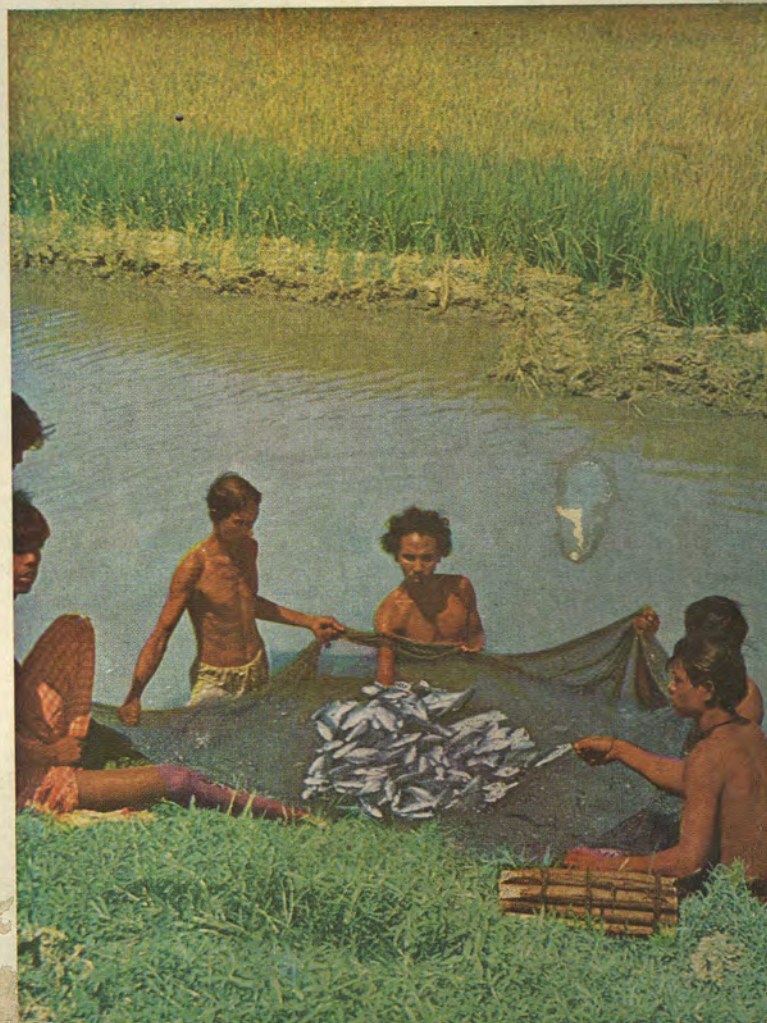

ANNUAL REPORT

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
BARRACKPORE [illegible] WEST BENGAL

ANNUAL REPORT

1979

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

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Printed by	:	Roman Printers 37 Andul Road Howrah 711 109

Published by —

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ANNUAL REPORT 1979
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
BARRACKPORE

1. DIRECTOR'S INTRODUCTION

History :

The Central Inland Fisheries Research Institute was formally established in March 1947 under the Ministry of Food and Agriculture, Government of India for the purpose of conducting scientific studies on inland fisheries of the country. The Institute is, since June, 1959, housed in its own buildings at Barrackpore on the left bank of the river Hooghly in an area covering about 5.2 ha. It came under the administrative control of the Indian Council of Agricultural Research on October 1, 1967.

Objectives :

The objective of the Institute is to evolve sound scientific principles which when applied can lead to the full exploitation of our country's vast inland water resources. Taking up the onerous task of achieving such a goal entails a thorough knowledge about modern concepts in aquaculture as well as apt fishery management techniques of capture fisheries. While aiming to formulate the scientific principles of fishery operations, due emphasis is given to the short term production oriented research projects in order to meet the ever-increasing consumer demand in our country. This is in addition to the long ranging projects that are of continuing nature. The ultimate aim is the rapid development of aquaculture in rural areas of the country where perennial as well as seasonal water bodies abound.

Organisational Structure :

The three major divisions of the Institute are (I) Freshwater Aquaculture Division, (2) Riverine and Lacustrine Fisheries Division, and, (3) Estuarine Fisheries Division, which are presently located at Bhubaneswar, Allahabad and Calcutta respectively. The Freshwater Aquaculture Division functions at Cuttack and Bhubaneswar. The research centres under the Riverine and Lacustrine Fisheries Division are located at Tadepalligudem, Kakinada, Gauhati, Bhagalpur, Buxar, Srinagar and Bangalore. Madras, Bokkhali and Kakdwip Research Centres are functioning under the Estuarine Fisheries Division. In addition to these, a Mans Research Centre has been established at Muzaffarpur, Bihar in 1979 under the Riverine and Lacustrine Fisheries Division. Kalyani Research Centre and the Krishnagar Operational Research Centre in West Bengal, Krishi Vigyan Kendra (Matsya) and Trainers' Training Centre (Fisheries) at Dhauli in Orissa are under the direct control of the Director. Besides these, Economics, Statistics, Extension, Library & Documentation, Administrative, Accounts, Audit and Stores Sections are situated at the Head Quarters of the Institute at Barrackpore.

Institute based All India Coordinated Research Projects, *viz.*, (i) Ecology and Fisheries of Freshwater Reservoirs (with main centre at Barrackpore and subcentres at Bhavanisagar, Bilaspur, Kangsabati, Nagarjunasagar, Ranchi, Rihand and Ukai); (ii)Composite Fish Culture and Fish Seed Production of Indian and Exotic Fishes (with main centre at Bhubaneswar and sut centres at Badampudi, Barrackpore, Bhavanisagar, Coimbatore, Durg, Gauhati, Godhra, Jaunpur, Kalyani, Karnal, Kausalyagang, Pune and Ranchi) ; (iii) Air-breathing Fish Culture in Swamps (with main centre at Barrackpore and subcentres at Bangalore, Patna, Gauhati, Kalyani and Palair) ; and (iv) Brackishwater Fish Farming (with main centre at barrackpore and subcentres at Ernakulam, Kakdwip, Kakinada, Keshpur, Madras and Panaji) continued to function during the year. The new Krishi Vigyan Kendra in Brackishwater Fish Farming at Kadkwip is yet another step to propagate fish culture techniques at common man's level. Diagrammatic representation of the organisation of the Institute is presented in the Organisation Chart appended to this report (Appendix II).

Library and Documentation :

During the year under report 380 books, 25 reprints, 137 miscellaneous publications and 1175 issues of periodicals were added to the library ot the Institute. A total of 37 foreign and 41 Indian journals were subscribed during the year. The library also obtained either as free gift or in exchange additional 125 Indian and foreign journals.The present library holdings inclusive of the year's arrivals comprise 4, 213 books, 3,760 outside reprints and 1,986 miscellaneous publications excluding the stock of journals, pamphlets, maps, departmental publications, etc. Besides maintaining old exchange relationships, 11 new exchange relationships were established during the year. "Accession lists" for the period January—December, 1978 were brought out and circulated. Fifty eight technical and non-technical queries from India and abroad were attended to by the Library and Documentation Section. The Institute supplied a number of publications to the Nissat—Insdoc Regional Centre, Jadavpur ; Documentation Procurement Section, INSDOC, Delhi ; Botanical Survey Eastern Circle, Shillong; B. Borooah College, Gauhati; T. V' Film Production Centre, Calcutta ; Zoological Survey of India, Calcutta ; Superintendent of Fisheries, Silchchar; National Institute of Oceanography, CSIR, Goa ; Dept. of Zoology, Haryana Agricultural University, Hissar ; Indian Statistical Institute, Baranagar, Calcutta and Fisheries Secretary, Govt. of West Bengal, Calcutta.

During the year, 38 reports on progress of research were compiled and sent to the ICAR. CIFRI News bulletin Nos. 1—4 covering the period July, 1979—October, 1979, Bulletin Nos. 29—30 entitled "Additional 126 Case Studies of Composite Fish Culture in India, incorporating second batch of studies performed during 1974—1978 in different parts of the country", and "Attainments of Composite Fish Culture Demonstration Centres in West Bengal 1976-77" respectively were brought out.

Besides "A Profile of CIFRI's Pioneering Role in

the Development of Production Technologies in Aquaculture" (special commemoration Bulletin, First Release of Postage Stamp on Fish Culture, 26th May, 1979), "Background Information on Research Work and Accomplishments of CIFRI, Barrackpore, West Bengal and "Final report of CIFRI/IDRC Rural Aquaculture Project (special Report No. 1 Nov., 1979) were brought out during the year.

"Study Mission's Appraisal of Inland Aquaculture and Reservoir Fisheries Management in USSR" by Dr. A. V. Natarajan was also brought out.

In view of the ICAR Golden Jubilee Year celebrations, under mentioned publications were also brought out.

Souvenir, CIFRI, Barrackpore

(In commemoration of the ICAR Golden Jubilee Year, 1979)

Lab to Land Programme on Riverine Spawn Collection, Aug—Sept, 1979 held at Riverine and Lacustrine Division, Allahabad Sub-station of CIFRI, Barrackpore.

Lab to Land Programme on Air-breathing Fish Culture, 21 Nov., 1979 held at Bangalore Research Centre of CIFRI, Barrackpore.

Lab to Land Programme on Air-breathing Fish Culture, 11 Aug., 1979 held at Mithapur Fish Farm, Patna Centre of CIFRI, Barrackpore.

Lab to Land Programme on Air-Breathing Fish Culture, 2 June, 1979 held at Ulubaria Farm, Gauhati Centre of CIFRI, Barrackpore.

Lab to land Programme on Training on Magur Farming, June 25-29, 1979 held at Rahara Research Centre of CIFRI, Barrackpore.

Important Fish Production Technologies Developed by CIFRI for Fish Farmers of India (special publication in commemoration of ICAR Golden Jubilee Year under Lab to Land Programme).

Eighty two scientific papers emenating as a result of research conducted at this Institute were published in different Indian and foreign journals.

Besides the above, 350 Sketches/diagrams, 175 posters and charts, 5,000 photographs, 175 slides, 100 cover designs and 400 miscellaneous reprographic items on various research activities and achievements of the Institute were prepared.

Honours, Awards, etc. :

Dr. V. G. Jhingran, Director, Central Inland Fisheries Research Institute was the President of the Zoology, Entomology & Fisheries Section of the 66th Session of the Indian Science Congress held at Hyderabad during January 3 to 7, 1979. 302 research papers were presented at the session under his presidentship. Dr. V. G. Jhingran, Director was awarded Dr. S. L. Hora Memorial Medal for the year 1978 by the Institute of Ichthyologists, Madras for his outstanding contribution in the field of inland fisheries research and development. In addition to this, Indian National Sciences Academy, New Delhi also announced its decision to award the Chandrakala Hora Memorial Medal to Dr. V. G. Jhingran, Director for the five-year period 1975—80 for his outstanding contribution in the field of inland fisheries research and development.

Dr. V. R. P. Sinha, National Project Director, UNDP/FAO Project and Head, Freshwater Aquaculture Research & Training Centre, and his team consisting of twelve scientists : Shri R. D. Chakraborty, Dr. S. B. Singh, Sarvashri H. A. Khan, M. A. V. Lakshmanan, K. K. Sukumaran, M. V. Gupta, K. N. Krishnamurthy, B K. Sharma, R. M. Rao, D. P. Chakraborty, Drs. K. G. Rao & P. M. Mathew of Pond Culture Division and All India Coordinated Research Project on Composite Fish Culture & Fish Seed Production were awarded the ICAR Award for their contribution in Composite Fish Culture for the biennium 1977-78. Dr. P. V. Dehadrai, Shri R. N. Pal, Drs. N. K. Thakur & S. C. Pathak and Shri V. K. Murugesan were jointly awarded the Rafi Ahmed Kidwai Memorial

Prize for the biennium 1976-77 for their outstanding work in developing technologies for air-breathing fish culture in India.

Dr. A. V. Natarajan, Scientist -3 participated in the International Workshop on Pen and Cage Culture of Fish at Tigbauan, Iloilo, Philippines during 11 to 28 February, 1979 and presented a scientific paper entitled "Experiments on raising quality fish seed in floating nurseries and its role in aquaculture in India".

Dr. K. L. Sehgal, Scientist-2 and Shri A. C. Nandy, S-1, were deputed to Philippines for undergoing training on Mass Culture of Fish Food Organisms for a period of 8 weeks (24 February—24 April, 1979) under the ICAR/SEAFDEC collaborative research work plan for 1978-79.

Dr. A. G. Jhingran, Scientist-3, and Shri Apurba Ghosh, Scientist-2 participated in the Vth International Symposium on Tropical Ecology held at Kuala Lumpur, Malaysia during 16th to 21st April, 1979 and presented scientific papers.

Sarvashri Kuldip Kumar and B. Venkatesh, Scientist-1 were deputed to Thailand for a group Training Course in Inland Aquaculture under the Colombo Plan during 11 June to 10 August, 1979.

Dr. A. V. Natarajan, Director, CIFRI visited USSR as the leader of the Indian Delegation in accordance with the Indo-Soviet Agreement on Cultural, Scientific and Technical Cooperation during the period 27th July to 6th August 1979.

Shri Apurba Ghosh, Scientist-2 attended the pond meeting on Productive Utilization of Wastes in developing countries as a member, convened by National Academy of Sciences, National Research Counicl USA during 6—8 August, 1979 in Washington D. C. The draft report of the Aquaculture Group, relating to the use of sewage in fish farming was jointly prepared by Dr. B. Hepher, Fish & Aquaculture Research Station, Dor, Israel and Shri Apurba Ghosh, CIFRI India.

Shri B. K. Sharma, Scientist-2 attended the ICLARM—SEARCA conference on Integrated Aquaculture—Aquaculture Farming Systems held at Manila, Philippines during 6th to 9th August, 1979 and presented a paper on Fish-cum-livestock farming in India.

Dr. V. R. P. Sinha, National Project Director visited Rome from October 1-13, 1979 for briefing on the operational methods relating to ICAR—UNDP/FAO project, Intensification of Freshwater Fish Culture & Training. He also participated as a member of FAO Task Force to formulate the research programmes on Cat Fish Culture at Bangkok, Thailand during November 1-15, 1979. Dr. V. R. P. Sinha also served as a member of UNDP/FAO International Task Force in India for research programme formulation for Lead Centre on Carp Culture at Dhauli.

Shri V. Ramachandran, Fishery Scientist, in-charge, Weed Control Unit of the Freshwater Aquaculture was selected as the adviser (Fisheries) to the North East Hill Council secretariat, Shillong and joined the post in July 1979.

Shri R. D. Chakraborty, Head of the Freshwater Aquaculture Division was selected as the Discussion Leader for the Fish and Shell Fish Culture in Freshwater Ponds session of the Inland Aquaculture Symposium held during February 12-14, 1979 at CIFRI, Barrackpore on the occasion of the ICAR Golden Jubilee celebration.

Dr. A. K. Mondal, Scientist-2 has been elected as a Fellow of the Zoological Society of Calcutta.

Shri P. Das, Scientist-2 has been nominated by the ICAR as the Coordinator, Lab to Land Programme at the Central Inland Fisheries Research Institute. Shri Das has also been elected a Fellow of the Council of Academy of Environmental Biology, Muzaffarnagar, U. P. for the year 1979-80.

Dr. P. U. Verghese, Scientist-1 has been deputed to the Marine Products Export Development Authority, Cochin as Deputy Director (Prawn Farming) for a period of two years.

Sarvashri M. Y. Kamal, Scientist-2, S. C. Pathak and S. K. Mukhopadhyay, Scientists-1 of this Institute were awarded Ph. D. degree by the Ranchi University, Allahabad University and Kalyani University respectively during the year.

Distinguished visitors :

The following scientists and distinguished persons, visited the Institute and its varions establishments during the year under report :

Dr. Istavan Telg	Director of Warm Water Fish Hatchery, Hungary.
Mr. Rado Gabov	Deputy Trade Commissioner, Trade commissioner, Trade Commison of the Hungarion.
Mr. L. Gajdos	Sales Manager of Agroinvest, Budapest.
Dr. Kapetsky	Food & Agriculture Organisation of the United Nations, Rome.
Dr. T. V. R. Pillay	Programme Director, ADCP of the Fisheries Department, FAO, Rome.
Dr. K. K. Chow	Food Technologist, FAO, Rome.
Dr. (Mrs.) M. N. Debuendo	Regional Agriculture Officer, Regional Officer of FAO, Bangkok, Thailand.
Dr. Rabelahatra Alexandre	Chief Fish Research Officer Bureau of Fisheries & Forests, Madagascar.
Mr. K. Kavari	Aquaculture Engineer FAO, Rome.
Dr. B. Hepher	Fish and Aquaculture Research Station, Dor, D. N. Hof-Hacarmel, Israel.
Dr. V. Carikul	Director, National Inland Fisheries Institute, Bangkok, Thailand.
Dr. P. Suraswade	Thailand.
Dr. N. Figian	Head, Department for Biology & Pathology of Fish and Bees, Veterinary Faculty, Yugoslavia.
Dr. J. Olah	Fisheries Research Institute, Szarvasm, Hungary.

Dr. M. Ishak	Director, Inland Water & Pisciculture Branch, Institute of Oceanography & Fisheries, Cairo, Egypt.
Mr. Robert H. Hudson	Managing Director, LKB Ltd., Hongkong.
Dr. M. A. Smith	British Council, Calcutta.
Dr. M. O. Farruk	World Bank, USA.
Dr. Eriel Heald	World Bank, USA.
Mr. Walter M. Carleton	American Embassy, New Delhi.
Dr. Yamazaki	Fisheries Research Station, Japan.
Mr. J. Kovari	Aquaculture Engineer Food & Agriculture Organisation of the United Nations, Rome.
Dr. S. K. Mukherjee	Ex-Vice Chancellor, University of Calcutta.
Dr. S. P. Ray Chaudhuri	Emeritus Professor, Department of Zoology, Calcutta.
Shri G. N. Mitra	Fisheries Adviser to the Government of Orissa, Cuttack.
Dr. S. K. Sharma	Deputy Director General, (Co-ordination & Extension), Indian Council of Agricultural Research, New Delhi.
Dr. R. Raghu Prasad	Additional Director General (Fisheries) Indian Council of Agricultural Research, New Delhi.
Dr. C. V. Kulkarni	Ex-Director of Fisheries, Government of Maharashtra, Bombay.
Shri K. H. Alikunhi	Fisheries Advisor to the Government of Kerala, P. O. Kodungallur, Dist.–Trichur, Kerala.
Dr. G. P. Dube	Visiting Professor, University of Bhopal, Bhopal.
Dr. Y. R. Tripathi	Director of Fisheries, U. P. Lucknow.
Shri D. S. Murthy	General Manager, A. P. Fisheries Corporation, Kakinada.
Dr. D. T. Lakdawala	Deputy Chairman, Planning Commission, New Delhi.

Dr. S. S. Dhanoa	Secretary, Indian Council of Agricultural Research, New Delhi.
Dr. A. G. K. Menon	Deputy Director, Zoological Survey of India, Madras.
Capt. J. S. Sambyal	Bengal Engineer Group, Roorkee.
Shri P. Basu	Commissioner of Fisheries, Gujarat.
Shri H. P. C. Shetty	Director of Instruction, College of Fisheries, Bangalore.
Dr. P. S. Prasad	Director of Fisheries, Bihar, Patna.
Dr. P. S. B. R. James	Joint Director, CMFRI, Mandapam camp, Tamil Nadu.
Dr. K. Maity	Operational Research Officer, Agricultural University, Bhubaneswar.
Shri N. Panda	Deputy Director of Fisheries, Berhampur, Ganjaw, Orissa.
Shri B. K. Raj	Assistant Director of Fisheries Baleswaram,Orissa.
Shri K. Raha	Fisheries Development Officer, Department of Agriculture, Tripura.
Shri S. P. Chowdhury	Chief Executive Officer, Fish Farmer Development Agency, Rohtak.
Shri B. L. Singha	Assistant Director of Fisheries, Chandigarh.
Dr. G. L. Roy	Assistant Director (Extension), Bidhan Chandra Krishi Vishava Vidyalaya, Mohonpur, Nadia.
Shri K. D. Pandey	Deputy Director of Fisheries, U. P., Lucknow.
Dr. N. C. Dutta	Department of Zoology, Calcutta University, Calcutta.
Dr. Ajit Sarkar	Department of Zoology, Calcutta University, Calcutta.
Dr. A. B. Das	Vishva Bharati University, Santiniketan.
Dr. S. G. Balsare	Taraporevala Marine Biological Research Station, Bombay.

Dr. P. V. R. Nair	Central Marine Fisheries Research Institute, Cochin.
Dr. P. V. Rao	Central Marine Fisheries Research Institute, Cochin.
Shri B. C. Das	Indian Statistical Institute, Baranagar.
Shri Bhanu Pratap Singh	Hon'ble Union Minister of State for Agriculture & Irrigation, Government of India, New Delhi.
Shri Dilip Chakraborty	Member, Lok Sabha, Parliament House, New Delhi.
Shri K. E. Sankaran	Chief Publicity & Public Relation Officer, Indian Council of Agricultural Research, New Delhi.
Shri T. V. Satyanarayanan	UNI, New Delhi.
Shri M. K. Sathaye	Special correspondent, Samachar Bharati, New Delhi.
Shri Ram Roop Gupta	Chief News Editor, Hindusthan Samachar, New Delhi
Shri K. S. Jayaraman	PTI, New Delhi.
Shri Bhakti Bhusan Mondal	Hon'ble Minister for Fishries, Govt. of West Bengal, Calcutta.
Shri A. K. Ghrai	Secretary (Fisheries), Govt. of West Bengal, Calcutta.
Shri G. V. K. Rao	Member, Planning Commission Government of India, New Delhi.
Dr. M. S. Swaminathan	Secretary, Agricultural & Rural Development, Ministry of Agriculture & Irrigation, Government of India, New Delhi.
Shri K. M. Mondal	Director of Fisheries, West Bengal, Calcutta.
Shri Amar Roy Pradhan	Haldibari, Coochbehar, West Bengal.
Shri Chitta Ranjan Mahaty	Member, Lok Sabha, Parliament House, New Delhi.
Shri Lilamoy Das	Minister of State, Fisheries, Government of Assam, Gauhati, Assam.
Shri S. P. Hazarika	Secretary to the Government of Assam, Revenue & Fisheries Department, Gauhati, Assam.

Shri Pritington Sangina	Minister of State, Fisheries, Meghalaya, Shillong.
Shri P. C. Misra	Special Secretary, & Home Fisheries, Government of Meghalaya, Shillong.
Shri Dalip Singh Talwandi	Minister of Animal Husbandry, Dairy and Fisheries, Punjab.
Shri A. K. Kawatra	Director & Warden of Fisheries, Punjab, Chandigarh.
Shri T. N. Singh	Hon'ble Governor of West Bengal, Calcutta.
Shri Pravash Roy	Minister-in-Charge for Irrigation, Waterway & Development of Sundarban, Government of West Bengal, Calcutta.
Shri C. Chellappan	Director of Fisheries, Tamil Nadu, Madras.
Brigadier T. K. Roy (Retd.)	Luthern World Service, Calcutta.
Dr. K. Kanungo	Vice-chancellor, OUT A, Bhubaneswar.
Dr. A. G. Sathyanesan	Senior Research Officer, Surgical Research Laboratory, Banaras Hindu University, Varanasi.
Dr. K. C. Bose	Professor and Head, Zoology Department, Ranchi University, Ranchi.
Dr. T. Narayanan	Director (A. H.), Planning Commission, New Delhi.
Dr. B. K. Soni	Deputy Director General (AS), Indian Council of Agricultural Research, New Delhi.
Dr. D. R. Rao	Central Institute of Fisheries Education, Bombay.
Shri Natabar Pradhan	Hon'ble Minister for Forests, Fisheries & Animal Husbandry, Orissa.
Dr. Radhanath Rath	Editor, "Samaj".
Dr. B. I. Sundararaj	Head, Depart of Zoology, Delhi University, Delhi.

Dr. M. N. Kutty	Dean, Fisheries College, Tamil Nadu Agricultural University, Tuticorin, T. Nadu.
Dr. T. A. Mammen	Joint Commissioner (Fisheries), Government of India, New Delhi.
Shri G. Thirumal	Commissioner & Secretary, Forest & Fisheries Department, Government of Tamil Nadu, Madras.
Shri C. S. Sharma	Additional Secretary, Indian Council of Agricultural Research, New Delhi.
Shri T. Baruah	Principal, Gram Sevak Training Centre.
Shri Kalita	Principal, Panchayat Training Centre.
Shri J. S. Bisht	Deputy Director, Agriculture Refinance Corporation.
Shri L. K. Vyas	Regional Manager, United Commercial Bank.
Shri Narayan Das	Ex-MLA, Gauhati.
Shri P. C. Bedi	Senior Analyst, Indian Council of Agricultural Research, New Delhi.

Important Events :

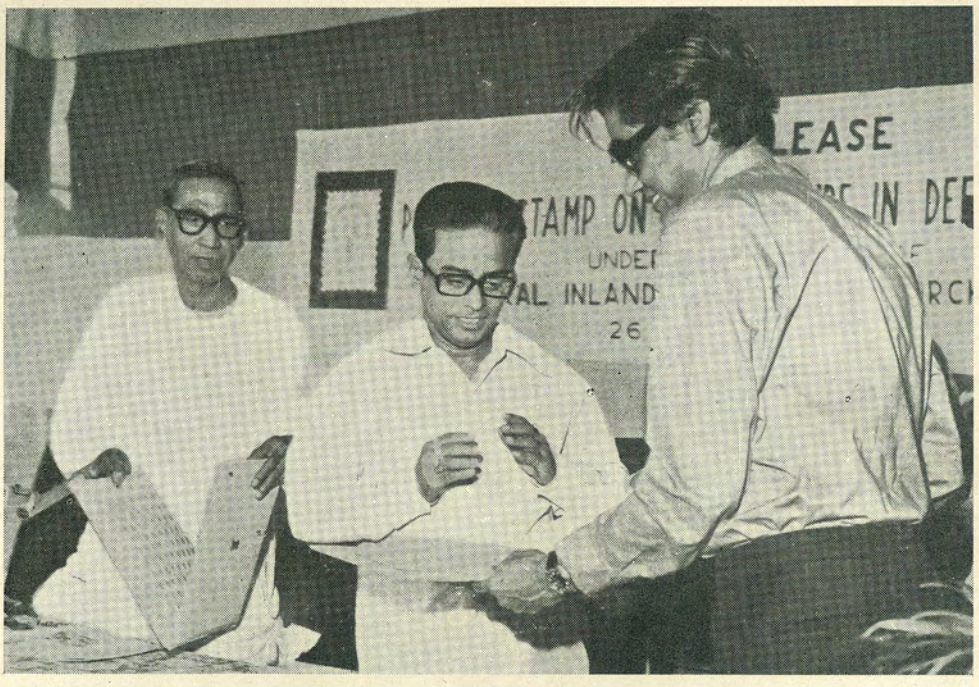
Launching the Lab to Land Programme :—

In commemoration of ICAR's Golden Jubilee year the Indian Council of Agricultural Research has launched a vigorous 'Lab to Land Programme' with a view to transferring the various production technologies evolved in the field of agriculture, animal husbandry and fisheries to small and marginal farming communities. For this purpose the Institute adopted 66 Golden Jubilee Fish Farmers and 660 beneficiaries. The aquaculture technology transfer process is underway in 33 centres and 66 work sites scattered all over India. The fish production technologies, numbering 28, were demonstrated to fish farmers in their own production units such that the package of practices under each technology is imbibed by them in a practical way.

Release of Special Postage Stamp :—

The P & T Department, Government of India, released a special postage stamp of 5 paise denomination on 26th November, 1979. In the fitness of things and as a token of recognition of the pioneering work of CIFRI in the field of aquaculture, the stamp was released by the Hon'ble Minister for Irrigation and Waterways, West Bengal, Shri Provash Chandra Roy, in a special function at Barrackpore.

A Summer Institute on "Capture and Culture Fisheries of Man-made Lakes in India" was conducted at Barrackpore from 7th July to 6th August, 1979 under the Directorship of Dr. A. V. Natarajan. Twenty five candidates from different Universities, Agricultural Universities, ICAR Institutions, Zoological Survey of India, State Fisheries Departments and Fisheries Development



Dr. Natarajan receiving the stamp album from Shri C. L. Deb, Post Master General

Provash Chandra Roy, Hon'ble Minister for Irrigation and Waterways, Govt. of West Bengal speaking on the occasion of the release of postage stamp on fish culture

An exhibition was organised on the occasion of first release of postage stamp on fish culture. A view of the main pavilion

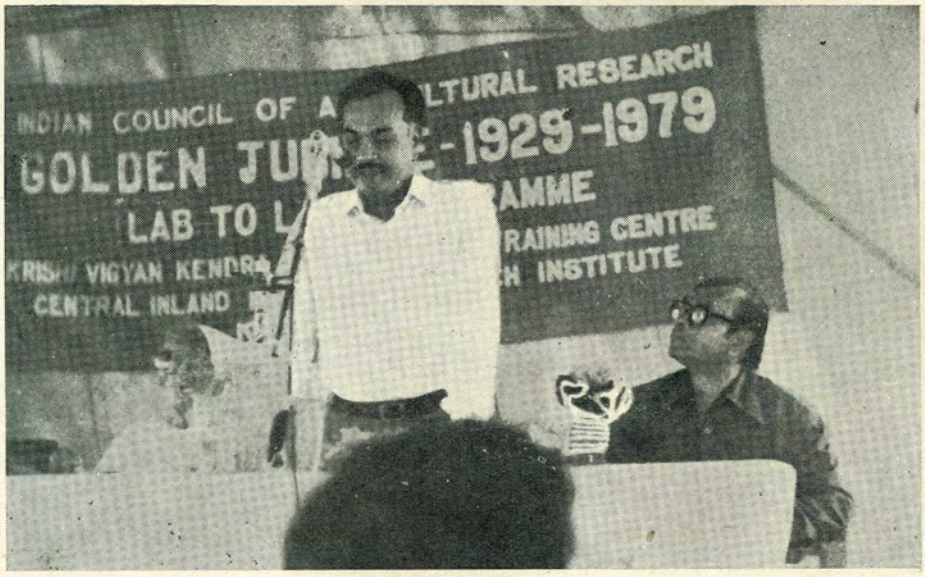
Dr. B. B. Pakrasi, Scientist explains the exhibits to Shri P. C. Roy, the Hon'ble Minister for Irrigation and Waterways

"LAB TO LAND PROGRAMME" IN PICTURES

At MADRAS Centre A Fish Farmers Day was organised under the Lab to Land Programme on October 5, 1979. Shri S. M. Dorairaj, M. L. A. inaugurated the Day (*Top*). Farmers had elaborate discussions with the scientists. The function was presidied over by Dr. A. Sreenivasan, Dy. Director of Fisheries, Tamil Nadu. The progress made by CIFRI in aquaculture front was commended by him. Dr. Sreenivasan also briefed the fish farmers on various facilities extended to them by the government and ICAR. The pro-

gressive farmers took keen interest in the deliberations. In the picture (*middle*), Shri S. Ramu, a Golden Jubilee farmer is driving in a point on the Day, Shri Dorairaj also inaugurated *a Polyculture programme in Pulicat Lake* (*bottom*).

The inaugural function of the Lab to Land Programme on air-breathing fish culture at BANGALORE Centre was held at the Seminar Hall, Veterinary College, Hebbal, Bangalore – 24 on 21. 11. 1979. Shri Yadav Rao, Honourable Minister of State for Fisheries, Govt. of Karnataka inaugurated the function (*top*). He pointed out the rural and labour–oriented nature of this fish culture system and stressed its social and economic relevance to our country. After the function, fingerlings of *Channa marulius* raised in the laboratory were released in Hennal tanks by the Honourable Minister (*bottom*). Similarly, advanced fry of *Channa striatus* and fingerlings of *Heteropneustes fossilis* were also stocked in the Golden Jubilee farmer's pond at Kodighalli. Scientists of the Bangalore Research Centre of Air-breathing fish culture Project discussed the various aspects of air breathing fish culture with the golden Jubilee farmer, beneficiaries and other fish farmers.



The KVK/TTC of CIFRI at DHAULI (Orissa) launched a vigorous Lab to Land Programme in Orissa. The Programme was inaugurated by Shri P. K. Patnaik, President, Rotary Club, Bhubaneswar (*Above*). A pond of 1.0 ha area was selected in the village Nakhasupatra under Itepur Gram-panchayat for the demonostration on Composite Fish Culture. The Hon'ble Speaker of Orissa State Legislative Assembly, S. P. Mohanty (seen below addressing farmers) released the seed of six species of fish into the pond.

Forty farmers of the villages were trained in Composite fish culture under this demonstration programme. Twenty five women, 90% of whom belonging to the scheduled caste were trained for 25 days in net making.

The trainees under the Lab to Land Programme of the Centre produced 40.87 lakhs spawn of common carp.

The CUTTACK Centre of CIFRI selected villages in Salepur Block and Raghunathpur Block as the work-sites for Lab to Land Programme. Common carp breeding and carp culture were demonstrated to the farmers at the work-sites.

In the picture shown above, Shri S. Patnaik, Scientist hands over inputs to a farmer benefitted under the Lab to Land Programme. The picture below shows a rich harvest from a fish culture pond under this programme at Raghunathpur, Dist. Cuttack.

Corporations participated. The course included theoretical and practical aspects of Reservoir Fisheries. A total of 82 lectures were delivered by the experts from and outside the Institute apart from practical demonstrations and field trips.

Workshop on CIFRI/IDRC Rural Aquaculture Project :

The first workshop on the CIFRI/IDRC Rural Aquaculture Project was held at Central Inland Fisheries Research Institute, Barrackpore on February 6-7, 1979. Inaugurating the workshop on February 6, Shri Bhakti Bhusan Mandal, Minister for Fisheries, Government of West Bengal, commended the work done at the CIFRI and hoped that the high yielding fish culture technologies developed at CIFRI, by their intensive field application would bring about socio-economic upliftment of the poorer section of the society, especially the fisherman. Shri Mandal, however, hinted at the prevailing gulf between the research institutions and the farmers, and stressed the need of its early abridgement through scientists and extension specialists working in the field.

Dr. V. G. Jhingran, Director, Central Inland Fisheries Research Institute, and the Project Director, welcoming the delegates highlighted the various high yielding fish culture technologies evolved at CIFRI through development-oriented research during the last three decades. As one of the technologies *viz.*, composite fish culture possessed the potentialities of revolutionising fish production in the country, it was felt imperative to disseminate the techniques through production-oriented field demonstrations among the rural fish farmers for extensive adoption and hence the Project. Dr. Jhingran observed that the Project was a joint venture of the ICAR, New Delhi and the International Development Research Centre (IDRC), Canada and was being operated in the States of West Bengal and Orissa since February 21, 1975. Dr. Jhingran also appraised the participants in brief the *modus operandi* of the project.

The workshop was conducted in three technical sessions. Technical Session I was held under the Chairmanship of Shri K. H. Alikunhi, Fisheries Adviser to the Government of Kerala. Shri S. D. Tripathi, Project Leader, CIFRI/IDRC Rural Aquaculture Project & Officer-in-Charge, West Bengal Centres highlighted the progress made at various West Bengal centres. Shri Tripathi mentioned that the project had not only demonstrated high fish productions (4,500—7,500 kg/ha/yr) from rural ponds but also recorded a maximum production of 4,890 kg/ha/yr from ponds at Jalpaiguri Centre (North Bengal) where water and soil conditions were characteristically acidic. The Project Leader also assessed the role of magur in composite fish culture and said that composite fish culture with magur as an additional component is equally lucrative. Field demonstrations of the techniques of monoculture of magur and singhi were also taken up by the project in West Bengal and high productions of 7.3 t/ha/6 months of magur with provision of water replenishment and 4 t/ha/6 months without water replenishment were shown. A production of 4.8 t/ha/6 months of singhi under intensive monoculture was also demonstrated. Shri Tripathi also made a mention of the extension activities undertaken by the CIFRI/IDRC Rural Aquaculture Project with a view to popularising modern fish culture technologies among the rural fish farmers.

Shri A. K. Ghorai, IAS, Secretary, Fisheries Department, Government of West Bengal presided over Session II which discussed achievements of Orissa Centre; observations of fish farmers, entrepreneurs and voluntary agencies ; economics of production and constraint analysis. In the session II, Shri M. A. V. Lakshmanan, Officer-in-Charge, Orissa Centre highlighting the activities of the project in Orissa made specific mention of high production rates achieved in composite fish culture and observed that the impact of demonstrations had resulted in fish farmers adopting scientific fish farming in Coastal Cental Orissa.

Technical session III was presided over by Shri M. M. Mohanty, Director of Fisheries, Government of Orissa

wherein observations on the economic aspects of Rural Aquaculture Project in West Bengal were presented by Shri M. Ranadhir, Economist, and discussion held thereon. Capt. Chaudhury of State Bank of India, Calcutta and Shri Mishra, Chief Executive Officer, FFDA, Ganjam (Orissa) outlined the credit policies of the Banks and suggested how fish farmers could make use of the facilities now being provided. The session concluded with a review of the achievments of the Project and impact on the fish farmer's community by Shri Tripathi, Project Leader.

Symposium on Inland Aquaculture :

A Symposium on Inland Aquaculture was organised by the CIFRI as a part of its Lab to Land Programme during the Golden Jubilee Year of the ICAR from February 12-14, 1979. The Symposium was inaugurated by Dr. S. K. Mukherjee, Ex-Vice Chancellor, Calcutta University at the Institute Campus. Dr. Mukherjee emphasised the need for seed production through all available sources. He appreciated the development brought about by the Institute in the techiniques of seed rearing since production of 80 lakhs of carp fry and 1.7 lakhs of carp fingerlings/ha is definitely a highly profitable commercial proposition. He suggested that waste materials could be utilised to minimise cost of fish production. Welcoming Dr. Mukherjee and other scientists from India and abroad, Dr. Jhingran, Director of the Institute, outlined the objectives of the Symposium and said that the constraints in inland aquaculture have been identified in the Workshop on Rural Aquaculture held recently at this Institute and that this Symposium would find a solution to some of these constraints. Dr. Jhingran giving details of the Lab to Land Programme hinted that the Symposium happens to be the first programme under the Golden Jubilee celebrations of the ICAR.

The Symposium was held in five technical sessions. Technical Session I was chaired by Dr. Y. R. Tripathi, Director of Fisheries, U. P. and dealt with aquaculture in ponds and tanks comprising fish and shell fish culture in fresh and brackishwater ponds.

Technical Session II dealt with other systems of aquaculture under the chairmanship of Dr. B. I. Sundararaj, Professor of Zoology, Delhi University. In Section (a) discussions were confined to aquaculture in raceways, cages, fish pens and net enclosures. Fish culture in such systems permits high stocking densities due to increased dissolved oxygen and low B. O. D. in the systems. However, identification of proper species for cage culture, studies on nutrition and fish seed, temperature tolerance were identified as some of the most important problems that need solution before such systems could be adopted in India. Section (b) dealt with the integration of aquaculture and agriculture and/or livestock. Dr. S. K. Sharma, Assistant Director-General (Extension), ICAR, emphasised the importance of integration of aquaculture and agriculture/livestock in the context of rural development.

Dr. M. N. Kutty, Prof. of Fisheries, Tamil Nadu Agricultural University, reviewed the papers presented under Section (c) dealing with 'aquaculture in recirculating water and recycling of wastes'. He explained the work being done at Tamil Nadu Agricultural University on the utilisation of sewage and sludge in indoor circulatory systems. Dr. Jhingran briefly outlined the working of the recirculatory system of fish culture at the CIFRI where fry of *Catla catla* and *Labeo rohita* were raised to fingerling size in almost one-third of the normal period for such growth in stagnant waters. Pointing out the advantages of such a system he said that 3-4 crops could be reared in single season by using this system.

Dr. P. V. Dehadrai acted as the Discussion Leader in the Technical Session III 'nutritional requirements' under the chairmanship of Dr. A. N. Bose, Vice-Chancellor, Jadavpur University. Dr. Bose emphasized the importance of the studies on nutritional requirements of fish in view of their great bearing on the economics of fish production. Dr. Dehadrai emphasized that in addition to studies on growth rate attention should be paid to the effects of different synthetic dietary regimes on the composition of fish tissue and to the use

Inaugural function of the Symposium on Inland Aquaculture. Shri S. D. Tripathi executing a vote of thanks. On the dais are (from left) Dr (Mrs.) M. N. Delmendo, Prof. G. M. Hughes, Dr. S. K. Mukherjee. Dr. V. G. Jhingran, Dr. G. N. Mitra and Dr. B. I. Sunder Raj

Delegates on a round at the exhibition conducted on the occasion of the Symposium on Inland Aquaculture. Shri R. M. Bhowmick explains the function of glass jar hatchery

of biochemical criteria as adjunct to growth measurements in evaluating nutritional requirements.

Shri G. N. Mitra, formes Jt. Commissioner of Fisheries, presided over Technical Session IV dealing with 'present status and strategy for development of aquaculture'. Shri Mitra pointed out that in the formulation of strategy quantitative evaluation of prospects and depth of planning are necessary. He suggested a flexible strategy to enable incorporation of new developments as and when necessary.

Technical Session V held under the Chairmanship of Dr. V. G. Jhingran, Director, CIFRI adopted 15 recommendations for aquaculture development and 13 for aquaculture research. Dr. P. V. Dehadrai, Project Coordinator, Air-breathing Fish Culture, proposed a Vote of thanks.

Rafi Ahmed Kidwai Memorial Prize for CIFRI Scientists :

The Rafi Ahmed Kidwai Memorial Prize for Agricultural Research for the biennium 1976-77 was awarded jointly to Dr. P. V. Dehadrai, Shri R. N. Pal, Dr. N. K. Thakur, Shri V. K. Murugesan and Shri S. C. Pathak for their outstanding contributions in the field of fisheries.

The team of scientists, under the leadership of Dr. Dehadrai, has developed a culture system of air breathing fishes suited for the utilisation of swamps and derelict ponds. The technology developed is a low input and high yielding one. Production of about 5,300 kg. of magur per hectare in a period of 5 months and murrels at the rate of about 4,000 kg. per hectare per year have been demonstrated. The technique of cage culture of singhi, developed by this group has shown a production potential of 6 kg per square meter and has facilitated the handling of a difficult fish in culture operations. An integrated culture method of magur and Koi along with Makhana has been evolved for enhancing the income from swamps through fish culture. Dr. Dehadrai and his co-workers have also carried out useful basic research on air-breathing fishes which have led to the development of the techniques of induced breeding and successful rearing of the spawn of these fishes with a high percentage of survival.

The contributions made by Dr. Dehadrai and his associates have openad up the possibility of utilising for fish culture the extensive areas of swamps and derelict waters unsuitable for carp culture, thereby helping to produce wealth from waste.

ICAR Award for Team Research :

The ICAR Award for Team Research in Fisheries for the biennium 1977-78 was awarded to 13 scientists of the Central Inland Fisheries Research Institute who have, through their joint effort, made significant contributions in the field of 'Composite Fish Culture'. The Awarded Scientists are :

Dr. V. R. P. SINHA : Dr. Sinha is an outstanding fishery scientist and as Project Coordinator of the all India Coordinated Research project on 'Composite Fish Culture and Fish Seed Production' He was responsible for leading a team which evolved suitable species combinations of culturable varieties in order to increase production through pond culture operations.

SHRI R. D. CHAKRABORTY : Shri Chakraborty has been closely associated with fish culture research and his contributions particularly to the development of feed for fry and fingerlings were noteworthy. These have helped in the overall improvement in the pond culture technology.

SHRI H. A. KHAN : The work of Shri Khan in the field of inland fisheries has been significant. Besides his contributions to the development of composite fish culture techniques, his investigations on induced breeding of fishes as well as the functional anatomy of the

pituitary of some of the fishes have special relevance in fish seed production.

DR. S. B. SINGH : The experiments conducted by Dr. Singh on culture of exotic carps with particular reference to raising of fingerlings and production of table size fish have been of considerable help in enhancement of per hectare production of fish in culture operations. Nearly a decade ago when the work on fish hybridization was only started he was successful in obtaining a hybrid variety as a result of a cross between the silver carp and the grass carp.

SHRI M. A. V. LAKSHMANAN : Shri Lakshmanan has been associated with investigations on carp culture for nearly two decades. His contributions in the field of induced breeding of Indian major carps, nursery management and rearing of carp fingerlings have made substantial impact in the development of package of practices for freshwater fish culture.

Shri K. K. SUKUMARAN : The extensive work carried out by Shri Sukumaran on the various aspects of inland aquaculture has substantially contributed to the knowledge of the breeding of carps, especially the exotic species. The application of this knowledge in seed production under the All India Coordinated Research project has created in different States an awareness of the prospects of becoming self sufficient in stocking material. Shri Sukumaran has worked as an Expert in this field in some of the South-East-Asian countries under the aegis of ESCAP/UNDP ;

SHRI M. V. GUPTA : The investigations and extensive field work carried out by Shri Gupta in prompting the technique of 'Composite fish culture' have been significent. The results achieved at the Kalyani Centre of the All India Coordinated Research Project on this subject have been largely due to Shri Gupta's unstinted work. His contributions have been widely recognised and he is currently serving as an Expert in Laos under an ESCAP Project ;

SHRI K. N. KRISHNAMURTHY : Shri Krishnamurthy's early contributions have been in the field of freshwater ecology which have direct relevance to pond culture. The knowledge and expertise he has developed have been suitably applied in studying the ecological factors responsible for determining the carrying capacity of pond system.

SHRI B. K. SHARMA : Shri Sharma, who has been one of the early associates of the All India Coordinated Project on 'Composite fish culture' has contributed by applying this technology in larger water bodies. This led to the successful establishment of an Operational Research Project in Kulia, West Bengal. The technique developed by him for retrieving the eggs of the common carp, which breeds naturally in ponds resulting in imbalances in species combinations, is specially helpful in aquaculture practices.

SHRI R. M. RAO : Shri Rao has made extensive studies on the biology of freshwater fishes and prawns, particularly of *Macrobrachium rosenbergii*. The detailed study of the prawn fisheries of the Hooghly estuarine system has given valuable information. His wide knowledge on prawns and their culture is currently being successfully applied at the Co-ordinated Project Centre in Andhra Pradesh.

SHRI K. G. RAO : Dr. Rao as an associate in the Operational Research Project in Kulia, West Bengal, has contributed to the successful implementation of the Project which has made a good impact in that region ;

SHRI D. P. CHAKRABORTY : Shri Chakraborty's experiments on 'Composite fish culture' carried out at Cuttack have shown that by periodic harvesting and removal of fish from ponds to reduce population pressure and intra and inter-specific competition would enhance production in ponds.

DR. P. M. MATHEW : Dr. Mathew's research work at the Pune Centre of the Co-ordinated Project

CIFRI Scientists who bagged "ICAR Award for Team Research" with Sri S. S. Barnala, Union Minister for Agriculture and Dr. M. S. Swaminathan

Dr. Vishwa Gopal Jhingran

has been specially significant in setting up an ali-time record of per hectare production of fish. This has been possible by adopting the technique of stocking the ponds straight away with fry instead of fingerlings, after eradication of all predators.

Dr. Vishwa Gopal Jhingran Retires :

Dr. Vishwa Gopal Jhingran, Director, on his attaining the age of superannuation, retired from the services of the Central Inland Fisheries Research Institute (ICAR) on the 30th day of June, 1979. Born on 18th June, 1919 Dr. Jhingran obtained the M. Sc. degree in Zoology from the Banaras Hindu University in 1941 and did Ph. D. in Fishery Biology in 1948 from Stanford University (California), U. S. A. He was elected Fellow of National Academy of Sciences of India in 1969 and Fellow of Zoological Society of India in 1970. Dr. Jhingran was awarded the Rafi Ahmed Kidwai Memorial Prize for the biennium 1972–73 by the ICAR and later in April, 1977 was honoured with the Padma Shri Award. Dr. Jhingran was also the President of the Inland Fisheries Society of India. He was the President of the Zoology, Entomology and Fisheries Section of the 66th Session of the Indian Science Congress held at Hyderabad in 1979. Dr. Jhingran was also awarded Dr. S. L. Hora Memorial Medal for 1978 for his outstanding contribution in the field of inland fisheries research and development.

Consequent upon his joining this Institute in November, 1948 as Assistant Research Officer, Dr. Jhingran made outstanding contributions towards the development of inland fisheries of India. Dr. Jhingran's work on the problem of depletion of fisheries of Chilka Lake led to formulation of clear out measures for the development of the fisheries of the lake. Dr. Jhingran is the first Indian scientist to carry out large scale tagging operation in Indian waters which he initiated in Chilka Lake. His work on composite fish culture in freshwater and on prawn and mullet culture in brackishwater has been of immense practical importance and represents a major breakthrough in inland aquaculture in India. His work has led to the initiation of rural aquaculture projects in West Bengal and Orissa.

During his tenure as Director of CIFRI, Dr. Jhingran formulated and guided the research activities of the Institute in the line of modern concept of scientific aquaculture which led the Institute to achieve the status of an institution of high international repute.

DR. (Miss) E. Mitra Retires :

Dr. (Miss) Eva Mitra, Scientist–2, on her attaining the age of superannuation, retired from the services of the Central Inland Fisheries Research Institute (ICAR) on the 30th April, 1979. Dr. (Miss) Mitra joined this Institute on 28th day of March, 1947 as Research Assistant. Dr. (Miss) Mitra made outstanding contributions in the field of aquatic weed control using chemicals.

Important Achievements :

Composite Fish Culture :

Experiments initiated at Jaunpur centre (U.P.) in seven ponds with same stocking density and species ratio gave production ranging from 6,118 kg to 6,762 kg/ha/8 months with feed and fertilisers, 4,271 kg/ha/8 months with supplementary feed alone, 2,396 kg/ha/8 months with fertilisation only and 1,682 kg to 1,864 kg/ha/8 months in control ponds indicating the importance of supplementary feed in attaining enhanced fish production.

At Karnal (Haryana), 6 species combination yielded production at the rate of 6,412 kg/ha/9 months. Culture of Indian major carps *viz.*, catla rohu and mrigal was carried out in a pond at Gauhati centre and production corresponding to 3,720 kg/ha/year was attained. In another pond with 6 species combination, production at the rate of 5,883 kg/ha/year was achived. At Ranchi centre (Bihar) production at the rate of 3,267 kg/ha/ year with 6 species combination was attained.

At Bhavanisagar centre (Tamil Nadu) with 5 species combination excluding grass carp, fish production to the tune of 2,565 kg/ha/8 months could be achieved.

At Badampudi centre (Andhra Pradesh) experiments were conducted to evaluate the culture possibility of freshwater prawn, *Macrobrachium malcolmosonii* along with the Indian and exotic carps. Two ponds stocked with five species (excluding grass carp) and *M. malcolmsonii* yielded production at the rate of 2,542 kg and 2,672 kg/ha/10½ months and prawn alone contributed 56·7 kg/ha/10½ months and 83·3 kg/ha/10 months. Another two ponds stocked with 6 species combination and *M. malcolmsonii* showed production at the rate of 3,567 kg and 4,537 kg/ha/10 months out of which prawn contributed 10·3 kg and 35·8 kg/ha/10 months respectively.

Record Fish Production from Gularia Reservoir :

A record fish production of 15 t (100 kg/ha) was obtained from Gularia reservoir in 1979 as against an average production of 22 kg/ha/year during 1969 to 1976. This success was achived through formulating a suitable stocking policy on the frame work of the detailed ecological studies of the environment. The reservior fetched a revenue of Rs 45,000/- from commercial fishing in 1978-79 as against the annual lease amount of Rs. 8,000/- paid to the State Government. Major carps (58·00%) dominated the catches, the species composition being *C. mrigala* (32·44%), *C. catla* (5·75%), *L. rohita* (6·73%) and *L. calbasu* (13·08%). Catfishes, dominated by *M. seenghala* (25·84%) and minor carps, mainly represented dy *P. sarana*, contributed 33·05% and 6·33% respectively to the total fish catch.

CIFRI blazes new trail in Brackishwater Aquaculture using saline ground water :—

The scientists at the Kakinada centre of the All India Co-ordinated Research Project on Brackishwater Farming have for the first time in the country demonstrated the possibility of brackishwater aquaculture in ponds receiving saling ground water. Under the Lab to Land programme of the ICAR investigations were conducted in two brackishwater ponds with a total water spread of 0·47 ha belonging to Shri G. B. V. Krishna Rao who was selected as the Golden Jubilee Farmer.

Culture of Hilsa ilisha in Confined Freshwater

Artificial fecundation of Hilsa was successfully achieved through 'Wet' method of stripping in river Narbada. The percentage of fertilisation ranged between 60 and 90. The eggs were hatched in nylon hapas fixed in ponds and also in indoor hatchery with provision of water circulation. The percentage of hatching in hapas ranged between 90 and 95.

Trout Farming

Rearing techniques of trout have further been improved and it has been possible to rear brown trout fry for over 8 months under farm conditions for the first time with a survival of over 40-50%. Fry of rainbow trout have also been reared for a record duration of 150 days in farm conditions with over 60-70% survival. In both the cases the fry were fed with artificial pelleted feeds developed in the laboratory.

Eradication of unwanted fish with ammonia gas

The technique of eradication of predatory and unwanted fish which take a heavy toll of fish and prawn seed in rearing ponds was demonstrated to the Kerala State Fisheries Officials. This method has assumed a new significance in view of the high price and insufficient supply of mahua oil cake that is currently in use for the purpose.

Within a few hours after the start of the application, a large number of predators including eels were found surfacing in distress and were easily caught. Many, however, died in the water.

Acids and Acid phosphatic fertilisers may be used to detoxify the water quickly. However, if left to natural processes, the water will remain toxic to fish for several days. The state Fishery Officials were cautioned that stocking with fish seed should be done only after laboratory tests indicating total harmlessness of water to fish seed.

Fish Culture in Jute retted ponds :

Investigations conducted in a jute-retted pond at JARI, Nilgunj exhibited encouraging results from the point of view of physico-chemical and biological parameters.

Recently catla, rohu, mrigal and the silver carp *H. molitrix* were stocked together with *Tilapia* in a 0.24 ha jute retted pond under the technical guidance of the scientists of the Institute. Encouraging growth of fishes have been attained without resorting to any management measures in terms of feed and fertilisers. Breeding of *Tilapia* in the jute retting pond during early post retting period has also been observed which further adds to the possibilities of sustained culture of the species through autostocking in such waters.

Fingerlings rearing—a record production :

A demonstration on the rearing of fingerlings was also given at the Ahmadpur centre of CIFRI/IDRC project where a pond prepared by anhydrous ammonia was stocked with fry (1.8g) at 200,000/ha and a production of 5,400 kg/ha obtained in two months with a survival of 89.43% which is the highest record so far. The average weights attained by catla and rohu were 35 and 26 g respectively.

Bio-gas slurry—a fertilizer and feed :

Research investigations under the project indicated that bio-gas slurry could be used both as a fertilizer and as a component in fish feed with advantage. As fertiliser it had an ameliorating effect on total alkalinity. As a component in fish feed along with rice bran it was found to result in four times as much growth as with 1:1 mixture of mustard oilcake and rice bran.

Research collaboration with other institutes
National level :—

The Institute continued its collaboration with various institutions and governments through a net work of centres under All India Co-ordinated Research Projects. The institute based Co-ordinated Projects were All India Co-ordinated Project on Composite Fish Culture of Indian and Exotic Fishes and Fish seed Production, Reservoir Fisheries, Air Breathing Fish Culture and Brackishwater Fish Farming. Our collaborators were the State Governments of TamilNadu, AndhraPradesh, Karnataka, Maharashtra, West Bengal, Uttar Pradesh Haryana, Bihar, Assam, Gujrat, Orissa, Madhya Pradesh, Goa and the three agricultural universities viz. Kerala Agricultural University, Andhra Pradesh Agricultural University and TamilNadu Agricultural University. A total of 30 centres functioned under these Projects.

The N. E. C. pilot project for the control of water hyacinth (*Eichhornia crassipes*) in the large Takmy fishery bheel (500 ha) of Loktak Lake, Manipur with CIFRI technical help and collaboration continued during the year and the infestation was completely controlled. As a result of the clearance of the weeds not only the fishery of the lake improved but also a rich crop of *Trapa* growth ensured and it proved to be a good source of income to poor people.

New exchange relationships were established with the following Institutes for furthering the dissemination of information to and from the Institute.

1) ICAR Research Complex for N. E. H. Region, Nagaland Centre, Medziphema.

2) Department of Zoology, Pachaiyappa's College, Madras.

3) Burla Research Centre of Central Institute of Fisheries Technology, Burla.

4) Department of Zoology, Fish Endocrinology Unit, University of Delhi, Delhi.

5) Fish & Meat Technology Section, Bhabha Atomic

Research Centre, Biochemistry & Food Technology Division, Trombay, Bomay.

6) National Research Development Corporation of India, New Delhi.

7) Fishery Training Institute, Balugaon, Puri Dist, Orissa.

International level

FAO/UNDP assisted ICAR project on "Intensification of Fresh Water Fish Culture and Training" started functioning at Dhauli/Bhubaneswar during the year. The layout of the hatchery to be constructed at Dhauli has been prepared and the design has been approved by the FAO, Rome.

The IDRC/CIFRI Project on Rural Aquaculture in villages near Puri, Aska, Bhawanipatna and Balasore was concluded successfully during the year and a final report was prepared and submitted to the sponsors of the project.

The Commonwealth Rural Technology programme (Asia/Pacific) of the Commonwealth Science Council, U. K. on the Management of water hyacinth obtained useful information for its First Review Meeting at Papua New Guinea in June, 1979 through a questionaire sent by Dr. G. Thyagarajan, Regional Coordinator of the meeting.

Discussions were held with the visiting UNDP task force for the establishment of a lead centre for carp culture at the Freshwater Aquaculture Research and Training Centre, Dhauli. The discussions covered important aspects like intensive fish culture, breeding and hybridization of fish, pond fertilization, aquatic weed control, etc.

The Institute has entered into arrangements for exchange of publications with the following institutions abroad :

1) The Inland Fisheries & Fish Culture Branches, Institute of Oceanography & Fisheries, Cairo, Egypt.

2) International Centre for Living Aquatic Resources Management, Metro Manila, Philippines.

3) Regional Seas Programme Activity Centre, UNEP, Geneva.

4) Marine Fisheries Institute, Republic of Kenya.

Research associations :

The scientists and the technical staff took active interest in the organisation and management of the "Inland Fisheries Society of India".

The Institute continued to have institutional membership of the following societies and associations :

Indian :

1) Asiatic Society, Calcutta.

2) Indian Science Congress Association, Calcutta.

3) Inland Fisheries Society of India, Barrackpore.

4) Marine Biological Association of India, Cochin.

5) Indian Society of Ichthyologists, ZSI, Madras

6) Association of Agricultural Librarians & Documentalists of India, New Delhi.

7) Indian Association of Special Libraries & Information Centres, Calcutta.

Foreign :

1) Societas Internationalis Limnologiae, Michigan, U. S. A.

Extension and Nation Building Activities :

Live fish farming

At Gauhati Centre of the Institute, a Lab to Land Programme on air-breathing fish culture technology was initiated in collaboration with the Directorate of Fisheries, Assam. Inaugurating the programme at a function held at Ulubaria Fish Farm on June 2, 1979, Shri Lilamoy Das, Minister of State for Fisheries, Govern-

ment of Assam stressed the need of increasing production of fish by adopting low-input technologies. The Minister requested the farmers to practise latest scientific techniques of pisciculture and appealed the scientists to help the farmers in this regard. He said that the Lab to Land Programme was a right step in this direction. Shri Das pointed out that the air-breathing fishes are ideally suited for derelict waters, swamps, bheels and fresh water ponds of Assam and if the culture of these fishes was taken up through the techniques evolved by Central Inland fisheries Research Institute it would enhance the employment potential of the rural area.

Presiding over the inaugural function, Shri Khiroda Bishaya, a progressive fish farmer of Assam, said that the possibilities of enhancing the fish production through scientific culture and judicious management have amply been demonstrated by Central Inland Fisheries Research Institute, what is needed is large scale adoption of such techniques. Shri M. Ahmed, Director of Fisheries, Assam welcomed the guests and participants.

Shri S. P. Hazarika, Secretary, Revenue, Forest, Fisheries and Soil Conservation, Assam, in his address emphasised the need of scientific fish culture and said that all suitable tanks, ponds and swamps of the State should immediately be utilised for fish farming.

Dr. P. V. Dehadrai, Project Coordinator, Air-breathing Fish Culture, Central Inland Fisheries Research Institute, Barrackpore highlighting the recent low-input air-breathing fish culture technology evolved by the Institute, appealed the fish farmers of the region to take up pisciculture on commercial basis by adopting scientific fish culture technologies.

In all nine progressive farmers expressed their views about air-breathing fish culture techniques and showed their keen willingness to switch on to this culture on Pilot Project basis.

A brochure explaining the technologies of air-breathing fish culture in English and Assamese was distributed to the participants.

About 100 fish farmers from all over Assam, staff and students of North Eastern Hill University, Shillong, staff and trainees of FFDA, Kamrup, staff of Assam Fisheries Department and Central Inland Fisheries Research Centre, Gauhati attended the function. Zoological Survey of India, Indian Council of Agricultural Research (North Eastern Hill Complex, Shillong) and Assam Agricultural University representatives were also present.

Brackishwater fish seed collection techniques :

Lab to Land Programme has been taken up at the Kakdwip Research Centre of the Central Inland Fisheries Research Institute. Shri Harishikese Maity, MLA, Kakdwip inaugurated the programme on 8th May, 1979 and Shri Probhanjan Mondal, MLA, Sagar was present as the Chief Guest. The function was largely attended by the local officials and fish farmers. Shri Maity explained how fish farming is being practised in brackishwater of this area since ages through traditional methods. He gave a clarion call to the scientists of the Kakdwip Research Centre to participate actively in the transfer and demonstration of the technologies developed at Central Inland Fisheries Research Institute on brackishwater fish and prawn farming and help in boosting up the economy of the fishermen community of Sunderban area.

Fabrication of seed collection gears, their operation for the collection of brackishwater fish and prawn seed from the intertidal pits and identification and segregation techniques were also demonstrated on 8th June, 1979. The demonstration programme was inaugurated by Shri Harishikese Maity, MLA, Kakdwip and the function was presided over by Shri A. K. Biswas, Jt. Block Development Officer, Kakdwip. One more demonstration of the operation of the 'shooting net' was given on 14th June, 1979. Both demonstrations were attended by the Golden Jubilee fish farmers, bene-

ficiaries and many other interested persons.

Live fish farming and seed production technology :

Gauhati Centre :

Under the coverage of Lab to Land programme, a 2-day training course on culture and seed production of air-breathing fishes was organised during July 12-13, 1979 at Kahikuchi Fish Farm (Gauhati) jointly by the Gauhati Centre of the Institute and the Directorate of Fisheries, Government of Assam, Gauhati for the benefit of the village extension workers and rural pisciculturists of the State. Inaugurating the programme on 12th July, 1979, Shri M. Ahmed, Director of Fisheries, Assam highlighted the achievements of the Coordinated Project on Air-breathing fish culture operating in the State of Assam and emphasised the need to arrange such training programmes. Shri Ahmed also mentioned that since the project has been able to demonstrate the scientific culture of air-breathing fishes, the techniques should now be passed on to the actual pisciculturists for extension and commended the right steps being adopted by ICAR, New Delhi, in this direction. Shri P. K. Dwarh, Jt. Director of Fisheries, Assam presided over the inaugural function. Shri T. Baruah, Principal, Gram Sevak Training Centre, Gauhati, welcomed the participants in the programme. Shri S. C. Pathak, Officer-in-Charge, Air-breathing Fish Culture Centre, Gauhati outlined the objectives of the training programme.

On 12th July, 1979 a lecture on culturable species of air-breathing fishes was delivered. The deliberations covered important aspects such as the types of fishes and their field identification, growing capacity, nutritional and recuperating value, their utility and cultural possibilities, etc. The lecture was followed by field demonstrations of cultured fish stock, identification of spawn, fry and fingerlings, different types of crafts and gears and their operations in the field.

On 13th July, 1979 three lectures on mixed culture and monoculture of magur and singhi and induced breeding technique of air-breathing fishes were delivered to the trainees. Trainees were also appraised with the latest research achievements and were shown the entire paraphernalia of induced breeding kit besides demonstration of induced breeding of magur and singhi. The training programme concluded with a fish farmer's seminar, wherein interesting discussions on the subject were made.

Freshwater fish seed production technology :

Pune Centre :

A demonstration on induced breeding of Indian and Chinese carps was undertaken in two ponds at the Pune Centre of the Institute. The programme was inaugurated by Shri V. P. Tupe, MLA, at a function held on 28th July, 1979 which was presided over by Dr. B. K. Tikadar, Jt. Director, Zoological Survey of India In addition to the fish farmers, a number of enthusiastic persons from the neighbouring area also witnessed the demonstration of induced breeding techniques. A wide publicity was given to the programme by the local press.

Jaunpur Centre :

At the Jaunpur Centre, controlled breeding of common carp was demonstrated to the neighbouring fish farmers and 1.4 lakh spawn was produced. About 16,200 fingerlings were raised from the resultant spawn and were sold at a cost of Rs. 1,425.60 p. against a production cost of Rs. 300.35 p. only.

Induced breeding and aquatic weed control :

Demonstrations in Orissa :

Demonstrations of the technologies 'Induced breeding' and 'Aquatic weed control' were inaugurated at selected centres in Cuttack District under the 'Lab to Land' programme of the Institute. The function conducted in this connection was inaugrurated by shri M. M. Mohanty, Director of Fisheries, Orissa, and presided

A haul of singhi (*Heteropneustes fossilis*) produced at the rate of 6946.6 kg/ha/5 months at Gauhati

over by Shri G. C. Das, Sub-Divisional Officer, Jagatsinghpur.

Technique of induced fish breeding including collection of major carp pituitary gland, preparation of the extract, selection and injection of brood fish represented by *Labeo rohita* (rohu) was demonstrated at Bhaslipur in the Raghunathpur Block on 1. 8. 79 in the premises of fish farmer Shri G. K. Pal. The demonstration was attended by Shri M. M. Mohanty, Director of Fisheries, Orissa, Shri G. C. Das, S. D. O. Jagatsinghpur, the B. D. O. and F. F. O. of the Raghunathpur Block, Press reporters, Fish Farmers (beneficieries) and other fisheries staff. Fish Farmers evinced keen interest, and at their request induced breeding of *L. rohita* was successfully demonstrated on 16th and 17th August, 1979.

At Bahugram (Salepuri block), fish breeding operations were conducted on 27th and 28th August, 1979 and the spawn obtained subsequent to breeding of *L. rohita* was stocked in the pond of the Golden Jubilee Farmer, Shri Golak Chandra Das. The function was attended by local dignitaries, ten beneficiaries and a number of local pisciculturists.

Demonstration of aquatic weed control technology was taken up at village Jaganathpur under Raghunathpur Block of Jagatsinghpur Sub Division in Cuttack District. A pond of 0.32 ha belonging to a small farming family of Bhabagrahi Mohapatra having thick infestation (33 kg/sq. m) of water hyacinth (*Eichhornia crassipes*) was selected. The herbicide 2, 4-D sodium salt at the does of 10 kg (a. i.) / ha was sprayed over the infestation in presence of a large number of distinguished visitors, representatives of press and All India Radio, along with 50 fish farmers (including 10 beneficiaries) from nearby villages. While showing the method of application, details of the technology were explained and questions asked by the fish farmers were answared. Pamphlets on the technology under demonstration as in the case of induced breeding were distributed to the fish farmers.

Riverine spawn collection technology demonstrations :

Allahabad Research Centre :

Techniques of fabrication of spawn collection nets, selection of suitable collection sites, monitoring of the nets, collection of spawn, sieving, storage, conditioning and transport of spawn were demonstrated to the identified fish farmers at Mahewapatti on 12 September, 1979 and again on 15 September, 1979 at village Chhatwa (Sirsa) in which not only the fishermen but the local dignitaries and press correspondents also participated.

Integrated Farming System :

Demonstrations on Fish-cum-Live Stock Farming :

Krishnanagar Centre :

The tribals of the village Asdan, Nadia, West Bengal were given demonstrations on fish-cum-live stock farming system under the Lab to Land Programme by the Operational Research Project of the Institute. The inaugural function on the pond site held at Krishnanagar on 23rd September, 1979 was marked by the release of fingerlings in the pond by Shri A. B. Mukherjee, Hon'able Minister of Animal Husbandry, Government of West Bengal. Shri H. P. Ray, District Magistrate, Nadia presided over the function. Besides 200 tribals, the function was attended by local fish farmers. In his welcome remarks, Dr. A. V. Natarajan, Director, Central Inland Fisheries Research Institute emphasised the need of exposing the farming communities to the recent advances in fish farming technologies by way of imparting trainings and providing practical demonstrations in their farming units so that they are induced to adopt the recent technologies for increased yields thus, improving their socio-economic conditions. Dr. Natarajan remarked that the produce by way of these demonstrations in the form of harvested fish, and the pigs raised would go to the 20 tribal families of the Asadan Village. Dr. Natarajan, thanked the Don Bosco Society and Shri Basudev Ghosh for providing the necessary pond facilities for tribalswelfare. Shri B. K. Sharma, Officer-In-Charge, Operational Research Project outlined the details of the technique of fish-cum-live stock farming wherein the excreta of the animals

(pigs and ducks) are utilised by the fish as feed in addition to serving as pond fertilisers, thus making this a low-input technology by cutting down the cost on fish feed and fertilisers. He remarked that the cost of production may range from Re. 1 to Rs. 1.40 per kg. The expenditure incurred towards purchase of pigs and ducks is largely realised from the sale proceeds of pig and duck meat and duck eggs. Inaugurating the function, the Hon'able Minister Shri A. Mukherjee stressed the need for integrating crop, livestock and fish farming and opined that the system can go a long way in solving the protein deficiency of our poor masses. Shri Mukherjee further suggested that fish production in West Bengal can be further augmented by utilising the paddy fields for paddy-cum-fish culture and also by using seasonal water bodies for short-term rearing of fish. Shri Mukherjee complemented the CIFRI Scientists for developing high yielding fish farming technologies and expressed his views that the State of West Bengal should take advantage of the technologies developed by the Institute. The Minister also expressed his happiness over the adoption of 20 tribal families as beneficiaries under the Lab to Land Programme of the Institute.

Shri H. P. Roy, District Magistate, in his Presidential remarks appreciated the work of the Operational Research Project leading to the development of fish-cum-livestock farming technogy suitable for the country's needs. Shri Roy remarked that inclusion of the tribals in the venture is a step in the right direction for helping the poor and landless through fish culture.

Shri Manas Kumar Das, Scientist-1 proposed a vote of thanks and the function came to a close after a colourful dance performance by the participating tribals.

Demonstrations on Sewage-fed Fish Culture and Paddy-cum-Fish Culture :

Rahara Research Centre :

Inaugural function of the demonstration of sewage-fed fish cultnre and paddy-cum-fish culture technologies under Lab to Land Programme of the Institute was held on October 25, 1979 at Ramakrishna Mission Boys' Home, Rahara. Dr. A. V. Natarajan, Director, Central Inland Fisheries Research Institute, welcomed the guests and emphasised the need for the utilisation of sewage waste in bio-production processes and integration of agriculture and animal husbandry with aquaculture which render aquaculture a low input industry. Shri Apurba Ghosh, Officer-in-Charge highlighted the salient achievments of sewage-fed fish culture and paddy-cum-fish culture experiments conducted at the Rahara Research Centre. Swami Ramananda, Secretary, Ramakrishna Mission Boys' Home, inaugurated the function and Shri B. N. Poddar, Joint Secretary, Department of Fisheries, West Bengal presided over the function. Shri Ganga Prasad Saha, Chairman, Titagarh Municipality, delivered a keynote address highlighting the potentiality of treated sewage effluent for increasing food production through agriculture and aquaculture.

The function was well attended by local dignitaries, fish farmers and agriculturists and was given a wide coverage by leading news agencies and the Calcutta Door Darshan. An exhibition, depicting the various technologies being transferred under the Lab to Land Programme, through posters and models was also organised for the benefit of the fish farmers.

After the inaugural function, netting domonstration at the experimental paddy-cum-fish culture plot and sewage-fed fish culture ponds were arranged and the management practices involved in the technologies were discussed in detail with the fish farmers.

Intensive Inland Aquaculture Technology Transfer Fortnight at Central Inland Fisheries Research Institute.

Celebrating the Golden Jubilee Year of the ICAR, the Central Inland Fisheries Research Institute launched celebrations on 'Intensive Inland Aquaculture Technology Transfer Fortnight' as part of the Lab to Land

Inauguration of Lab to Land Programme at the Operational Research Project Centre, Krishnagar. Shri A. B. Mukherjee Hon'ble Minister for Animal Husbandry, Govt. of West Bengal speaks on the occasion

Programme, on 12 September 1979 in the premises of the Institute at Barrackpore. The Honourable Governor of West Bengal, Shri T. N. Singh graciously inaugurated the function which was presided over by shri B. B. Mondal, Hon'able Minister of Fisheries, Government of West Bengal.

Welcoming the Hon'able Governor Shri T. N. Singh, Hon'able Minister of Fisheries Shri B. B. Mondal, Government of West Bengal and the distinguished guests, Dr. A. V. Natarajan, Director, Central Inland Fisheries Research Institute said that the 'Lab to Land Programme' of the ICAR has been launched with a view to transferring the various field-tested production technologies evolved in agriculture, animal husbandry and fisheries to small and marginal farming communities representing the lowest socio-economic strata in backward areas. Their exposure to the recent advances in farming technology is expected to motivate them to adopt these technologies for increased yield from their production units and help in the process to improve their economic conditions. The Central Inland Fisheries Research Institute, being a constituent Institute of ICAR, has drawn up a plan of action to take various fish production technologies evolved by the Institute over the years to the farmers' doors. For this purpose the Institute has adopted 66 Golden Jubilee Fish Farmers and 660 beneficiaries. The aquaculture technology transfer process was already under way in 33 centres and 66 work-sites scattered all over India. These fish productiontechnologies, were being demonstrated to fish farmers in their own production units such that the package of practices under each technology is imbibed by them in a practical way.

Dr. Natarajan emphasised that there is an unsatisfied market demand for major carps, especially in West Bengal and neighbouring States. The Institute is rightly proud of itscarp production technology well known all over the country as composite fish culture. Repeated trials all over the country have shown that a fish crop of 3,000 to 4,000 kg/ha is easily attainable under this technology. The Institute has developed a culture system for using the derelict waters, low in dissolved oxygen, incorporting air-breathing fishes. Under this system of culture, fish crop comprising magur and singhi, @ 4,000 kg/ha could easily be harvested. Waste recycling into production processes is given due importance in the research thrust of the Institute taking advantage of the fact that fish, in general, is a well known biological meliorator. A culture technology incorporating sewage as a fertilising input has been developed by the Institute and repeated trials have shown that a fish crop in the range 7,000-9,000 kg/ha can be raised. The Institute is not unaware of the need for low-cost production technologies. Taking this into consideration and following holistic ecosystem approach, the Institute has evolved integrated farming system, integrating fish with pig and fish with ducks such that the excreta of pigs and ducks are available to fish as feed and as fertiliser to the ponds. The cost of production in such a production technology is as low as Re. 1 per kg of fish in case of fish-cum-pig and Re. 1.40 per kg in case of fish-cum-duck. He further added that appropriate production technologies for brackishwater bodies have been developed with particular reference to shrimps. A running water system incorporating the principles of recirculation and biological filtering has been developed which has all the ingredients of fish seed production factory. The Institute has shown that by adopting simple management measures, the yield/ha from reservoirs can be raised from the existing 10 kg/ha to 75 kg/ha. Such then is the wide ranging spectrum of production technologies developed by the Institute for different water bodies.

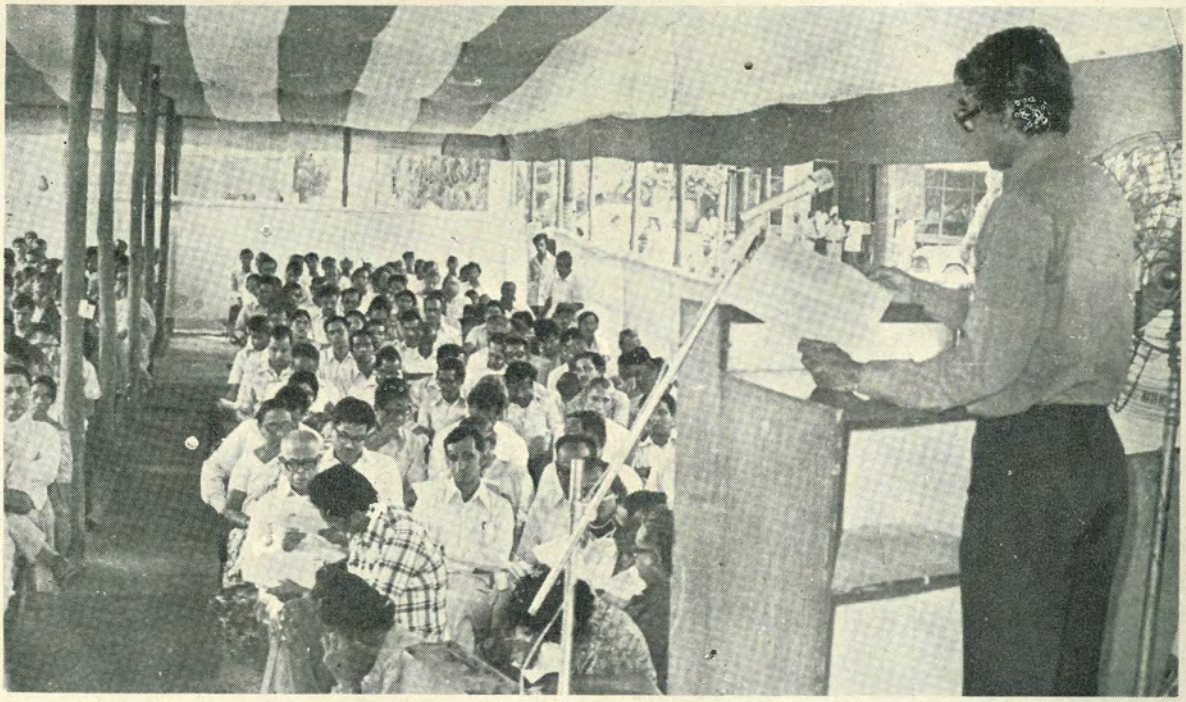
Dr. Natarajan further opined that of the 1.6 million ha area available for freshwater aquaculture, about 30% only is utilised on a scale not very different from subsistence aquaculture. Two million ha of brackishwater cultural area available in the country remains almost untouched. An estimated 3 million ha area under

reservoirs remains largely neglected. Adoption of management practices developed by the Institute would raise fish production from reservoirs by an additional 2 lakh tonnes, providing additional income of Rs. 8 crores and giving employment to 60,000 fishermen. It is, therefore, ironic that with so much resources readily available and biotechnologies crying for application, there should be tardy progress in aquaculture development in the country. He said that there is a need for pragmatic thinking and practical policies for development of these resources and a national perspective and coordinated policy for implementation of aquaculture programme. Dr. Natarajan opined that a massive effort should be launched for large scale production of carp seed through hypophysation technology. States on the direct monsoon belt like Assam, West Bengal and Kerala must act as core national carp seed production centres by bringing more areas for carp seed production to subserve national needs. He also stressed on a more constructive leasing policy for water bodies ; proper training and education of the small and marginal farmers ; a better extension linkage between States and Centre and development of fishermen cooperatives to augment fish production on one hand and facilitate easy marketing of aquaproducts on the other hand. Before closing his welcome remarks Dr. Natarajan thanked the Hon'ble Governor and the distinguished guests.

While inaugurating the Intensive Inland Aquaculture Technology Transfer Fortnight Hon'ble Governor Shri T. N. Singh observed that during the past 32 years, the CIFRI has done a great deal of work and there is a lot to be done towards achieving perfection in science and technology for human development. Shri Singh further observed that more than half of the population of the country do not get good nourishment and as such there is great urgency of doing more work in the field of all types of food technologies including fishery, poultry and the vegetable products. The Governor remarked that the needs of the people by 2,000 A.D. will be much more than double of the present need and appealed to the scientists to aim at increasing fish production for undernourished population.The Governor remarked that we cannot think indifferently about the country since a large number of people live under the poverty line. The Governor expressed his desire that Dr. Natarajan, his colleagues and friends may realise this issue that they have something substantial to contribute for the country which is a noble task and they can help in solving its problem of hunger. The Governor, Shri Singh appreciated the concept of operational research project in fish culture as a great effort in a country where large numbers of tanks and other derelict swampy water bodies are available and where large number of people are fond of fish which is in short supply. We should be capable of producing over 50 to 70 tons of fish per hectare area, the Governor observed. The Governor also referred to the soaring price of fish and demanded that the production efforts should be so directed that the prices are lowered and the technology is transferred to the rural fish farmers in the country. The Governor wished all success to the scientists in their efforts and inaugurated the Intensive Aquaculture Technology Transfer Fortnight.

In his pressidential remarks, Shri B. B. Mondal, Hon'ble Minister of Fisheries, Govt. of West Bengal stressed the need of extension of the research results originated in the laboratories to the fish farmers and the entrepreneurs. He felt that the Central and State Governments have to perform the duty of mass communication so as to reach the benifits of research to the poor fish farmers. He emphasised the need for establishment of carp hatcheries in each district of West Bengal and thus to satisfy the market demand of carp spawn countrywide. The Minister appreciated the research work being done at the CIFRI and hoped that the culture systems developed by the Institute will help to meet the protein demand of the country and supply cheap fish protein to the people of India. He also opined that the natural stocks in rivers should be replenished by stocking the rivers with major carp seed, which may further help in augmenting fish production from rivers and reservoirs. Shri Mondal congratulated

His Excellency, The Governor of West Bengal Shri T. N. Singh addressing the inaugural session of Intensive Aquaculture Technology Transfer Fortnight



The Director Dr. A. V. Natarajan welcoming the chief guest, fish farmers and scientists

Shri T. N. Singh, Governor of West Bengal inaugurating the exhibition on the occasion of the Intensive Aquaculture Technology Transfer Fortnight

Dr. A. V. Natarajan, Director, CIFRI explaining the achievements to the Governor Shri T. N. Singh and Shri B. B. Mondal, Minister for Fisheries, West Bengal at the exhibition

the scientists and wished them all success in their endeavour.

Dr. P. V. Dehadrai, Senior Scientist proposed a vote of thanks and invited the Hon'ble Governor Shri T. N. Singh to formally open the exhibition arranged on this occasion.

The exhibition arranged on the occasion depicted the achievements of the Institute by way of models, charts, blow-up photographs, transparencies, etc. of the research activities of the Institute. The Scientists with the aid of the working models explained to the distinguished visitors and the fish farmers various fish culture technologies developed at the Institute.

The function was also marked by the release of the Souvenir brought out by the Institute in commemoration of the Golden Jubilee year of the ICAR.

RIVERINE SPAWN COLLECTION TECHNOLOGY TRANSFER FORTNIGHT ;

Under the 'Lab to Land Programme' of the ICAR the Riverine and Lacustrine Division of the Institute organisedan intensive celebration fortnight on the transfer of technology of the riverine fish spawn collection techniques during September, 1979 under which five functions at Mahewapatti, Madhuka, Chhatwa (Sirsa), Maja Road and Allahabad were held. The inaugural function held on 12, September, 1979 at Mahewapatti village, Dist. Allahabad was inaugurated by Shri Fazle Ahmed Khan, I. A. S., Commissioner, Allahabad and presided over by Dr. Y. R. Tripathi, Director of Fisheries, Uttar Pradesh. Dr. A. G. Jhingran, Senior Scientist while welcoming the guests outlined the achievement of the Institute in evolving a suitable riverine fish spawn collection technology. Dr. Y. R Tripathi, Director. U. P. Fisheries in his presidential address complimented the scientists of the Institute for their sincerity and devotion in evolving the technologies now being adopted by the fish farmers and entrepreneurs. He also projected the State's requirements of carp spawn to seed the cultivable waters and the role the riverine fish spawn has to play in meeting the target. Inaugurating the intensive celebrations fortnight, the Chief Guest, Shri Khan stated that it was a revelation to him that so much of science is involved in fisheries and expressed his great appreciation for the efforts put in by the Institute in evolving low cost technologies for increasing freshwater fish production in the country. He urged people to change their habits to reduce their dependence on cereals and hoped that the farmers would be benefited by the technologies developed by the Institute. Shri K. P. Srivastava, Scientist-1 proposed a vote of thanks on the occasion. A number of fishermen including the Golden Jubilee fish farmers and beneficiaries, District Officers connected with rural development, social and harijan welfare, information and extension as well as the local people attended the function.

An exhibition depicting the achievements of the Institute in the field of inland fisheries research and development was also arranged on this occasion which was visited by a large number of people. The All India Radio, Allahabad and the local press gave a wide coverage of the activities and interviwed the Commissioner, Director of Fisheries U. P. and the Senior Scientists of Riverine and Lacustrine Division on various matters pertaining to the inland fisheries which was broadcast in their rural programme on 14.9.79.

In the form of subsidy, improvised spawn collection nets were distributed to the Golden Jubilee fish farmers and beneficiaries by the Chief Guest.

FISH FARMERS' DAY :

Fish Farmers' Day was organised at CIFRI,

Barrackpore on 13th September, 1979 as a part of technology transfer fortnignt under the 'Lab to Land' Programme of the Institute in commemoration of ICAR Golden Jubilee Year. The function was presided over by Shri K. M. Mondal, Director of Fisheries, Government of West Bengal, and Shri A. K. Ghorai, IAS,.Secretary of Fisheries, Government of West Bengal as Guest-in-Chief, made the event glorius. In his presidential address, Shri Mondal besides mentioning the scope of augmenting the fish production through large scale implementation of high yielding and commercially viable production technologies developed at CIFRI, outlined the economic constraints of the technologies for mass adoptation by small and marginal fish farming community of rural West Bengal. In this context, Shri Mondal emphasized the urgent need of evolving low investment fish culture technologies easily acceptable by rural entrepreneurs. Replying to the questions of participating 200 farmers, he pointed out that cases of large scale destruction of fish stock by 'Folidol' had been mounting up posing a social problem. Since no remedial measure for such destructive system is foreseen, Shri Mondal stressed that people be made to understand the importance of fish culture in improving the socio-economic status of rural mass, through extension, training courses and demonstrations.

In his deliberations, Shri Ghorai briefly explained the importance of adequately planned extensive extension activities needed to dessiminate the results of researches to the rural flok for field application. Shri Ghorai also stressed that the fish farmers' days should specifically be problem-oriented ones so that attending farmers get sufficient scope to come in contact with fisheries scientists to discuss in detail the problems they come across in the implementation of modern scientific fish farming techniques in their ponds.

Earlier, welcoming the distinguished guest and others taking part in the function, Dr. A. V. Natarajan, Director, CIFRI highlighted the advances made by CIFRI in evolving various high yielding fish culture techniques both in the field of freshwater and brackish-water aquaculture and appealed to the participants for their concerted efforts to adopt these techniques to enhance fish production from the rural environments.

At Allahabad :

Three fish farmers' days were observed by the Riverine & Lacustrine Division on 13, 16 and 18 September, 1979 at Madhuka, Maja Road and Allahabad respectively during the intensive fortnight celebrations.

At Allahabad, a week-long exhibition besides, the fish farmers' days was also arranged on 18 September, 1979. The programme was inaugurated by the eminent soil scientist Prof. N. R. Dhar and was presided over by Smt. Ranjan Nehru, the distinguished social worker. Shri J. C. Malhorta, Head, Riverine and Lacustrine Division welcomed the guests and presented the activities and the achievements of the Institute.

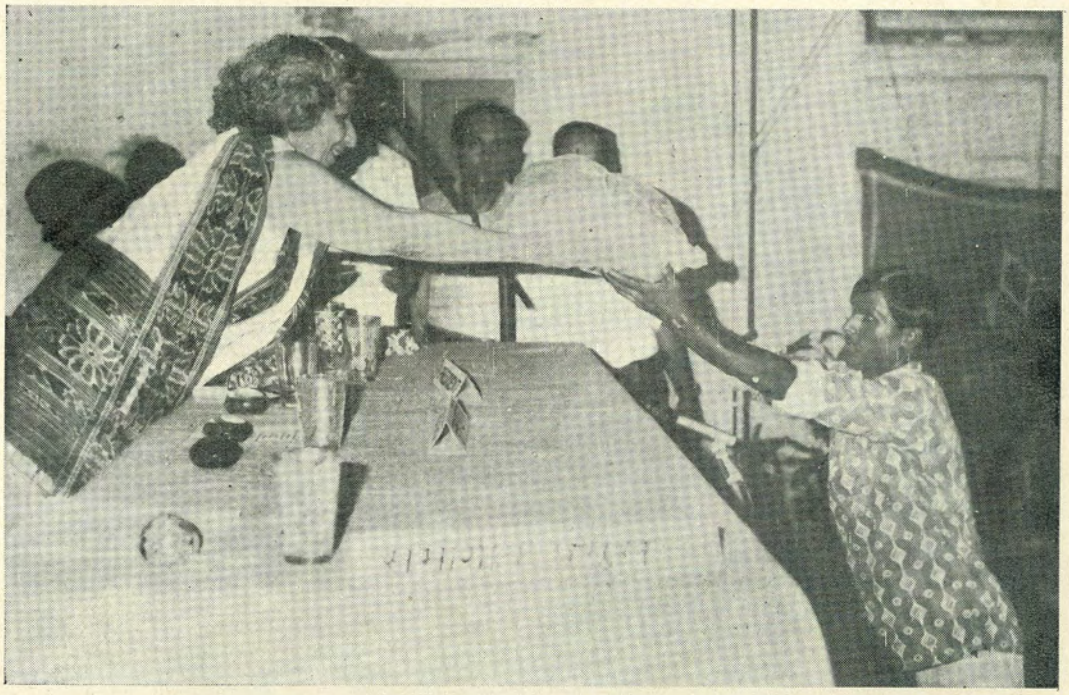
Mrs. Ranjan Nehru presiding over the function said that fish farming if encouraged and developed in a proper way would play an important part in ameliorating the present economic condition of the people in the rural areas of the country. She also remarked that in this context the efforts of the Institute to transfer these technologies to the rural masses were the right approach specially so as it was being done in the International Year of the Child in a country were majority of children suffer from malnutrition. Prof. N. R. Dhar, inaugurating the function, explained the food value of fish which he said is rich in minerals and proteins and opined that the fish is much better than meat, egg and beef. He further advised the experts and scientists to serve the nation to the best of their ability.

Fish farmers' day at Barrackpore

Scientists share their knowledge with the farmers

A view of the gathering

Fish farmers' day at Allahabad



Smt. Rajan Nehru distributes fishing nets to the farmers

A farmer examines riverine spawn and learns to identify them

Shri Tushar Kanti Ghosh, who opened the exhibition, congratulated the scientists of the Institute for their efforts and suggested that the modern technology and know-how should be made available to the people to receive the best advantages of the expertise. Dr. A. G. Jhingran, Senior Scientist of the Division proposed a vote of thanks.

During the intensive celebrations fortnight, fishermen, fishculturists and people engaged in the trade had fruitful group discussions with the scientists of the Riverine & Lacustrine Division. On 11 September a radio talk entitled 'Machhali Paalan Main Naya Prayog' highligting the efforts and achivements of the CIFRI was broadcast in hindi over the All India Radio, Allahabad by Dr. A. G. Jhingran, Senior Scientist of the Division in the Rural Progromme.

A bulletin comprising small articles on various aspects on riverine spawn collection technique was released and distributed on 12 September, 1979 for the benefit of the fish farmers and local public.

Aquaculture training to flood-hit fish farmers in West Bengal :

The unprecedented floods that hit West Bengal in September-October, 1978 brought in its wake a good number of problems, not the least important of which is its impact on fish farmers and fishermen in the districts of Bankura, Purulia, Howrah, Nadia, Midnapore, 24-Parganas, Birbhum, Hooghly and Murshidabad.

A survey undertaken by CIFRI and State Fisheries Department revealed large-scale damage to dykes of fish ponds and tanks, deterioration of water quality, siltation, etc. besides large-scale loss of fish, extensive damage to fishing gear, etc. The ICAR decided to launch a crash programme with a view to rehabilitating these flood-hit fish farmers by providing them through CIFRI necessary skills and know-how in dyke construction and repair, desiltation methods, water and soil quality improvement measures and to motivate farmer participants to take to modern methods of aquaculture.

The crash rehabilitation programme was formaly inaugurated on 9th April, 1979 by Shri S. K. Ghorai, Secretary (Fisheries), Government of West Bengal and presided over by Shri K. M. Mondal, Direcior of Fisheries, West Bengal. Dr. A. V. Natarajan, Acting Director, CIFRI in his welcome address explained the significance of the programme to the participating fish farmers and expressed the hope that the training should help them tide over not only their present difficulties but also provide them an opportunity to undate their farming skills to take to modern aquaculture which has all the potential to improve their income manifold. He further pointed out that the programme assumes special significance in ICAR Golden Jubilee Year in commemoration of which CIFRI has taken up a vigorous national programme for transfer of various aquaculture techenologies to fish farmers. He wished the participants a successful training and success in their subsequent efforts in fish culture in their rehabilitated farming units. Shri P. Das, Senior Extension Officer proposed a vote of thanks.

Training course under the crash programme have been organised by the Extension Section of the Institute and so far 160 trainees from a number of flood affected districts of West Bengal have been imparted training under the coverage of the above programme.

Finance :

The provision of funds for the financial year April 1979 to March 1980 was as under :—

Non-plan	:	Rs. 97,92,000.00
Plan	:	Rs. 48,60,000.00
Total	:	Rs 1,46 52,000.00

Against the above provision, the expenditure from 1.4.79 to 31. 12. 1979 was as follows :—

Non-plan	:	Rs. 80,08,329.00
Plan	:	Rs. 17,62,629.00
Total	:	Rs. 97,70,958.00

Aquaculture training being imparted to flood-hit fish farmers in West Bengal

2. PROGRESS OF RESEARCH

Research on different problems under 25 projects operataing at the Institute, 5 problems under CIFRI/ IDRC Project and 15, 11 & 2 problems under the All India Coordinated Projects on 'Composite Fish Culture & Fish Seed Production', 'Air-breathing Fish Culture in Swamps' and 'Reservoir Fisheries' respectively were continued during the year 1979. The progress achieved under each Project is outlined in the following pages.

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

Problem : 1.1 Composite culture of Indian and exotic species

1.1.1.1 Rearing of Indian major carp fry to fingerlings for optimum survival and growth under high stocking density

Personnel : P. R. Sen, S. N. Datta, S. Jena, D. R. Kanaujia and A. N. Mohanty

Duration : Two years

Four months rearing of catla, rohu and mrigal from fry to fingerling stage at a combined stocking density of 2 lakhs/ha and in the ratio of 1:1:1 in two ponds with provision of supplementary feeding (about 2.1 tonnes/ha) resulted in production of healthy fingerlings ranging from 10.0 g to 17. 7 g, 3.3 g and 6.65 g, and 10g respectively.

1.1.2.2 Composite culture of Indian and exotic carps to raise marketable fish

Personnel : R. D. Chakraborty, P. R. Sen, N. G. S. Rao, S. Jena, S. R. Ghosh and D. R. Kanaujia

Duration : Continuing

The experiment on composite culture of Indian major carps and exotic carps at 10,000/ha stocking density in the species ratio of Sc 2.5 : C 1.0 : R 2.0 : M 1.0 : Gc 1.5 : Cc 2.0 is in progress in its second year. Phased stocking was resorted to, initially at 5000/ha at low water level raising it later to 10,000/ha with increase in water level. Replenishment of harvested number of marketable fish was done at the end of one year. The relatively lower rates of production (5200 kg/ha and 4500 kg/ha at the end of 18 and 17 months) were perhaps due to low water level consequent to unprecedented drought and the persisting bloom of *Microcystis* which restricted the use of feed and fertilisers.

1.1.2.3 Intensive culture of Indian major carps

Personnel : R. D. Chakraborty, P. R. Sen, N. G. S. Rao, S. Jena, S. R. Ghosh and D. R. Kanaujia

Duration : Three years

Catla, rohu and mrigal fingerlings were stocked in the ratio of 4 : 3 : 3 at 6,000/ha stocking density in two ponds. Production to the tune of 3400 kg and 2,700 kg/ha have been estimated at the end of one year.

1.1.6 Composite culture of Indian and exotic carps to raise marketable fish with the use of fertilisers (without feed)

Personnel : N. G. S. Rao, P. R. Sen, S. N. Datta, S. Jena, D. R. Kanaujia and A. N. Mohanty

Duration : Continuing

In a short-term experiment on composite of culture of carps using only very little fertilisers (cow dung at 80 kg/ha and TSP at 80 kg/ha) and eliminating the costly input, supplementary feed mixture, productions of 1245 kg/ha and 1557 kg/ha were estimated at the end of 6 months. The ponds had been stocked with fingerlings of catla, rohu, mrigal, silver carp and a common carp at a density of 6,000/ha in the ratio of 2.5 : 2.0 : 1.5 : 3.0 : 1.0 respectively.

Problem : 1.2 (Research work suspended since 1975)

Problem : 1.3 & 1.4 (Research work completed in 1972)

Problem : 1.5 (Research work completed in 1970)

Problem : 1.6 (Research work completed in 1972)

Problem : 1.7 (Research work completed in 1973)

Problem : 1.8 (Research work completed in 1971)

Problem : 1.9 to 1.11 (Research work completed in 1972)

Problem : 1.12 & 1.13 (Research work completed in 1973)

Problem : 1.14 (Research work suspended since 1975)

Problem : 1.15 (Research work suspended since 1973)

Problem : 1.16 (Research work completed in 1971)

Problem : 1.17 (Research work suspended since 1975)

Problem : 1.18 (Research work completed in 1975)

Problem : 1.19 (Research work completed in 1973)

Problem : 1.20 (Research work completed in 1974)

Problem : 1.21 Carp fry rearing for optimum survival and growth under high stocking density

Personnel : P. R. Sen & D. K. Chatterjee

Duration : Continuing

Cobalt chloride and manganese were provided along with the feed to rohu spawn stocked at 5 m/ha in experiment ponds. Addition of cobalt chloride and manganese resulted in greater survival rate (61.0%) than in the control (49.5%).

Problem : 1.22 (Research work completed in 1976)

Problem : 1.22.1 (Research work completed in 1979)

Problem : 1.23 (Research work completed in 1976)

Problem : 1.24 (Research work completed in 1977)

Problem : 1.25 Intensive culture of fish food organisms

Personnel : A. C. Nandy, S. K. Majumdar & P. R. Das

Duration : Continuing

Culture of zooplankters :

Large-scale production of a freshwater cladoceran,

Moina sp. has been successfully achieved in yard experiments with different feeds such as freshly cultured unicellular algae (*Scenedesemus obliquus*), dried brewer's yeast, prepared wet yeast and groundnut oil cake. The propagation and growth of *Moina* sp. was remarkably higher with activated yeast than with the other feeds tried. Maximum density of 42,000 u/l was attained from an initial inoculum of 15 u/l in eight days of culture providing activated yeast @ 100×10^3 cells/*Moina*/day.

Culture of phytoplankters :

Sustained culture of two brackishwater diatoms, *Nitzschia closterium* dand *Skeletonema costatum* has been achieved by using Allen and Nelson and TMRL nutrients. Maximum cell density of 12.5×10^6 cells/ml/6 days and 15×10^6 cells/ml/7 days respectively was attained from an initial inoculum of 64×10^4 cells/ml.

Production of activated yeast :

Mass production of activated yeast (2-2. 5 billion cells/ml in 2 days) has been achieved in the laboratory by using brown sugar, urea and muriate of potash at a dose of 40 g, 3 g and 1 g respectively.

Techinques for harvesting and preserving algae for culture :

A simple method of harvesting algae from cultures through adjustment of pH of the culture media has been developed. This technique performed better than either with alum or lime flocculation and effects rapid and almost complete recovery of algal cells. Flocculation was induced by the addition of a floc forming chemical. 93—98% algal recovery could be achieved within one hour. Harvested algal slurry was neutralised to the initial pH, kept in plastic bags and stored at frozen condition Samples of *Chlorella vulgaris* and *Scenedesmus obliquus*, tested for viability by actual reproduction of cells in culture were found viable after five months freezing.

Problem : 1.26	(Research work completed in 1977)
Problem : 1.27	(Research work completed in 1976)
Problem : 1.28	(Research work could not be carried out due to technical difficulties)
Problem : 1.29	Comparative study of the efficacy and economics of available fish poisons of plant origin
Personnel :	S. Jena, V. Ramachandran & S. R. Ghosh
Duration :	Continuing

Laboratory experiments were conducted with different concentrations of pesticides in glass jars without soil base. Tamarind seed husk @ 8—10 ppm was observed to be the most effective pesticide in killing the test fishes (*Tilapia*, *Cyprinus*, *Channa* sp. and Indian major carps) within two hours.

Problem : 1.30 & 1.31	(Research work completed in 1979)
Problem : 1.32	(Research work completed in 1977)
Prhblem : 1.33	Studies on the detection of digestive enzyme complex of freshwater culturable food fishes
Personnel :	B. N. Saigal, Amitabha Ghosh and K. S. Banerjee
Duration :	Five years

Investigations on the digestive enzymes of *Labeo rohita* have been initiated during December 1979.

Problem : 1.34	Observations on cultural possibilities of fish in jute-retted pond water

Personnel : B. N. Saigal, Amitabha Ghosh, S. K. Saha, B. Venkatesh & K. S. Banerjee

Duration : Five years

A pond (0.07 ha) exclusively used for jute-retting purpose in village Patulia in 24-pargans district, West Bengal, was stocked with Indian major carps and some air-breathing fishes in the ratio of catla 4 : rohu 2 : *mrigal* 2 : *Anabas* 1.5 : *Clarias* 0.5 at a combined stocking density of 7,000/ha. seven quintals of jute was retted in the pond and the pond water regained normal conditions about 2 weeks after the retting was over. Plankton density ranged as 3.5 to 3.8 cc/20 l during November and December. Do which came down to nil reappeared after 15 days. pH ranged between 6.8 and 7.8 during the period. After 54 days of rearing, catla, rohu and mrigal had attained av. wt. of 61, 34 and 19.2 g from their initial av. wt. of 25, 10 and 10 g respectively. The culture experiment is in progress.

Problem : 1.35 Culture of fish along with paddy

Personnel : S. N. Datta, S. Jena, A. N. Mohanty & R. K. Nigam

Duration : Continuing

Work on raising the fingerlings of economic varieties of fishes to serve as the much needed stocking material in paddy plots, suitable sites were selected and work initiated in Salepur and Raghunathpur Blocks in Orissa. Fry of catla, rohu, mrigal and common carp have been released in plots where Mashuri variety of paddy has been planted.

Problem : 1.36 (Research work suspended in 1978)

Problem : 1.37 (Research work completed in 1978)

Problem : 1.38 (Research work suspended since 1977)

Problem : 1.39 Effect of lime in pond soils

Personnel : B. K. Chatterjee, K. C. Pani

Duration : Continuing

Studies on the effect of three forms of lime *viz.*, calcium oxide, calcium hydroxide and calcium carbonate on acidic pond soil (pH 5.2) and the change in soil reaction and release of nutrients have been initiated in the laboratory.

Problem : 1.40 Comparative efficiency of organic manures on the fertility of pond soils

Personnel : D. K. Chatterjee & K. C. Pani

Duration : Continuing

Comparative efficiency of organic manures *viz.*, cowdung, poultry manure, mustard oil cake and compost (*Pistia*) were studied using soil with medium organic matter (1.33% Org. c.) under laboratory and yard conditions. Transformation of these manures were studied at three rates (300, 600 and 1200 kg C/ha) with three replications for each treatment against a set of control. While all the manures helped in increasing total alkalinity and dissolved phosphate in water with the increased rate of application, dissolved NH_4+NO_3-N was recorded higher values only at 1,200 kg C/ha except for the compost treatment.

In yard, all these manures were tried only at 1,200 kg C/ha except for the compost treatment.

In yard, all these manures were tried only at 1,200 kg C/ha using plankton production and survival and

growth of carp fry as indices of response. Primary production and volume of plankton were higher with all the treatments compared to control and were maximum with poultry manure (0.279 mg 0_2/l/hr) followed by compost (0.58 cc/5 litres). The average survival and growth of mrigal fry were higher with all the treatments except for the compost. Cowdung (93.3%, 2.27 g) was found to be the most efficient followed by poultry manure (90%, 2.22g) and mustard oil cake (83.3%, 2.75 g) as against control (83.3%, 1.67 g).

Problem : 1.41 Effect of size of stocking materials on production in composite fish culture
Personnel : V. R. P. Sinha, R. D. Chakraborty & K. K. Sukumaran
Duration : Continuing

The work could not be taken up due to technical difficulties.

Problem : 1.42 Statistical relationship between the inputs and fish production in composite fish culture
Personnel : M. Rout
Duration : Continuing

Experimental results were grouped into four different classes (location-wise and according to their operational activity). Input and production ratio was calculated as Rs. 1.26, 1.00, 0.73 and 0.65 for western, eastern, central and southern sectors respectively. A second degree equation calculated from the variables, showed a decrease in production with increase in inputs after a certain limit.

Problem : 1.43 Seasonal changes in the fat content in flesh of Indian major carps under different ecological conditions
Personnel : N. K. Tripathy, V. R. P. Sinha & Paul Raj
Duration : Continuing

Preliminary studies on the fat content of the muscle of *Catla catla*, *Labeo rohita* and *Hypophthalmichthys molitrix* indicated increased deposition of fat during the months of March and July. A slight decline in fat content was noticed during May in all the three species.

Problem : 1.44 Studies on the ecological changes in newly constructed ponds at Dhauli and their management
Personnel : D. K Chatterjee, V. R. P. Sinha, K. K. Sukumaran & S. Jena
Duration : Continuing

The work could not be carried out regularly due to low waterlevel of the pond for most of the period. However, observations for a limited period on the treatment with lime alone and in combination with nitrogen, phosphorus, nitrogen+phosphorus and organic manure (cowdung) showed some improvement in dissolved phosphate with cowdung and N+P treatments, whereas volume of plankton was more with lime alone.

Problem : 1.45 Culture of *Mystus seenghala* and *M aor*
Personnel : V. R. P. Sinha & N. G. S. Rao
Duration : Two years

Pond stocked *Mystus seenghala* fingerlings attained an average size of 407 mm/350 g in 10 months. The survival of fingerlings was found to be poor.

Problem : 1.46 (Research work completed in 1979. Final Report is being prepared)
Problem : 1.47 (Research work completed in 1978)

Problem : 1.48 Alternative cheap protein source for carp fry and fingerlings
Personnel : P. R. Sen, N. G. S. Rao & D. K. Chatterjee

Duration : Two years

Growth of major carp fry, fed with two formulated pelleted diet was compared against fry fed on mixture of ground nut oil cake and rice polish. It was observed that growth was optimum with formulated feed having about 45% protein, 40% carbohydrate and 3% fat.

Project 2 : Induced Fish Breeding

Problem : 2.7 Isolation of fish gonadotropin for hypophysation of carps in large-scale

Personnel : V. R. P. Sinha

Duration : Seven years six months

Lyopholization was done of the second fraction for investigating the amino acid profile of fish gonadotropin. Further work could not be done since the amino acid analyser went out of order. The project is suspended till the amino acid analyser is available.

Problem : 2.8 Induced breeding of important cultivated fishes (other than carps)

Personnel : R. M. Bhowmick (up to March, 1979), G. V. Kowtal, R. K. Jana and S. D. Gupta

Duration : Five years

Brood fish stock of *P. pangasius* and *N. chitala* were maintained. Hypophysation of one set of *P. pangasius* was tried. The males were in oozing condition. However the female did not respond. The gonads revealed advanced stage of resorption. Further attempts could not be made.

Problem : 2.9 Studies on the process of maturation, ovulation and resorption of gonads in Indian major carps

Personnel : G. V. Kowtal, R. M. Bhowmick (up to March, 1979), R. K. Jana and S. D. Gupta

Duration : Six years

Histological studies of gonads of Indian major carps, catla, rohu and mrigal in various stages of maturity are in progress.

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

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

Duration : Five years

Preliminary study has been made on the histomorphology of the pituitary and gonad of the pond-bred common carp and rohu with the help of recent staining techniques. Detailed study of the cellular organization of the hypophysis with reference to the sexual maturity of the above fishes are in progress.

Problem : 2.11 Effect of hormones in hypophysation and vitamins on maturity of carps

Personnel : S. D. Gupta, H. A. Khan and R. M. Bhowmick (up to March, 1979)

Duration : Four years

Fingerlings of mrigal were injected @ 5 and 10 mg/kg with leutocyclin (progesteron) at 7 days interval and the experiment lasted for a month. The injected specimens did not show any change in their gonadal development as compared to control.

This hormone was tried on rohu (av. wt. 0.65 kg) @ 5 mg/kg at 10 days interval over a period of 2 months. It was noted that in case of injected female fishes the abdomen was more bulging and soft as compared to control. The treated fishes responded more favourably to hypophysation than the control.

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

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

Duration : Three years

Throughout the year interrenal tissue and chromaffin tissue were collected from *Labeo rohita* captured from riverine sources and ponds and were processed for histological preparation of slides. A preliminary observation was made which have some idea regarding the possible involvement of interrenal tissue during the gonadal maturation process.

Through study is to be made to see whether extra administration of corticosteroids would enhance the process of maturation in Indian major carps or not.

Problem : 2.13 Studies on the factors responsible for multiple spawning of carps

Personnel : R. M. Bhowmick

Duration : 2 years

The results obtained so far indicated that the same specimen of Indian major carps could be bred twice in a season though these carps normally breed only once a year either naturally or by hypophysation.

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

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

Duration : Four years

Histological studies revealed that the head kidney of catla contains thyroid follicles. Pharyngeal region of the above fish was also taken up for study. The stained sections revealed unevenly distributed thyroid follicles along the ventral aorta. Studies on other species are in progress.

Problem : 2.15 Biochemical changes associated with the gonadal cycle in certain freshwater carps

Personnel : Paul Raj

Duration : Three years

Preliminary studies were made on the water content, total dry matter, and total lipid content of the eggs in respect of common carp and rohu.

Project 3 : *Reservoir fisheries*

Problem : 3.8 Fisheries of the Peninsular tanks : Introduction and propagation of less known culturable species

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

Duration : Seven years

The project envisages introduction and propagation of less known culturable species like *Pangasius pangasius, Cirrhinus cirrhosa* and *Labeo fimbriatus* in freshwater tanks of Karnataka. 1200 *C. cirrhosa,* 500 *L. fimbriatus* and 45 *P. pangasius* from the Cauvery stretch of

Tamil Nadu have been stocked in a tank for follow up studies.

Problem : 3.13 Composite fish culture of Indian and exotic carps in tanks simulating long seasonal irrigational tanks

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

Duration : One year

i) *Physico-chemical conditions of water* :

The physico-chemical conditions of water in the tanks under observation were as follows :

Physical factors	*ASC Tank*	*I. T. I Tank*
Temperature °C	25.02—31.0	24.2—29.5
Colour	Muddy to Greenish	Muddy to clear

Chemical factors

PH		6.0— 9.6	6.8 –8.5
Dissolved oxygen	ppm	3.0— 10.08	3.76 – 12.16
Free carbon dioxide	ppm	Nil— 40.0	Nil— 25 20
Carbonate alkalinity	ppm	Nil— 36.0	Nil— 24.0
Bicarbonate alkalinity	ppm	96.0—246.0	100.0—222.0
Hardness	ppm	36.0— 72.0	32.0— 56.0
Specific conductivity	$\times 10^{-6}$ mhos	240.0 –268.0	260.0—278.0
Nitrate	ppm	Tr.— 0.208	Tr.— 0.064
Phosphate	ppm	Tr.— 0.096	Tr.— 0.034
Silicate	ppm	1.23—11.6	0.8— 2.0
Iron	ppm	0.08-- 3.58	Tr.— 1.0

The water was clear throughout the period of observation in ITI tank while turbidity up to 100 ppm due to algal bloom in ASC tank was noticed during April '79. April '79 recorded the highest temperature in both tanks while the second highest temperature was noticed during October '79. The minimum was during January '79. Concentration of nutrients was more perceptible in ASC tank during April '79. Free Carbon dioxide was present in almost all months in ASC tank except February '79 with the minimum (4.0 ppm) during July '79 and maximum (40.0 ppm) during March '79 while in ITI tank it was present in all months except in January '79 and ranged from 8.0 to 25.2 ppm. A peak (0.208 ppm) in nitrate concentration was noticed in ASC tank during March '79 which was reduced during April, 1979 (0.114 ppm) with the appearance of phytoplankton and incursion of rain water from that month onwards. Dilution in the nutrient concentration was noticed in both the tanks in the later half of the year due to influx of rain water. A decline in the values of nitrate, phosphate and an upward trend in the concentration of silicate and iron was evident in ASC tank in the second half of the year with the persistant greenish colouration. Declining trend in the Nitrate concentration was noticed in the ITI tank from January to December, 1979. Phosphorous was found in traces in the second half of the year in ITI tank. Phosphorous which was in traces was found to increase from March '79 and April '79. With the death and decay of algal blooms in ASC tank it was found in traces only from July '79 onwards with the presistent greenish colouration of the water. No significant relationship between specific conductivity and nitrate was in evidence. ITI tank exhibited lower values of pH, free carbondioxide, carbonate hardness as also nutrients in general than the ASC tank.

ii) *Plankton* :

In general both ASC and ITI tanks showed the dominance of zooplankton during the year with a significant change towards phytoplankton (blooms) as observed in ASC tank during the month of April, November and December 1979. The dominant forms contributing the

blooms were *Microcystis*, *Phormidium*, *Ocillatoria* of Myxophyceae, *Pediastrum* of Chlorophyceae and *Synedra* of Diatomaceae. In the ASC tank the density of plankton ranged between 3,52,850 to 19,03,500 by numbers/m^3 and 4.5-30.5 ml/m^3 by volume, while in ITI tank plankton density ranged between 1,22,000 to 21,68,000 by numbers/m^3 and 0.5 ml to 26 ml/m^3 by volume. Maximum number of plankton was observed in November '79 in ASC and October '79 in ITI tanks respectively. The phytoplankton encountered in ASC were of Myxophyceae, Chlorophyceae and Diatomaceae, while those of zooplankton were of Protozoa, Rotifera, Cladocera and Copepoda. Rotifera and Copepoda were common in their abundance in both the tanks, they being followed by Cladocera.

iii) Littoral and benthic organisms :

In ASC tank, the density of organisms ranged from 1.109 u/m^2 by numbers and from 0.22-12.25 g/m^2 weight. The organisms observed were insects (*Notonecta*, *Ranatra*, *Cerixa*, *Nepa*, Mayfly nymphs and mosquito larvae), fishes (*R. daniconius*, *G. affinis* and *C. punctatus*) and prawns.

The density of organisms in the benthic region ranged from 54-247 u/m^2 and from 0.054-53.80 g/m^2 by numbers and weight respectively, organisms observed being Chironomids mostly.

iv) Fish stocking and production :

With a variation in the stocking density of 5,200/ha and 4,000/ha of Indian and exotic carps in the composite fish culture experiments at ASC and ITI tanks respectively having a water spread area of 1.25 ha and 0.33 ha, during the year a gross computed fish production of 1,750 kg/ha/10½ months and 4,250 kg/ha/yr were recorded.

An intensive composite fish culture experiment in the 1.25 ha ASC tank and 0.33 ha ITI tank at Doorvaninagar with a stocking density of 3,000/ha in each comprising of Indian and exotic carps are being continued. The stocking ratio at ASC is catla-1.1, rohu-1.0, mrigal-0.6, common carp-0.6 and grass carp-0.45 while at ITI tank catla-0.45, rohu-0.2, mrigal-0.15, common carp-0.15 and grass carp-0.05.

Problem : 3.14 Ecology and fishery development of Gulariya Reservoir

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

Duration : Five years

Hydrology : Physico-chemical characteristics of the Gulariya reservoir were : water temperature ranged from 18.0 to 35.0°c ; turbidity 7.00 cm (June) to 80.0 cm (July), pH, alkalinity and hardness of water ranged as 6.8—8.2, 36.0—40.0 ppm and 18.0—30.0 ppm respectively. These values almost reflected the variations in the previous year. Ca++ ions concentration ranged from 20.0 to 28.0 ppm indicating an increasing trend over the corresponding values of last year (17.5 to 22.0 ppm). Inorganic nutrients *viz.*, nitrates, phosphates and silicates ranged from 0.06 to 0.13, 0.04 to 0.12 and 6.0 to 8.8 ppm respectively.

Gross primary productivity, net productivity and respiration rate ranged from 50.0 to 137.5, 25.0 to 125.0 and 12.5 mg C/m^3/hr respectively.

Plankton : A peak production of plankton (2,249 u/l) occurred in May. Least plankton abundance (175 u/l) was observed in January. Total planktonic biomass varied from 0.70 ml/m^3 (May) to 0.17 ml/m^3 (January). A positive corelation was found between temperature and plankton abundance.

Amongst phytoplankters (67.12%), Bacillariophyceae showed maximum abundance (25.76%), closely followed by Chlorophyceae (25.72%), Myxophyceae (8.92%)

and Desmidiaceae (6.72%). *Navicula* sp., *Melosira* sp., *Cymbella* sp., *Nitzschia* sp., and *Amphora* sp. among the green algae ; *Microcystis* sp. among the blue green and *Cosmarium* sp. among the desmids were the dominant forms encountered.

Zooplankton forming 32.88% of the total plankton comprised copepods (15.62%), rotifers (10.29%), cladocerans (5.70%) and protozoans (1.27%) in order of abundance. Nauplii persistently dominated the copepod group. Among rotifers *Keratella* sp. followed by *Filinia* sp. and *Trichocerea* sp. were the prominant forms. The cladocerans were represented by *Bosmonia* sp., *Chydorus* sp. and *Moina* sp. and the protozoans by *Arcella* sp. and *Stylomchia* sp.

Intensive fishing operations in May.June, drought conditions during July to September and heavy water discharge from October to December could be mainly responsible for numerical variations in the plankton density.

Macrobenthic fauna : Macrobenthic population varied from 924 u/m² (January) to 2,024 u/m² (June). The benthos was dominated by insect larvae (6.08%), followed by oligochaets (29.8%) and gastroponds (9.4%). The insect larvae comprised *Chironomus* sp., *Chaborus* sp., *Piylopoterus* sp. *Cubearlesis* sp. etc. Zone III was observed to be the richest (1964 u/l) compared to the II & I zones. The population of bottom biota this year showed an increasing trend over the minimum and maximum values of 396 and 968 u/m² respectively recorded during the previous year.

Natural breeding of major carps in the reservoir : Due to failure of monsoons resulting in prolonged drought conditions the breeding grounds of major carps could not get innundated. As such no natural spawning of major carps in the reservoir could be observed. Induced breeding experiments were initiated but due to adverse environmental condition only partial success could be achieved and only 1.26 lakhs spawn of major carps were produced.

Stocking : 69,500 major carp fingerlings. obtained by rearing Yamuna spawn, salvaging from the nullahs near Gulariya and purchased locally, were stocked in the reservoir. 10% of the fingerling were tagged.

Only 8 anchor tagged fish were recovered from the reservoir during commercial fishing operations in May—June, 1979.

A record production of 100 kg/ha/yr was obtained in 1979 against an average production of 22 kg/ha/yr during 1969-1976. The reservoir fishery fetched a revenue of Rs. 45,000/- this year against an annual lease amount of Rs. 8,000/- paid to the State Government. Major carps (58.0%) comprising *C. mrigala* (32.44%), *C. catla* (5.75%), *L. rohita* (6.73%) and *L. calbasu* (13.08%) dominated in the commercial catch. Catfish group, mainly dominated by *M. seenghala* and minor carps represented by *P. sarana* contributed 33.05% and 6.33% respectively in the total catch. Murrels and eels constituted 2.32% and 0.30% respectively.

The abundance of major carps, *C. mrigala* (size range 40-70 cm), *C. catla* (55-80 cm) and *L. rohita* (40-70 cm), distinctly indicated the effect of seeding the reservoir with major carp fingerlings during the years 1976-77 and 1977-78.

Breeding of catfishes : A large number of breeding pits (Thalas) of *Mystus seenghala* were observed in the reservoir and the size composition of the specimens sampled revealed intensive breeding of this species in the reservoir.

Problem	: 3.15	Ecology and fisheries of Peninsular tanks
Personnel	:	B. V. Govind, P. K. Sukumaran S. L. Raghavan and M. F. Rahman
Duration	:	Five years

The project which pertains to the assessment of the production potential of tanks with a view to maximise fish yield under varying edaphic conditions was initiated.

Problem :	3.16	Biology of *Puntius dorsalis* (Jerdon)
Personnel :		P. K. Sukumaran
Duration :		Two years

The 750 specimens of *P. dorsalis* (47-172 mm) analysed for food contents showed preference for phytoplankton.

Project 4 : Riverine carp spawn prospecting and collection techniques

Problem :	4.1	(The work is being done under a Co-ordinated Project)
Problem :	4.2	(The work is being done under a Co-ordinated Project)
Problem :	4.3	(Research work suspended since 1972)
Problem :	4.4	(Research work completed in 1973)
Problem :	4.5	Yearly variation in the quality and quantity of spawn in the rivers Ganga and Yamuna
Personnel :		K. P. Srivastava, R. K. Dwivedi and N. K. Srivastava
Duration :		Continuing

Spawn prospecting investigations were conducted at Madhuka centre on the river Yamuna near Allahabad during the monsoon season from 10th July to 13th September. 1979. During the period the river experienced only two floods of minor nature with peaks at 4.39 m and 3.12 m above the summer level. This could be due to acute drought conditions that prevailed in the Yamuna basin. On 13th September 1979 the water level of the river was 1.91 m below the summer level. During 1979 monsoon season 467 ml (2,33,500) of spawn was collected using 5 standard 1/8″ meshed Midnapure type shooting nets as against 2,365 ml (11,82,500) of spawn collected during the 1978 monsoon season. Spawn was available in two spurts, the first contributing 392 ml (83.94%) while the second spurt only 75 ml (16.06%). The first spurt lasted for 92 hours and the second for 44 hours only, the average catch/net/hr having been estimated as 1.1 and 0.4 ml respectively.

Average percentage of desirable spawn was estimated as 67.6 and 43.8 in respect of the two spurts. About 100 ml of spawn was released for rearing in the Jail nursery, Naini. The reared samples had 83.3% major carps comprising *C. mrigala* (43.3%), *C. catla* (3.3%) and *L. rohita* (36.7%).

Fish landing and spawn data is being analysised to corelate the spawn production of the centre with the landings of major carps at the assembly centre in the stretch and to study the pattern of fluctuation in the quantative and qualitative abundance of the spawn in the stretch of the Yammuna.

Project 5 : Brackishwater Fish Farming

Problem :	5.17	Brackishwater shell fish culture in Madras region
Personnel :		K. Raman, Munawar Sultana, S. Srinivasagam, K. Gopinathan (from August onwards), P. M. Abdul Kader and S. Krishnan
Duration :		Three years

In a field experiment in the 0.01 ha pond at Adyar, *Penaeus indicus* (67.6 mm/1.53 gm) stocked @ 12,000/ha showed an average growth increment of 83.3 mm/26.8 g in about 3½ months.

In a yard experiment the feed, fish meal+rice bran+ tapioca (2:2:1) was fortified with algal power, oyster shell powder and vitamin B complex separately and was given to *P. indicus* fry @ 10% body weight. The original feed was kept as control and the same with aeration as another treatment. At the end of 60 days the growth increment did not show any beneficial effect of the added items. However, the feed alone with aeration gave better conversion, than others. Mortality was high in the B complex treatment.

Two feeds comprising (I) rice bran+fish meal+ tapioca (2:2:1) and (II) prawn head powder+bengal gram + groundnut oil cake + tapioca (2:2:1:1) were analysed for their nutritive values. Though the second feed contained 40% protein compared to 29% in the first, the growth of prawn was better with the first feed. However, carbohydrate in the first feed was more than double than in the second.

In a yard experiment, 10 cement tubs were stocked with *P. indicus* fry @ 10/tub and the feed, fish meal+ rice bran+tapioca was tried with five different proportions of fish meal (10%, 20%, 30%, 40% and 50%) in each mixture with one replicate for each. The results at the end of 2 months showed 20% and 30% as the bests among the combinations. Further studies in this direction are being conducted.

Yard experiments were conducted with replicated to study the effect of unilateral eye stalk ablation on the growth of *Scylla serrata*. An average growth of 9.56 mm/21.73 gm/month was recorded in the ablated specimens (35-102 mm) as against 8.75 mm/10.1 gm/month in unablated specimens (24-60 mm).

In the field experiment nylon hapas and dealwood boxes were fixed in the lake as cages. The unilateral ablated specimens showed an average monthly growth of 12 mm as compared to 9.43 mm in the unablated ones with a survival rate of about 50% in all cases.

Problem : 5.18 Oyster cum fish culture

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

Duration : Six years

During April, large oysters kept in trays showed a height range of 70—120 mm and a length range of 50-83 mm and those recently removed from asbestos sheets showed corresponding ranges of 40 to 80 mm and 30 to 65 mm. The remaining ones growing on asbestos sheets showed height range of 30 to 58 mm and length range of 25 to 70 mm. The spat fallen later were 5 to 30 mm in height and length.

During May, because of a severe cyclone the oyster raft was broken and the oysters strewn all over. Afterwards they were salvaged and the experiments was reset in June. The measurements of oysters in trays were : height 60 to 125 mm and length 45 to 72 mm. Growing oysters on asbestos sheets showed corresponding ranges of 30 to 60 mm and 30 to 52 mm. Spat attached during March–April were in the range of 8 to 35 mm (height) and 8 to 32 mm (length). Large-scale spat fall was noticed during October/November on the asbestos sheets kept in dealwood boxes immersed in the lake.

Hydrological features of lake water at the experimental site were : water temperature 27.0-33.2°C, transparency 13.0-35.0 cm, D. O. 4.8-8.8 ppm and salinity 16.0–34.0 ppt.

The fauna collected from Oyster boxes comprised of *Epinephelus*, *Etroplus*, *Lutianus*, *Gobius* and *Sparus* among fishes ; *Alpheus*, *Penaeus* and *Macrobrachium* among prawns and *Scylla* and *Thalamita* among crabs. The total weight of fishes was 5.63 kg and that of crabs 1.69 kg collected in four months.

Problem : 5.19 (work programme transferred to Problem 5.76)

Problem : 5.20 (Research work completed in 1976)

Problem : 5.21 (Research work completed in 1977)

Problem : 5.22 Rearing of fry of brackishwater fishes

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

Duration : Five years & nine months

Mullet fry (15.4 mm/40 mg) were stocked in a 0.01 ha pond at Adyar @ 70,000/ha. In 140 days the fry showed an increase of 51.68 mm in length and 3.94 g in weight over the initial values with the monthly growth rate of 11 mm.

Study made on the identification of mullet fry *Valamugil cunnesius* (Val.) revealed that the axillary scales at dorsal and ventral fins appear first (18 mm) followed by the one at pectoral fin (24 mm). After this, the dark spot at pectoral fin appears (26 mm), which is followed by the appearance of adipose eyelids (38 mm). The results would be useful in sorting of the species at early stage.

Mullet fingerlings were stocked @ 25,500/ha in a 0.01 ha pond and reared with natural food. Fingerlings of *Liza macrolepis* (initial length and weight 76.0 mm/ 6.3 gm) showed growth rate of 6.0 mm/1.6 gm/month and *Mugil cephalus* (initial length and weight 31.3 mm/ 0.5 gm) 26.7 mm/2.8 gm/month. Survival was 100% in the experiment. Fingerlings of *L. macrolepis* (initial length and weight—83 mm/5.5 gm) reared in an enclosure with natural food gave growth rate of 4.7 mm/1.8 gm/month. Survival obtained was 100% in this experiment.

Experiment was temporarily suspended due to low water level in the pond. No progress.

Fry and fingerlings of *Gerres lucidus* and *Etroplus maculatus* were acclimatised to freshwater and were reared in plastic pools and their growth rates were 6 and 3 mm/month respectively. In a 0.01 ha brackishwater pond fry of *Gerres* spp., *Sillago sihama*, *E. maculatus*, *Siganus canaliculatus*, *Epinephelus* sp. *Lutianus* sp., and *Therapon jarbua* were stocked. *Gerres* spp. and *T. jarbua* gave 6.8 and 13.2 mm/month growth respectively. From the same pond monthly harvest of 580 to 2860 gm of *Tilapia* was obtained. The total yield worked out to 758 kg/ha/6 months.

Samples of *M. gulio*, *Tachysurus nenga* and *Plotosus canius* were analysed for biological studies.

Mystus gulio in the 0.01 ha pond at Adyar were found to have bred during November/December 1976 and April/May 1979. The juveniles in the first brood stock showed an increment of 45.3 mm/3.34 gm in 233 days (average 5.8 mm/0.43 gm/month) and those in the second brood stock, 28.0 mm/2.0 gm in 112 days (average 7.5 mm/0.54 gm/month) while the parent stock did not show appreciable increment (2.8 mm/11.2 gm/4 months).

Four experiments were conducted on the rearing of *M. gulio* with artificial feeds. Fish meal, prawn head powder and oyster meat with and without tapioca were used as feeds in the above experimcnts. Of these in 3 experiments the oyster meat gave better growth (5.0 mm/1.2 g, 7.0 mm/2.0 g and 10.75 mm/1.25 gm/month respectively) and in one experiment fish meal+tapioca gave better growth (9.4 mm/month). Another experiment is in progress.

Food of *Hemiramphus gaimardi* consisted mostly of plant matter (93.4%), a few diatoms, algae, zooplankters, crustacean remains and molluscs. Sex ratio was male : female : : 34 : 66. All stages of maturity were encountered in the lake. Spent specimens occurred in April. A few juveniles (7 nos) of *Hemiramphus gaimardi* (75-103 mm) were collected from Kovalam and released in a cement tub with water of salinity 10 ppt. Six of them died after two days. The remaining one transferred to higher salinity (38 ppt) also died in the next day. Another sample of 3 juveniles of *H. gaimardi* when kept in sea water with aeration also died within 3 days.

The stomach contents of *Nematalosa nasus* consisted of a mixture of sand grains, decayed organic matter, diatoms and algal bits. Ripe gonads were recorded in July and August.

In the multiple stocking and multiple harvesting experiment two more harvests were made during the period under report. *Penaeus indicus* accounted for 700g. *Liza macrolepis* for 500 gm and *Tilapia* for 5900 gm. No artificial feeding was done during the period. *Chanos* (1910 g) and *M. cephalus* (5220 g) and a few *L. macrolepis* (690 g) were not harvested and are being maintained for conducting induced breeding experiments.

No further stocking was done.

Problem : 5.23 Experimental culture of brackishwater fish food organisms in the laboratory and field
(Merged with project 1.25)

Problem : 5.24 Effect of hormones on the growth and photosynthetic behaviour of plankters (work programme transferred to project 5.23)

Problem : 5.24a Effect of hormones and trace elements on fish food organisms
(work transferred to Freshwater Culture Division & new number is given as 1.47)

Problem : 5.25 Nutritional requirements of cultivable brackishwater fish and prawns
(suspended)

Problem : 5.26 Transformation of nitrogen and phosphorus in water logged saline soils relative to different grades of water salinity
(completed in 1977)

Problem : 5.27 Surveying of Kankaramari Char and Kakdwip and designing brackishwater fish farm
(suspended)

Problem : 5.28 Behaviour of lake-mouth bar and its bearing on the fishery of lake Pulicat

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

Duration : Five years

The lake-mouth remained open throughout the year with the width fluctuating between 200 and 400 m. Two small outlets formed during the end of the north of the main bar-mouth, got merged with the latter and became one, the whole being shifted apparently northward by accretion at the southern tip of the mouth and erosion at the north.

The hydrobiological data collected from the sea, lake-mouth and a few other centres ranged as follows :

Parameter	*Sea*	*Lake mouth*	*Other centres*
Water temp (°C)	28.0-34.5	25.5-34.1	24.0-38.2
Salinity (ppt)	30.0-36.0	10.0-40.0	2.0-48.0
D. O. (ppm)	6.4-12.0	4.8-12.4	4.0-12.8
Phosphate (ppm)	0.02-0.09	0.02-0.2	0.02-0.3
Silicate (ppm)	8.0-11.0	8.0-13.0	3.0-20.0
Nitrate (ppm)	0.01-0.08	0.04-0.07	0.0-0.05
Transparency (cm)	—	6.5-30.0	7.0-30.0
Phytoplankton (u/haul)	—	70-128	70-127
Zooplankton (u/haul)	—	60-360	21-127

The total landings from the lake were estimated as 1416.285 t showing a substantial increase of almost 400 t over those of the previous year. This is possibly attributable to the long open condition of the bar-mouth and the disruption of fishing at the opening early in 1978 because of quarrels between fishermen villages. Prawns occupied the first place in the catch from the whole lake (47.88%). Mullets were the next in abundance in the whole lake (16 85%) and northern sector (26.44%) whereas in the southern sector perches (12.41%) dominated over mullets. In the whole lake the other dominant groups in order of abundance were clupeids (11.26%), perches (10.12%), crabs (6.57%), catfishes (2·49%) and Beloniformes (2.13%). In the southern sector they were clupeids (10.08%), mullets (9.37%), crabs (9.05%) and cat fishes (2.42%) whereas in the southern sector, these groups were clupeids (12.77%), perches (7.53%), Beloniformes (4.04%), crabs (3.39%) and cat fishes (2.59%).

The biggest catch from the whole lake was recorded in February and the lowest in August.

problem : 5.29 Role of silt load in the Hooghly estuary on nutrient balance of the environment and its effect on primary production processes
(Completed in 1977)

Problem : 5.30 Shape and structure of ponds, feeder canal and dykes relative to stability, water management and fish culture under brackishwater environment
(suspended in 1978)

Problem : 5.31 Studies on the macrophytic flora in lake Pulicat with special reference to their utilisation as organic manure and artificial feed for fish
(completed in 1978)

Problem : 5.32 Culture of edible protunid crabs
(Merged with project 5.17)

Problem : 5.33 Nursery management in the culture of *Eleutheronema tetradactylum* (suspended in 1978)

Problem : 5.34 Stock manipulation in polyculture of freshwater carps, brackishwater fishes and prawns in low saline ponds at Bakkhali

Personnel : S. M. Pillai. D. D. Halder, R. K. Chakraborti, P. K. Chakrabarti, A. K. Roy and P. K. Ghosh

Duration : Four years

The low saline (K-pond 0.25 ha) was stocked at the rate of 8,000/ha with *C. catla, L. rohita, C. mrigala, H. molitrix, M. cephalus, L. tade, L. parsia* and *P. monodon.* The stocking ratio of freshwater carps : brackishwater fishes : prawns was 2:2:1. The freshwater fishes were stocked under the programme of single stocking while the pattern of repeated stocking and harvesting was practised for brackishwater fishes. The average stocking sizes of the fishes and prawns were : *C. catla* 156.0 mm/62.0 g (Gr. I), 240.9 mm/170.8 g (Gr. II) ; *L. rohita*—111.8 mm/22.5 g (Gr. I) ; 250.6 mm/190.0 g (Gr. II), C. mrigala—84.8 mm/10.0 g (Gr. I), 320.5 mm/344.5 g (Gr. II) ; *H. molitrix*—56.8 mm/3.0 g (Gr. I), 262.2 mm/200.0 g (Gr. II) ; *M. cephalus*—87.5 mm/8.4 g (Gr. I), 234.0 mm/145.0 g (Gr. II) ; *L. tade*--236.5 mm/141.2 g ; *L. parsia*--95-5 mm/12.2 g ; *P. monodon*--28.4 mm.

Final harvesting was done by mahua oil cake application at the rate of 200 ppm. The average final size of the fishes and prawns attained were *C. catla*-333.8 mm/500.9 g, *H. molitrix*-481.3 mm/1.034 kg, *M. cephalus*-277.4 mm/236.7 g, *L. tade* 304.5 mm/300.0 g, *L. parsia*-127.1 mm/21.1 g and *P. monodon*-225.0 mm/80.0 g. The fishes and prawns registered a total survival of 33.2 percent during the culture period. The gross and net productions obtained from this culture operation were 852.608 kg/ha/yr and 790.108 kg/ha/yr respectively with a survival rate of 33 2%

The respective phyto-and zooplankton concentrations of the culture pond fluctuated from 100-420 units/l of water and 8 -34 unit/l of water. The minimum concentration of the plankton was observed in the month of February while the maximum concentrations of phyto- and zooplankton were noticed in August and July. Among phytoplankton *Ankistrodesmus* sp., *Nitzschia* sp., *Anabaena* sp., *Spirulina* sp., *Gyrosigma* sp. and *Spirogyra* sp., were the common forms. Calanoid and Cyclopoid copepods and their nauplii, *Brachionus* sp., Mysids and *Moina* sp., were often encountered among zooplankton.

In the water phase, temperature, pH, CO_3, HCO_3, D. O., salinity and phosphate ranged from 25.2-35.1°C, 8.4-9.1, 12.0-42.0 ppm. 6.2-10.6 ppm, 0.75-1.7 ppt and 0.009-0.076 ppm. Turbidity and primary productivity of the pond fluctuated between 80-200 mm and 312.5-620.0 mg C/m²/hr respectively.

Problem : 5.35 Culture of *Chanos chanos*
(Merged with project 5.37)

Problem : 5.36 Collection and rearing of *Penaeus monodon* seed for stocking and supply
(Merged with project 5.41)

Problem : 5.37 Crop rotation under mixed prawn-cum-fish culture

Personnel : N. K. Das, D, D. Halder, P. K. Ghosh, N M. Chakrabarti, H. C. Karmakar and D. Sanfui

Duration : Five years

Mixed culture of prawns : Three ponds (0.02/ha) each were stocked with *P. styliferus, M. monoceros* and *M. brevicornis* in the first experiment and only one of the above ponds was utilised for culture alongwith *P. monodon* in the second experiment. Stocking density tried in each case was 2 lakh/ha. The details of the experiments and production achieved are presented below :

First experiment :

Species	*Intial size (mm/g)*	*Culture period (days)*	*Final size range (mm/g)*
P. indicus	24.0/0.2	90	86.6/6.0 to 88.5/7.0
P. styliferus	18.5/0.3	90	61.3/2.8 to 78.6/5.0

Species	*Intial size (mm/g)*	*Culture period (days)*	*Final size range (mm/g)*
M. monoceros	8.1/0.05	90	82.4/4.1 to 94.9/8.0
M. brevicornis	21.7/0.2	90	80.0/5.0 to 90.6/7.0

Production ranging from 157.250 to 320.5 kg/ha/yr were obtained from the three ponds.

Second experiment :

Species	*Initial size (average)* mm.	*Period of culture (days)*	*Final size rangd (mm/g)*
P. monodon	12.5	90	90.0/5.6 to 135.5/28.0
P. indicus	15.0	90	87.5/6.5 to 90.0/8.0
P. styliferus	12.5	90	65.5/3.0 to 75.0/4.0
M. monoceros	3.5	90	80.5/4.0 to 90.9/7.5
M. brevicornis	12.5	90	81.3/5·5 to 92.5/7.5

A production @ 552.7 kg/ha was obtained in the second experiment monoculture of *P. monodon* : In the first experiment, 3 ponds and in the second experiment 3 ponds (0.02 ha each) were stocked with early juveniles of *P. monodon* and reared for 90 days in each case. In the first experiment, the stocking density tried were 25,000 and 30,000/ha while in the second experiment, stocking rate tried were 20,000-30,000/ha. The details of the experiments conducted and productions obtained are presented below :—

First experiment :

Species	*Initial average size (mm)*	*Final size range (mm/g)*
P. monodon	16.5	73.7/3.0 to 184.0/24.0

Production of *P. monodon* alone ranged from 109.5 to 176.0 kg/ha with a survival of 60 to 100%.

Second experiment :

In the second experiment prawns in the above average size grew to 88.8 mm/7.1 g to 122.1 mm/14.0 g only and the poor survival range of 7.8-17.5% resulted in a vary low production of only 30.0 to 36.0 kg/ha. In case of fish with other prawns, the total production increased to 9.00 to 91.0 kg/ha.

Prawn-cum-fish culture : Three ponds of 0.06 ha each were stocked at the rate of 3 lakh/ha with the prawns, *P. indicus*, *P. monodon*, *P. styliferus*, *M. monoceros*, *M. brevicornis* and the fish, *L. parsia*, *L. tade* and *C. chanos*. Details of the experiments carried out on the principle of repeated harvesting and stocking are presented below :

Species	*Initial average size (mm/g)*	*Final size (mm/g)*
P. indicus	22.4/0.2	83.2/5.5-134.8/21.0
P. monodon	20.0/0.2	111.6/12.5-189.0/50.0
P. styliferus	18.5/0.3	62.2/2.5-70.0/3.5
M. monoceros	8.1/0.05	74.0/4.68-100.0/9.1
M. brevicornis	21.7/0 2	71.0/4.0-80.0/7.5
L. parsia	16.0-24.8	98.8/10.0-162.5/40.0
L. tade	56.3/2.3-217.0/98 0	122.0/25.0-310.0/319.0
C. chanos	287.8/225.0-337.7/300.0	357.7/337.9-458.0/800
Other fishes	—	—

The above experiment was carried out for a period of 300 days and the total production of prawn + fish shows the yield range of 606.0-1231.2 kg/ha with prawn and fish survival ranging from 30–35.31 and 14.21-63.8% respectively.

Physico-chemical conditions of ponds :

Physico-chemical conditions of the pond water were studied. The temperature, salinity, Do, ailkalinity, pH and transparency ranged from 24.6-34.0°C, 4.6-19.3% ; 0.8-22.3 ppm ; 82.0-160.0 ppm ; 8.0-8.8; and 90.0-220 cm respectively.

Problem : 5.38 Stock manipulation in selective culture of *Lates calcarifer*

Personnel : D. D. Halder, P. K. Chakrabarti, H. C. Karmakar, N. M. Chakrabarti, B. Basak and D. Sanfui

Duration : Three years

A 0.125 ha pond was stocked at the rate of 560 nos/ha with *Lates calcarifer* (av. size 349 mm/582 gm). The fish were cultured for a period of six months during which they have attained an av. final size of 416.69 mm/ 850 gm. The production worked out to be 332.8 kg/ha/ 6 months with an overall survival of 69.01%.

Problem : 5.39 Intensive culture of *Penaeus indicus* in association with penaeid prawns
(merged with 5.37)

Problem : 5.40 Stock manipulation in intensive farming for mullets in combination with prawns and other fishes

Personnel : Kuldip Singh, D. D. Halder, N. K. Das, R. K. Chakrabarti and A. Hajra

Duration : Five years

In the first experiment, a pond (0.08 ha) was initially stocked with *Liza parsia*, *L. tade* and *Chanos chanos*, at stocking densities of 1.25 lakh/ha, 2,100/ha and 1,100/ha and with initial average sizes of 34.4 mm/0.31 g, 226.2 mm/101.8 g, and 295.6 mm/177.5 g, respectively in case of the three species. Later on prawns *P. monodon* (average size 139.9 mm/25.0 g) were also added at the rate of 36,000/ha. Larger individuals of the species stocked were removed periodically but complete harvesting was done after a culture period of 7½ months only. A production of 1,118.06 kg/ha/7½ months was obtained. *Chanos* showed the best growth and survival. It attained an average size of 391.9 mm/473.0 g after 195 days of rearing when it was partially harvested and showed an average growth rate of 1.515 g/day with a survival of 97.86%.

In the second experiment, a pond (0.08 ha) was stocked with *Liza tade*, *P. monodon* and *L. parsia*, @ 2,500/ha, 9.000/ha and 26,800/ha respectively. *P. monodon* had the initial size of 15-18 mm, *Liza parsia*, comprising two groups had the initial size of 52.3 mm/ 1.4 g and 77.1 mm/6.8 g and *Liza tade* constituted by 3 groups had the initial average size of 226.5 mm/96.5 g, 269.1 mm/183.6 g and 310.0 mm/280.0 g respectively. The larger individuals of *L. parsia* and *L. tade*, were removed periodically and were replaced with smaller ones as far as possible. Thus, after a period of 8 months of rearing, out of the total number (2187) of *L. parsia* and of *L. tade* (309), recovery was 1,013 (46.3%) and 302 (97.7%) respectively. *P. monodon*, showed cent per cent survival. A production of 1,380.75 kg/ha/8 months i. e., 2,071.12 kg/ha/yr, was obtained. The final average size of *L. tade* was 220.8 mm/108.1 g and 270.4 mm/210.9 g for group No. 1 and No. 2 respectively. *L. parsia* attained an average size of 122.4 mm/ 21.0 g (group No. 1) and 165.4 mm/51.5 g (group No. 2) and the final average size of *P. monodon* was 125.6 mm/ 18.0 g.

The hydrological parameters of culture ponds like water temperature, depth, turbidity, pH, D. O. and salinity ranged from 22.3-32.7°C, 58-98 cm, 140-330 mm secchidisc, 8.3-9.0, 4.6-8.4 ppm and 6.9-19.7 ppt,

respectively. The primary productivity of the culture pondswas in the range of 78-1,354 mg C/m^3/hr. Plankton production quantitatively ranged from 0.08 ml to 0.5 ml of the settled sediment. The dominant forms of zooplankters were mysids, *Diaptomus*, *Cyclops*, nauplii, *Brachionus* etc. The phytoplankton were dominated by *Oscillatoria* and *Lyngbya* (Myxophyceae), *Chlorella* (Chlorophyceae) and *Navicula*, *Nitzschia*, *Pinnularia*, *Gyrosigma* (Bacillariophyceae) etc.

Problem : 5.42 Supplementary feed for brackishwater fishes and prawns (Research completed in 1977)

Problem : 5.43 (Research work merged with problem 20.3)

Problem : 5.44 (Research completed in 1977)

Problem : 5.45 (Research completed in 1977)

Problem : 5.46 (Research work merged with problem 5.47)

Problem : 5.47 Utilisation of industrial, agricultural and municipal wastes in aquaculture

Personnel : R. K. Banerjee, B. B. Pakrasi, S. C. Banerjee and S. K Chatterjee

Duration : Four years

Excess of nitrogen in sewage causes luxuriant growth of filamentous algae mainly Cyanophyceae in ponds receiving sewage, which results in steady rise in pH with the increasing photoperiod.

Sprinkling of copper-sulphate solution of 1 kg/l in the afternoon hours has been found to control the growth of phytoplankton population. The acidic wastes from rayon factory containing traces of zinc are also found to be effective in controlling Cyanophyceae.

Lime treatment in organic waste treated system has been found to mineralise the organic nitrogen. It has been observed that the pond soil treated with lime @ 100 kg/ha helped the mineralisation of organic nitrogen and also in the increase of C/N ratio from 3.4 to 9.4.

Problem : 5.48 & 5.49 (Research work suspended since 1978)

Problem : 5 50 Location, collection assessment of resources, acclimatisation and transport of brackishwater fish and prawn seed

Personnel : G. R. M. Rao, K. Raman, K. V. Ramakrishna, R. D. Prasadam, S. Radhakrishnan, C. P. Rangaswamy, M. Kaliyamurthy, S. Srinivasagam, Munawar Sultana and K. O. Joseph

Duration : Three years

Ingress of prawn and fish post-larvae at the lake mouth was generally poor during the period. A few post larvae of *Mugil* spp., *Hemiramphus gaimardi*, *Gerres* spp., *Ambassis gymnocephalus*, *Therapon jarbua*, *Aplocheilus* sp. and gobids among fishes and *Penaeus indicus*, *P. monodon* and *M dobsoni* among prawns were encountered.

Velon not collections made at lake-mouth and at few selected centres along the periphery of the lake showed *P. indicus*, *P. semisulcatus*, *P. monodon*, *M. dobsoni* and *M. monoceros* in addition to a few species of palaemonids among prawns and *Mugil* spp. *Ambassis gymnocephalus*, *Gerres* spp , *Therapon jarbua*, *Hemiramphus gaimardi*, *Siganus* sp.. *Lutianus* sp., *Etroplus* sp., and Gobids.

Juveniles of *Mystus gulio* (58-100 mm), *Gerres oyena* (20–25 mm), *Gerres lucidus*, *Etroplus maculatus* and *P. indicus* were transported from Kovalam (50 km ; 90 minutes), Pulicat (53 km ; 1 hr) and Adyar (20 km ; 1 hr) in open containers. Mortality (60%) occurred only in *G lucidus*. 100 nos of fry of *Gerres* spp. were also similarly transported from Kovalam without any mortality.

Fry of *G. lucidus* and *E. maculatus* were transported from Kovalam in a plastic bucket. The mortality was 60% in the former species only. About 200 numbers of fry of *S. sihama* and *Gerres* spp. were transported without mortality from Adyar river mouth. Fingerlings and fry of *S. canaliculatus*, *Epinephalus* sp., *Lutianus* sp. and *Gerres* sp. were transported from Kovalam in a plastic bucket by road. Mortality was 80% in *S. canaliculatus* and total in *Gerres* sp. only.

Problem : 5.51 Studies on the ecology of commercial brackishwater bheries of variant productivity

Personnel : B. B. Pakrasi and N. N. Majumder

Duration : Five years

In southern zone of the Hooghly Matlah estuarine system the primary productivity ranged from 395.2 to 416.0 mg/m^3/hr and salinity from 22.5 to 32.07‰. Available nitrogen in the soil varied from 18 82 to 30.80 mg/100 g in southern zone and at the canal site of the northern zone it was 34.0 mg/100 g. The decomposed organic matters in bheris of higher salinity seem to be the main source of nutrients The pond soils receiving municipal effluents exhibited higher average nitrogen than those ponds having no provision of municipal effluents.

Problem : 5.52 Rationalisation of frequency of festilisation of fish ponds

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

Duration : Four years

Two sets of yard experiments each in 3 replicates were conducted to study the effect of fertilisation at varying frequencies of 3, 7, 15, 30 and 60 days on the growth of fry of *L. parsia* and post larvae of *P. monodon*. Fertilisation was done using urea and superphosphate @ 100 kg N and 50 kg P_2O_5/ha/yr.

Among the frequencies tried, experiment of 3 days maintained higher dissolved inorganic nitrogen (1.15 ppm) and phosphorus (0.40 ppm) compared to that of control (0.07 and 0.02 ppm respectively). Maximum production of plankton and growth of *L. parsia* fry (36 mm/568 mg) and *P. monodon* post larvae (31 mm/259 mg) were also recorded in the above frequency of fertilisation as compared to control (28 mm/214 mg and 16 mm/30 mg respectively).

Problem : 5.53 Estimation of total biomass in enclosed brackishwater ecosystems

Personnel : Babu Lal (up to September, 1979) A. C, Banerjee, (from October, 1979), B. B. Pakrasi, S. B. Saha and S. C. Banerjee

Duration : Three years

The total monthly average of biomass in brackishwater bheri at Taldi ranged from 147.20 mg/sq. m (in January) to 215 mg/sq. m (in July) and showed a direct correlation with the water salinity (Range-10.80 to 22.55‰).

With the increase in salinity the total monthly average of the biomass was found to increase and recorded as high as 202.47 mg/sq. m. in August.

Problem : 5.54 Survey of nutrient status of soils of intertidal regions of lower Suderbans

Personnel : G. N. Chattopadhyay and P. R. Das

Duration : Three years

Soil samples were collected from different brackish-water fish culturable areas of Contai coast, Sagar and adjacent islands, Bakkhali and Kakdwip regions and Raidighi region and were consequently analysed for different physico-chemical properties to know the nutrient status of these soils under different inundation conditions. Analysis of the samples, so far done, showed the E. C. values to range from 6.1 to 8.2 m mhos/cm under perennial tidal inundation, between 5.8 to 7.8 m mhos/cm under seasonal tidal inudation and between 6.0 to 6.1 m mhos/cm in uninundated mangrove swamps. pH values under the three inundation groups ranged from 7.1 to 7.7, 6.9 to 8.3 and 7.7 to 8.2 respectively, Available nitrogen status of the studied soils showed them to be poor in this respect and the values ranged from 5.1 to 7.1 mg/100 g soil under perennial tidal inundation and from 4.2 to 9.8 mg/100 g soil under uninundated condition. Available phosphorus values of the soils under these three conditions were from 2.5 to 4.2, from 2.3 to 6.1, and from 3.1 to 3.4 mg/100 g soil respectively which indicated the phosphorus status of the studied soils to be moderately high. Studies on production potentials of the soils in respect of fish food organisms have been initiated in the laboratory.

Problem : 5.55 (Research work completed in 1979)

Problem : 5.56 Development of compounded feed in relation to biochemical and nutritional requirements of *P. monodon* and other prawns

Personnel : A. Hajra, D. D. Halder and S. M. Pillai

Duration : Two years

Using locally available cheaper ingredients, three feeds were compounded from rice bran, prawn meal, mustard oil cake, wheat flour and blood meal taking into consideration the detailed nutritional requirements of *P. monodon* and other prawns. Vitamins and minerals were mixed in all the three feeds. Calcium phosphate was included for rigidity of the structure of crustacea. To test the efficacy of blood meal it was included in one feed only. The percentage composition of the feed are detailed below :

Ingredients	*Feed I*	*Feed II*	*Feed III*
Prawn meal	50%	25%	25%
Mustard oil cake	25%	50%	45%
Rice bran	5%	15%	10%
Wheat flour	15%	5%	10%
Blood meal	—	—	5%
Calcium phosphate	2%	2%	2%
Vitamins and minerals	3%	3%	3%

(Vitamins included were thiamine mononitrate, riboflavin, nicotinamide, pyriodoxine hydrochloride, calcium pantothenate, cyanocobalamine, ascorbic acid, calciferol, vitamin E. N. F. and biotin and minerals included were calcium phosphate, ferrous sulphate, magnesium phosphate and manganese hypophosphite).

Evaluation of the diets by bioassay and determination of the detailed biochemical composition of feed are under progress.

Problem : 5.57 Mass production potential of *Penaeus monodon* and *P. indicus* in brackishwater pond

Personnel : D. D. Halder, P. Ravichandran, Kuldip Singh, A. K. Roy, A. Hajra and B. Basak

Duration : Five years

The experimental period was restricted to three months owing to reduced salinity during other months. Moreover, availability of adult prawns during the season was scarce and required numbers could not be procured.

Two trials were made during the period under report. In the first case, one female and one male prawn were ablated and the female prawn reached second stage but was observed to have fungal infections. Even after treating with 20 ppm formalin, the prawn could not recover. The second set was done with 8 females (80-120 cm). But maturation was not seen in any of them owing to the drop in salinity from 30 ppt to 12 ppt during the period. Non-availability of aeration facilities led to poor survival of prawn during conditioning period.

Problem : 5.58 (Research work marged with problem 1.25)

Problem : 5.59 Studies on the role of organic matters and redox potential in maintaining nutrient status of brackishwater pond soils

Personnel : G. N, Saha. B. B. Pakrasi, S. C. Thakurtha, S. B. Saha and S. P. Ghosh

Duration : Four years

Regular observations were made on the variations of redox potential and organic matter in *bheries* at Taldi and also in laboratory. It was noticed that *bheri* with higher organic matter (0.7% c) was in more reduced state (−100 to + 25 mv) containing more of ammonia (0.60 ppm) and that the *bheri* with lower organic matter content (0.40% c) having less reduced condition (+10 to +240 mv). Similar results were also obtained in laboratory studies. An inverse relationship was discerned between organic matter and redox potential.

Problem : 5.60 Standardisation of transport techniques of commercially important brackishwater prawn and fish seed

Personnel : A. R. Chaudhuri, B. B. Pakrasi, H. Singh and S. K. Chatterjee

Duration : Three years

Chloral hydrate at various concentrations (0.5-2.0 g/l) was tried to find out an optimal dose, which can safely be used to narcotise *P. monodon* post-larvae during transport. A dose of 1 g/l was found to induce moderate sedation and all the post-larvae became active immediately after their release into fresh canal water. The observation was made for 18 hours.

1500 nos. of *P. monodon* post-larvae were packed with oxygen in a polythene bag having 4 litres of water (salinity 5.0 ppt) and 93 per cent survival was achived upto 24 hrs, when 2000 nos. of *P. monodon* seed packed with chloral hydrate 66% survival was achived upto 30 hrs. In control without the provision of anesthetic drug the survival was only 50%.

Problem : 5.61 Studies on the ecology of brackishwater ponds with special reference to culture of commercial penaeid prawns

Personnel : R. K. Chakrabarti, P. K. Ghosh and D. Sanfui

Duration : Three years

Three sets of experiments were conducted in two ponds (0.02 ha). One pond (p-24) was subjected to tidal water exchange for 5-7 days in each fortnight without any manuring programme. The other pond (p-14) was not connected directly with feeder canals and was manured alternately with 250 kg urea + 250 kg SSP and 500 kg poultry manure per ha/yr.

1st set : p-24 and p-14 were stocked at the rate of 1 lakh/ha of *P. monodon* (16.5 mm) and reared for 45 days (17.4.79-6.6.79).

From p-14, 67% juveniles of 62.5 mm av. length and 7.7 kg misc. fish and prawn, and from p-24, 36.6% juveniles of 58.0 mm av. length with 2.9 kg miscellaneous fish and prawn were obtained.

2nd set : In pond 14 and 24, 500 *P. monodon* (50.66 mm) were released. From p-14 a total harvest of 8.1 kg was done in 104 days (18. 6.79 3.10.79) including 1.480 kg *P. monodon*. Apart from this a large number of *L. calcarifer* (398 nos. 82-120 mm) were removed during periodical sampling. In pond 24, a total harvest of 6.645 kg of miscellaneous prawns and fishes was obtained but no *P. monodon* was recovered .69 *Lates* seed (15-161 mm) were removed during sampling.

3rd set : During this period (15.10.79 - 22.12.79), 102 *P. monodon* (82 120 mm) were reared in p-14 with supplementary feeding. A total harvest of 5.630 kg including 2.590 kg *P. monodon* was obtained. In p-24, 126 *P. monodon* (89-124 mm) were stocked and a total harvest of 6.060 kg was done which compraised only 0.760 kg of *P. monodon*

The hydrological conditions and primary productivity for these two ponds are given below :

Parameters	*P-14*	*P-24*
	Range (*April to Dec.*)	*Range* (*April to Dec.*)
Water temp. °C	21.3-32.6	21.0-32.3
Turbidity (Seechidisc mm)	165-650	68-445
Depth (cm)	38-90	23-84
Salinity (‰)	5.1-20.5	5.0-20.5
D. O. (ppm)	3.6-10.8	4.6-10.0
Total Alkalinity (ppm)	99-182	82-172
pH (unit)	8.1-9.0	8.3-9.0
Primary productivity (mg C/m³/hr)	148-545	93-573

Problem : 5.62 Multiple cropping of *P. monodon* and mullets in low saline ponds at Bakkhali

Personnel : P. K. Chakrabarti, R. K Chakrabarti, S. M. Pillai, P.Ravichandran and A. K. Roy

Duration : Four years

One set of rearing experiment with *P. monodon* was carried out in five ponds (0.02 ha each) stocked @ 10 nos./m² to 40 nos./m². Survival rates observed were 10.2%, 50%, 60%, 70%, 72.5% indicating poor survival at high stocking density (40 nos./m²). Entry of unwanted prawns in large numbers was the main reason for such poor survival. Further experiments in this regard are in progress.

Two crops were raised in two ponds of 0.12 ha. Due to the entry of carnivoros fish, *Lates calcarifer* in large numbers in both the ponds and also due to low dissolved oxygen level found in one of the ponds because of bloom of a zooplankton, *Brachionus* sp. survival was very low (2.83 & 8.42%).

Problem : 5.64 Estimation of standing crop and evaluation of supplementary feed for brackishwater fishes at

different stages of their growth

Personnel : D. D. Halder, A. K. Roy, H. C. Karmakar and N. M. Chakrabarti

Duration : Two years

a) *Liza tade* :

i) A randomised complete block design experiment was conducted in nine 0.02 ha nursery ponds with three different densities (40, 60 and 80 thousand/ha), to study the effect of rearing density on the growth and survival of *L. tade* frv during nursery stage. No significant difference was observed in growth and survival at varying densities. However maximum average weight increment (7 58 g) was registered when stocked at a density of 60,000/ha during nursery rearing for a period of 100 days, and maximum average survival of 19.73% was observed when stocked at a density of 40,000/ha. Fertilisation with urea and superphosphate (1:1) @ 40 kg/ha/month and supplementary feeding daily with rice bran @ 5% of the wt. of fish were kept constant in all the experimental ponds during the whole experimental period.

ii) A statistically designed pond experiment was conducted to optimise the stocking density in culture of *L. tade*. Fertilisation with urea and superphosphate (1:1) @ 40 kg/ha/month was done uniformly in all the experimental ponds. Feeding daily with rice bran @ 5% body weight of total fish weight for first two months and @ 3% of biomass for rest of the period was done in all the experimental ponds. In a culture period of 118 days, maximum average weight increment of 53.33 g and survival of 88.5% could be obtained when fingerlings were stocked at density of 5,000/ha which demonstrated significantly (p 0.01) better res lts both in terms of growth and survival than in other treatments (8.5 and 12 thousand/ha). But significantly higher net average yield of 7.217 kg/0.02 ha/118 days was observed when stocked at the highest density of 12,000/ha. The results suggest the possibility of stocking at a rate higher than 12,000/ha for better yield.

iii) In fry rearing, feeding experiments were conducted in four 0.02 ha ponds for a period of 113 days with three different mixture of supplementary feed along with a control feed. Fertilisation with urea and superphosphate (1: 1) @ 40 kg/ha/month and feeding @ 6% body weight of biomass were applied daily in each of the experimental ponds. Maximum weight increment of 10.875 g and moderate survival of 33.24% was observed when fish were fed with fish meal + rice bran (1 : 3). But by feeding at the same rate with fish meal and wheat power and rice bran (1 : 2 : 2) maximum survival of 82.62% and moderate growth of 5.875 g could be obtained.

Physico-chemical and biological parameters of all the ponds of the above-mentioned experiments (i), (ii) and (iii) with *L. tade* studied in detail.

(b) *Liza parasia* :

i) In nursery ponds, efficacy of two artificial feeds *viz.* rice bran and rice bran + prawn meal was tested in six 0:02 ha ponds. Stocking density was kept constant at 1 lakh/ha. Supplementary feeds were applied @ 10% of total biomass of the stocking material. After 50 days period the average size attained by the treatments and control were 62.64 mm/3.1 g (av. initial size 19.94 mm/0.122 g), 74.17 mm/5.3 g (av. initial size 19.30 mm/0.106 g) and 52.46 mm/1.7 g (av. initial size 20.70 mm/0.117 g) and the rate of survivals were 78.80% , 83.67% and 68.75% respectively. The range of phyto-and zooplankton density of the above mentioned treated and control ponds were 800-1000 unit/litre and 1220-2710 nos./litre ; and 500-3100 unit/litre and 802-3050 nos/litre ; and 600-1600 unit/litre and 905 2305 nos/litre respectively.

ii) In a stastistically designed yard experiment, the effect of stocking density on the nursery rearing of *Liza parsia* was studied in 9 plastic pools each containing 100 litres of water, The range of survival rate during 7 days of experiment in 3 replicates under 3 experimental

treatments (1, 2 and 3 nos./l) was observed to be 15-40%, 3-7.5 and 0.7-1.3% The experiment could not be continued for more than 7 days due to tremendous mortality. Later, an experiment with low stocking densities (0.7, 0.8 and 0.9/l) was initiated. The range of survival rate was found to be 20-60%, 6.6-51.7% and 4.3-38.5% respectively.

(c) *Lates calcarifer* :

i) Seed of *Lates calcarifer* had appeared in the estuary in the first fortnight of April and 13,877 nos. of postlarvaes was collected by shooting net spending 17 man-hours.

ii) A 32 factorial experiment on the principle of randomised complete block design with 3 replicates was conducted in the laboratory for 14 days to study the food preference of *L. calcarifer* for different stages (sizes) of their life. Three different live food organisms (zooplankton, mysids and gobids) were used as feed of three different sizes of *L. calcarifer viz.*, 10-15 mm, and 15-20 mm and 20-25 mm size. Statistical analysis of the results showed that main effect of feed, size of the animal and also the main effect of interaction between feed and size of the animal are significant (P 0 01). Significantly better result was observed when fed with mysids for both the size-groups of 15-20 mm and 20-25 mm. Food were applied on *ad libitum* basis.

iii) In a statistically designed laboratory experiment on the effect of 5 different water heights *viz.*, 6 cm, 12 cm, 18 cm, 24 cm and 30 cm with two replicate each on survival and growth of *L. calcarifer* fry were studied for 15 days. Significantly (P 0.1) best survival was observed in 30 cm water height (86%) followed by 24 cm water height which was significantly higher than 12 cms (50%), 18 cm (46.7%) and 6 cm (45%). Both 18 cm (19.53 mm) and 24 cm (15.53) mm showed significantly better growth than at other water heights.

iv) Statistically designed laboratory experiment was conducted and continued for ten days to find out suitable stocking density for nursery rearing of *L. calcarifer*. Among the three stocking densities 1 no/litre (95.83% survival) and 2 nos/litre (87.78% survival) showed significantly better survival than 3 nos/litre (72.59%).

v) In nursery rearing experiment three ponds of area 0.02 ha each were stocked @ 25,000/ha, 15,000/ha and 10,000/ha with the fry of *Lates calcarifer* of average size 15.43 mm, 15.50 mm and 34.32 mm. In 180 days experimental period the respective average size attained was 208.51 mm/133.35 gm, 125.17 mm/37.25 gm and 220.0 mm/157.22 gm.

Physico-chemical parameters of experiments (ii), (iii), (iv) and (v) were studied.

d) Estimation :

To estimate the standing crop of fishes *viz.*, *L. tade* and *L. parsia*, the technique of successive hauling was found suitable. It was observed from these experiments that if efforts are constant two hauls are sufficient to predict the standing crop. Error of estimation for prediction of standing crop of *L. tade* ranges from 2 6-31.5% for size group 145.88-196.20 mm and 2.2-27.50% for size group 30.2-76.2 mm. But the error of estimation for prediction of standing crop of *L. parsia* was found to be 20,0-51.2% for the size group 35-96 mm.

Problem : 5.65 Induced breeding of brackishwater fishes in Madras region

Personnel : K. V. Ramakrishna, R. D. Prasadam, G. R. M. Rao, S. Radhakrishnan, M. Kaliyamurthy, C. P. Rangaswamy, K. O. Joseph and P. M. Abdul Kader

Duration : Six years

One set of *Mystus gulio* (Female : Male : : 1 : 2) was injected with carp pituitary extract. The female responded quickly and was ready to ooze after three

injections while males did not respond. The fishes died within two days.

Two yard experiments were conducted to culture fish food organisms using filtered brackishwater (20 ppt) enriched with a basal dose of yeast and manured with different organic substances such as extracts of fresh cowdung, vegetable leaves, groundnut oil cake, powdered blue-green algae and green algae applied separately and in combination of 2 or 3 @ 500 ppm of each, The culture container was plastic bag kept in earthenware vase and they were inoculated with 1 ml wild plankton suspension.

Leaf extract + yeast + groundnut oil cake gave the maximum yield of micro organisms (I4.0 ml/1), followed by leaf extract + yeast (12.5 ml/1). Among the individual items tried, leaf extract showed the maximum production (7.0 ml/1) followed by groundnut cake (6.75 ml/1), yeast (6.3 ml/1), blue-green algal powder (5.5 ml/1), green algal powder (3.0 ml/1) and cowdung extract (0.75 ml/1). The forms cultured in the media were *Chlorella* sp.. *Navicula* sp , *Nitzschia* sp., and *Lyngbya* sp.

Problem : 5.66 Studies on nutrition of Penaeid prawns, *Panaeus monodon* and *P. indicus* and plaemonid prawn, *Macrobrachium malcolmsonii*

Personnel : T. Rajyalakshmi and N. N. Sarkar

Duration : Three years

Four feeds were formulated using soyabean powder, pila (pond snail) meat, and shrimp meal as main feed ingredients. The protein level was maintained below 40% to compare with results of earlier studies made at Kakdwip. Post-larvae of *Penaeus monodon* (10 12 mm/6 mg) and *P. indicus* juvenile (15-20 mm/0.5 g) were used on test animals.

Experiments were carried out in the temperature range of 25-28°C and salinity 7 ppt in glass jars. Replicates were maintained.

The nutritive value of the feeds given, protein utilisation, the digestion co-efficient etc. are being analysed.

Project 6 · Freshwater prawn culture

Problem : 6.1 (Research work completed in 1976)

Problem : 6.2 Culture of *Macrobrachium malcolmsonii*

Personnel : J. Rao, K. V. Rao, T. S. R Raju, K. S. Rao, D. R Rao & P. S. C. Bose

Duration : Four years

Experiments on the culture of *M. malcolmsonii* were continued in three ponds (0.1 ha each) at Badampudi fish farm. Monoculture of the species in one pond and mixed culture with selected species of fish like catla, silver carp, grass carp and rohu in two ponds were carried out.

Fingerlings of the selected fish species were stocked at different ratios in different ponds @ 4,500/ha. The stocking rate of *M. malcolmsonii* was kept at 50,000/ha for the first crop and 30,000/ha for the second crop. *M. rosenbergii* was stocked at the rate of 10,000/ha in pond III.

Regular monthly manuring with cattle dung (@ 10,000 kg/ha) and liming (@ 200 kg/ha) ponds was done. While the fish species and prawns were fed with rice bran and groundnut oil cake in the ratio of 1 : 1 @ 2% body weight of fish and 10% body weight of prawn. Hydrilla was given to grass carp regularly.

A maximum production of 390.6 kg/ha of *M. malcolmsonii* was obtained in the first crop in a culture period of 128 days and 416.9 kg/ha in the second crop in a span of 204 days, resulting in a total prawn production of 807.5 kg/ha in addition to 2.06 tonnes/ha of fish in pond I. 3.33 tonnes/ha of fish (10 months) and 190.5 kg/ha of *M. rosenbergii* was obtained during the second crop (185 days) from pond III, while the first crop (119 days) of *M. malcolmsonii* yielded 250.7 kg/ha. Thus, a total production of 441.2 kg/ha of both the species of prawn was achieved in addition to fish.

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

Survey of juvenile potential of *M. malcolmsonii* from three centres, Chilkampadu on Undi irrigation canal, Marteru on Narsapur canal and Koderu on bank canal, all leading from river Godavari in West Godavari district was conducted and the relative abundance of juveniles at these centres was estimated.

Problem : 6.3 & 6.4 (Work programme transferred to problem 14.1)

Problem : 6.5 Culture of *Macrobrachium biramicum choprai* in ponds

Personnel : J. C. Malhotra, Shree Prakash, R. C. Singh & D. P. Verma

Duration : Six years

With a view to assessing the availability of the *Macrobrachium biramicum choprai* seed, a stretch of river Ganga from Baika Khut to Sahaon was surveyed during August to September. The percentage of *M. biramicum choprai* ranged from 20 to 80 in the catches and a gradual increase in the availability of *U. choprai* juveniles from upstream to downstream was also observed. Choprai juveniles were available during sunset to sunrise only.

About 500 juveniles of *M. biramicum choprai* (size 20-25 mm) collected at and around Sahaon were transported to Buxar and stocked in one of the experimental ponds. Supplementary feeding was done twice a week using mustard oil cake and rice polish in the ratio of 1 : 2. The juveniles had attained a size of 30-35 mm during a period of three months rearing.

Problem : 6.6 Seed production of the gaint fresh water prawn *Macrobrachium rosenbergii*

Personnel : M. Subrahmanyam and three Technical Assistants.

Duration : Three years

During the year under report 14,106 seed of *Macrobrachium rosenbergii* were produced ; of these 12,095 seed were distributed to the private farmers under the Lab to Land Programme and 842 seed were stocked in a 10' × 2' plastic pool in the laboratory and a small pond for raising the brood stock for laboratory culture. Due to lack of proper facilities the estimated target of production could not be achieved. Results from farmers' ponds are expected in 1980 only.

Problem : 6.7 Development of artificial feeds for rearing the larvae of commercially important palaemonid prawns

Personnel : K. Janakiram and T. Rama Prabhu

Duration : Three years

Experiments on rearing the larvae of two species of freshwater prawns, *Macrobrachium rosenbergii* (6 trials) and *M. malcolmsonii* (2 trials) were conducted by feeding them on live food organisms and on prepared

feeds in aged and diluted sea water in small plastic containers (251) with the provisions of continuous aeration. Of the various food items tried during the period, mussel meat, brackishwater plankton, newly hatched freshwater anostracans (used for brief time) and silkworm pupae were partly helpful. The larvae of *M. rosenbergii* survived for more than 60 days with the first set of food items in a couple of trials while, the larvae survived for about 22 days only by employing the later combination of food items. The larvae of *M. malcolmsonii* survived for about 35 days in one trial.

The live food organisms like rotifers were cultured as and when required in cement cisterns in brackishwater medium enriched with cowdung and hay extracts. The rotifers attained a maximum of about 10,000 nos/l. The freshwater anostracans (hatched out from previous year's collection of eggs) were maintained for some time in a cement cistern in freshwater. The resulting eggs were collected for future use.

Project : 7 : Murrel and live fish culture

The work is being conducted under a Co-ordinated Project

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, H. S. Majumder, R. N. De, N. D. Sarkar & G. P. Bhattacharya

Duration One year

Exploitation and demarkation of the natural resources for the brackishwater fish and prawn seed was done in details along the Ichhamati stretch of the estuarine complex of the Lower Sunderbans, in the coastal regions of Digha, at Port Canning at the Matlah estuary and Raidighi along the Thakuran estuary. The abundance of the different commercially important species of the Ichhamati estuary is as follows.

KALINAGAR		*No./net/hr.*
P. monodon	—	216 (June)
P. indicus	—	20 (May)
HASNABAD		
L. parsia	—	180 (February)
E. tetradactylum	—	74 (August)
M. monoceros	—	100 (May)
M. brevicornis	—	124 (September)
ITINDAGHAT		
M. rude	—	146 (August)

At Digha, during April, *Liza parsia* numbering 500/net/hr. were collected with the help of shooting net, Out of this, 100 specimens in good condition were kept in the plastic bags. Aeration was done in these bags for a period of one hour. The fry thus conditioned were transported to Barrackpore for stocking in a pond at the Institute campus. It was packed in the polythene bag and air was filled using a compressor. Thirty nine specimens reached in live condition.

Problem : 8.2 & 8.3 (Research work completed in 1973)

Problem : 8.4 (Research programme merged with Problem 8.1)

Problem : 8.5 (Research work completed in 1976)

Problem	: 8.6	(Research work kept in abeyance)
Problem	: 8.7	Reproductive biology of cultivable brackishwater fishes
Pesonnel	:	K. K. Bhanot
Duration	:	Four years

Development of the gonads of brood fishes *Sillago panigus* and *Scatophagus argus*, with respect to salinity was studied. *S. panijus* measuring 400-415mm and 380-400 gms were obtained at Digha from the coastal creeks, during the month of August--September. The young immature specimens (20-30 mm in length) were available in the freshwater zone of the Hooghly estuary during March--April. The egg-size of the mature specimens collected at a zone having 12.8 ppt salinity ranged from 12-15 micrometer divisions and they were very loosely attached to each other.

S. argus (165 mm) was obtained from the coastal creeks of Digha during April—May. The egg-size ranged 8-10 micrometer divisions. No mature specimens could be obtained in the shore-seine catches at Digha.

Problem	: 8.8	(Research work suspended since 1978)
Problem	: 8.9	(Research work suspended since 1978)
Problem	: 8.10	(Research work suspended since 1978)
Problem	: 8.11	Studies on prawn seed trade in West Bengal based on sample census
Personnel	:	G. C. Laha, P. B. Das, A. R. Chowdhury, B. B. Das & B. B. Pakrasi
Duration	:	Four years

Prawn seed collection centres at Hatbere, Taldi, Itindaghat, Hingalgunj, Bibirabad, Kalinagar, Kulpi, Nischintapur, Kakdwip, Barunhat, Sangrampur, Nazat, Sandeshkhali, Daharani and Hasnabad located in lower Sunderban complex were covered in June, 1979. Centres are divided into two classes (a) centres where collection were made in all the days in each lunar phase during the breeding seasons, and (b) centres where collection are made in the canal only from 2nd to 10th day both in new-moon and full moon phase and from 5th to 12th day in both phase in the main river. Besides an inventory was done at Ghatal for estimation of seed of *M. rosen-bergii*. The breeding season of the species starts later in comparison to *Penaeus monodon*. Collection of seedof *M. rosenbergii* is generally done from 5th day to 12th of the lunar phase.

Project 9 : Selective breeding and hybridization

Problem	: 9.1	(Research work completed in 1973)
Problem	: 9.2	(Researeh work completed in 1972)
Problem	: 9.3	(Research work suspended since 1973)
Problem	: 9.4	Hybridization of carps with special reference to cytogenetical features of the hybrids
Personnel	:	R. K. Jana, R. M. Bhowmick (up to March, 1979) & H. A. Khan
Duration	:	Five years

Rearing of F_2 offsprings is continuing in a 0.04 ha pond and they recorded an average growth of 492 mm/ 1.925 kg in 23 months.

Somatic chromosomes of F_2 hybrid have been studied from kidney tissue. A number of metaphase plates have been studied and the diploid chromosome number is 50 as in case of the parents. Morphologically the chromosomes are comprised of meta and submetacentric, and telo and subtelocentric types.

Pharyngeal teeth of F_2 hybrid are 11 numbers on each side.

Problem : 9.5 (Merged with Problem 9.4)

Problem : 9.6 (Problem kept in abeyance)

Problem : 9.7 Breeding of selected stock of grass carp and silver carp

Personnel : S. B. Singh, B. K. Mishra, R. K. Dey, P. V. G. K. Reddy & H. K. Muduli

Duration : Five years

Quinaldin had been successfully tried during the stripping of grass carp and silver carp. Rearing of shooting specimens of grass carp along with the normal ones of the same progeny for about eight months have indicated that the normal ones attained almost the same size as the shooting specimens, suggesting that the phenomenon is likely to be food dependent.

Problem : 9.7.1 Studies on morphology, growth and maturity of the hybrid between grass carp female and silver carp male

Personnel : S. B. Singh, B. K. Mishra, R. K. Dey, P. V. G. K. Reddy & H. K. Muduli

Duration : Three years

The hybrids between grass carp female and silver carp male produced during August, 1977 are being reared in rearing ponds. Some hybrids are being observed to possess large scales on the lateral lines. Some of the male hybrids were observed to exhibit roughness of the pectoral fins and oozing milt when tested for attainment of maturity. The single surviving specimen of the hybrid between silver carp female and catla male produced in August, 1977 died after nearly 21 months or rearing. It was a male specimen showing roughness of the pectoral fin and measuring 497 mm/1.45 kg.

Problem : 9.8 Hybridization between *Catla catla* × *Hypophthalmichthys molitrix* ; *Labeo rohita* × *Cyprinus carpio* ; *Cirrhinus mrigala* × *C. carpio* & *Catla catla* × *C. carpio*

Personnel : K. H. Ibrahim (up to Oct., 1978), G. V. Kowtal & S. D. Gupta

Duration : Two years and six months

Hybridization between catla × silver carp was attempted on two occassions but due to prevalent drought conditions and unfavourable water temperature the spawn produced survived for only 2-3 days on both the occassions. Rahu × common carp hybrids were produced in the caurse of 3 experiments but none survived beyond 3 days due to adverse weather conditions.

Project 10 : Fish farm designing

Problem : 10.1 (Research work completed in 1977)

Problem : 10.2 Studying seepage losses in ponds

Personnel : C. Saha, K. L. Srivastava, S. L. Kar, C. D. Sahoo & M. D. Mantry

Duration : Six years

Seepage loss in 18 newly dugout ponds during January to April indicated the average total loss of water from the ponds as 25 cm per month when the canal water supply was closed.

No significant improvement occurred during first filling of the pits with silt for reduction of seepage, while during subsequent filling the water retentivity in the pits treated with silt was better.

Problem : 10.3 Surveying of Kankramari char and designing brackishwater fish farm

Personnel : A. Sengupta & B. Basak

Duration : Two years

Survey work could not be initiated due to some technical difficulties.

Problem : 10.4 & 10.5 (Research work kept in abeyance)

Project : 11 Economics in fishery investigations

Problem : 11.1 (Research work completed in 1974)

Problem : 11.2 (Research work completed in 1974)

Problem : 11.3 (Research work completed in 1973)

Problem : 11.4 (Research work completed in 1976)

Problem : 11.5 (Research work completed in 1976)

Problem : 11.6 (Research work completed in 1977)

Problem : 11.7 (Research work completed in 1977)

Problem : 11.8 Returns from investment in inland fisheries research (Research work kept in abeyance)

Problem : 11.9 The price spread of inland fish

Personnel : M. Ranadhir, S. Paul & H. K. Sen

Duration : Three years

The bulk of the price spread at an average of Rs. 4/- per kg. is in between the wholesale merchant at site and the auctioneer at the wholesale market (Howrah). The retail margin on average is at Rs. 2/- per kg.

Problem : 11.10 Infrastructural base for Aquaculture in West Bengal

Personnel : S. Paul & H. K. Sen

Duration : Three years

On the basis of work done during 1979, the following are the interim findings of the study :

i) The existing marketing setup does not pose a serious threat to culture fisheries as the producer's share in consumer's price is substantially higher when compared to crop husbandry products.

ii) The initial reluctance of institutional agencies in financing aquaventures continues to be there partly due to subsistence character of operations and partly due to unbankable schemes.

iii) Matters regarding market regulations and leasing rights are still only engaging the attention of policy makers in the concenred organisation.

All the relevant aspects of the problem are being closely examined.

Project 12 : Exotic fish culture

Problem :	12.1 & 12.2	(Research work completed in 1973)
Problem :	12.3	(Research work completed in 1972)
Problem :	12.4	(Research work completed in 1976)
Problem :	12.5	Techniques for large-scale production of grass carp and silver carp seed
Personnel :		S. B. Singh, R. K. Dey, B. K. Mishra, P. V. G. K. Reddy and H. K. Muduli
Duration :		Four years six months

Usefulness of recirculation and aeration of water in the brood fish pond was further substantiated and use of an aircompressor in one of the brood fish pond proved highly effective in maintaining the brood stock of grass carp and silver carp. Hypophysation of grass carp and silver carp this year could be started only from August onwards on account of delayed onset of regular monsoon. The response to hypophysation was however, encouraging after the conducive ecological conditions set in. Altogether 24 sets of grass carp and 33 sets of silver carp were tried for induced breeding. Out of these, 9 sets of grass carp and 14 sets of silver carp were tried during favourable ecological conditions of which 8 sets of grass carp and 12 sets of silver carp were successfully induced-bred. The dose of carp pituitary hormone administered was at the rate of 10-18 mg/kg body weight in the case of female and 2-4 mg/kg body weight in males. The percentage of hatching was poor in the pond environment whereas in the glass jar hatchery it was highly encouraging. This year during the fish breeding season, the receptivity period in the case of female grass carp prolonged up to the third week of September whereas it was so only up to the third week of August in the previous years. Delayed onset of monsoon coupled with proper brood fish care using an air-compressor and favourable ecological conditions might have contributed to the prolongation of the receptivity period in grass carp. This observation points towards domestication of grass carp and production of its seed for a prolonged period thereby enabling to meet the everincreasing demand of seed of this valuable exotic fish. Extended breeding of silver carp was also achieved.

Altogether 8.7 lakhs of grass carp spawn (a record production) and 6.2 lakhs of silver carp spawn was achieved.

Problem :	12.6	Compatibility and competition between silver carp and Indian carps
Personnel :		R. K. Dey, S. R Ghosh, P. V. G. K. Reddy and H. K. Muduli
Duration :		Four years six months

A field experiment of six months duration to study the compatibility and competition between silver carp and Indian major carp (mrigal) had been initiated in December '78 in 4 nursery ponds (0 04 ha) at a stocking density of 5000/ha and species ratio of Sc 2 : M 3 in two ponds and C 2 : M 3 in the other two ponds. Feeding and fertilization was resorted to. The experiment concluded in January '79 indicated that silver carp produced no perceptible adverse effect on mrigal as compared to that of catla on mrigal.

Problem :	12.7	Optimum production of fingerlings and fish of exotic species under composit culture

Personnel : S. B. Singh, R. K. Dey, P. V. G. K. Reddy, B. K. Mishra and H. K. Muduli

Duration : Four years

Fingerlings rearing : The study will de initiated at the Dhauli fish farm and ponds are being prepared for the purpose.

Large fish culture : A field experiment of one year duration for large fish culture of silver carp, grass carp and common carp had been initiated in two rearing ponds (0.08 ha) at a stocking density of 3000/ha and species ratio of Sc 4 : Gc : 3 : Cc 3 without feeding and fertilization except supplying aquatic weeds to grass carp. The experiment was vitiated due to repeated entry of tilapia and also due to poaching.

Problem : 12.8 Maturity of grass carp with different feeds

Personnel : S. B. Singh, R. K. Dey, P. V. G. K. Reddy, B. K. Mishra and H. K. Muduli

Duration : Three years

An experiment to study the maturity of grass carp with different feeds was initiated in 4 rearing ponds (0.08 ha) in April '79. In each pond 10 females of grass carp of about 1.5 kg average size were stocked and the items of feed given were *Hydrilla*, napier grass, pulse waste and *Hydrilla* along with early seedlings of paddy as a source of vitamin E.

The effect of different kinds of feeds on maturity of grass carp was studied during the last fish breeding season and it was observed that the conventional aquatic weed (*Hydrilla*) and napier grass successfully induced optimum maturity in the female grass carp.

Problem : 12.9 Short-term large fish culture of exotic carps

Personnel : S. B. Singh, R. K. Dey, P. V. G. K. Reddy, S. R. Ghosh and B. K. Mishra

Duration : Three years

An experiment of 3 months' duration on short term large fish culture of silver carp, grass carp and common carp had been initiated in April '79 in two rearing ponds (0.08 ha) at 1000/ha stocking density and species ratio of Sc 4 : Gc 3 : Cc : 3 under intensive feeding and fertilization. The experiment got vitiated during third month of rearing due to poaching.

Project 13 : Coldwater Fish Culture

Problem : 13.1 (Research work completed in 1970)
Problem : 13.2 (Research work completed in 1977)
Problem : 13.3 (Research work completed in 1971)
Problem : 13.4 (Research work completed in 1970)
Problem : 13.5 (Research work completed in 1970)
Problem : 13.6 (Research work completed in 1972)
Problem : 13.7 (Research work completed in 1970)
Problem : 13.8 (Research work completed in 1977)
Problem : 13.9 (Research work suspended since 1972)
Problem : 13.10 (Research work suspended since 1976)
Problem : 13.11 (Research work suspended since 1975)
Problem : 13.12 (Research work suspended since 1975)
Problem : 13.13 (Research work completed in 1977)

Problem : 13.14 Mass culture of fish food organisms under temperate climate

Personnel : K. K. Vass, Usha Bali and V. K. Bali

Duration : Upto December, 1980

Mass culture of *Gammarus pulex* (a good natural food of trout) was taken up in cages kept in running water streams. Individuals of 8-12 mm in length were stocked @ 133 g/m² cage area and were fed with rice-bran and oil cake @ 5% body weight, twice daily. The increment after 180 days in the cages was 200 g/m². The culture in still water conditions did not prove a success. Detailed ecological studies on food and feeding habits, fecundity and breeding behaviour of the species have been undertaken from the natural stream populations. Maximum numbers of juveniles (10-15%) were recorded between July and September. Average number of eggs per brood ranged from 10 to 20 between May and October. The rate of oxygen consumption worked out to be 0.28 ppm/hr/individual for adults (7-14 mm size) and 0.08 ppm/hr/individual for juveniles.

Feeding trials under laboratory conditions, with cultured Cladocerans on *Schizothorax* fry collected from streams were made. The fry feeds voraciously on cladocerans and shows less preference for phytoplankton. The technique of mass culturing cladocerans in the field will be helpful in rearing *Schizothorax* fry in the farms.

Problem : 13.15 Study of carrying capacity of a single bead in Sindh trout stream

Personnel : M. J. Bhagat (upto September, 1979), K. K. Vass, V. K. Bali, and J. P. Singh (State Fisheries Officer)

Duration : Four years

Three sampling stations of Sindh stream at Gund (2,097 m. above MSL), Mamer (1,925 m. above MSL) and Parang (1,729 m. above MSL), were selected for the study. The stream bed is rock studded with big and small boulders. The morphometric parameters showed wide seasonal fluctuations.

Physico-chemical features : Highest ambient temperature was recorded in July (23-24°C and lowest in March–April (8-13°C). Water flow was very much variable in the various stretches of the stream because of drawing water for hydro-electric purposes and melting of snow in summer months. The average flow through the sampled stretch was 85.6 m³ per second, with a range of 1.25-199 m³/second. The stream water was alkaline. The pH ranged between 7.2 and 7.7 (average value 7.6). The stream water was well oxygenated with the DO ranging between 6.0 and 11.2 ppm (average value 8.8 ppm). Free carbon dioxide was very low, ranging from nil to 2.6 (average value 0.88 ppm). The carbonate and biocarbonate values were 2 to 14 ppm (average 7.3 ppm) and 8-114 ppm (average 41.5 ppm) respectively. The total alkalinity thus ranged between 14 and 144 ppm. Silicates fluctuated between 0.006 and 0.12 ppm. During summer with the enhanced flow the silicates got diluted and showed very low values as compared to winter. Specific conductivity ranged between 188 and 225 micro mhos at 25°C.

Biological parameters :

i) *Benthos* - Insects formed the main benthic life in the stream, the groups encountered being Diptera, Trichoptera, Plecoptera, Coleoptera and Ephemeroptera. The number of benthic forms ranged from 32-106 units/m² with an average of 76 units/m².

ii) *Plankton* : The plankton samples mostly comprised of Diatomaceae and Cyanophyceae, the zooplankton being absent. The Cyanophyceae forming 5 30% were represented by only *Oscillatoria* sp. (4/1). The diatomaceae formed 94.7%, comprising *Navicula* sp. (7/1), *Amphora* sp. (5/1), *Gomphonema* sp. (8/1),

Cymbella sp. (2.5/1), *Diatoma* sp. (1/1) and *Ceratoneis* sp. (48/1).

For growth and population studies 21 brown trouts (size range : 210-340 mm) were released in the stream after tagging. The investigation has indicated that the Sindh stream is thinly populated.

Problem : 13.16 Induced breeding and culture of Schizothoracid fishes for the table A) *Schizothorax esocinus* and *S. micropogon*, B) *S. plagiostomus*

Personnel : H. B. Singh, Shyam Sunder, Usha Bali, M. J. Bhagat (upto September, 1979), Nissar Ahmed Qureshi (State Fisheries), K. K. Vass and Bashier Ahmed (State Fisheries)

Duration : Four years

No progress of work due to nonavailability of brood fish of the species during the year.

Problem : 13.17 (Research work completed in 1977)

Problem : 13.18 (Research work completed in 1976)

Problem : 13.19 (Research work completed in 1977)

Problem : 13.20 Standardisation of rearing techniques of brown trout and rainbow trout from swim-up fry to yearling

Personnel : K. K. Vass, H. B. Singh, V. K. Bali, G. N. Bhat (State Fisheries), M. J. Bhagat (upto September, 1979) and G. N. Gazi (J & K Fisheries)

Duration : Four years

Brown trout : Main thrust in the project was to evolve a package of practices including the feed in order to increase the rate of survival from fry to fingerling stage. For the first time the fry have been successfully reared for about 10 months (from 15. 2. 1979 to 4. 12. 1979) under farm conditions and a record survival of 40-45% obtained during the period. In 300 days rearing period, fry increased from an average of 95 mg (20-100 mg range) to 7.0 g (3.0-23 g range). In spite of very heavy diet load coming into the raceways through the feeding channel survival up to 45% could be achieved. On August 8, 1979, there was a cloudburst in Daehigem catchment area in which some fry stock was lost. Initially for the first three months the fry were fed on moist pelleted feed alternated with wet feed (sheep liver) and from then onwards the fry were exclusively fed on dry pelleted feed which was specially formulated and prepared in the laboratory. The feed contained 31% of crude protein. The main ingredients of the feed were : fish meal (55%) vegetable meal (35% yeast (3.5%)and shark liver oil (3.0%) supplemented with a mixture of minerals, trace elements and vitamins. The feed was given six times a day @ 8 to 10% of body weight depending upon the water temperature. A conversion ratio of 1 : 2 has been obtained in the present study. The efficiency of the feed was estimated to be 49.11%. The physico-chemical perameters of water during the period were : temperature 8.5-16.5°C ; pH 6.4-7.1, DO 9.0-10.4 ppm and carbon dioxide nil-1.5 ppm.

Rainbow trout : Similar success was achieved with rainbow trout fry which were reared for the first time for more than 180 days (from 23.5.1979 to 4.12.79) under farm conditions. A record survival of 50-60% was obtained. In 180 days rearing period, the fry increased from an average length of 24 mm (20-27 mm

range) to 82 mm (50-170 mm range) and from an average weight of 125 mg (100-150 mg range) to 5.6 g (1.5-11.5 g range). During early phase of swim-up fry, the feeding was initiated with egg yolk and skimmed milk (1 : 1) supplemented with a pinch of salt. After the fry were stocked in nursery tanks, they were fed on moist pelleted feed alternated with sheep liver for the first two months and subsequently only on dry pelleted feed. Some feed as given to brown trout was tried on rainbow trout as well. A conversian ratio of 1 : 2.07 was obtained and feed efficiency was estimated as 48.3%. The physicochemical parameters were almost the same as in the case of brown trout treatment, except that the water was more alkaline.

The feed and the feeding techniques when standardized in next two years will help in improving the survival of trout fry and it would than be possible to raise good stocking material of brown and rainbaw trouts on a mass scale at Laribal farm.

Problem : 13.21 (Research work taken up at Deharadun has been completed in 1979)

Problem : 13.22 Rearing of brown and rainbow trout fingerlings to table size

Personnel : Shyam Sunder, H. B. Singh, Usha Bali, G. N. Bhat (J & K Fisheries), N. A. Jan (J & K Fisheries) and K. K. Vass

Duration : Three years

Brown trout : During 3rd week of May, 1979, brown trout fingerlings (150-190 mm in T. L. and 38 g av. wt.) were stocked in 2 ponds at Harwan @ 130 fish per pond. In pond 1, the pelletised feed containing 28% crude protein (which was put to trial in earlier experiment also) was given, whereas in pond 2 the newly formulated feed with 47% crude protein content was given. The ingredients of the latter feed were silkworm pupae powder (80%), wheat middlings (13%), yeast (5%), vitamin + minerals (2%) and common salt with a pinch of cobalt chloride. Terramycin (10–15 mg/kg was also mixed with the feed.

On sampling after 150 days (actual feeding days 120) an average increment of 215 mm (175–240 mm range) in the fish of pond No. 1 and 244 mm (192-280 mm) in the fish of pond No. 2 was observed. The average increase in weight per fish recorded was 88 g (60–180 g range) with a conversion factor of 4.1 in pond No. 1 and 143 g (70-220 g range) in pond No. 2 with a conversion factor of 2.0. The Growth of fishes fed on 47% crude protein feed was very encouraging. The actual mortality recorded from pond 1 was 40 whereas from pond 2, it was only 30.

Rainbow trout : Due to nonavailability of fingerlings investigations could not be taken up.

The physico-chemical features of the pond waters were : water temperature 12-21°C ; pH 7.2-7.4 ; DO 6.4-9.6 ppm, free carbon dioxide 1.4-2.0 ppm and total alkalinity 40-105 ppm.

Problem : 13.23 Studies on biology of *Schizothorax escoinus* and *S. micropogon* from River Jhelum

Personnel : Usha Bali, Shyam Sunder and M. J. Bhagat (upto September, 1979)

Duration : Four years

Detailed biological studies were undertaken on *Schizothorax micropogon* from river Jhelum. Specimens in the size range of 219-455 mm and 100-800 g in weight were examined in detail. Gut contents encountered were : decayed organic matter 30-46% ; sand and mud 25-35% ; diatoms 20-30% and algal forms 4-6%.

Twenty five specimens (205-426 mm in total length and 120-600 g in weight) were analysed for fecundity, which ranged from 5000–21,500 ova. For age and growth, 104 specimens were studied during the year with the aid of operculum, vertebrae, and otolith.

Project 14 : Riverine and Estuarine Fish Catch Statistics

Problem : 14.1 Riverine fish catch statistics of the middle and lower stretch of the Ganga river system

Personnel : S. J. Karamchandani, G. N. Mukherji, M. A. Khan, Balbir Singh, R. A. Gupta, R. K. Tyagi, N. K. Srivastava, Ram Chandra, B. Ghosh (upto 8. 6. 79), D. N. Srivastava, R. K. Dwivedi, S. Prakash, A. K. Lal, B. L. Pandey, R. C. Singh and A. Sarkar

Duration : Continuing

Fish landings at Sadiapur, Daraganj, Buxar, Bhagalpur and Lalgola centres were estimated to be 100.26, 37.18, 13.30, 101.48 and 21.55 t respectively during the period December 1978 to November 1979. Details of species-wise landing are presented in Table. (P. 66)

The total yield showed a decline by 30.0% at Sadiapur, 3.57% at Bhagalpur and 19.47% at Lalgola and an increase by 29.0% at Daraganj in comparison to that of the preceding year, At Sadiapur, the decrease in the catches was largely due to poor catches of major carps and miscellaneous fishes. The important feature of the capture fishery in this region (Sadiapur and Daraganj) was the sudden increase in the hilsa catches—the increase being 0.097 t to 1.09 t from 1978 to '79.

Data on length frequency of eight commercially important species were collected at Sadiapur fish landing centre. The mean length of these species for the year 1979 alongwith their respective mean lengths for the years 1967, 1974, 1975 and 1977 are presented below :

Showing species-wise fish landings (t) at different centres in the middle and lower stretch of the Ganga River system

	C. mrigala	*C. catla*	*L. rohita*	*L. calbasu*	Major carps	TOTAL	*M. aor*	*M. seenghala*	*W. attu*	Catfishes	TOTAL	*Hilsa ilisha*	Others	TOTAL
Sadiapur t	6.51	2.17	1.46	20 06		30.20	12.81	5.46	1.15		19.42	1.75	48.89	100.26
%	6.49	2.17	1.46	20.00		30.12	12.78	5.45	1.14		19.37	1.75	48.76	100.00
Daraganj t	2.62	2.59	0.79	0.95		6.95	1.60	6.09	2.29		9.98	0.43	19.82	37.18
%	7.04	6.96	2.13	2.55		18.68	4.29	16.39	6.17		26.85	1.14	53.33	100.00
Buxar t	0.31	0.26	0.40	0.50		1.47	1.81	1.63	1.13		4.57	0.07	7.19	13.30
%	2.33	1.95	3.01	3.76		11 05	13.61	2.26	8.50		34.37	0.53	54.05	
Bhagalpur t	3.07	6.50	4.29	0.77		14.63	5 25	5.06	23.56		33.87	0.28	52.70	101.48
%	3.02	6.41	4.23	0.76		14.42	5.17	4.99	23.22		33.38	0.28	51.92	
Lalgola t	0.06	0.15	0.20	0.00		0.41	0.54	0.03	0.13		0.70	9.02	11.42	21.55
%	0.20	0.60	0.93	0.00		1.90	2.51	0.14	0.60		3.25	41.86	52.99	

Species	Mean length (mm)				
	1979	1977	1975	1974	1967
C. mrigala	466	587	692	586	483
C. catla	562	691	805	750	595
L. rohita	672	530	694	614	567
L. calbasu	438	456	454	466	403
M. aor	472	481	434	517	512
M. Seenghala	522	473	452	523	533
W. attu	553	565	464	574	599
H. ilisha	433	381	473	353	328

Problem : 14.2 (Research work merged with Problem 14.1)

Problem : 14.3 (Research work completed in 1969)

Problem : 14.4 (Research work completed in 1971)

Problem : 14.5 (Research work completed in 1973)

Problem : 14.6 (Research work kept in abeyance)

Problem : 14.7 (Research work completed in 1977)

Problem : 14.8 (Research work suspended since 1975)

Problem : 14.9 (Research work suspended since 1974)

Problem : 14.10 (Research work completed in 1977)

Problem : 14.11 (Research work suspended in 1978)

Problem : 14.12 (Research work completed in 1977)

Problem : 14.13 (Research work completed in 1978)

Problem : 14.14 (Research work merged with Problem 14.1)

Problem : 14.15 (Research work suspended in 1979)

Problem : 14.16 Pilot survey to evolve sampling methodology for estimating inland resources and total catch of fish in West Bengal

Personnel : K. K. Ghosh, Padam Singn, S. K. Raheja, A. Chowdhury, R. N. De, A. K. Roy, N. D. Sarkar, N. C. Mondal, A. R. Pal, A. Srivastava and P. M. Mitra

Duration : Three years ten months

The first phase of field work of the Pilot Sample Survey—inventory of water resources and collection of information regarding type of water resources, area etc.- in the selected 10 clusters of 4 villages each in 24-Parganas district of West Bengal has been completed. The proforma for the second phase of the survey—collection of detailed information on the fish catch by physical observation in some randomly selected (second stage sample) water resources of each cluster—has been finalised and corresponding field work has been initiated.

The analysis of the data for the first phase of the survey is now in progress at IASRI, New Delhi. However, preliminary analysis showed that 1686 water units covering an area 166.6 ha existed in the selected clusters of villages out of which 185 water units (about 11% of the total water units) covering an area of 14.9 ha (about 9% of the total water area) remained unexploited. Except for only one flowing water unit (canal) and 8 brackishwater ponds all the water units are freshwater ponds or tanks. 103 freshwater ponds covering an area of 10.75 ha are seasonal in nature. The water area of selected villages is a little over 3% of the total area of the selected villages.

Project 15 : Fish pathalogy

Problem : 15.1 (Research work complited in 1976)

Project 16 : Weed Control

Problem : 16.1 (Research work completed in 1973)

Problem : 16.2 (Research work being done under Problem 16.7)

Problem : 16.3 Evolution and evaluation of herbicide formulations

16.3.1 Standardization of preparation and application techniques of formulation for long term control of rooted aquatics and noxious algae

Personnel : V. Ramachandran, A. K. Sahu, T. Ramaprabhu, K. M. Das and G. C. Sahu

Duration : Ten years nine months

Herbicides impregnated in brick pellets or coated on sand particles are found to be quite easy to prepare and effective for step-down control of several of the rooted emergent (water lilies *Nymphaea* and *Nymphoides* spp.) and submerged (*Ottelia alismoides*, *Bergia* sp., and *Ceratophylum demersum*) aquatic weeds. 2,4-D soaked brick pellets at 5 Kg a. i./ha (2 applications) gave complete control of *Ottelia alismoides* and *Nymphoides* in shallow weed infested nursery ponds. Fresh plants germinating from burried seeds had to be controlled by repeat treatments. The pellets prepared at 5 percent active ingredient also have similar effect when tried in two treatments of 8 and 12 kg a. i./ha. However, as the rate of pellet application became less (250 kg/ha) with higher active ingredient the effect was restricted to a fewer plants only.

A 1% sand granular formulation of diuron prepared in the laboratory was effective against submerged weeds and marginal aquatic grasses *Panicum* sp. at 5 kg a. i. per hectare and *Ceratophyllum demersum* at 1-2 kg a. i./ ha. Diuron was also effective against algal blooms, mats and bottom weeds at doses of 0.2 ppm a. i. (equivalent to 2.5 kg a. i./ha). It was found that the herbicide does not inhibit growth of plankton or bottom biota which increased abundantly after the clearance of the algal mats and macrophytes.

Diuron was found to be effective for control of algal blooms (*Microcystis*) also at 0.1–0.3 ppm.

16.3.2 Control of submerged weeds by Paraquat formulation

Personnel : S. Patnaik and K. M. Das

Duration : Two years eleven months

In yard trials *Ceratophyllum demersum*, *Hydrilla verticillata* and *Najas indica* could be cleared with 4 to 6 ppm Paraquat in 8-10 days. With lower doses the kill was partial and there was regeneration from left over parts. Toxicity tests conducted indicate that median tolerance limits for *Labeo rohita* and *Cyprinus carpio* fingerlings were 6.0 ppm and 12.3 ppm respectively with paraquat when water temperature was 29.5°C.

The work is completed but few field trials have to be carried out for confirmation of results.

Problem : 16.4 (Research work completed in 1973)

Problem : 16.5 (Research work suspended in 1979)

Problem : 16.6 (Research work suspended in 1979)

Problem : 16.7 (Research work completed in 1977)

Problem : 16.8 (Research work completed in 1976)

Problem : 16.9 (Research work completed in 1976)

Problem : 16.10 (Research work suspended in 1979)

Problem : 16.11 (Kept in abeyance)

Problem : 16.12 (Research work suspended in 1979)

Problem : 16.13 Studies on aggressive capacity, viability and perennation of reproductive bodies of noxious aquatic weeds

Personnel : S. Patnaik and K. M. Das

Duration : Three years

Pistia stratiotes and *Salvinia cucullata* were observed to grow actively during August to October. *Pistia* was observed with flowers during September to February. In *Pistia* the number of seeds recorded was 8-10 per plant. In *Salvinia* sporocarps were observed during December to January. The water qualities during the period of study was recorded.

The work under this project is in progress.

Project 17 : Frog Farming

Problem : 17.1 to 17.4 (Research work completed in 1973)

Problem : 17.5 (Research work suspended since 1972)

Problem : 17.6 (Research work completed in 1975)

Problem : 17.7 Development of hatchery complex for Indian commercial frog species

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

Duration : Four years six months

In 1979, the suitability of the hatchery techniques developed, a record Production of aboutone million pre-hatching stages and hatchlings of the Indian bull frog was achieved, just in one week, by operating the frog hatchery. This miniature frog hatchery complex was also designed and fabricated and installed by us. One

State Officer deputed by the Directorate of Fisheries, Government of West Bengal, received direct practical training in frog breeding and hatchery work.

Problem : 17.8 (a) Nursery management for Indian commercial frog species
Personnel : A. K. Mondal and S. C. Mondal
Duration : Five years six months

Laboratory experiments were conducted in glass jars and enamel trays, using tadpoles of *Rana tigrina* and *R. crassa* as test animals and silkworm pupae as feed for the control of cannibalism and for their proper growth and survival. It was observed that feeding with fresh silkworm pupae powder, in addition to zooplankton, produced excellent growth and nearly cent per cent survival in tadpols through complete check of cannibalism than when they were fed with the same material stored for a long time. The results showed that due to prolonged storage under ordinary room temperature, there is a deterioration in the quality of feed, possibly due to denaturation of proteins.

Problem : 17.8 (b) Rearing of tadpoles *Rana tigrina* upto the juvenile stage with supplementary feed
Personnel : S. N. Mohanty
Duration : Three years

Work on this project could not be carried out due to transfer of the Principal Investigator.

Problem : 17.9 (a) Mono-culture of *Rana hexadactyla*
Personnel : A. K. Mondal and S. C. Mondal
Duration : Two years

The project is in abeyance.

Problem : 17.9 (b) (Research work completed in 1976)
Problem : 17.9 (c) (Research work completed in 1977)

Problem : 17.10 Culture of earthworms for feeding frogs
Personnel : C. R. Das and V. Panigrahi
Duration : Four years

Fxperiments on mass culture of earthworms were conducted in the field. The population multiphed up to 30 times in one month's time. Cowdung, rotten leaves @ 200 kg/ha.and compost manure were used in ratio of 1 : 1 : 1 at a fortnight interval. These contributed substantially to food of frogs.

Problem : 17.11 Studies on the ecology of *Rana tigrina* Daud and their behaviour in nature
Personnel : S. N. Mohanty
Duration : Four years

Frogs were found to hibernate during winter months (mid November-January) and aestivate in summer (April-May).

Problem : 17.12 Culture possibilities of brown plant hopper, *Nilaparvate lugens* for feeding frogs
Personnel : S. N. Mohanty
Duration : Three years

Rate of multiplication of brown plant hopper declined

during summer and winter months and high temperature was found to be detrimental to the insects.

Problem : 17.13 Optimum per hectare production of early frogs, juveniles and adult frogs of *Rana hexadactyla*

Personnel : C. R. Das and V. Panigrahi

Duration : Five years

Rearing experiments conducted with spring and monsoon bred tadpoles of *R. hexadactyla* @ 25,000/ha and 50,000/ha resulted in 75% and 65% metamorphosed early frogs in the spring offsprings and 60% and 55% in the monsoon offsprings respectively.

Experiments on early frogs at a stocking density of 50,000/ha attained an av. l/av. wt. of 55 mm/46 g size in 7 months time.

A rearing experiment conducted in a 0.018 ha rearing enclosure with ; juveniles of *R. hexadactyla* (av. l/av. wt. of 51.2 mm/22.1 g) at a stocking density of 6,000/ha recorded a production of 410 kg/ha in 14 months time against a previous production of 370 kg/ha.

Another rearing experiment is in progress.

Paoject 18 : Sewage-fed Fisheries

Problem : 18.1.5 Culture of *Tilapia mossambica* in ponds fertilised intensively with sewage effluents

Personnel : Apurba Ghosh, K. K. Bhanot (Smt.) and S. K. Saha

Duration : Two years

In January, culture of *Tilapia mossambica* was initiated in a 0.11 ha pond fertilised with primary treated effluents and stocked @ 25,000 nos./ha in sex ratio of 3 male : 2 female. Post stocking fertilisation was done periodically. Harvesting was started from April and tilapia was utilised as forage feed to magur. During early May, mass mortality of tilapia occurred due to pesticide poisoning of the pond from adjoining field and only a few tilapia, could survive. The toxicity was removed but due to accumulation of sludge at the pond bottom, breeding activity of tilapia was very much reduced during the remaining period of culture. A total of 145 kg of tilapia could be fed to magur.

Problem : 18.1.6 (a) Production of carps in mixed culture operation with sewage effluents

Personnel : Apurba Ghosh, K. K. Bhanot (Smt.) and S. K. Saha

Duration : Four years

The work could be undertaken only in December due to floods.

Composite culture of carps in a pond (0.17 ha) stocked with fingerlings of rohu, catla and mrigal at a stocking density of 15,000/ha and species ratio of catla 2.5 : rohu 3.5 and mrigal 4. could be undertaken in December. The work could not be taken up in September, 1978 due to devasting floods and the same was undertaken in December. Initial manuring of the pond was done using 10.2 lakh litres of primary treated effluents prior to stocking. Effluents ranging from 34,000-68,000 itres/month were taken in the pond at weekly/ fortnightly interval within a period of two months after stocking. A total production of 226 kg i. e. @ 1,329.4 kg/ha/five months rearing was obtained. The average growth registered during the culture period byindividual species was : Catla 232.7 mm/145.5 g from initial stocking size of 172 mm/62.5 g ; rohu 231.2 mm/160.0 g from initial size of 180 mm/76.0 g and mrigal 205.9 mm/85.09 from initial size of 188 mm/62.5 g.

Another experiment on mixed culture of carps in the ratio of calta 1 : rohu 2.5 : mrigal 2.5 : common carp 2 : silver carp 2 at a stocking density of 15,000 fingerlings/ hectare has been initiated in August. The pond was initially fertilized with 4,30,000 litres of domestic sewage effluent. The major carps were stocked in August, while silver carp and common carp were stocked in October. No other supplementary feed or fertilizer was used. The average size of fishes at the time of stocking was ; rohu 106.0 mm/13.6 g ; mrigal 118.2/15 g ; Catla 98.3 mm/30.6 g ; silver carp 96.5 mm/10 g and common carp 93.4 mm/15 g. Growth studies of the stocked species have indicated that rohu had grown to 271.2 mm/250 g ; mrigal 243.9 mm/140 g ; catla 307.5 mm/475 g ; common carp 300.4 mm/525 g and silver carp 143.9 mm/34.1 g in 4 months.

The range of various physico-chemical parameters of the pond water during January to December ranged as under :

pH	7.6--8.4
D. O.	0.96—4.2 ppm
CO_2	nil—13.4 ppm
Alkalinity	165—416 ppm
NO_2—N	nil—0.04 ppm
NO_3—N	0.06—0.21 ppm
NH_3—N	0.46—3.66 ppm
Albuminoid NH_3	nil—trace
Phosphate	0.94—3.672 ppm
Calcium	29—62 ppm
Magnesium	12.3—26.4 ppm
COD	4.2—30.8 ppm
BOD	11.9—34.4 ppm
Specific conductivity	$799\times10^{-6}-1220\times10^{-6}$

The soil quality of the pond bottom was as follows :

pH	6.2—6.8
Organic carbon	1.82—7.46%
Available nitrogen	29.4—47.2 mg/100 of soil
Available phosphorus	24.2—38.3 mg/100 g of soil
Sand	52.6%
Silt	27.9%
Clay	19.5%

Qualitative and quantitative studies of the plankton during September to December revealed that phyto-plankton dominated over zooplankton. *Microcystis* sp. ranging from 1.320 units/litre in September to 18,500 units in November was the most abundant blue green alga. Other blue green algae represented were : *Spirotaenia* sp. and *Spirulina* sp. Among zooplankton, copepoda, cladocrea and rotifera were present in the order of abundance given. The dominant genera were *Brachionus, Keratella, Filinia, Moina, Diaphanosoma, Daphnia, Cyclops, Diaptomus* and Nauplii stages of copepods.

Problem : 18.1.6 (b) Rearing of fry of Indian and exotic carps to fingerling stage using primary treated sewage effluents

Personnel : Apurba Ghosh, K. K. Bhanot (Smt.) and S. K. Saha

Duration : Four years

One nursery pond (0.03 ha) was fertilised with 2 t of sludge and was stocked with common carp fry @ 1,50,000. Fry grew to an average size of 80.6 mm/13 9 g in three months.

Problem : 18.1.7 (Research work suspended in 1978)

Problem : 18.1.8 (Research work suspended since 1977)

Problem : 18.1.9 (Research work suspended in 1978)

Problem : 18.1.10 The etiology of common parasitic diseases of some culturable fishes reared in sewage-fed pond and control of the same under conditions of intensive fish culture

Personnel : A. K. Ghosh

Duration : Four years

Fingerlings of Indian major carps transported from a local pond for stocking in sewage-fed culture pond were observed to be infected with myxospores. The fish were treated with potassium permanganate @ 1 ppm prior to stocking. Lime treatment @ 250 kg/ha to control myxospores was also done. The infection is now under control and the fish are growing satisfactorily.

Problem : 18.1.11 Paddy-cum-fish culture in freshwater by renovating paddy plot

Personnel : Apurba Ghosh, S. K. Dutta, A. B. Mukherjee, S. K. Saha and K. K. Bhanot (Smt.)

Duration : Three years

Paddy culture

In the 'Kharif' season deep water pest resistant hybrid paddy (Jaladhi-II) was sown in June 1978. Due to flood in September 1978 about 3/4 th of paddy plot was badly damaged and the remaining crop was harvested in December 1978 and about 400 kg of paddy was produced. After the harvesting of Jaladhi crop, the plot was prepared for cultivation of a high yielding variety 'Ratna'. The soil of the plot was initially fertilized with 66.6 kg/ha of urea, 400 kg/ha of super phosphate and 66.6 kg/ha muriate of potash. Two more doses of urea (146 kg/ha) were applied during the period of 4 months of 'Ratna' cultivation. Pesticides *viz.*, demicron (400 ml/ha) and benzene hexachloride (13.3 kg/ha) were used to control paddy pest mainly rice hispa. Care was taken to prevent the leakage of pesticides into the perimeter canal harbouring fish by erecting a small dyke all along the periphery of the plot.

During 'Ratna' cultivation regular irrigation was provided from the perimeter canal by adopting common lift irrigation method. Harvesting of 'Ratna' was made in the 2nd week of June and a production of 3,333 kg/ha was achieved. Thus a total production of 3,733 kg/ha/annum of paddy was produced.

Fish culture

The perimeter canal (0.27 ha) was fertilized with 4.8 t/ha of cowdung in July 1978. Indian major carps (mrigal, catla, rohu) were stocked @ 3,000/ha in the ratio of 4 : 3.5 : 2.5 in August. But due to unprecedented flood in the last week of September the experiment got vitiated and all the fishes escaped from the perimeter canal into the adjoining swampy area. Restocking with Indian major carps @ 2,000/ha was done in the last week of November in the same ratio. The fish had an initial average size of catla, 58.27 mm/22.7 g ; rohu, 51.2 mm/16.13 g and mrigal 97.33 mm/12.4 g. Paddy and fish were grown together in the entire area for a period of 2 months i. e November and December 1978 and in the perimeter canal for four months. The fishes were fed @ 3% body weight with mustard oil cake and rice bran in 1 : 1 ratio. A total of 106.5 kg of fish was harvested after six months of rearing. In July 1979 fresh 'Jaladhi' paddy was sown in the paddy plot.

The perimeter canal, was fertilized with 11.1 t/ha of cowdung in July and stocked with Indian major carps, Chinese carps, magur and prawn @ 3,000/ha in september and October in the ratio of rohu 4 : mrigal 3 : catla 1.5 : *Clarius batrachus* 0.7 : *Macrobrachium rosenbergii* 0.5 : silver carp 0.3. The initial length and weight of the species at the time of stocking were rohu 52.3 mm/11.6 g, mrigal 61.0 mm/13.3 g, catla 64.6 mm/15.2, silver carp 30.8 mm/4 g. *M. rosenbergii* 11.2 mm/9.9 g. During the 5 months culture period, the

average length/weight attained by the fishes were as follows : rohu 172.2 mm/64 g. catla 232.0 mm/75 g, mrigal 132.4 mm/48.6 g, silver carp 180 mm/50 g.

Physico-chemical characteristics of the perimeter canal water during the period of investigation varied as follows :

Temperature	16.3°C—30.4°C
pH	7.7 - 8.4
D.O.	1.9 - 5.4 ppm
CO_2	nil - 14.0 ppm
HCO_3	110 - 310 ppm
NO_2	nil - traces
NO_3-N	traces - 0.002 ppm
NH_3-N	0.01 - 0.892 ppm
PO_4	0.09 - 0.84 ppm
COD	4.0 - 21.6 ppm
Chloride	42.6 - 96.0 ppm

Quantitative and qualitative study of plankton for the period July '78 to March '79 indicated that fertility of the perimeter canal had improved as compared to the previous year when the plankton population of freshly dug-out perimeter canal was found to be very poor. Phytoplankton (4164–6000 units/litre) deminated over zooplankton (1456 units/litre) Diatoms and *Euglena* sp. *Peridinium* sp. blooms were observed in February and October respectively. Zooplankton were abundant in March constituted by rotifers and copepods. Common phytoplankton genera encountered were *Chlamydomonas, Eudorina, Pandorina, Peridinium, Euglena, Phacus, Navicula, Nitzchia* and *Amphora.* Among zooplankton the representative genera were *Brachionus, Polyarthra, Keratella, Cyclops, Diaptomous,* Nauplii, *Ceriodaphnia* and *Diphanosoma.*

Problem : 18.2 Culture of *Clarias batrachus* in oxidation pond using tilapia as forage

Personnel : Apurba Ghosh, K. K. Bhanot (Smt.) and S. K. Saha

Duration : Two years

An experiment on the culture of *Clarias batrachus* was initiated in a pond (0.076 ha) fertilised initially with 3,60,000 litres of domestic sewage effluents. The pond was stocked with magur fingerlings (of average size 122.5 mm/14.08 g) at a stocking density of 40,000/ha.

Tilapia was cultured in a separate pond fertilised with domestic sewage effluents. The cultured tilapia was given as feed in enamal trays to magur after chopping and boiling. Magur was observed to feed on boiled tilapia flesh and clean bones were left over in the trays. Within a period of 10 months a total of 145 kg tilapia had been fed to magur. Magur had grown to an average size of 185 mm/62.5 g. The experiment indicated the possibility of utilising small-sized tilapia, otherwise unsuitable for human consumption, for culture of desired carnivorous fishes like magur etc.

During the period of culture physico-chemical characteristics of the pond water were as follows :

Temp.	19.4	-	31°C
pH	7.2	-	8.4
DO.	8.9	-	6.4 ppm
CO_2	traces	-	60.3 ppm
Alkalinity	200	-	360 ppm
NO_2	N - nil	-	0.003 ppm
NO_3	N - traces	-	0.52 ppm
NH_3	N - 0.72	-	4.12 ppm
Phosphate	0.960	-	4.896 ppm
COD	8.4	-	53.6 ppm
BOD	11.6	-	37.9 ppm
Sp. conductivity	533×10^6	—	1028×10^9 mhos
Calcium	16.4	–	48 ppm
Magnicium	11.2	–	28.9 ppm

The soil quality of the pond bottom was as under :

pH	6.1	- 6.9
Org. carbon	2.4	- 8.31%
Available nitrogen	27.3	- 43.4 mg/100 g of soil and
Available phosphorus	23.2	- 49.0 mg/100 g of soil.

The studies are being continued.

Project 19 : Hilsa Fisheries

Problem : 19.1 (Research work completed in 1973)
Problem : 19.2 (Research work completed in 1974)
Problem : 19.3 (Resarch work suspended since 1973)
Problem : 19.4 (Research work completed in 1973)
Problem : 19.5 (Research work completed in 1973)
Problem : 19.6 (Research work suspended since 1973)
Problem : 19.7 (Research work merged with problem 14.1)

Problem : 19.8 (Culture of *Hilsa ilisha* (Ham.) in confined freshwater

Personnel : J. C. Malhotra, M. Peer Mohammed, P. M. Sherief, K. L. Saha, S .K. Sarkar, B. K. Banerji, S. P. Singh, Ramji Tewari, K. K. Bhanot and S. B. Saha

Duration : Seven years

Investigations under the project were carried out in the river Narmada and Ganga.

In River Narmada : Artificial fecundation was again successfully achieved thraugh 'wet' method of stripping and the percentage of fertilization varied between 60 and 90. The resultant fertilised eggs were hatched in nylon cloth hapas fixed in ponds and in the indoor hatchery wherein continuous water flow was maintained throughout the hatching period. The percentage of hatching in the hapas fluctuated between 65 and 90 while in the hatchery it ranged between 90 and 95. In the indoor hatchery, it was observed that when the incubator was made of 1/15″ mesh monofilament nylon neeting, 70-80% of the hatchlings could be segregated from dead eggs and egg stocks.

The hatchlings thus produced were stocked in two nursery ponds at Ukai Fish Farm on 22.8.79 and 4.9.79. In these ponds 2 5-3.0 mm long hatchlings have grown to an average size of about 82 mm in the length range of 36-92 mm on 19.10.79.

Experiments on routine and randon activity-metabolism were also performed on pond-reared hilsa (av. length 4.4 cm) at 27°C, at ambient oxygen near air saturation. The standard metabolism was estimated at 120mg/kg/hr while routine metabolism was 160/mg/kg/hr.

Experiments were also carried out to determine qualitative requirements of the water soluble vitamins-pyridoxine and thiamine, in hilsa hatchlings of av. size 5 mm. It was observed that hatchlings fed with thiamine and pyridoxine defficient diets became morbid and sluggish in about 7 days time.

Biochemical studies have shown that total protein contents of the developing eggs and hatchlings progressively decrease till the resorption of the yolk. Further, the changes in the free Amino Acid contents showed : a steady level from fertilization till hatching ; increase in the FAA content in the hatchlings till the resorption of the yolk and decrease with concomitant increase in the total protein contents after complete resorption of the yolk.

Fertilized eggs of hilsa were transported in sealed containers under oxygen as well as in open containers, by road, to distance requiring 8 hours to cover. The respective mortalities were estimated as 10 and 25%.

To explore the possibilities of culturing hilsa in the reservoirs, 15,000 hatchlings of hilsa of average size 5 mm were released in the Ukai Reservoir at a place (a bay) about one km upstream of the dam.

The 2.5-3.0 mm long hatchlings, stocked in one of the ponds at Ukai on 18.8.78, completed one year on 17.8.79 and attained an average length of about 180 mm in the size range of 140-195 mm. On 25.9.79 an exceptionally heavy bloom (500,000-1,000,000 units/ litre) of euglenoids developed in the pond and, despite immediate control measures 176 specimens in the size range of 145-200 mm died, probably due to gas embolism. Experiments are in progress to evolve a method for the control of such blooms in future.

In River Ganga : Due to nonavailability of matured and oozing specimens of *H. ilisha* in the Ganga downstream of Farakka Barrage, the artificial fecundation could not be done and as such material for stocking the ponds could not be produced.

Problem	: 19.9	Fluctuations in the hilsa fisheries of the Hooghly estuary
Personnel	:	D. K. De and G. P. Bhattacharjee (upto May, 1979)
Duration	:	Five years

Gonadal maturity, fecundity and spawning behaviour of *Hilsa ilisha* (34.9 - 52.2 cm/523 - 1925 g) collected from the upper stretch of the Hooghly estuary around Nawabganj was studied. The fecundity of the fish was estimated between 4,17,938 and 14,75,676 and the egg measured 0.76 - 0.87 mm in diameter. The presence of only a single size group of ova in the mature ovary indicates that the spawning of this species is seasonal when the eggs are shed in a single spawning act.

Project 20 : Water pollution Investigations

Problem	: 20.1	(Research work completed in 1973)
Problem	: 20.2	(Research work completed in 1975)
Problem	: 20.3	(Researeh work completed in 1977)
Problem	: 20.4	(Research work completed in 1977)
Problem	: 20.5	Investigations on the Ganga and the Yamuna river ecosystem at Allahabad to determine the biological indicators of water quality
Personnel	:	S. N. Mehrotra, A. G. Jhingran and S. P. Singh
Duration	:	Seven years

The effects of sewage discharge in the Ganga and the Yamuna were studied at three points *viz.*, above the outfall (AOF), at the outfall (OF) and below the outfall (BOF). No appreciable difference in water temperature was recorded at the three points. The range of variation during the year being 20-32°C. Transparency was found to be less at the OF (3-32 cm) as compared to other points (4-65 cm). Free CO_2 ranged between 2.8 and 11.8 ppm at the OF whereas at other points it was either absent or in lower concentration. Alkalinity remained high (210-280 ppm in Yamuna, 250-410 ppm in Ganga) at the OF. Hardness also indicated higher values (45-68 ppm) at the OF. The inorganic nutrients like nitrates (0.64–0.94 ppm), phosphates (0.4–1.2 ppm) and silicates (18-20.0 ppm) were fairly

rich at the OF areas as compared to other points. The OF areas were rich in mineral content specially calcium (30–36 ppm) and magnesium (4.6-6.4 ppm) ions. Free NH_3 was fairly high (0.4-3.4 ppm) at the OF areas Chloride ions were more in Yamuna (29-41 ppm) than in Ganga (10-11.2 ppm). Dissolved oxygen showed lowest value (2.0 ppm) at the OF in Yamuna.

Plankton : The AOF area in rivers Ganga and Yamuna was dominated by Bacillariophyceae (*Navicula* sp., *Synedra* sp., *Diatoma* sp. and *Tabellaria* sp.) followed by Chlorophyceae (*Spirogyra* sp., *Pediastrum* sp. and *Botryococcus* sp.) and Myxophyceae (*Merismopedia* sp , *Phormidium* sp. & *Anabaena* sp.) amongst phyto plankton and Rotifera (*Keratella* sp., *Asplanchna* sp., *Polyarthra* sp., *Trichocerca* sp., amongst zooplankters. The OF region in Ganga was dominated by *Merismopedia* sp. & *Spirogyra* sp.) *Diatoma* sp , *Pediastrum* sp., and *Phormidium* sp., whereas in Yamuna dominance of *Coelosphaerium* sp., *Spirogyra* sp., *Gyrosigma* sp. *Oscillatoria* sp. and *Pediastrum* sp. was observed. The BOF area indicated almost similar trend as at the OF region. The zooplankters encountered in the three regions of the two rivers were *Keratella* sp. and nauplii. *Brachionus* sp. was present in OF region only.

Bottom Biota : The AOF area was dominated by molluscs—*Corbicula* sp., *Viviparus* sp., *Lymnaea* sp. and *Melanoides* (*Melanoides*) *Lineatus* in both the rivers. The OF region was characterised by the absence of molluscs and the presence of *Chironomus* sp. and *Tubifex* sp. Molluscs (*Corbicula* sp. *Viviparus* sp. and *M.* (M) *Lineatus*) again appeared in the BOF region. *Chironomus* sp. and *Tubifex* sp were sparsely represented of the BOF region as compared to OF region.

Fish Fauna : There was no difference in the fish fauna available at the three regions. The species encountered were *Puntius* sp., *G. chapra*, *A. morar*, *C. garua*, *M. cavasius* and *R. rita*.

Problem : 20.6 (Research work completed in 1977)

Problem : 20.7 (Research work completed in 1978)

Problem : 20.8 Pollution studies in inland waters caused by pesticides

Personnel : R. S. Panwar, R. N. Seth, D. N. Singh and R. K. Tyagi

Duration : Four years

Safe concentrations of three pesticides *viz.*, DDT-25 E. C., Y-BHC-20 E. C. and Malathion-50 E. C. for the test fish *Cyprinus carpio* (Av. lenght 55.5 mm) at 31°-34°C were found to be 1.5×10^{-3} mg/1, 1.2×10^{-3} mg/1 and 2.47×10^{-2} mg/1 respectively, application factor being 0.01.

Observations to study toxicity of herbicide 2,4-D (Active ingredient 2-4 Dichloro-phenoxy Acetic Acid 80% and insert ingredient : Moisture, Sodium chloride etc. 20%) were made on the test fish *Cirrhinus mrigala* (Av. length, 42.5 mm ; av. weight 1.102 g) under static condition at 33.5 to 36.5°C water temperature. Physico-chemical characteristics of the water used were : pH 7.7, D O 5.4-7.6 ppm, total alkalinity 160-164 ppm and hardness 60-64.2 ppm.

Histopathological studies of *C. mrigala* (length, 98.5 mm weight 6.7) exposed to 0.005 ppm of DDT to 45 days were carried out. In liver, narcosis in hepatic cell and displacement of nucleus were observed. At certain places, where the effects were more chronic, extrudening nucleous was observed. In kidney, the effects were more severe, compared to liver. Bowman's capsules had lost their normal structure. Shrinkage in renal tube cell, and causing widening of lacunae were and observed when compared to controlled fish.

Studies are being conducted in toxicity of herbicide 2,4-D with oligochaetes and *Daphnia* sp. at 26 to 28°C water temperature.

Problem : 20.9 The impact of pesticides on respiratory metabolism and energy utilisation of aquatic animals

Personnel : M. Peer Mohamed, S. N. Mehrotra, G. N. Srivastava and R. A. Gupta

Duration : Four years

Experiments were performed to find out the routine metabolism of *C. mrigala, L. rohita* and *C. catla* at high ambient oxygen. It was found out that in *C. mrigala* the routine metabolism was 148 mg/kg/hr (Av. wt. 22 g ; T. L. 14.3 cm) and 112 mg/kg/hr (av. wt. 10.0 g ; T. L. 10.7 cm) at 35°C. In another set of experiments with *C. mrigala* of different weights av. wt. 8.2 g, 14.3 g and 25 g, the routine metabolic rates were 75, 110 and 151 mg/Kg/hr respectively, at 30°C. At 25°C, the routine metabolic rate of *L. rohita* (av. wt. 2 5 g ; T. L. 5.1 cm) and *C. catla* (av. wt. 3.1 g ; T. L. 6.41 cm) was 70 and 90 mg/kg/hr respectively.

Experiments were also performed to find out the upper temperature tolerance limit in *C. mrigala*. It was found out that *C. mrigala* (av. wt. 3.3 g) can tolerate upto 39.8°C at high ambient oxygen.

To find out the influence of ammonia toxicity on the survival of *C. mrigala*, experiments were performed in one size group having av. T. L. 1.2 cm. The experiments with other size groups of the fish are in progress.

In another set of experiments on low ambient oxygen tolerance, it was found that the asphyxial oxygen level for *C. catla* (av. wt. 4.1 g) was 0.62 mg/l at 25°C. The present results corroborate the earlier results obtained on the asphyxial oxygen level for the same species.

Problem : 20.10 Pollutional effect of industrial wastes on aquatic ecosystem

Personnel : R. S. Panwar, R. K. Saxena, D. N. Singh and R. K, Tyagi

Duration : Three years

The physico-chemical condition of the effluent of Kanoria Chemicals Ltd. prior to its being discharged into Rihand reservoir was studied. Free chlorine of the effluents varied from 88.77 to 1122.13 ppm and chloride from 59.9 to 6360.2 ppm (pH was found to be high 8.6 to 8.8) in pre-monsoon and monsoon seasons but it was little acidic (pH 6.0) during spring season.

pH of effluent at the outfall (Station 1) ranged from 7.2 to 8.4, free chlorine from 88.79 to 90.19 ppm and chloride from 59.4 to 160.39 ppm. At station 2 (20 m distance from out fall) free chlorine suddenly dropped to 0.698-1.1347 ppm during pre-monsoon and 15.02-19.08 ppm in spring seasons. At station 3 (50 m), it was found in traces during pre-monsoon and 0.7-11.06 ppm in spring seasons. At station 4 (100 m), 5 (300 m), 6 (500 m) and 7 (800 m) pH ranged from 7.4-7.8.

pH of the soil at the outfall region showed alkaline range (8.6-8.8). Chloride content ranged from 69.3 to 70.5 mg/100 g.

Plankton was observed to be nil during pre-monsoon and monsoon seasons but few phytoplankters (*Microcystis, Synedra* and *Navicula*) were recorded during spring season. Zooplankton was found to be rich during pre-monsoon and monsoon seasons, and was represented by *Cyclops, Diaptomus, Bosmina, Keratella* etc. Benthos were totally absent upto 500 m from the outfall.

Fish mortality was recorded during spring and pre-monsoon seasons within the affected zones. The dead

fishes comprised *C. mrigala* (1-15 kg), *Mystus aor* (600 g), *W. attu* (1.2 kg), *L. calbasu* (400 g) and weed fishes.

Laboratory experiments were conducted with 0.35% combined effluents on test fish, *C. carpio* (av. length 37.25 mm). The fish showed signs of distress, loosing its equilibrium and finally mortality occurred within 8 hrs. after exposure.

Problem : 20.11 Environmental pollution in the Hooghly estuary with reference to heavy metals disposed through industrial wastes

Personnel : B. B. Ghosh, N. N. Sarkar and M. M. Bagchi

Duration : Three years

The effluents, water, bottom sediments, fish and shrimps were sampled in and around the outfall (450-750 m above and upto 1.25 km below the outfall) of tannery, paints and varnishes, rubber and viscose rayon textile. Zn content in the various effluents varied between 0.06 ppm and 4 ppm, the maximum being noted in the rayon effluent, while 0.3-1.0 ppm of Cr was indicated in the tannery waste waters In all the cases, bottom sediments showed higher accumulation of Zn (max. 4.2 ppm) and Cr (max. 3.0 ppm), compared to effluent, water, fish and shrimps. An accumulation of 0.3 ppm of Zn in *Setipinna phasa* and 0.4 ppm in shrimps was noted, while the corresponding values for Cr was 0.05 ppm and 0.02 pom. A low value of DO (2.9 ppm) was noted near the outfall of paints and varnish. Highly acidic condition (pH 3.0) and appreciably low hardness were recorded at the rayon outfall while hardness as low as 64 ppm was also indicated at the tannery outfall which seemed to greatly influence the metal toxicity in these outfall areas compared to other regions.

Problem : 20.12 (Research work completed in 1979)

Problem : 20.13 Effect of supernatant waste water on the fisheries of Kulti estuary

Personnel : P. Ray, B. B. Pakrasi, S. B. Saha, A. B. Mukherjee and S. K. Chatterjee

Duration : Four years

Supernatant waste water of Calcutta sewage from Kulti canal at the Lock Gate and soil were characterised for the winter season. pH, DO, BOD, Alk Salinity. and sp. Conductivity of water ranged between 5.5-7.8, nil, 25-320 ppm, 170-174 ppm 7-00.3 and 2798-5556 m. mhos during high and low water levels while for soil the values were 7.6, 8.4–23.3 and 5556 m. mhos respectively for pH, immediate oxygen demand and sp. conductivity. The total pollution load calculated in terms of BOD ranged between 7.2-92.7 tonnes (av. 49.95 tonnes).

Diurnal variation study for pH, DO and Sp. conductivity ranged between 7.8-7.9, nil-3.9 ppm and 6039–26542 m. mhos. Phyto-and zoo plankton ranged between 85-2075/1 Phyto-and zoo and 14-35/1 respectively.

Toxicity test by static bio-assay

Toxicity test was performed for 96 hrs on the Calcutta Municipal wastes collected from the Lock Gate before disposal during high and low tide periods using *C. mrigala* (1.2-1.8 cm size) as test animal. With L. T. water the LC_{50} ranged between 87 and 100 per cent, while with H. T. water, only 40 per cent mortality was observed. DO in both the cases was maintained between 4.5-5.0 ppm and pH between 7.4-7.7.

Problem : 20.14 Aquatic pollution in the Hooghly estuary with reference to Haldia Oil Refinery Complex

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

Duration : Three years

Studies on the oil pollution in the Hooghly estuary due to the discharge of effluents from Haldia Oil Refinery Complex were initiated.

Characterisation of the treated Haldia Oil Refinery effluent indicated the following variations in physico-chemical parameters : pH 5.5 - 9.0 ; DO 2.6 - 6.0 mg/ 1; BOD 7-30 mg/1 ; Oil 2-12 mg/1 ; Specific conductivity $2181 \times 10^{-65} - 3999 \times 10^{-6}$ m. mhos and hardness (as $CaCo_3$) 230 — 470 mg/1.

Static toxicity bioassay experiments were conducted on the treated oil refinery effluent using zooplankton (*Daphnia lumholtzi*) as test animals at 28°C (room temperature). Twenty four hours LC_{50} value was found to be 10% by volume of the waste and 100% mortality was observed after 96 hours exposure. This indicated that though the factory adopts treatment measures, the fish food organisms are effected by this effluent, which is ultimately discharged into the Hooghly estuary.

Problem : 20.15 Studies on the pollution in Backingham canal and its effect on the confluent estuarine ecosystems

Personnel : K. O. Joseph, K. Raman, K. V. Ramakrishna, G. R. M. Rao, S. Radhakrishnan and M. Kaliyamurthy

Duration : Three years

Hydrobiological samples were collected from six sampling points in the Buckingham canal. Of these centres, Moosamani and Blamani stations (adjacent to lake Pulicat) are clear zones (D O 5.2 ppm and B. O. D 1.0 and 1.6 ppm). Ennore Lock station, which is near to Ennore estuary is slightly polluted but heavy organic pollution was observed at other stations— Central, TV Tower and Kotturpuram near to Adyar estuary. Water is totally depleted of D O and B. O. D. shows a high value (200-460 ppm). The light black colour, organic sulphuretted smell of hydrogen sulphide and septic odor of sewage are perceptible in all these three stations. Sediments collected were analysed for various parameters.

Phytoplankton samples collected from the poliuted and unpolluted zones of the Buckingham canal showed that blue-green algae dominated the polluted zones and diatoms the unpolluted zones.

Samples of soil were collected from 6 stations and analysed for bottom fauna. Stations at Central, Adyar and TV Tower did not show any fauna, while gastropods (*Carithidium* sp.) amphipods and bivalves were recorded from stations on Pulicat lake and Ennore.

From stations in the Pulicat lake and Ennore area, nylon net samples showed good numbers of mullets. perches, prawns and crabs, whereas from the city centres only very few fishes (some of them dead) were recorded.

Experiments were conducted to study the effect of addition of small doses of air-dried estuarine slush (formed mainly from city sewage) to pond soil for increasing the production of fish food organisms. Super-phosphate and trace elements viz., molybdenum, boron and zinc were also applied separately to study their added effect in improving the nutrient status. Molybendm gave the best plankton growth followed by boron, super-phosphate and zinc. Better plankton production was obtained with estuarine slush alone when compared with pond soil. The changes in the nutrient status of soil and water were also studied.

Problem : 20.16 Impact of fertiliser factory wastes on the hydrobiology of river Ganga

Personnel : Krishna Chandra, S. N. Mehrotra and Balbir Singh

Duration : Four years

The stretch of River Ganga, near Dumduma (Sirsa), where the effluents from IFFCO factory are proposed to be discharged @ 5000 cubic meter/day was surveyed to select the sampling points at the outfall, above outfall and below the outfall.

Collection of water and plankton samples were initiated in the month of October, 1979 by vertical hauls on three consecutive days, with a view to study the pre-pollutional hydrobiological conditions of river Ganga.

The air and water temperature ranged as 26—36.0°C and 28–30.6°C respectively. The pH of water showed alkaline range (8.2-8.4). dissolved oxygen ranged from 6.4 to 9.2 ppm, alkalinity from 240-244 ppm, chloride from 31.60 to 35.64 ppm, and carbonate hardness from 98.0 to 120.0 ppm, whereas free carbon dioxide and free ammonia were absent in the water samples. The primary productivity was estimated at 25.0 mg C/m³/hr. Diurnal variations of plankton and physico-chemical conditions were also estimated. pH of soil was 7.4 and soil was sandy in nature.

The phytoplankton densities in surface collections were 4550 u/l, 11300 u/l, 7450 u/l and 6050 u/l at 6.00 hrs, 12.00 hrs, 18.00 hrs and 24.00 hrs respectively. In vertical haul collections, the plankton densities were 761 u/l, 12000 u/l, 6171 u/l and 8371 u/l at 6.00 hrs, 12.00 hrs, 18.00 hrs and 24 00 hrs respectively. The phytoplankton consisted of Chlorophyceae (56.2%), Myxophyceae (18.6%) Bascillariophyceae (15.2%) and Desmidiaceae (10.0%). Chlorophyceae was represented by *Ulothrix*, *Spirogyra*, *Scenedesmus*, *Pediastrum*, *Zygnema* and *Ankistrodesmus* ; Myxophyceae by *Phormidium*, *Polycystis*, *Anabaena*, *Nostoc* and *Oscillatoria* ; Bascillariophyceae by *Navicula* and *Synedra* ; and *Desmidiaceae* by *Cosmarium* and *Sorastrum*.

The zooplankton was conspicuous by its absence in the collections.

Project 21 : Fisheries of river basins

Problem : 21.1 Ecology and development of Mans in Gandak basin

Personnel : V. R. Chitranshi, H. P. Singh and D. Kapoor

Duration : Five years

Sikanderpur Mans :

Catch statistics : About 4.42 t of fishes were estimated to have been landed from the *Mans* during the period March to November, 1979 ; the monthly landings ranging from 54.6 kg (September) to 1026.3 kg (April). Major carps (38.62%) dominated in the catches, followed by air breathing fishes (10.18%). The dominant species in the catches were *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*, *Labeo calbasu*, *Channa* spp. and *Notopterus notopterus*. Miscellaneous species comprised 51.2% in the catches.

The gill nets of different mesh-sizes were commonly used, the other gears being bamboo traps for small-sized fishes, and long lines with live baits and spears for murrels and catfishes.

Hydrology : Air and water temperatures ranged from 25.0 to 36.5°C and 22.2 to 33.5°C respectively, transparency nil to 237.0 cm, pH 7.4 to 8.4, free Carbon dioxide nil to 8.0 ppm, total alkalinity 150.0 to 570.0 ppm and D. O. 0.8 to 11.84 ppm. The depletion of D. O. (0.8 ppm) at station IV caused heavy mortality between 24th and 26th July, 1979.

Primary productivity : Gross and net organic carbon

productions fluctuated between 62.0 and 375.0 mg $C/m^3/hr$, and 31.25 and 281.0 mg $C/m^3/hr$, respectively. Respiration value fluctuated between 11.25 and 112.50 mg $C/m^3/hr$.

Plankton : The phytoplankters were dominant from May to September 1979 and the zooplankters in March, April, October and November, 1979. The dominant forms belonged to protozoans, rotifers, copepods and cladocerans among zooplankters. Of the phytoplankters, *Closterium, Spirogyra, Pediastrum, Volvox, Cosmerium, Microspora, Zygema* and *Ulothrix* among Chlorophyceae , *Microcystis, Nostoc, Oscillatoria, Coelospherium, Spirulina* and *Phormidium* among Myxophyceae and *Navicula, Nitzschia, Cyclotella, Cymbella, Tabellaria* and *Fragrilaia* among Bacillariophyceae were the most important. Myxophyceae was the most dominant and was followed by Chlorophyceae and Bacillariophyceae. *Microcystis* was the prominent phytoplankter.

Macrovegetation : This *mans* is generally choked with *Eichhornia* sp., the density being 36 to 57 units and 13.3 to 36.7 kg per sq. metre.

The infestation densities of *Hydrilla* sp. and *Ceratophyllum* sp. were between nil and 5.6 kg per sq. metre, and nil and 5.2 kg per sq. metre respectively.

Manika Mans :

Catch statistics : 4.49 t of fishes were estimated to have landed from this *mans* during the period June to November 1979, monthly catches ranging from 400.7 kg (November) to 1361.8 kg (July). Air breathing fishes made up 40.73% the landing of major carps being nil. The dominant fishes were (in the order of their abundance) *Chanos* sp. *H. fossilis* and *N. notopterus*. The miscellaneous species formed 59.27% of the catches.

The types of fishing gears used were same as in Sikanderpur *Mans*.

Hydrology : Air and water temperature ranged from 27.0 to 38.0°C and 26.2 to 33.5°C respectively ; transparency, nil to 258.0 cm ; pH 7.6 to 8.4, free carbon dioxide nil to 10.0 ppm total alkalinity 74.0 to 145.0 ppm and D. O. 2.24 to 10.4 ppm.

Plankton : The zooplankters dominated over the phytoplankters in most of the months. Only in the months of August and October, the phytoplankters were dominant. The composition of zooplankton and phytoplankton was more or less the same as in Sikanderpur *Mans* except that there was a total absence of *Microcystis* in this *Mans*.

Macrovegetation : This *Mans* is heavily infested with the submerged (*Hydrilla* sp. and *Ceratophyllum* sp,) and rooted emergent (*Nymphaea* sp., *Nelumbo* sp., *Nymphoides* sp. and *Claedsis* sp.) weeds.

The infestation density of *Hydrilla* sp. and *Ceratophyllum* sp. ranged from 3.4 to 25.7 kg/sq. m. and 1.2 to 3.1 kg/sq. m. respectively.

Project 22 : Fish culture in running water

Problem :	22.1 (a, b & c)	(Research work suspended since 1978)
Problem :	22.2	Catfish culture in running water
Personnel :		S. P. Singh, J. C. Malhotra, K. P. Srivastava, R. N. Seth

Duration : Eight years

Assessment of catfish seed resources :

A survey was undertaken in about 100 km stretch of river Ganga, about 25 km of Yamuna and about 10 km of river Tons around Allahabad from March to June, 1979, to assess the catfish seed resources in time and space. A similar survey was also conducted in Gulariya reservoir near Allahabad during March, 1979.

The formation of breeding nests (*Thalas*) was observed from the month of March and the breeding activities lasted till June. The breeding nests were encountered in the rivers Ganga and Yamuna but no *Thala* could be located in the river Tons. In Gulariya reservoir, *Thalas* were found abandoned as heavy trap fishing was in progress in the reservoir, catching adult *M. seenghala*.

During this period, a total of 10,300 hatchlings of *M. seenghala* (10-60 mm) could be collected from 21 *Thalas*, in Mehdaurighat stretch of river Ganga in 8 days.

Rearing experiments :

The hatchlings of *M. seenghala* collected from the breeding *Thalas* were transported in plastic bags under oxygen and stocked in 1/12" nylon cages (1×1×1m) kept floating in river Ganga at Shankerghat (Allahabad). Prior to stocking, the hatchlings were given both with 1 ppm acriflavin and then conditioned. The details of rearing experiments are given below :

Expt. No.	No. of hatchlings stocked	Initial size range (Av. size) mm.	Attained size range (Av. size) mm.	No. of rearing days
I	50	28-35 (30)	206-275 (238)	210
II	100	56-60 (55)	120-158 (125)	150
III	125	40-45 (43)	110-190 (140)	206
IV	150	10-15 (12)	91-180 (113)	147
V	250	15-30 (20)	94-142 (112)	190
VI	52	170-285 (202)	279-386 (313)	318

In the cages, the hatchlings of *M. seenghala* (Expt. nos.I–V) were initially fed with chironomid egg-mass and after 5 days with semi boiled trash fish and chironomid egg-mass. After the hatchlings were observed to feed on the semiboiled trash fish the feeding with chironomid egg-mass was discontinued. The semiboiled trash fish was given twice daily @ 20% of the body weight for the first 30 days and subsequently @ 10% of body weight (Expt. No I to V). In Expt. VI, the feed (semi bioled trash fish) was given @ 5% of body weight twice daily when average weight increased from 43 to 195 g. The trash fishes mainly were *Aspidoparia morar*, *Puntius* sp. *Oxygaster bacaila* and *Gadusia chapra*.

To find a suitable substitute for the chironomid egg-mass and semiboiled trash fish, other feeds *viz.* mollusc egg-mass, semiboiled trash fish and G. O. C. (1 : 1) in paste form and fish meal soaked in warm water were experimented with. But they were not acceptable to the hatchlings of *M. seenghala*.

The rearing of the *M. seenghala* hatchlings in cages gave 100% survival till November. The drought conditions probably affected the flow pattern of the river and a channel (50 m wide) with negligible current was formed at the cage culture site. This resulted in bacterial infection on the fingerlings (95–180 mm) causing 50-70% mortality in the cages. Acriflavin bath (1 ppm) and immediate shifting of the culture experiment site helped in checking the mortality within a week. The bacterial infection could not be identified.

Problem : 22.3 Cage culture in lentic water

Personnel : R. K. Saxena, M. A. Khan, N. K. Srivastava & B. D. Saroj

Duration : Six years

Of the total stock fishes, raised from spawn in floating cages at Jari Tank and reared subsequently in cages at Gulariya reservoir for 3 years upto August 1979, rohu, mrigal and calbasu were observed to attain maturity in their third year of cage life. Matured specimens consisting of mrigal 4 $\overset{\uparrow}{O}$ (245-310 mm) + 6 $\overset{O}{+}$ (225-332 mm) rohu 2 $\overset{\uparrow}{O}$ (230-285 mm) + 2 $\overset{O}{+}$ (360-390 mm); and kalbasu 1 $\overset{O}{+}$ (380 mm) were shifted to a separate cage for induced breeding experiments and the rest of the stock is being further reared to ascertain the time of attaining maturity especially of calta which had not matured on completion of 3 years of rearing in cages.

C. carpio hatchlings which were stocked in cages on 6. 3. 78 and reared with Indian major carps, attained an average length of 174.2 mm and weight of 199.0 g in 20 months.

Due to nonavailability of riverine spawn, rearing experiments during the year have been initiated with induced bred spawn of mrigal (6-7 mm) and rohu (5-6 mm) stocked @ 5,000 and 43,000/cage of $3m^2$ respectively. The survival recorded in case of mrigal which attained an average length of 23 3 mm in 34 days was 40% and that of rohu (av. length 25.0 mm in 35 days) was 21.0%. Live plankton was given as feed in these experiments besides the usual feed comprising of a mixture of GOC, R. P. and soyabean (1 : 1 : 1) in powder form supplemented with Nuvimin forte and yeast. This has surpassed the maximum survival of 6% recorded earlier in identical experiments during 1977 and 1978.

Experiments to evaluate feasibility of rearing fry to fingerling stage of Indian major carps in cages were also carried out. In these experiments, 8000 fry (12-25 mm) of Indian major carps obtained from Fish Seed Syndicate, Calcutta were used in combination with fry obtained through hypophysation of rohu, mrigal and catla. The details of the stocking are given below :

Cage No.	Date of Stocking	Fry Total stocked /Av. length	Break up of stocking fry obtained from	
			Syndicate	Induced bred spawn
1	2.9.79	5,500 (19.6 mm)	3,700 (Rohu, Catla, Mrigal)	1,800 (Mrigal)
2	10.10.79	800 (48.6 mm)	—	800 (Rohu)
3	2.9.79	4,300 (17.1 mm)	4,300 (Rohu, Mrigal, Catla)	—
4	10.10.79	1,700 (26.0 mm)	—	1,700 (Rohu)

In these experiments, mrigal attained average lengths of 67.3 mm and 95.7 mm in cages 1 and 3 respectively in 3 months whereas rohu attained average lengths of 68.2 mm and 54.6 mm in cages 2 and 4 respectively. Supplementary feeding was done with provisions of fish meal as an additional component in supplementary feed for cages 2, 3 & 4. Growth of fish in these cages was slightly better than in cage No. 1 in which fish meal was not included.

Problem : 22.4 Pen culture in lentic waters

Personnel : V. Kolekar, M. Choudhury, R. K. Singh and R. Chandra (upto August, 1979).

Duration : Three years

A total of 82 fingerlings of common carp was stocked in nylon pen to study their growth in pens. Due to heavy cyclonic weather, 34 fingerlings were lost on 1. 7. 79 and the remaining 48 fingerlings (av. length 62 mm) could be ranged from 2. 7. 79 to 26. 11. 79. During the period they attained an average lengh of 102 mm. Supplementary feeding was done with oil cake and rice bran @ 8% of the body weight.

Hydrological studies conducted during the course of experiment showed no significant change in the physico-chemical characters of the water collected from inside and outside the pen.

Problem : 22.5 (Research work kept in abeyance)

Problem : 22.6 Nutritional and biochemical studies of captive carps

Personnel : Five years

Nutritional experiments :

Experiments were conducted in glass aquaria (50 l)

to find out the effect of feed mixtures comprising commercial casein, groundnut oil cake and rice polish in varying ratios on the growth of *C. mrigala* fingerlings. Fingerlings of av. wt. 9.7 g showed 30% increment in body weight when fed with casein + rice polish + groundnut oil cake (1 : 3 : 2) followed by 23.5% gain in weight in case of fingerlings of av. wt. 13.2 g fed on casein + groundnut oil cake (1 : 2.5) and only 15 5% increase in body weight of fingerlings with av. wt. 9.0 g fed on casein + rice polish (1 : 3). All the feeds were supplemented with 2% mineral mixture and 1% vitamin mixture.

Experiments to study the seasonal biochemical variations in different tissues of captive carps and reservoir carps in relation to gonadal development was initiated in in June and July 1979 with *C. mrigala* collected from reservoir and cages. Serum studies showed an average cholesterol level of 171.6 mg/100 ml in cage fish and 125.3 mg/100 ml in reservoir fish. Gonad of reservoir fish showed higher protein and lipid levels than that of cage fish whereas in liver and muscle both the protein and lipid values were higher in case of fishes collected from cages. Water content of gonads of reservoir fish was significantly lower than that of fishes from cage. Water content of muscle and liver tissues of reservoir fish were higher than that of the cage fish. These differences in biochemical components of the fishes procured from reservoir and cage may be attributed to their physiological conditions. The fishes collected from reservoir were in maturing stage whereas those obtained from cages were immature ones.

Project : 23 Bundh Breeding

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

Personnel : G. N. Mukherjee, S. J. Karamchandani, G. N. Srivastava, K. Chandra and S. K. Wishard

Duration : Six years

Canal breeding experiments were conducted during July 23—August 5, 1979 with a few sets of major carp brooders at a newly selected site at Bainiganj in the Chhatarpur district of Madhya Pradesh. Despite all attempts, breeding could not be achieved due to the acute drought condition prevailed in the entire region. However, studies on hydrobiological factors conducive for breeding of major carps were carried out.

Problem : 231 (b) Bundh breeding of major carps

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

Duration : Eight years

Investigations were carried out in the three dry bundhs, *viz.* Nain, Sonar and Alipura No. 2 in the vicinity of Nowgong (BKD) to determine the meteorological, physico-chemical, and biological parameters conducive for breeding of major carps.

Rainfall in the catchment area contributing to a 2.5 times rise in bundh water was found necessary to stimulate sexual activity in the spawners. Cloudy weather, lightning, drizzling, etc., virtually had no role to play in the breeding of fishes introduced in the bundh.

Air and water temperature recorded at the time of breeding was 27°C, as was observed in the previous year. Transparency dropped to a range of 4.0—9.0 cm due to the incoming freshets carrying a high load of silt. High values of turbidity were found conducive for breeding. Zeta potentials due to lyophobic colloids of micro-size ranged as 25-50 m V in the water samples collected during the spawning of carps at a specific conductivity between 45 and 50 m mhos. However, at the same zeta values breeding did not take place when the sp. conductivity was higher (100 m mhos). This indicated the specific role of electrolytes in the ambient water for breeding of major carps.

Chemical consitutuents of waters at the time of spawning were marked by declining values of total alkalinity, chloride, calcium, magnesium and pH, and increasing values of free CO_2, dissolved oxygen and total iron.

A total of 161.6 lakhs eggs were collected from the three bundhs. Fertilization varied from 76.5–82.0% and hatching was estimated at 62% in Nain, 60.7% in Alipura No. 2 and 19.6 % in Sonar bundh.

Project : 24 Freshwater Urban Aquaculture

Problem : 24.1 Intensive rearing of Indian major carps in circulatory filtering system.

Personnel : V. G. Jhingran, A. V. Natarajan, K. L. Sehgal, B. B. Ghosh and Kuldip Kumar

Duration : Two years

During the year under report, fingerling rearing of *Catla catla*, *Labeo rohita* and *Hypophthalmichthys molitrix* was undertaken. The rearing of fry to fingerlings of both Indian and exotic carps for periods ranging from 29-39 days proved highly economic in utilization of time and space. In case of catla fry stocked @ 4.2 lakhs/ha, the average length increased from 27 mm to 79 mm in 39 days with 73.2% survival. The fry were fed @ 8–10% body weight four times daily on compound formulated mash comprising defatted soyabeans (60%), fish meal (20% with crude protein (level 25%) rice bran (10%), mustard oil cake (10%), wheat starch (10% used as binder) and vitamin mineral premix @ 5 g/kg feed. Similarly in case of *L. rohita*, rearing of fry for the same period has shown 97% survival. The average size attained by fry was 83.0 mm from an initial size of 20-25 mm. The feed conversion ratio was 1.0 to 1.4.

In case of silver carp rearing, the fry (23.0 mm) stocked @ 5.0 lakhs/ha attained an average length of 83.0 mm with 97.0% survival. The fry were fed on formulated compound mash and crumbles 4 times daily 8–10% body weight. The rate of feed conversion was 1 : 1.5.

In a subsequent experiment of rearing advanced fingerlings of *L. rohita* at 4-6 lakhs/ha stocking density, 84% survival was achieved. The fish with an initial length of 108 mm and 10 g in weight had grown to 195 mm in length and 33 g in weight. The fingerlings were fed on formulated agglomerates diet containing fish meal 25%, rice bran 30%; ground nut oil cakes 30%; wheat bran 5% and wheat starch as binder 10% ; and poultry live stock mineral premix 5g/kg feed. The rearing period was 85 days.

The crude protein content of agglomerate ranged 21.4-23.0% while its water stability ranged 90-100 minutes. The feed was kept in baskets hung in the pond at six different points. The feeding rate ranged from 5.0-3.0% body weight at water temperature range 26.0-32.5°C. The feed conversion rate was 1 : 2.2. In this experiment the water circulation was provided for six hours a day throughout the rearing period.

Problem : 24.2 (Completed in 1978)
24.3 (Suspended in 1979)

Project : 25 Beel fish ries

Problem : 25.1 Ecology and fishery management of a selected beel in Assam.

Personnel : Ravish Chandra, M. Choudhury, V. Kolekar and R. K. Singh

Duration : Five years

Investigations on culture of common carp in pens were carried out in Dighali beel. No significant difference was observed in the quality of the water of the pen and the beel in respect of pH, DO, CO_2 CO_3, HCO_3 and PO_4. Fingerlings were stocked @ 25 fingerlings per sq. m. Sampling was done weekly and fishes showed an average increment of 10 mm/month. The fishes were fed with oil cake and rice bran in the ratio of 1 : 1 and the feeding was done @ 8% of the body weight.

Plankton analysis :

Plankton samples were collected from different sectors of the beel. Average monthly occurrence of plankters was 637 u/l which consisted 347 u/l of phytoplankters and the rest of zooplankters. The common genera observed were *Spirogyra, Mougeotia, Ulothrix, Navicula, Tabellaria, Synedra, Fragilaria, Surirella, Oscillatoria, Anabaena, Cosmarium, Desmidium, Microsterias*, etc. among the phytoplankters and *Asplanchna, Filinia, Brachionus, Lecane*, Nauplii, *Cyclops, Ceratium*, etc. among the zooplankters.

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

Problem : CFCSP 1.1 Composite Fish Culture and Seed Production

Personnel : V. R. P. Sinha (upto 9.7.1979), S. B. Singh, K. K. Sukumaran, K. K. Ghosh, D. V. Pahwa, M. Y. Kamal, R. M. Rao, K. N. Krishnamurthy, M. Sinha, K. G. Rao, P. M. Mathew, J. B. Rao, D. N. Mishra, B. C. Tyagi, P. K. Aravindakshan, A. Mukherjee, J. C. Markandeya, D. P. Chakraborty, P. K. Saha, B. K. Singh, P. C. Mahanta and P. N. Jaitly

Duration : Nine years

With a view to evaluate production potential as well as to augment sustained higher yield from fresh water ponds, composite fish culture experiments by adopting different combinations of Indian and exotic carps were continued at a number of centres of the project located at various states to cover wide range of varying agro-climatic zones. Fish breeding experiments were further intensified to develop easily acceptable breeding technology to overcome the present day shortage of fish seed in the country.

The Pune Centre (Maharashtra) of the project achieved the record fish production of 10,194 kg/ha/yr surpassing the previous highest production of 9,400 kg/ha/yr recorded in the experimental ponds of the Institute at Cuttack in 1974. The production now stands to be the highest recorded from freshwater ponds and is favourably comparable to the highest production records in still water ponds in the world. The other striking feature of the experiment was the use of fry (av. size : 34 mm/0.6 g) of six species of Indian and exotic carps as stocking material instead of fingerlings as is usually done. The rate of survival was highly encouraging (98.8%) indicating the feasibility of introducing fry as stocking material in scientifically managed, ponds free from predators, in another experiment, with five species combination (i. e., excluding grass carp) and fry as stocking material, the production obtained was 7,043 kg/ha/yr.

Fish Seed Production : Indian and Chinese carps were successfully spawned in all the centres of the project. Breeding of grass carp at Bhavanisagar centre and catla at Kalyani centre was achieved for the first time. A total number of about 190 7 lakhs spawn comprising 113.374 lakhs of Indian major carps, 6.366 lakhs of Chinese carps and 70.965 lakhs of common carp were produced at various centres.

Problem : CFCSP 1 2 Composite Fish Culture and Fish Seed Production (Centrally Sponsored/Agricultural University based centres).

Personnel :	V. R. P. Sinha (upto 9.7. 1979), S. B. Singh, S. K. Mohanty, P. E. B. Menon, C. N. Patel, N. Sukumaran, R. L. Thawait, P. V. Rao, S. A. Kadri, V. R. Khadre and N. Ramanathan.
Duration :	Four years

The Centrally sponsored centres have shown highly encouraging results in terms of improvement in the rate of fish production. At Kausalyagang Centre (Orissa), production corresponding to 2,934 kg/ha/8 months with provision of both supplementary feed and fertilizers 1,528 kg/ha/9 months with supplementary feed alone and 1,348 kg/ha/yr with fertilizers alone (cattle dung) was obtained. At Coimbatore centre (Tamil Nadu Agricultural University) production ranged from 1,804 kg/ha/12.5 months to 2,363 kg/ha/14 months At Tuticorin, production to the tune of 1,289 kg/ha/190 days and 2,072 kg/ha/200 days in 2 ponds could be achieved. At Durg centre (Madhya Pradesh), fish production obtained in 11 months with supplementary feed and fertilisers was 2,487 kg/ha; with fertilizers alone the production was 2,276 kg/ha, and with the use of rice bran only as supplementary feed the production was 1,149 kg/ha. At Godhra centre (Gujurat) experiments on composite fish culture are in progress.

Fish Seed Production : At Kausalyagang centre (Orissa), 155 99 lakhs spawn of carps were produced comprising 85.44 lakhs spawn of Indian major carps, 0.10 lakhs of Chinese carps and 70.45 lakhs of common carp. At Godhra centre (Gujurat) 30 45 lakhs of Indian major carps and 1.3 lakhs of common carp spawn could be produced. At Tuticorin centre (Tamil Nadu Agricultural University) 3.0 lakhs of Indian major carps and 0.35 lakhs spawn of Chinese carps were produced through induced breeding. Some of the fish seed produced were reared in the ponds at different centres upto fingerling stage and much of the fish seed was handed over to the respective state fisheries departments.

Problem : CFCSP 2	(Research work completed in 1977)
Problem : CFCSP 3 & 4	(Research work suspended in 1979)
Problem : CFCSP 5	(Research work suspended since 1975)
Problem : CFCSP 6	Biology and role of grass carp, *Ctenopharyngodon idella* in composite fish culture
Personnel :	K. K. Sukumaran
Duration :	Three years

The experiments initiated during the year could not be continued due to some technical difficulties.

Problem : CFCSP 7 & 8	(Research work completed in 1978)
Problem : CFCSP 9	(Research work suspended since 1978)
Problem : CFCSP 10	Operational Research Project on composite fish culture
Personnel :	B. K. Sharma, M. K. Das, S. R. Das and Dilip Kumar
Duration :	Seven years

Demonstration on composite fish culture :

Demonstrations for transfer of technology of composite fish culture and integrated fish-cum-livestock farming were given in the ponds of the farmers. Production ranging from 3,000 to 4,225 kg/ha/yr was obtained while earlier average yield from these ponds before

adoption of composite fish culture technology was only about 700 kg/ha/yr.

Fish-cum-livestock farming : One of the serious constraints in composite fish culture technology is the high input requirement of fish feed and pond fertilizer. To overcome this, attempts were made to evolve suitable farming systems of combining live stock raising with composite fish culture and to standardise the number of animals required per unit water area for proper manuring and high fish yields without the use of pond fertilizers and fish feed. Integration of piggery and duckery with fish culture has given encouraging results rendering the technology a low-input one.

Fish-cum-pig farming : Three experiments have been conducted on fish-cum-pig farming in pond having an area range of 0.1 to 0.5 ha. Pigs were reared in pig-sties where they have been fed on concentrate pigsmesh and green cattle fodder. The pig-dung collected from the pigsties was recycled in the ponds stocked with catla, rohu, mrigal, silver carp, grass carp and common carp fingerlings at a stocking density ranging from 6,000 to 9,000 fingerlings/ha. No conventional feeding to fish or fertilization of pond was made. Fish production ranging from 6,750-7,300 kg/ha/yr and 4,018 kg/ha/6 months were obtained besides 1,095 and 720 kg of pig flesh using the exotic and indigenous varieties of pigs for rearing experiments. The cost of production of fish worked out to be as low as Re. 0.93 per kg of fish.

Fish-cum-duck rearing : Fifty ducks were reared in a 0.5 ha pond along with fish, *viz.*, catla, rohu, mrigal, silver carp, grass carp and common carp which were stocked @ 6,040 fingerlings/ha. The ducks were given free range during day time over the entire pond surface where duck droppings were automatically recycled in the pond thus aiding in pond fertilization. At night the ducks were sheltered in floating duck house within the pond. Droppings collected from the duck house were released in the pond every morning. No conventional fish feeding and pond fertilization were done. Fish yield of 4,300 kg/ha/yr along with 125 kg of duck flesh and 835 eggs were obtained. The cost of production worked out to be Rs. 1.40 per kg of fish.

This integrated system of fish-cum-livestock farming ensures bright possibilities of attaining high animal protein production at low cost.

Problem :	CFCSP 11	Biology of silver carp, *Hypophthalmichthys molitrix* (C & V) and its performance in composite fish culture
Personnel :		B. K. Sharma
Duration :		Five years

The work could not progress due to some technical difficulties.

Problem :	CFCSP 12	(Research work suspended since 1978)
Problem :	CFCSP 13	Composite fish culture for demonstrations to fish farmers
Personnel :		P. Das, Dhirendra Kumar, B. Roy and U. Bhowmik
Duration :		Two years

The demonstration-cum-production oriented experiment initiated in a pond (0.25 ha) at V. C. College, Rahara, Khardah during 1978 has been completed during the year under report. To start with, the pond was stocked with catla, rohu, mrigal and silver carp @ 7,000 fingerlings/ha in the ratio of C2. 25 : R2.0 : M 3.5 : Sc 2.25. Though the Indian major carps were stocked during September 1978, the stocking of silver carp was done in two instalments one during September 1978 and the other during January 1979. The management measures adopted in this experiment included fertili-

sation of pond with inorganic and organic manures, and provision of supplementary feeding. Harvesting of the pond was done during September 1979 and a total quantity of 1,432.83 kg of fish was removed. The gross and net production worked out on the basis of the above yield were 5,731.32 and 5,556.1 kg/ha/yr respectively. Seven demonstrations were organised on various steps involved in composite fish culture for the farmers and interested persons during the course of the experiment.

Problem : CFCSP 14 (Research work suspended since 1978)

Problem : CFCSP 15 (Research work completed in 1977)

Problem : CFCSP 16 (Research work suspended since 1978)

Problem : CFCSP 17 (Research work completed in 1977)

Problem : CFCSP 18 Fish nutrition : 1. Protein, carbohydrate & vitamin requirements of certain Indian major carps in relation to temperature

Personnel : B. N. Singh and V. R. P. Sinha

Duration : Two years six months

The experiments with synthetic diets fortified with vitamins similar to those used for studies on mrigal were initiated on rohu and catla fingerlings. However, the ongoing experiments had to be terminated due to some technical difficulties. Further experiments are being initiated with synthetic diets.

Problem : CFCSP 19 Use of some cactii as piscicide

Personnel : Dilip Kumar

Duration : Two years

Experiment could not be taken up during the year due to some technical difficulties.

Problem : CFCSP 20 Popularisation of modern aquaculture techniques

Personnel : P. Das, D. Kumar, U. Bhowmik and B. Roy

Duration : Continuing work is in progress

Problem : CFCSP 21 Biology of *Puntius gonionotus* in composite fish culture ponds

Personnel : M. Sinha, P. K. Saha

Duration : Two years

Breeding of *Puntius gonionotus* was done during the year by hypophysation. The species was stocked in two ponds of 0.23 ha and 0.15 ha in March, 1979 along with other five species (catla, rohu, mrigal, silver carp and common carp). In one pond weed was given in addition to conventional supplementary feed. In the other pond no weed was given. This was done to study the growth of fish in composite fish culture ponds with and without weed. After 8 months of culture the average weight of this species recorded was 370 g (in pond with weed) and 250g (in pond without weed). Studies on maturity and fecundity are in progess.

Problem : CFCSP 22 (Research work kept in abeyance)

Problem : CFCSP 23 Oxygen requirement of the fish biomass in composite fish culture pond

Personnel : Dilip Kumar

Duration : Two years six months

The work had to be kept suspended during the year due to some technical difficulties.

Problem : CFCSP 24 Study of the causative organisms of parasitic fish diseases in the integrated fish farming ponds

Personnel : Manas Kumar Das, B. K. Sharma, S. R. Das, Dilip Kumar

Duration : Four years

A total of 370 diseased fishes from the various intensive fish culture ponds were examined systematically for the causative organisms of the disease. Four new species of protozoa (Cindospora : Myxosporidia) were established causing pathogenic manifestations in the host fishes.

Myxobolus rohitae affecting the scales of the host fish *Labeo rohita*, when present in large numbers causes perforations on the scales of the host fish. In very acute cases deformities and degeneration of the scales occur accompanied by secondary infection by fungus which results in fish mortality.

Myxobolus asymmetricus affecting the internal eye muscles of *Catla catla*, when present in large numbers causes swelling of the exopthalmus and protrusion of the eye. Infected fishes were found to be sluggish and had retarded growth.

Thelohanellus ophthalmicus n. sp. affects the eyes of *Catla catla*. The parasites are located in the internal eye musculatures and sclera of the eye. The parasites are often found along with *M. asymmetricus*, causing pronounced swelling of the exopthalmus in the host's eye.

Henneguya namae affects the gill of the fish *Ambasis nama*. Though apparently pathogenicity is not visible, excessive mucus secretion shows an indication of disease. The work in relation to the pathogenic effect of the protozoan parasites on the fishes and method of their effective control is in progress.

Project : ABF All India Coordinated Research project on Air-Breathing Fish Culture

Problem : ABF 1 Air-breathing fish culture

Personnel : P. V. Dehadrai, R. N. Pal, Subir K. Mukhopadhyay, Protap K. Mukhopadhyay, R. K. Das, S. C. Pathak, Y. S. Yadav, N. K. Thakur, S. K. Munnet, M. P. Singh Koli, V. K. Murugesan and P. Kumaraiah

Duration : Eleven years nine months

Technical and economic viability of the air-breathing fish culture technology was demonstrated at various centres of the project. Low-cost input technology of air-breathing catfish culture in small shallow ponds yielded very high production and proved to be highly profitable. Production of 5540 kg/ha/5 months of *H. fossilis* was achieved at the Gauhati centre in a small pond of 0.015 ha using mixture of rice bran, mustard oil cake and fish meal and a mixture of rice bran and fish offal/poultry feed gave a production of 4212 kg/ha/11 months at the Patna centre. Under intensive culture system a record production of 6890 kg/ha/9 months of singhi was achieved at the Kalyani centre. Technique of induced breeding of air-breathing fishes by hypophysation in specially prepared paddy fields has been standardised and demonstrated to farmers at different centres of the project.

Problem : ABF 2 Nutrient balance of the soil and water in weed infected swamps

Personnel : R. K. Das and P. V. Dehadrai

Duration : Four years

A novel method of removing the weeds and regular raking of the swamp bottom has proved to be successful in bringing the nutrients into water phase in stages and sustain higher level of primary production. The estimated nutrient level in the bottom soil of a swamp at Kalyani was as high as 2386 kg/ha of available nitrogen

and 1727 kg/ha of available phosphorus which when raked twice a month could maintain the optimum carrying capacity for 10 years without any fertilization or manuring. The other beneficial effects of raking were gradual increase of pH from acidic to neutral, sharp rise in alkalinity, release of toxic gases from the bottom soil and increase in the dissolved organic matter content of the water which adds to the productivity of the swamp.

Problem : ABF 3 Food conversion among air-breathing fishes and studies on the effect of photoperiod and temperature on the gonadal maturity of *C. batrachus*

Personnel : R. N. Pal, P. V. Dehadrai and R. K. Das

Duration : Two years

Work could not be carried out as the Principal Investigator was on training at U. S. A.

Problem : ABF 4 & 5 (Research work completed in 1977)

Problem : ABF 6 Nutritional and Biochemical studies on Air-breathing Catfish, *Clarias batrachus*

Personnel : P. K. Mukhopadhyay, P. V. Dehadrai, and S. K. Mukhopadhyay

Duration : Four years

Protein requirement of *Clarias batra hus* has been found out at summer and winter temperature using standard test diet. The optimum protein level for maximum growth of *Clarias* was found to be 45%. Studies on the digestive physiology and enzymatic activities have been given valuable basic information which will be used in formulating artifical feed for semi- and intensive culture of air-breathing cat fishes.

Problem : ABF 7 (Research work completed in 1977)

Problem : ABF 8 (Research work merged with Problem ABF 13

Problem : ABF 9 (Research work completed in 1977)

Problem : 10 (Research work merged with ABF 3)

Problem : ABF 11 Economic potential of Air-breathing fish culture and plans for its development in certain pockets of West Bengal.

Personnel : P. V. Dehadrai, M. Randhir, R. N. Pal, S. K. Barua and P. N. Bhattacharya.

Duration : Two years

Work suspended as the Senior Economist was transferred to Bhubaneswar.

Problem : ABF 12 (Research work completed in 1977)

Problem : ABF 13 Some aspects of toxicity and metabolism of malathion and carbonuron in the air-breathing catfish *Clarias batrachus* in relation to its culture in paddy fields

Personnel : P. K. Mukhopadhyay (in collaboration with Dr. D. K. Dube of Biochemistry Department, Calcutta University) and P. V. Dehadrai

Duration : Two years

Increased activities of the microsomal drug metabolising ensymes, N- and O- demethylase and the haemoprotein, cystochrome P-450 in the liver and gills of *C. batrachus* exposed to 1.0 ppm malathion indicated that organs other than liver may be of importance in the biotransformation of environmental xenobiotics. Sustained increase in the activity of these enzymes in *Clarias* under malathion indicated gradual development

of a tolerance mechanism by virtue of which it would well thrive in the pesticide contaminated environment.

Problem : ABF 14 Investigations on the possibilities of NPN utilisation by the catfishes, *Clarias & Heteropneustes*

Personnel : P. V. Dehadrai and P. K. Mukhopadhyay

Duration : Two years

Synthetic test diets containing different levels of urea were fed to air-breathing catfishes and the effects on growth. body composition in regard to proximate principles, certain macromolecular constituents of blood and tissues viz. total protein, urea, glucose, total ascorbic acid etc. and few enzymes of nutrient and energy matabolism viz. aminotransferances, glucose 6-phosphatase, urease, alkaline phosphotase have been investigated. The fate of NPN in the body of the fishes was also determined by isotopic studies through the location of 15 N in different tissues after feeding the fishes with 15N urea and assimilation of NPN by the air-breathing catfishes has been positively ascertained.

Problem : ABF 15 Study on some biochemical factors in the eggs of *clarias* and *Heteropneustes*

Personnel : S. K. Mukhopadhyay, P. V. Dehadrai and P. K. Mukhopadhyay

Duration : Two years

Protein and lipids have been isolated and q alitative study of protein and lipids is being carried out.

Problem : ABF 16 Intensive culture of *clarias batrachus* and *Heteropneustes fossilis*

Personnel : P. V. Dehadrai, S. K. Mukhopadhyay, P. K. Das and P. N. Bhattacharya

Duration : Six months

Intensive culture of magur and singh iwere carried out in newly constructed 0.1 ha and 0.04 ha ponds respectively. Magur was fed with dried marine trash fish, epic fish feed and bio-gas slurry (1 : 2 : 7) and singhi was fed with epic fish feed and bio-gas slurry (2 : 8). However, the envisaged target production could not be achieved due to complete failure of water management system.

Problem : ABF 17 Intensive culture of *clarias batrachus*

Personnel : S. C. Pathak and Y. S. Yadav

Duration : Six months

Mixed culture of *H. fossilis* and *C. batrachus* in the ratio of 1 : 1 at a stocking density of 1,20,000 per hectare in a 0.1 ha pond gave a production of 5042.75 kg/ha/year.

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

Problem : R 1 Ecology and fisheries of freshwater reservoirs

Personnel : A. V. Natarajan, G. K. Bhatnagar, Ch. Gopalakrishnayya, V. R. Desai, Y. Rama Rao, M. Ramakrishnaiah, A. Mathew, B. P. Gupta, V. V. Sugunan, R. K. Singh, V. Pathak,

N. P. Shrivastava,
D. K. Kaushal, S. N. Singh,
V. T. Prabhakaran and
(Smt.) G. K. Vinci

Duration : Continuing

Bhavanisagar (Tamil Nadu)

Both the total inflow and total outflow of water during the year were almost equal, recording an increase over 1978. Maximum rainfall was recorded during November, the total for the year (980.50 mm) being considerably higher than during 1978 The average water level in the reservoir was maximum (919.55 ft) during January and minimum (907.99 ft.) during July. Atmospheric temperature was maximum during April and May (39°C) and minimum during January (18°C). The monthly average wind speed was maximum (11.08 km/hr) during August and minimum (2 km/hr) during November and December

The total landing was 192 t giving a production of 51.86 kg/ha. *L. calbasu* ranked first with a total landing of 59,189 kg (30.81%) followed by *M. aor* (42,827.5 kg, 22.30%) and *W. attu* (27,254.5 kg, 14.19%). The recorded increase in the total landings however was not proportionate to the increase in fishing effort.

Studies on the breeding biology of *L. calbasu*, *O. bimaculatus* and *P. dorsalis* were continued.

Experimental fishing using 28 gill-nets each with a hung length of 35 m and varying in mesh size from 60–300 mm yielded an average daily catch of 57.751 kg in 35 days, fishing in the lotic sector, 32 kg in 28 days' fishing in the moyar sector, 26.3 kg in 33 days' fishing in the intermediate sector and 14.5 kg in 40 days' fishing in the lentic sector confirming the earlier results. The Gangetic major carps *Catla catla*, *L. rohita*. *L. calbasu* and *C. mrigala* were available in 130-260 mm meshed nets.

A total of 2,19,313 fingerlings comprising 1,89,729 *C. mrigala*, 29,484 *L. fimbriatus* and 100 *C. catla* were stocked in the reservoir.

An experiment on pen culture of carp seed was undertaken in a 0.025 sq m pen constructed in Poongar swamp by enclosing the area with bamboo frames provided with an inner lining of 1/32″ meshed nylon netting and stocked at 4.6 million spawn/ha. The stock was thinned on the 30th day and rearing of the remaining seed continued for another 60 days. The initial harvesting of fry after 30 days gave a production of 7.83 lakhs/ha while that of fingerlings 4.96 lakhs/ha, the total production being 12.79 lakhs/ha with an overall survival of 27.8%. A total of 260 kg of feed was used during the 90 days' experiment.

Nagarjunasagar (Andhra Pradesh)

The total rainfall was 579.65 mm as against 735 mm during 1978. The total inflow (17,026, 443 cusecs) being less than that of last year, the water level in the reservoir was also low (548.63 ft.) resulting consequently in a reduced water-spread area (2,528.36 m sq ft.).

A study of the hydrobiological parameters indicated water temperature to range from 25.5° (February) to 29.0°C (April), transparency 25.5 (August) to 350.0 cm (January), pH 8.0 (August) to 8.6 (April and January), bicarbonate alkalinity 15.84 (August) to 129.98 ppm (March), calcium 22 (August) to 38 ppm (March), Magnesium 6.48 (August) to 14.40 ppm (March), total hardness 72 (August) to 155 ppm (March), dissolved oxygen 5.58 (January) to 7.12 ppm (August), ammoniacal nitrogen 0.12 (May) to 0.20 ppm (April), nitrate nitrogen 0.18 (April) to 0.60 ppm (March), phosphorus traces to 0.001 ppm, iron 0.08 (January & April) to 0.60 ppm (February), silica 20 (August) to 38 ppm (January) and specific conductivity 250 (August) to 805 m mhos/cm (March). A general increase in the values of bicarbonate alkalinity, calcium, magnesium, total hardness, dissolved

oxygen, silica and specific conductivity was observed over that of 1978 while water temperature, transparency and iron showed a decrease. Chemical stratification with regard to pH, bicarbonate alkalinity and specific conductivity was recorded from 21 to 24 m contining upto 39 m in January, and at 21 m in April and May.

Net primary production ranged from 323.31 (intermediate sector) to 699.60 mgC/m²/day (lentic sector), the average for the whole reservoir (510.56 mgC/m²/day) showing an increase over that of 1978. The average plankton production in the reservoir (3.569 ml and 40,79,086 units/m³) also showed an increase over that of 1978. April was the most productive month (23.778 ml/m³) when 70.703 ml of plankton/m³ was recorded from Peddamunagal Bay. Diatoms forming 79% (by number) of the total plankton yield dominated during January and were followed by myxophyceae (20%) which attained its peak during April. Zooplankton production reached its peak during July and was at its minimum during August.

Recruitment studies indicated *Salmostoma phulo phulo* (46.33%), *Rhinomugil corsula* (12.86%), *Ambassis nama* (12.67%), *A. baculis* (7.29%), *Macrobrachium lamarrei* (7.10%), *Glossogobius giuris* (6.33%), *Osteobrama cotio* (5.56%) and miscellaneous (1.86%) in the drag net catches, young of Gangetic major carps being conspicuous by their absence.

Based on 9 months' sampling, fish yield from the the reservoir was estimated at 178.6 t showing a decline of over 9.8 t over 1978. Lentic Sector and its bays contributed the bulk (43.1%) of the total landings, followed by Peddamunagal Bay (27.3%), lotic sector (19.9%) and intermediate sector (10.6%). Carps accounted for 25.8%, catfishes 66.1% and miscellaneous 8.1%. Among carps, Gangetic carps accounted for 7.4%, the increase being probably due to stocking programmes undertaken in recent years. *P. pangasius* (27.06%) followed by *M. aor* (18.26%), *S. childrenii* (12.66%) and *M. seenghala* (6.55%)dominated among catfishes, the former two being predominant in lentic sector while *S. childrenni* dominated in the lotic sector and *M. seenghala* the Peddamunagal Bay. *L. fimbriatus* (10.43%) and *L. Calbasu* (6.22%) were forth and sixth in term of total landings, both dominant in the Lentic sector.

Biological studies on *L. fimbriatus*, *L. calbasu*, *T. khudree*, *S. childrenii*, *M. seenghala*, *P. pangasius*, *M.* aor, *P. taakree* and *O. vigorsii* were continued. In *L. fimbriatus* the average length from scales for 1 to 5 years was estimated to be 265, 370, 461, 540 and 587 mm with corresponing weight at 189, 565, 1165, 1958 and 2571 g. In *P. pangasius*, length at 1 to 6 years was estimated from pectoral spines to be 302, 415, 510, 595, 658 and 704 mm with corresponding weight at 184, 494, 939, 1156, 2069 and 2561 g In *M. aor*, pectoral spines indicated the length for 1-5 years to be 257, 382, 480, 558 and 620 mm with corresponding weight being 80, 262, 520, 819 and 1125 g. Commercial fishery is mainly sustained by the III and IV year groups.

Getalsud reservoir , Bihar)

The soil of Getalsud reservoir is acidic (pH 6.0) in nature. Organic carbon (0.68%), available nitrogen (35.9 mg/100 g) and available phosphorus (4.5 mg/100 g) showed an average nutrient status of the basin soil.

Depth profile studies showed the presence of a thermocline during April (a fall of 1.2°C at 10-11 m depth) and May (a fall of 1.6°C at 4-5 m depth and again a difference of 1.2°C at 8-9 m depth) in the lentic sector alone. Chemical stratification was also recorded in the lentic sector alone in respect of pH, dissolved oxygen, carbondioxide, and bicarbonate alkalinity during April between 6-7 m. Though the depths at which chemical stratification occurred during May and June varied, there was no stratification with respect to pH and bicarbonate alkalinity in June.

Plankton maxima were observed during February-March, plankton production being minimum during

monsoon months. Myxophyceae among phytoplankton and rotifers and copepods among zooplankton were the dominant forms.

Benthic organisms were more abundant in the lotic sector than in other sectors.

Experimental fishing indicated that the maximum catch (6.26 g/m^2) was obtained in gill nets having 40 mm mesh bar ; the species composition of the catch being *C. mrigala*, *C. reba*, *L. bata*, *L. calbasu*, *L. rohita*. *M. corsula*, *P. sarana*, *O. pabda*, *R. cotio*, *N. notopterus*, *M. armatus*, *C. catla*, *G. giuris* and *O. bacaila*. Studies on the food and feeding habits of 11 species of trash fishes from the reservoir indicate that they feed on phytoplankton and decayed organic matter. Breeding of major carps of the reservoir was a failure due to drought.

2,81,112 fingerlings (50-75 mm) comprising 60% catla, 25% rohu and 15% mrigal were stocked in the reservoir.

Govindsagar (Himachal Pradesh)

Total rainfall was 313.97 mm. The water level in the reservoir fluctuated by 103.21, from a minimum level of 1555.95' in June to 1659' in October. The mean monthly inflow and outflow ranged from 5918 (December) to 53871 cusecs (July) and 17486 (February) to 27042 cusecs (July) respectively. Studies on reservoir plankton showed that the average density both by volume (1.511 ml/m^3) and numbers (64229 u/1) was far below the average planktonic biomass produced during 1978. Lentic zone and its main stream, Lunkher Khad recorded the maximum standing crop of plankton. However, phytoplankton predominated over zooplankton in all the zones. Benthic fauna in the lotic zone comprised mainly insect larvae during October to December.

The total fish landing was estimated at 618.7 t as against 827 t during 1978, the catch/ha being about 59 kg. *C. carpio* (30.72%) continued to dominate the catch followed by *L. dero* (23.09%), *C. mrigala* (16.84%), *L. rohita* (14.72%), *C. catla* (5.50%) and *H. molitrix* (5.18%). A consistent increases in the landings of *C. carpio*, *C. mrigala* and *H. molitrix* has been observed.

A total of 7,43,760 fingerlings of *C. carpio* were stocked in the reservoir by the State Department.

Experiments have been initiated on the cage culture of silver carp in the reservoir.

Rihand reservoir (Uttar Pradesh)

Commercial fishing started from March this year and the yield from the reservoir was estimated at 99.16 t. Though the number of fishing units/day was more or less the same during September to December, the catch/net/day dropped from 0.494 (September.) to 0.186 kg (December). The average catch/net/day was 0.432 kg as against 0.668 kg during 1978. A decreasing trend in the catches with increasing fishing effort is confirmed.

Experimental fishing with multi-meshed (20 to 150 mm) gill nets in the intermediate sector during April gave a yield of 0.005 kg/net/hour. *S. silondia* (68.93%) followed by *C. garua* (17.55%) dominated the catches. The highest catch (39.71%) was contributed by 80 mm meshed net followed by 40 mm (19.46%) and 45 mm (17.88%).

a) Research completed :

Since the Institute embarked on time bound project programe in 1967, investigations on 129 problems ; i. e., one problem in the year 1969, seven in 1970, four in 1971, nineteen in 1972, twenty four in 1973, five in 1974, eleven in 1975, sixteen in 1976, twenty eight in 1977, eleven in 1978 and fourteen in 1979 were completed. Brief reports of the problems completed during 1979 are presented below :

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

Problem : 1.22.1 Culture and life history of cladocera
Personnel : D. R. Kanaujia
Duration : Two years

Life-history and culture possibilities of commonly occurring cladocerans in fish ponds namely *Simocephalus vetulus*, *Ceriodaphnia cornuta* and *Miona micrura* were studied under laboratory conditions. *S. vetulus* multiplied best in pond water containing nannoplankton and hence could be cultured in water with microphusoplankters. *C. cornuta* was successfully cultured in media with cowdung or in combination with chemical fertilizers. *M. micrura* could be easily cultured in pond water.

Effect of temperature and food on the number of eggs, instar duration and longevity were studied in respect of the three species and *Daphnia lumholzi* as well. Final report is being prepared.

Problem : 1.30 Fish culture in rural areas in Orissa
Personnel : C. Selvaraj, M. A. V. Lakshmanan and A. N. Mohanty
Duration : Five years

The demonstrations in fish seed rearing and fish culture carried out in some selected villages in Puri and Cuttack Districts indicated the possibility of extending the technologies of fish culture to several areas.

The response of the farmers and the results of their work on fish seed rearing revealed the possibility of making many villages self-sufficient in quality fish seed. When the seed is made available to the farmers within their village area itself many farmers take to fish farming on scientific lines. This assures (1) a profit to the farmers through seed raising and (2) availability of quality fish seed.

The villagers of Korapada could achieve a production of 3435 kg/ha/13 months in their community pond of 0.08 ha yielding a net profit of Rs. 2,287/-. When the farmers are convinced of the profitability and viability of the technology for improving their financial conditions through practical demonstrations carried out in their ponds, they start renovating the derelict ponds or taking up the fallow ponds on lease for initiating scientific fish farming.

The studies pointed out the constraints encountered by the farmers in adopting the technology of composite fish culture. The non-availability of quality fish seed in adquate quantity and the wide gap between the results of research on one hand and their application in the field on the other due to lack of proper extension service are some of the principal constraints. Hence the work on demonstration of different aspects of scientific fish culture should be intensified to generate greater awareness among the farmers about the profitability in adopting the technologies. When the major constraints impeding the progress of rural aquaculture development are removed, more stress has to be placed on establishing more spawn production centres to meet the ever-increasing demand for quality fish seed in rural areas.

Problem : 1.31 Use of anaesthetics in transport of carp seed
Personnel : S. N. Dutta and S. N. Mohanty
Duration : Four years

Among tertiary amyl alcohol, chloral hydrate and amyl alcohol tried as anaesthetics in fish seed transpor-

tation, better survival of fry of Indian major carp wa recorded with tertiary amyl alcohol.

Fry packed in sealed polythene bags treated with tertiary amyl alcohol+oxygen resulted in remarkably high survival (98 per cent) even after 24 hrs. exposure.

1.39 : Final report is being prepared

1.41 : Final report is being prepared

Project 5 : Brackishwater fish farming

Problem : 5.34

: Stock manipulation in ploy culture of freshwater carps, brackishwater fishes and prawns in low saline ponds at Bakkhali

Personnel : A. V. P. Rao, P. K. Ghosh, B. B. Pakrasi, A. N. Ghosh, Mrs. T. Rajyalakshmi, D. D. Halder, R. K. Banerjee, A. K. Roy, S. M. Pillai, R. K. Chakraborty and P. K. Chakraborty

Duration : Three years

Polyculture of freshwater carps, brackishwater fishes and prawn was carried out under the programme of stock manipulation in a coastal low saline pond at the Bakkhali fish farm. The seeds of Indian and exotic carps for these experiments were procured from Kakdwip spawn market and Cuttack respectively, whereas the brackishwater prawn and fish seeds were locally collected by operating shooting nets in creeks adjacent to the farm. Before the initiation of each experiment the stocking ponds were scientifically prepared during which period the seeds were tentatively reared in nursery ponds. The pond preparation schedule included manuring of the pond with raw cowdung (@ 5000 kg/ha) and fertilisation with urea and single super-phosphate (each @ 500 kg/ha) at alternate fortnights during the entive period of experimentation.

Artifical feeding was practiced for the standing crop with rice bran, wheat powder/maize powder and mustard oil cake at the ratio of 1 : 1 : 1. The fishes were fed @ 5% of their total body weight. During summer months when the water level goes down considerably the standing crop was fed at a higher rate of 8% of the body weight. Altogether three crops were raised under this project and the details of the culture operations are furnished below :

In the first experiment (1976-77) the low saline K pond of 0.25 ha at the Bakkhali fish farm was stocked with *C. catla, L. rohita, C. mrigala, H. molitrix, C. carpio, L. tade, L. Parsia, M. cephalus, C. Chanos* and *P. monodon* @ 8000/ha. The gross and net productions obtained from this culture were 1500 kg/ha/yr and 1400 kg/ha/yr respectively. The fishes and prawns registered a total survival of 53.7%.

In the second experiment (1977-78), *C. catla, L. rohita, C. mrigala, H. molitrix, C. carpio, M. cephalus, L. tade, L. parsia, C. chanos* and *P. monodon* were stocked @ 5300/ha. In a culture duration of one year the respective gross and net production obtained were 1390.436 kg/ha/yr and 1306.936 kg/ha/yr. The overall survival of the fishes and prawns was 64.4%.

The third experiment (1978-79) was carried out with *C. catla, L. rohita, C. mrigala, H. molitrix, M. cephalus, L. tade, L. parsia* and *P. monodon* @ 8000/ha. The gross and net productions obtained from this culture were 852.608 kg/ha/yr and 790.108 kg/ha/yr, respectively and the overall survival of the fishes and prawns was 33.2%.

Physico-chemical and biological parameters of the pond were studied regularly. The adverse effect of high turbidity, which prevailed during most of period of experimentation, on plankton concentration of ponds could be significantly reduced with the application of mahua oil cake and cowdung and also due to discharge of brackishwater (upto 2 ppt) in to the stock ponds

from time to time. The respective phyto-and zooplankton concentrations of the ponds fluctuated from 180 to 1700 and 900 to 4417 units/litre in 1976-77, 150 to 300 and 950 to 1850 units/litre in 1977-78, and 100 to 420 and 800 to 3400 units/litre in 1978–79. The species encountered were *Anabaena*, *Ankistrodesmus*, *Nitzschia*, *Spirulina*, *Gyrosigma*, *Spirogyra*, *Chlorella*, *Navicula*, *Chlorobotrys*, *Mastogloea* and *Euglena* (phytoplankters), *Brachionus*, *Calanoids* and *Cyclopoids*, nauplii, *Moina* and Mysids (300 plankton).

Problem : 5.42 Final report is being prepared

Project : 16 Weed Control

Problem : 16.3.1 Standardization of preparation and application techniques of formulations for long-term control of rooted aquatics and noxious algae
Personnel : V. Ramachandran, K. M. Das and G. C. Sahu
Duration : Twelve years

Herbicides impregnated in brick pellets or coated on sand particles are found to be quite easy to prepare and effective for step-down control of several of the rooted emergent (water lilies *Nymphaea* and *Nymphoides* spp.) and submerged (*Ottelia alismoides*, *Bergia* sp. ; *Ceratophylum demersum*) aquatic weeds. 2,4-D soaked brick pellets at 5 kg a. i./ha (2 applications) gave complete control of *Ottelia alismoides* and *Nymphoides* in shallow, weed infested nursery ponds. Fresh plants germinating from burried seeds had to be controlled by repeat treatments. The pellets prepared at 5 per cent active ingredient also have similar effect when tried in two treatments of 8 and 12 kg a. i./ha. However as the rate of pellet application became less (250 kg per ha) with higher active ingredient the effect was restricted to a fewer plants only.

A 1% sand granular formulation of diuron prepared in the laboratory was effective against submerged weeds and marginal aquatic grasses *Panicum* sp. at 5 kg a. i, per hectare, and *Ceratophylum demersum* at 1-2 kg a. i./ha. Diuron was also effective against algal blooms, mats and bottom weeds at doses of 0.2 ppm a. i. (equivalent to 2.5 kg a. i./ha). It was found that the herbicide does not inhibit growth of plankton or bottom biota which increased abundantly after the clearance of the algal mats and macrophytes.

Diuron was found to be effective for control of algal blooms (*Microcystis*) also at 0.1-0.3 ppm.

Problem : 16.3.2 Control of submerged weeds by paraquat formulation
Personnel : S. Patnaik and K. M. Das
Duration : Three years

In glass jar experiments the minimum effective dose of paraquat for clearance of *Hydrilla verticillata*, *Najas indica* and *Ceratophyllum demersum* was observed to be 4 ppm, 4 ppm & 3 ppm respectively. The experiments were repeated in plastic pools having mixed infestation of the above weeds. The weeds were fully cleared with 4-6 ppm paraquat in 8-10 days. With the lower doses the kill was partial and there was subsequent regeneration from the left over viable parts of the plants. The fishes like *Cyprinus carpio* fingerlings introduced in the experimental pools were killed. In yard experiments paraquat above 3 ppm was observed to be toxic to fingerlings of *Labeo rohita*. The paraquat doses 4-6 ppm killed zooplankton while phytoplankton were not affected in yard trials.

Project : 17 Frog Farming

Problem : 17.10 Culture of earthworms for feeding frogs

Personnel : C. R. Das and V. Panigrahi
Duration : Three years

Culture experiments of *Pheretima* and *Megascolex* in laboratory, yard and field show that regular application of cowdung, roteen leaves and compost (1 : 1 : 1) in soil base at 15 days interval resulted in multiplication of the worms 25 times. Under field conditions manuring at the rate of 200 kg/ha resulted in better multiplication up to 30 times.

Project 18 : Sewage-fed fish culture

Problem : 18.1.5 Culture of *Tilapia mossambica* in ponds fertilized intensively with sewage effluent
Personnel : Apurba Ghosh, K. K. Bhanot (Smt.) and S. K. Saha
Duration : Two years

Culture of *Tilapia mossabmica* was initiated in a 0.11 pond in January. The pond was fertilised with primary treated effluents and stocked with *Tilapia* brooders @ 25,000 nos/ha in sex ratio of 3 male : 2 female. Post stocking fertilisation was done periodically. Harvesting was started from April and *Tilapia* was utilised as forage feed to magur. During early May, mass mortality of *Tilapia* occurred due to pesticide poisoning of the pond from adjoining field and only a few *Tilapia* could survive. The toxicity was removed but due to accumulation of sludge at the pond bottom, breeding activity of *Tilapia* was very much reduced during the remaining period of culture. A total of 145 kg of *Tilapia* could be fed to magur.

Project : 20 Water pollution investigations

Problem : 20.12 (Research work completed in 1979. Final report is being prepared)

Project : ABF All India Co-ordinated Research project on Air-breathing Fish Culture

Problem : ABF-17 Intensive culture of *Clarias batrachus*
Personnel : S. C. Pathak and Y. S. Yadav
Duration : Six months

Mixed culture of *H. fossilis* and *C. batrachus* in the ratio of 1 : 1 at a stocking density of 1,20,000 per hectare in a 0.1 ha pond gave a production of 5042.75 kg/ha/year.

RESEARCH CONTEMPLATED

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

Problem : 1.49 Monoculture of Indian major carps, catla, rohu and mrigal
Problem : 1.50 Fortifying conventional feeds as per amino acid requirements of carps
Problem : 1.51 Improvement in the harvesting technique in carp culture ponds

Project 2 : Induced fish breeding/physiology of reproduction

Problem : 2.16 Seasonal changes on the hypothalamo-hypophyseal complex in relation to reproduction in some freshwater Indian major carps and exotic carps

Project 3 : Reservoir fisheries

Problem : 3.17 Culture of fish in 'pens' fixed in peninsular tanks

Project 5 : Brackishwater fish farming

Problem : 5.66 Studies on nutrition of penaeid prawns, *Penaeus monodon* and *P. indicus* and the palaemonid prawn, *Macrobrachium rosenbergii*

Problem : 5.67 Cultivation of Derris plant for increasing rotenone content

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

Problem : 5.69 Pen culture of penaeid prawns, *P. indicus*, *P. monodon* and *P. semisulcatus* in coastal waters of Chilka Lake

Project 6 : Freshwater prawn culture

Problem : 6.8 Rearing technique for the palaemonid prawns

Problem : 6.9 Culture of fishes and prawns in pens and cages

Project 11 : Economics in fishery investigations

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

Problem : 11.12 Economic feasibility study of a well-laidout fish farm with dependable water supply and determination of minimum economic size of a farm

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

Problem : 11.14 Cost price structure of aquaculture in eastern region of India

Project : 14 Riverine and estuarine fish catch statistics

Problem : 14.17 Assessment of wanton destruction of early juveniles of commercial species in upper Hooghly Estuary

Project 15 : Fish pathology

Problem : 15.2 Investigations on the parameters of fish blood to monitor fish health in culture fishery operations

Problem : 15.3 Studies on microbial activity on treatment of organic manure and subject to feed resources of fish culture ponds

Problem : 15.4 Histo-pathology of diseased fishes

Problem : 15.5 Isolation of bacteria causing fish diseases ; establishment of certified fish cell lines

Project 16 : Weed control

Problem : 16.14 Studies on aquatic weed biocoenoses

Project 17 : Frog Farming

Problem : 17.14 Breeding of the commercially important frogs and raising the tadpoles upto froglets stage to replenish natural population

Project 25 Beel Fisheries

Problem : 25.1 Pen culture and study of ecology and Fishery management of a selected beel in Assam

Problem : 25.2 Ecology and fisheries of beels

Project 26 Energy Flow in Aquatic Ecosystem

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

Project 27 Radio-Tracer Technique

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

Problem : 27.2 Studies on transformation and fate of applied nitrogenous fertilisers in freshwater ponds and swamp using 15-N

Project 28 Adaptive Research in Fish Culture

Problem : 28.1 Low cost fish culture in the village ponds

Problem : 28.2 Utilisation of domestic/kitchen ponds for fish culture.

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

Project 29 Fish Nutrition and Feed Technology

problem : 29.1 Aminoacid profile and proximate composition of conventional fish feeds

Problem : 29.2 Aminoacid requirements of Asiatic carps, rohu, *Labeo rohita*, catla, *Catla catla*, mrigal, *Cirrhinus mrigala*, silver carp, *Hypophthalmicthys molitrix* and grass carp, *Ctenopharyngodon idella*

Project 30 Cat Fish Culture

Problem : 30.1 Poly culture of *Pangasius pangasius* and *Mystus* spp.

Project 31 Inland Fisheries Resource Assessment

Problem : 31.1 Assessment of (i) fisheries resources of Ganga River System-principal channel (ii) carp seed resources and potential of Ganga River System (iii) fisheries resources of the H. M. Estuarine System

Project 32 Rural Aquaculture Praject

Problem : 32.1 Use of biogas slurry as fish feed

Problem : 32.2 Use of Tobacco and tea waste as fish toxicants

Problem : 32.3 Biochemical and nutritional studies on silver carp and grass carp and formulation of compounded feed for intensive culture

Problem : 32.4 Effect of cation and anion exchange capacity, pH and type of clay minerals on fertility of fish ponds

Problem : 32.5 Use of biogas slurry, cock phosphate and basic slag in pond fertilisation

Co-ordinated Project: All India co-ordinated project on composite fish culture and fish seed production.

Problem	:	CFCSP–25	Adoptive experiment of semi–intensive magur culture under field condition
Problem	:	CFCSP–26	Impact of field demonstration in adoption of scientific carp culture technology

Co-ordinated project: All India co-ordinated research project on air-breathing fish culture.

Problem	:	ABF-18	Feed formulation for *Clarias batrachus* and *Heteropneustes fossilis* using organic wastes

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EXTENSION

Celebrating the Golden Jubilee Year of the ICAR, the Institute launched celebrations on 'Intensive Inland Aquaculture Technology Transfer Fortnight' as a part of the Lab to Land Programme which is basically oriented to intensify its extension activities through arrangement of country-wide demonstration programmes, field based training courses, etc. The highlights of extension activities of the Institute during the year being reported upon are briefly summerised below. In addition to the extension programmes covered under the Lab to land Programme, the Institute also continued to provide extension services to the public, Government Agencies and other allied organisations.

Demonstration Programme :

With a view to exposing the farming community, specially small and marginal farmers representing the lowest socio-economic strata in backward areas, to recent advances in farming technology, the Institute drew a massive demonstration programme to transfer the production technologies eminently suitable for brackish and freshwater aquaculture evolved at CIFRI, both in the field of culture and capture fisheries, to farmers' doors through 33 demonstration Centres and 66 worksites spread all over India. In those centres 28 production technologies were demonstrated to fish farmers in their own production units. A series of such demonstration programmes are mentioned below :

a) *Induced Breeding and Aquatic Weed Control-Demonstrations in Orissa* : Technique of induced fish breeding including collection of major carp pituitary gland, preparation of the extract, selection and injection of brood fish represented by *Labeo rohita* (rohu) was demonstrated in a fish farmers' Unit at Bhasilpur in the Raghunathpur Block on 1. 8. 79 which was attended by 8 selected fish farmers and 12 beneficiaries. The fish farmers and beneficiaries evinced keen interest and at their request induced breeding of *L. rohita* was successfully demonstrated on 16th & 17th August, 1979 and postlarvae obtained were stocked in a prepared nursery pond of a fish farmer. At Bahugram (Salepur Block), fish breeding operations were conducted on 27th & 28th August, 1979 and the spawn obtained subsequent to breeding of *L. rohita* was stocked in the pond of a farmer. Demonstration of aquatic weed control technology was taken up at village Jaganathpur under Raghunathpur Block of Jagatsinghpur Sub-Division in Cuttack District. A pond of 0.32 ha belonging to a small farming family of Bhabagrahi Mohapatra having thick infestation (33 kg/sq m) of water hyacinth (*Eichhornia crassipes*) was selected. The herbicide 24-D sodium salt at the dose of 10 kg (a. i.)/ha was sprayed over the infestation in presence of a large number of distinguished visitors, representatives of press and All India Radia, along with 50 fish farmers (including 10 beneficiaries) from nearby villages. While showing the method of application, details of the technology was explained and questions asked by the fish farmers were answered. Pamphlets on the technology under demonstrations as in the case of induced breeding, were distributed to the fish farmers.

b) *Demonstration on Fish-cum-Livestock Farming*—At *Krishnanagar Research Centre* : The tribals of the village Asadan, Nadia, West Bengal were given demonstrations on fish-cum-live stock farming system under the Operational Research Project of the Institute. The inaugural function held on the pond site at krishnanagar on 23rd September, 1979 was marked by the release of fingerlings in the pond. Besides 200 tribals, the function was attended by local fish farmers. The details of the technology of fish-cum-live stock farming wherein the excreta of the animals (pig and ducks) are utilised by the fish as feed in addition to serving as pond fertilisers

were explained and practical demonstration held thereon for the participating tribal fish farmers.

Demonstration of fish culture in ponds receiving saline ground water : The scientists at the Kakinada Sub-centre of the All India Co-ordinated Research Project on Brackishwater Farming have for the first time in the country, demonstrated the possibility of brackishwater aquaculture in ponds receiving saline ground water. The demonstration was conducted in two brackishwater ponds of a farmer with a total water spread of 0.47 ha. The ponds were stocked with milk fish (*Chanos chanos*) @ 5,000 juveniles / ha in May and Tiger Prawn (*Penaeus monodon*) @ 20,000 juveniles / ha in June, 1979 respectively. During a culture period of 5 months *Chanos* grew from 69.0 mm / 1.5 g to 374.5 mm / 356.5 g and the prawn from 36.9 mm / 0 8 g to 122.9 mm / 16.2 g within 4½ months. By allowing the ground water devoid of oxygen and having a high concentration of free carbondioxide, to flow through a 500 m long shallow canal a proper balance between the dissolved gases was arrived at before feeding the water into the ponds. The high salinity of the water (43.7 ppt) in the pond was controlled by dilution with suitable quantity of fresh water from an adjacent drain so that a range of 4.8 to 20.3 ppt. of salinity was maintained during the culture period. Supplementary feed in the form of a mixture of groundnut oilcake, rice bran and fish meal in equal proportions was given @ 3% of the body weight only for 50 days from August 18th onwards. Prior to that the development of benthic algae in the shallow ponds (30 cm) was enough to sustain the stock. Deficiencies of nutrients were corrected by application of Urea and Superphosphate @ 100 kg each/ ha/annum. The field demonstration was organised on 16.10.79 in the farm. The demonstration showed that a production of 1,340 kg of *Chanos* and 216 kg of Tiger prawn per ha in 5 and 4½ months respectively through monoculture is easily attainable.

Air-breathing Fish Breeding Technology Demonstrations : A training-cum-demonstration-programme of induced breeding of air-breeding fishes was organised by the Patna Research Centre of the CIFRI during 3-12, September, 1979 at village Sipra under Phulwarisharif block of the Patna District. Two hundred fish farmers and entrepreneurs from several nearby places visited the place and watched the demonstrations every day. Under the programme, farmers were familiarised with the technique of induced breeding of singhi, magur and koi through pituitary hormone injection. The technique of breeding magur in paddy field was also demonstrated to them. An exhibition depicting maturity condition, spawning behaviour, etc., of the fishes was arranged. Technique of pituitary gland collection from carp's head was also shown to the interested farmers. The training programme was given a wide coverage by the local Newspaper.

At Gauhati Centre demonstration in induced breeding of magur and singhi was undertaken at a fish farmer's pond. Ten pairs of magur and singhi were injected in presence of enthusiastic fish farmers. Breeding was successful in both the species.

Demonstration on Composite Fish Culture : A netting demonstration was arranged by Krishi Vigyan Kendra / Trainers' Training Centre, Dhauli (Orissa), in a pond at the Nakharupatna village which was taken up by villagers for composite fish culture. The fingerlings of catla, rohu, mrigal, silver carp, grass carp and common carp were stocked in the month of January, 1979. The stocking composition was, catla 200 (8%), silver carp 200 (8%), grass carp 62 (2.5%), rohu 1,723 (67%), mrigal 161 (6.5 %) and common carp 200 (8%). The total number of fingerlings stocked was 2,546. The netting demonstration was arranged in August 1979 in the presence of Dr. M. S. Swaminathan, Secretary, Ministry of Agriculture & Irrigation (Department of Agriculture) who appreciated the growth attained by all the six species stocked, espesially catla, silver carp and grass carp which have shown better growth ranging from 2 to 3 kg.

The Krishi Vigyan Kendra and Trainers' Training Centre, Kausalyagang organised a public demonstration on composite fish culture on 17th September, 1979 at Nakharupatna village near Dhauli. The programme aimed at an intensive extension and individual attention to the neglected sector of the rural communities with an effort to successfully transfer the technologies evolved by the Institute to the farmers' field. The netting demonstration on composite fish culture were witnessed by the visiting dignitaries and the fish farmers. The KVK trained farmers of Nakharupatna village also participated in the demonstration programme. Fishes captured showed very good growth during the period of 8 months. The weight of catla, silver carp and grass carp ranged from 2.5-3.0 kg on an average, whereas, rohu, mrigal and common carp ranged from 0.7 to 0.9 kg.

Demonstration on Sewage-fed Fish Culture and Paddy-cum Fish Culture : Demonstration of sewage-fed fish culture and Paddy-cum-fish culture technologies organised by Rahara Research Centre of the Institute on October 25, 1979 at Ramkrishna Mission Boy's Home, Rahara. The function was well attended by local dignitaries, fish farmers and agriculturists. Netting demonstrations at the experimental paddy-cum-fish culture plot and sewage-fed fish culture ponds were arranged and the management practices involved in the technologies were discussed step by step with fish farmers,

Riverine Spawn Collection Technology Demonstrations : The Riverine and Lacustrine Division of the Institute at Allahabad organised an intensive programme on demonstration of techniques of fabrication of spawn collection nets, selection of suitable collection sites, monitering of the nets, collection of spawn, sieving, storage conditioning and transport of spawn were demonstrated to the identified fish farmers at Mahewapatti on 12 September, 1979 and again on 15 September, 1979 at village Chhatwa (Sirsa).

Demonstration of Eradication of unwanted fish with ammonia gas : The Cuttack Research Centre of the Institute recently demonstrated to the Kerala State Fishery Officials the technique of using anhydrous ammonia for eradicating predatory and unwanted fish which take a heavy toll of fish and prawn seed in rearing ponds. This method has assumed a new significance in view of the high price and insufficient supply of Mahua oil-cake currently in use for the purpose. The site for the demonstration was a 3.3/ha brackishwater farm pond in Narakkal near Cochin. The average depth of water was about 70 cm after reducing the water level to a minimum during the ebb tide. 280 kg. of ammonia in 7 cylinders was used to work out to 10 ppm N in the water on a trial basis. Within a few hours from the start of the application, apart from fishes died in the water, a large number of predators like eels and other fishes and prawns also were surfacing in distress and were easily caught. For quick detoxification of the treated water, acids and acid phosphatic fertilisers may be used. During this field trials it was also demonstrated that the dinoflagellate *Peridinium* bloom present in the water could be cleared by ammonia application.

TRAINING IMPARTED : The extension wing of the Institute organised 2-week training course on "Survey of brackishwater fish and prawn seed resources and selection of sites for establishment of brackishwater fish farms, tarms, at Kakdwip Research Centre from January 15-30, 1979 for 10 officials of Department of Fisheries, Govt. of Orissa.

As a result of devastating unprecedented floods in the major districts of West Bengal during September-October 1978, the fish farming communities suffered a great loss through large scale destruction of their fish ponds, tanks & fishing gears, loss of fish, siltation of ponds and tanks, deterioration of water quality, etc. With a view to rehabilitate the flood hit fish farming communities, a series of short duration field oriented training pro-

gramme was organised at the Institute's Composite Fish Culture Centre at Kulia (Kalyani), West Bengal. The programme was initiated on April 9, 1979.

The training programme conducted by the Extension wing comprised short term courses of 4 days each on (i) Stock pond management (ii) Induced breeding of carps ; (iii) Nursery pond management ; (iv) Rearing pond management ; (v) Magur breeding and culture, and (vi) Common carp breeding. Out of 24 planned courses spread over a period of one year from April, 1979 to March 1980, 19 courses have been conducted so far. Altogether 302 fish farmers from 10 different flood hit districts of West Bengal have been trained. Five more courses are being conducted which are scheduled to be completed by March, 1980. Suitable candidates for undergoing the training were selected and deputed by the Department of Fisheries, Government of West Bengal. Class-room lectures were delivered in regional language by senior scientists of the Institute. In the practicals that followed the lectures, trainees were made to work in the field for better comprehension of the techniques.

A 10—day training course was organised on Brackishwater Prawn and fish farming from 11. 6. 79 to 20. 6. 79 for the officials of Dept. of Fisheries, Govt. of Orissa and West Bengal and State Fisheries Development Corporation, Calcutta. Twentyone trainees of the above departments underwent the training at the Kakdwip Research Centre.

Training on various aspects of aquaculture was arranged for Mr. Alexandre Rabellahatre, Fellow of FAO/ UNDP at the Institute and its Research centres at Kakdwip, Khardah, Krishnagar, Bhubaneswar/Cuttack during the period June 12-22, 1979.

The Extension Wing organised a 2-month training course on "Brackishwater prawn farming" at Kakdwip Research Centre, Kakdwip from July 7 to August 31, 1979 for the officials of Orissa Maritime and Chilka Area Development Corporation Ltd., and Central Agricultural Research Institute, Port Blair.

ADVISORY SERVICE : Necessary advice/suggestions were extended to 87 fish farmers desirous to take up scientific fish farming based on modern concept of aquaculture in 157 ponds and 4 *bheris* owned by them. A number of queries covering various aspects of commercialy viable freshwater and brackishwater aquaculture technologies evolved in the Institute were received and replies mailed to 161 interested persons from fish farmers community, allied agencies both in Government and private sector, college/universities and financial organisations.

FISH-SEED SUPPLY : On request of Government of Bangladesh, the Institute supplied a gift consignment of about 20,000 healthy fingerligs of exotic silver carp and grass carp for stocking in their nursery ponds. The fingerlings were successfully transported to Banapole border in West Bengal where the same were handed over to the representatives of Government of Bangladesh.

The extension wing of the Institute supplied 31.37 lakhs of spawn and 63,000 fry of common carp procured from Cuttack & Bhubaneswar Research Centre to the fish farmers of the 10 flood affected districts of West Bengal through the State Fisheries Department.

TALKS DELIVERED : The Scientists of the extension wing of the Institute delivered undermentioned lectures

"Importance of extension services to fill communication gap in Aquaculture" to the trainees of CIFE on 8. 9. 79.

"Extension services to bridge communication gap in inland fisheries" to the participants of Summer Institute on 1. 8. 1979.

"Extension activities of CIFRI" to the ARS Probationers of the Institute on 3. 2. 79.

"Role of National Demonstration in inland fisheries" to the ARS probationers of the Institute on 5. 2. 79.

"Inland fisheries extension" to the trainees of Central Fisheries Extension Training Centre, Hyderabad on 24. 12. 79.

"Modern aquaculture and its operational cost" to the trainees of State Bank of India on 21. 9. 79.

"How to improve rural economy through modern fish farming" to the fish farmers of Tamluk, on 27. 10. 79.

"Achievements of the Institute" to the trainees of Dept. of fisheries, Govt. of M. P. on 15. 11. 79.

"Need and scope of introduction of brackishwater aquaculture techniques through extension services" to the trainees of Department of Fisheries, Govt. of West Bengal and Orissa, on 31. 8. 79.

"Fingerling stocking, supplementary feeding under the course of stock pond management" to the trainees of crash training programme, on 16. 5. 79.

"Eradication of aquatic insects, stocking of spawn and supplementary feedings, harvesting of fry under the course of nursery pond management" to the trainees of crash training programme, on 31. 7. 79.

"Weed clearance, eradication of predatory and weed fishes under the course of rearing pond management" to the trainees of crash training programme on 17. 8. 1979.

"Importance of induced breeding, rearing of brood fishes and selection of mature fish for breeding under course of breeding of carps" to the trainees of crash training programme on 31. 7. 79.

FISH FARMERS' DAY : Two fish farmers' Days were arranged and conducted under 'Lab to Land' programme, one at Barasat (24 Parganas) and the other at CIFRI Barrackpore. The scientists of the Extension Section also participated in two others Fish Farmers Days conducted by different organisations.

Three fish farmers days were observed by the Riverine & Lacustrine Division on 13, 16 and 18 September, 1979 at Madhauka, Majox Road and Allahabad respectively during the intensive fortnight celebrations.

A fish farmers' Day was organised by the Madras Research Centre at Pulicat Village in Tamilnadu on 5, October, 1979. The Scientists and other staff of the Research Centre held detailed discussions with a number of enthusiastic individuals interested in taking up fish culture and explained to them the various steps involved in brackishwater spawn and fish farming and the resultant profit in the ventures. Collection technique of prawn and mullet fry and their stocking in the ponds were demonstrated to the fish farmers.

PUBLICITY : Shri R. D. Chakraborty, Head, Freshwater Aquaculture Division as per request of the TV Centre, Orissa provided background materials for telecast on the subject of the 'Role of the Cuttack Substation of the CIFRI, (ICAR) for fisheries development in Orissa'.

Shri S. Patnaik, Scientist (S-2) gave a talk (in local language) over the All India Radio, Cuttack, on the 'Lab to Land' programme of the Research Station, under the 'Golden Jubilee' of the I. C. A. R. as per request of the All India Radio authorities.

The Films Division, Govt. of India, took shots on field training that was imparted to the fish farmers under the crash training programme and the valedictory fun-

ction of the Ist course of the training programme organised by the extension wing of the Institute for inclusion in the documentary film on agricultural development.

Dr. A. G. Jhingran, Scientist S-3 delivered a talk entitled "Machhli Paalan Main Naye Prayog" in Hindi dealing with efforts and achievements of CIFRI which was broadcast by the All India Radio, Allahabad on 11. 9. 79.

NEWS FLASH : The Doordarshan Kendra, Calcutta and the All India Radio, Calcutta covered the inaugural functions of the Workshop on the CIFRI / IDRC Rural Aquaculture Project and the Symposium on Inland Aquaculture held at CIFRI on 6. 2. 79 and 12. 2. 79 respectively.

The news on symposium on Inland Aquaculture was broadcast in Bengali local news of AIR on 13. 2. 79.

The news about the work and achievements of the Institute appeared in the Amrita Bazar Patrika and the Dainik Janani on 7. 2. 79 and 8. 2. 79. respectively.

The news about Symposium, Workshop and Exhibition in February, 1979 appreared in "Bidagdha" a Bengali fortnightly paper on February 16, 1979.

MEETINGS ATTENDED : Shri P. Das, Scientist S-2 Extension Wing of the Institute participated in the meeting on "Research and Extension Council" of the Bidhan Chandra Krishi Vishwa Vidyalaya at Mohanpur, Kalyani on July 19, 1979. Shri Das also participated in the meeting of the Core Committee for finalising the syllabus of the course on Fisheries Technology at Polytechnique Institution organised by Ministry of Education.

STUDENTS / TRAINEES : Students / trainees from the following Institutes / Organisations visited Institute's Headquarters during the year. Lectures on various aspects on inland fisheries and field visits were arranged for them.

Students of IASI, New Delhi on 5. 1. 1979

Students of Gyan Bharati School, Calcutta on 5. 1. 79

Trainees of Extension Training Centre, Hyderabad on 15. 1. 79

M. Phil students of Presidency College, Madras on 18. 1. 79

Trainees of Cooperative Training College, Kalyani on 4. 5. 79

Trainee village organisers of Comprehensive Area Development Corporation, Calcutta on 23. 7. 79

Trainees of CIFRI, Bombay on 8. 9. 79

Trainees of the Fisheries Training Centre, Nowgaon Govt. of M. P. on, 15. 11. 79

Trainee nurses of NRS Medical College, Calcutta on 28. 11. 79

Teachers and students of St. Joseph Girls' College Waltair on 18. 2. 79

Teachers and students of final B. Sc. (Zoology) of Puniab University, Chandigarh on 31. 12. 79

FILM SHOWS : Films on Induced Breeding and Composite Fish Culture were screened for the fish farmers participating in the Fish Farmers' Days organised at Barrackpore & at a number of Research Centres of the Institute located at various States of the Country and for the students / trainees of different Institutes / Organisations and also for the distinguished persons who visited the Institute during the year under report.

EXHIBITIONS : Two exhibitions with the help of posters, charts, models, live fishes, blow-up photographs, etc. were organised at the Institute, one during February 6-15, 1979 in connection with the Workshop on Rural Aquaculture followed by Symposiumon Inland Aquaculture and the other during September 12-18, on the occasion of inauguration of Lab to Land Programme in commemoration of the ICAR Golden Jubilee year. In addition to the above 4 other exhibitions were also orga-

nised and held on difierent occasions at various places in the country. Also participated in the following exhibitions by way of contributing suitable exhibits :

a) Exhibition held at Kalikapur, Sonarpur 24-Parganas West Bengal

b) Subhas-O-Vardhaman exhibition held at Burdwan, West Bengal in collaboration with Department of Fisheries, West Bengal ;

c) Exhibition held on the "World Environment Day" organised by West Bengal Prevention and Control of Water Pollution Board Calcutta ;

d) 'Silpa Mela' held at Khardah, West Bengal ;

e) Exhibits were supplied to ICAR, New Delhi for exhibition held at Delhi during IFRAD Global Convention, Golden Jubilee Symposium and International Trade Fair.

CONFERENCES AND SYMPOSIA

Under the Sectional presidentship of Dr. V. G. Jhingran, the then Director of this Institute, the Section of the Zoology, Entomology & Fisheries of the 66th Session of Indian Science Congress Association was held at Hyderabad during January 3 to 7, 1979 and the Scientists of this Institute presented 60 scientific papers at the Zoology, Entomology and Fisheries Section.

A workshop on CIFRI / IDRC Project on Rural Aquaculture was organised at Barrackpore during February 6-7, 1979.

A Symposium on Inland Aquaculture was organised by the Institute at Barrackpore during February 12-14, 1979. A number of Fish Farmers, Officials of the State Fisheries Department, Chief Executive Officers of the Fish Farmers' Development Agencies, representatives of financial institutions and scientists from various Institutions participated in the same. The symposium was inaugurated by Dr. S. K. Mukherjee, Ex-Vice Chancellor, Calcutta University, One hundred fifty papers by the Scientists of the Institute were presented at the symposium.

Shri P. K. Mukhopadhyay, S-1 presented a paper at the symposium on 'Bio-chemistry of Xenobiotics' in the 48th Annual General Meeting of the Society of Biological Chemistry held at Industrial Toxicology Research Centre, Lucknow during 10-13 October, 1979.

Shri P. K. Sukumaran, Scientist of the Bangalore Centre participated in the Summer Institute on Fish Pathology at Fisheries College, Mangalore during July, 1979.

Dr. K. L. Sehgal, S-2 and Shri V. R. Desai, S-1 were deputed for participation in the All India Seminar on Ichthyology at Nainital held during October 28-31, 1979. Fourteen scientific papers from different scientists were presented from this Institute at the above symposium.

Shri S. R. Ghosh, S-1 attended the seminar on Gas Chromatography held at Calcutta during 5-6 November, 1979.

Shri B. K. Sharma, S-1 participated in the ICLARM-SEARCA Conference on Integrated Aquaculture—Aquaculture Farming System held at Manila, Phillipines during 6th to 9th August, 1979 and presented a paper on Fish-cum-Livestock Farming in India.

Dr. (Mrs.) T. Rajyalakshmi, S-2, Shri B. B. Ghosh, S-1 and Shri P. Ray, S-1 attended the National Seminar on the Protection of Marine Environment held at the National Institute of Oceanography, Dona Paula, Goa during November 13-15, 1979 and five papers were presented by the Scientists of the Institute.

Sarvashri G. N. Saha, S-1 and R. K. Banerjee, S-1 participated in the XII Annual Convention of the Indian Society of Agricultural Chemists held at Durgapur during 27-28, 1979 and two papers were presented by them at the above convention.

Shri B. N. Saigal, Scientist-2 and Smt. S. Das, Library Assistant (T-3) participated in the 19th Meeting of IASLIC held at Calcutta on 19th September, 1979.

PERSONNEL

Retirement :

Dr (Miss) Eva Mitra, S-2 retired from the service on 30. 4. 1979.

Dr. V. G. Jhingran, Director, retired with effect from 30. 6. 1979.

Promotion :

The following members of staff promoted to next higher grade during the year :

Dr. A. V. Natarajan	Scientist 3	to	S-3 Special grade
Dr. P. V. Dehadrai	,,	to	do
Dr. V. R. P. Sinha	,,	to	do
Shri S. K. Das	T-II-3	to	T-4
,, P. K. Ghosh	,,	to	T-4
,, P. Dasgupta	T-2	to	T-I-3
,, M. D. Mantri	T-II-3	to	T-4
,, C. D. Sahoo	,,	to	T-4
,, N. C. Roy	T-1	to	T-2
,, N. P. Saha	,,	to	,,
,, S. K. Gupta	,,	to	,,
,, K. L. Das	,,	to	,,
,, Ranjit Singh	,,	to	,,
,, Kishan Deo	,,	to	,,
,, M. M. Das	,,	to	,,
,, S. C. Bhowmick	,,	to	,,
,, S. C. Moitra	,,	to	,,
,, A. K. Banerjee	,,	to	,,

Grant of Advance Increments :

The following members of staff have been granted advance increments as mentioned against their names :

Name	Increment
Shri J. G. Chatterjee	Three
,, S. N. Sadhukhan	Two
,, K. P. Singh	One
,, Tarapada Ghosh	One
,, Swapan Chatterjee	Two

Appointments :

Following appointments were made during the year :

Name	Designation	Place of Posting
Shri R. M. Bhowmick	S-3	Dhauli
, K. M. Rao	S-2	Dhauli
,, N. K. Thakur	S-2	Patna
Dr. B. N. Singh	S-2	Dhauli
Shri K. S. Rao	Jr. Clerk	Tadepalligudam
,, Kalipada Nath	,,	Barrackpore
,, Purna Chandra Behara	,,	Bhubaneswar
Miss Mrinalini Bhattacharjee	,,	Barrackpore
Shri B. K. Behura	Driver (T-1)	Cuttack
,, S. K. Mansur Ali	Forest Guard	Kakdwip
Mrs. Hemlata Halder	Peon	Barrackpore
Shri Shree Nath	Fisherman	Allahabad
, Sripal Singh	Fisherman	Harwan (Srinagar)
,, T. Rajagopal Rao	Fisherman	Badampudi

Transfer :

Following transfers were made during 1979.

	Name	Designation	From	To
1.	Dr. A. V. Natarajan	S-3	Allahabad	Barrackpore
2.	Shri M. Ranadhir	S-2	Barrackpore	Bhubaneswar
3.	Shri T. Ramaprabhu	S-2	Kakinada	Cuttack
4.	Dr. B. N. Singh	S-2	Barrackpore	Bhubaneswar
5.	Shri N. K. Tripathy	Liasion Officer	Bhubaneswar	Cuttack
6.	Shri Ram Chandar Singh	T-4	Buxar	Lalgola
7.	Shri B. Ghosh	T-1-3	Allahabad	Khardah
8.	Shri S. N. Mohanty	S-1	Bhubaneswar	Kalahandi
9.	Shri P. L. N. Rao	S-1	Bhubaneswar	Balasore
10.	Shri D R. Kanaujia	'S'	Cuttack	do
11.	Shri S N. Sar	S. R A.	Ahmedpur	Barrackpore
12.	Shri R. N. Pal	S-2	Gauhati	Barrackpore
13.	Dr. S. P. Rai	S-1	Cuttack	Barrackpore
14.	Shri B. K. Saha	T 4	Kalna	Rahara
15.	Shri K. P. Singh	LFA (T-1)	Rahara	Bhagalpur
16.	Shri B. C. Jha	S-1	Ranchi	Bilaspur
17.	Shri D. R. Rao	T-4	Tadepalligudem	Kakinada
18.	Shri Ravish Chandra	S-2	Gauhati	Allahabad
19.	Shri P. S. C. Bose	T-II-3	Gauhati	Allahabad
20.	Shri K. L. Das	Driver	Barrackpore	Calcutta
21.	Shri R. L. Balmiki	Driver	Calcutta	Barrackpore
22	Shri M. J. Bhagat	S. R. A.	Srinagar	Barrackpore
23.	Dr. Babulal	S.1	Calcutta	Barrackpore

	Name	Designation	From	To
24.	Shri S. B. Saha	S-1	Calcutta	Barrackpore
25.	Shri G. Lahiri	Sr. Steno	Barrackpore	Calcutta
26.	Shri B. K. Ghosh	Jr. Clerk	Barrackpore	Khardah
27.	Shri K. P. Nath	Jr. Clerk	Khardah	Barrackpore
28.	Shri D. P. Verma	T-I-3	Buxar	Gauhati
29.	Shri B. K. Banerjee	'S'	Khardah	Barrackpore
30.	Shri A. R Chowdhury	T-4	Calcutta	Barrackpore
31.	Shri N. C. Basu	S. T. A.	Dhauli	Kakdwip
32.	Dr. M. L. Bhowmick	S-1	Ahmedpur	Barrackpore
33.	Sri J. G. Chatterjee	'S'	Itahar	Barrackpore
34.	Shri Suraj Bahadur	Driver	Itahar	Barrackpore
35.	Shri Pasupati Lal	Driver	Ahmedpur	Rahara
36.	Shri Harihat Das	Driver	Cuttack	Kakinada
37.	Shri Khalia Behara	Boatman	Ranchi	Kausalyagang
38.	Shri S. K. Burman	Fisherman	Bakkhali	Barrackpore
39.	Shri R. C. Biswas	Lab. Boy	Kakdwip	Rahara
40.	Shri N. K. Mondal	Fisherman	Kakdwip	Krishnagar
41.	Shri L. K. Halder	Fisherman	Ahmedpur	Barrackpore
42.	Shri D. Bhanja	Fisherman	Ahmedpur	Khardah
43.	Shri A. M. Patra	Lab. Boy	Itahar	Barrackpore
44.	Shri L. K. Halder	Fisherman	Ahmedabad	Barrackpore
45.	Shri Lakshmi Ram	Fisherman	Karnal	Muzaffarpur
46.	Shri M. P. S. Kohli	'S'	Patna	Gauhati
47.	Shri P. C. Kachari	Watchman	Gauhati	Barrackpore

The following scientists rendered their services to the Institute during the year :

DIRECTOR

Dr. V. G. Jhingran (upto 30. 6. 1979)

Dr. A. V. Natarajan (officiating from 1. 7. 1979)

Freshwater Aquaculture Division, Dhauli

Name	Designation	Section	Place
Dr. V. R. P. Sinha	S-3	Freshwater Aquaculture Research and Training Centre	Dhauli
Shri K. K. Sukumaran	S-2	,,	,,
,, H. A. Khan	,,	,,	,,
,, M. Ranadhir	S-2 (from July 1979 onwards)	,,	,,
,, C. Saha	S-1	,,	,,
Dr. R. Paul Raj	,,	,,	,,
Shri B. R. Shirsat	,,	,,	,,
,, S. N. Mohanty	,,	,,	,,
,, P. L. N. Rao	,,	,,	,,
,, C. S. Purushothaman	,,	K V K	,,
,, Dilip Kumar	,,	,,	,,
,, George John	,,	F. A. R. T. C	Dhauli
,, K. Suresh	,,	,,	,,
,, R. D. Chakraborty	S-3	Cuttack Centre, Cuttack	Cuttack
Dr. S. B. Singh	,,	,,	,,
Shri V. Ramchandran	FS	,,	Cuttack
,, S. Patnaik	S-2	,,	,,
,, P. R. Sen	,,	,,	,,
,, N. G. S. Rao	,,	,,	,,
,, R. M. Bhowmick	JFS	,,	,,
,, M. A. V. Lakshmanan	,,	,,	,,
,, D. S. Murty	,,	,,	,,
,, C. Selvaraj	S-1	,,	,,
,, G. V. Kowtal	,,	,,	,,
,, R. K. Jana	,,	,,	,,
,, R. C. Das	,,	,,	,,
,, M. Rout	,,	,,	,,
Dr. C. R. Das	,,	,,	,,
,, S. P. Rai	,,	,,	,,
Shri S Jena	,,	,,	,,
,, S. D. Gupta	,,	,,	,,
,, D. K. Chatterjee	,,	,,	,,
,, S. R. Ghosh	,,	,,	,,
,, S. N. Dutta	,,	,,	,,
,, A. K. Sahoo	,,	,,	,,
,, D. R. Kaunijea	S	,,	,,
,, R. K. Nigam	,,	,,	,,

Name	Designation	Section	Place
Shri Apurba Ghosh	S-2	Sewage-fed fisheries	Barrackpore
Smt. K. K. Bhanot	S-1	,,	,,
Shri S. K. Saha	,,	,,	,,
,, A. K. Ghosh	,,	,,	,,
,, N. K. Naskar	,,	,,	,,

Riverine & Lacustrine Division

Shri J. C. Malhotra	S-3	Allahabad Research Centre	Allahabad
Dr. A. G. Jhingran	,,	,,	,,
Shri G. N. Mukherjee	S-2	,,	,,
Dr. R. S. Panwar	S-2	,,	,,
Shri S. J. Karamchandani	JFS	,,	,,
Dr. Peer Mohammad	S-1	,,	,,
Shri S. P. Singh	,,	,,	,,
,, S. K. Wishard	,,	,,	,,
,, K. L. Shah	,,	,,	,,
,, K. P. Srivastava	,,	,,	,,
,, R. K. Saxena	,,	,,	,,
,, G. N. Srivastava	,,	,,	,,
,, Balbir Singh	,,	,,	,,
,, S. N. Mehrotra	,,	,,	,,
,, R. A. Gupta	,,	,,	,,
,, M. A. Khan	,,	,,	,,
,, D. N. Singh	,,	,,	,,
,, P. M. Sherif	,,	,,	,,
,, R. N. Seth	,,	,,	,,
,, R. K. Tyagi	,,	,,	,,
,, R. K. Dwivedi	,,	,,	,,
Dr. K. Chandra	,,	,,	,,
Dr. K. K. Vas	S-2	Srinagar Research Centre	Srinagar
Shri Shyam Sunder	S-1	,,	,,
Dr. H. S. Raina	,,	,,	,,
Smt. Usha Moza	,,	,,	,,
Shri V. K. Bali	,,	,,	,,
,, M. J. Bhagat	S	,,	,,
,, K. V. Rao	S-1	Tedepalligudem Research Centre	Tadepalligudem
,, K. J. Rao	S-1	,,	,,
Dr. M. Subrahmanyam	S-2	Kakinada Research Centre	Kakinda
Shri T. Ramaprabhu	,,	,,	,,
Dr. K. J. Rao	,,	,,	,,
Shri A. K. Lal	S-1	Bhagalpur Research Centre	Bhagalpur
,, S. K. Sarkar	T-4	,,	,,
,, A. Sarkar	T-II-3	,,	,,
,, K. P. Singh	T-I-II	,,	,,
,, S. N. Sar	SRA	,,	,,
Dr. R. Chandra	S-2	Gauhati Research Centre	Gauhati
Shri R. K. Singh	S	,,	,,

Name	Designation	Section	Place
,, M. Choudhury	S	Gauhati Research Centre	Gauhati
,, V. Kolekar	,,	,,	,,
,, B. V. Govind	S-2	Bangalore Research Centre	Bangalore
,, S. Ayyappan	S-1	,,	,,
,, P. K. Sukumaran	S	,,	,,
,, V. R. Chitransi	S-1	Mazaffarpur Research Centre	Mazaffarpur
,, H. P. Singh	S	,,	,,
,, A. Kapoor	SRA	,,	,,
,, Sree Prakash	S	Buxar Research Centre	Buxar
,, C. B. Joshi	S-1	Coldwater fisheries Unit	Bilaspur

Estuarine Fisheries Division

Shri B. B Pakrasi	S-3	Calcutta Research Centre	Calcutta
Dr. Miss Eva Mitra	S-2	,,	,,
Shri G. N. Saha	,,	,,	,,
,, P. Ray	JFS	,,	,,
,, S. C. Banerjee	S-1	,,	,,
,, R. K. Banerjee	,,	,,	,,
,, S. C. Thakurta	,,	,,	,,
,, S. B. Saha	,,	,,	,,
,, G. C. Laha	,,	,,	,,
,, Hardial Singh	,,	,,	,,
,, S. K. Mondal	,,	,,	,,
Dr. Babu Lal	,,	,,	,,
Shri S. Karmakar	S	,,	,,
,, A. C. Banerjee	,,	,,	,,
,, A. R. Choudhury	SRA	,,	,,
,, A. Choudhury	,,	,,	,,
,, D. D. Halder	S-3	Kakdwip Research Centre	Kakdwip
,, A. Sengupta	S-1	,,	,,
,, N. K. Das	,,	,,	,,
,, R. K Chakraborty	,,	,,	,,
,, M. K. Mukhopadhaya	,,	,,	,,
,, S. M. Pillai	,,	,,	,,
,, P. Ravichandran	S-1	,,	,,
,, S. K. Mondal	,,	,,	,,
,, P. K. Chakraborty	,,	,,	,,
,, Kuldip Singh	,,	,,	,,
,, P. K. Ghosh	S	,,	,,
,, A. K. Roy	,,	,,	,,
,, N. M. Chakraborty	,,	,,	,,
,, H. C. Karmakar	,,	,,	,,
,, A. Hajra	,,	,,	,,
,, K. Raman	S-2	Madras Research Centre	Madras
,, K. V. Ramakrishna	,,	,,	,,
,, R. D. Prasadam	S-1	,,	,,

Name	Designation	From	To
„ G. R. M. Rao	S-1	Madras Research Centre	Madras
„ C. P. Rangaswamy	„	„	„
„ M. Kaliyamurthy	„	„	„
„ S. Radhakrishnan	„	„	„
„ S. Srinivasagam	„	„	„
„ K. Gopinathan	„	„	„
Smt. M. Sultana	„	„	„
Shri K. O. Joseph	S	„	„
„ S. Krishnan	T-2	„	„
„ K. K. Ghosh	S-2	Estuarine Section	Barrackpore
„ B. B. Ghosh	„	„	„
„ K. K. Bhanot	S-1	„	„
„ A. C. Nandy	„	„	„
„ M. M. Bagchi	„	„	„
„ P. M. Miyra	„	„	„
Dr. G. N. Chattopadhyay	„	„	„
Shri J. N. Pal	S	„	„
„ S. K. Majumdar	„	„	„
„ D. K. De	„	Estuarine Section	Barrackpore

Projects Directly under Director's Control

Shri S. D. Tripathi	S-3	Rural Aquaculture Project	Barrackpore
Dr. M. L. Bhowmick	S-1	„	„
Shri K. M. Das	„	„	„
„ J. G. Chatterjee	„	„	„
„ Anup Kumar Datta	„	„	„
„ D. Narayanswamy	„	(On study leave)	„
„ D. Nath	S	„	„
„ P. Das	S-2	Extension Section	„
„ D. Kumar	S-1	„	„
„ U. Bhowmick	„	„	„
„ B. Roy	„	„	„
„ B. N. Saigal	„	Library & Documentation Section	„
„ B. Venkatesh	„	„	„
„ V. K. Unnithan	„	„	„
„ Amitabha Ghosh	S	(On study leave)	„
Dr. K. L. Sehgal	S-1	Technical Cell	„
Shri Kuldip Kumar	„	„	„
„ S. Paul	„	Economics Section	„
„ B. K. Sharma	„	Operational Research Centre	Krishnagar
„ S. R. Das	„	„	„
„ M. K. Das	„	„	„
Dr. A. K. Mondal	„	Kalyani Research Centre	Kalyani
Dr. T. Rajyalakshmi (Mrs.)	S-2	Barrackpore	Barrackpore
Shri N. A. Reddy	S-1	„	„

Co-ordinated Projects :

Composite Fish Culture & Spawn Prospecting

Name	Designation	Section	Place
Dr. B. N. Singh	S-1	CFCSP	Bhubaneswar
Dr. K. G. Rao	,,	,,	,,
Shri D. V. Pahwa	S-2	,,	Karnal
,, J. C. Markandeya	S-1	,,	,,
,, M. Y. Kamal	S-2	,,	Ranchi
,, A. Mukherjee	S-1	,,	,,
,, P. N. Jaitely	S	,,	,,
,, R. M. Rao	S-1	,,	Badampudi
,, J. B. Rao	,,	,,	,,
,, K. N. Krishnamoorthi	,,	,,	Bhavanisagar
,, P. K. Aravindakshan	,,	,,	,,
,, M. Sinha	,,	,,	Kalyani
,, D. P. Chakraborty	,,	,,	,,
,, P. K. Saha	S	,,	,,
Dr. P. M. Mathew	S-1	,,	Pune
Shri B. K. Singh	S	,,	,,
,, K. K. Ghosh	S-2	,,	Barrackpore
,, D. N. Mishra	S-1	,,	Jaunpur
,, B. C. Tyagi	,,	,,	,,
,, P. C. Mahanta	S	,,	Gauhati

Air-breathing Fish Culture

Dr. P. V. Dehadrai	S-3	ABF	Barrackpore
Shri S. K. Mukhopadhyay	S-1	,,	,,
,, P. K. Mukhopadhyay	,,	,,	,,
,, R. K. Das	,,	,,	,,
,, S. C. Pathak	,,	,,	Gauhati
,, Y. S. Yadav	,,	,,	,,
Dr. N. K. Thakur	,,	,,	Patna
Shri S. K. Munnet	,,	,,	,,
,, M. P. Singh Kohli	S	,,	,,
Shri V. K. Murugesan	S-1	,,	Bangalore
,, P. Kumaraiah	,,	,,	,,

Reservoirs

Dr. A. V. Natarajan	S-3	Reservoir Fisheries	Allahabad
Shri M. A. Khan	S-1	,,	,,
,, Ch. Gopalakrishnayya	S-2	,,	Nagarjunasagar
,, M. Ramakrishnayya	S-1	,,	,,
,, V. V. Sugunan	,,	,,	,,
Smt. G. K. Vinci	,,	,,	,,
Shri V. Pathak	S	,,	,,
,, G. K. Bhatnagar	S-2	,,	Ranchi
,, B. C. Jha	S-1	,,	,,
,, S. N. Singh	S	,,	,,
Dr. B. P. Gupta	S-1	,,	,,

Name	Designation	Section	Place
Dr. Abraham Mathew	S-1	Reservoir Fisheries	Bhavanisagar
Smt. S. Sivakami	,,	,,	,,
Dr. Y. Rama Rao	S-2	,,	Bilaspur
Shri D. K. Kaushal	S	,,	,,
,, V. K. Sharma	,,	,,	,,
,, M. D. Pisolkar	,,	,,	,,
,, V. R. Desai	S 1	,,	Rihand
,, N. P. Srivastava	S	,,	,,

The following members of staff (Technical) rendered their services during the year :

LIASION OFFICER

Tripathi, N. K.

SENIOR ARTIST T-5

Ghosh, J

SENIOR LIBRARY ASSISTANT T-5

De, Anjali (Mrs.)

OVERSEER T-4

Bhattacharjee, P. N.

ARTIST PHOTOGRAPHER T-4

Mazumdar, A. R.

DEMONSTRATOR T-4

Dutta, B. R.
Kumar, Kuldeep
Radheshyam
Sarkar, S. K.

TECHNICAL ASSISTANT T-4

Das, P. B.
Das, P. R.
De, R. N.
Kar, S. L.
Mazumdar, H. S.
Raghavan, S. L.
Singh, R. C.
Ramaraju, T. S.
Rao, D. R.
Rao, K. S.
Reddy, P. V. G. K.
Saha, B. K.
Sarkar, S. K.
Mantri, Muralidhar

TECHNICAL ASSISTANT T-II-3

Abdul Kadir, P. M.
Agarwal, K. K.
Basak, B.
Bhattacharjee, G. P.
Bose, P. S. C.
Chanda, Ram
Das, K. M.
Ghosh, Bhaskar
Panigrahi, V.
Rahman, F.
Roy, A. K.
Sarkar, N. D.
Satpathy, R. C.
Srivastava, D. N.
Srivastava, N. K.

ARTIST T-II-3

Das, S. K.

SENIOR LIBRARY ASSISTANT T-II-3

Das, Sukla (Mrs)

PHOTOGRAPHIC ASSISTANT T-II-3

Ghosh, P. K.

ESTIMATOR

Sahoo, Chakradhar

TECHNICAL ASSISTANT T-I-3

Banerjee, K. S.
Ekka, A. K.
Ghosh, S. P.
Mazumdar, N. N.
Mondal, N. C.
Paul, A. R.
Sarkar, Aloke
Saroj, B. D.
Sen, H. K.
Verma, D. P.

TECHNICAL T-2

Krishnan, S.
Lakra, Camil
Langer, R. K.
Mishra, J. P.
Mohanty, A. N.
Muduli, H. K.
Sahu, G. C.
Sarkar, N. N.
Serangi, N.
Singh, M. P.

ARTIST T-2

Dasgupta, P.

ELECTRICIAN T-2

Chatterjee, S. K.
Guin Narsing
Sadhukhan, B. N.

MECHANIC T-II-3

Sathpati, R. C.

MECHANIC T-2

Singh, Donald

LABORATORY AND FIELD ASSISTANT T-1

Chatterjee, Swapan Kumar
Das, B. B.
Jain, Aloke Kumar
Krishnan, S.
Langer, R. K.
Mohanti, A. N.
Mondal, S. C.
Mishra, J. P.
Lal Bhai
Pani, K. C.
Saha, Sukumar
Sahoo, G. C.
Saful, Debashis
Sarengi, N.
Singh, K. P.
Singh, M. P.
Tiwari, Ranjit

SAMPLE SORTER T-1

Banerjee, A. K.
Gupta, S. K.
Moitra, S. C.
Nath, A. K.
Saha, K. P.
Saha, N. P.
Saha, R. D.

SENIOR GESTETNER OPERATOR T-1

Bhowmick, S. C.

SENIOR BINDER T-1

Das, M. M.

DRIVER/ENGINE DRIVER/LUNCH DRIVER/MINI BUS DRIVER VEHICLE DRIVER T-2

Basmedaya
Das, S. C.
Negi, R. S.
Roy, R. M.
Saha, J. C.
Sonhi, B. B.
Singh, R. N.
Tarai, D.

DIVER/ENGINE DRIVER/LAUNCH DRIVER/MINI BUS DRIVER VEHICLE DRIVER T-1

Bahadur, Suraj
Balmiki, R. L.
Biswas, N. C.
Chatterjee, U. K.
Das, K. L.
Deb, K. R.
Deo, Kishen
Dutta, K. K.
Das, Harihar
Ganesh K.
Ghosh, T. P.
Kahall, B.
Lal, Pasupati
Mazumder, A. K.
Norh, C. K.
Roy, B. B.
Singh, Badal Lal
Subramani, M. G.

CARPENTER T-2

Bhattacharjee, S.

PLUMBER

Deb, S. K.

PUMPMAN T-1

Das C. R.
Roy, N.

The following members of Staff (Administrative) rendered their services during the year :

ACCOUNT OFFICER

Deb. P. C.

ASSISTANT ADMINISTRATIVE OFFICER

Roy, K. C.
Rajani, K. B.
Sthanapati P. K.

P. A. TO DIRECTOR

Lahiri, G.

SUPERINTENDENT

Biswas, M. L.
Chatterjee, N. G.
(Expired on 10. 12. 79)
Das, A. K.
Roy, M. R.
Kanungo, P. C.
Sengupta, A. K.
Saha, S. C.
Datta, B. C.
(from 3. 11. 78)

ASSISTANT

Bhattacherjee, B. C.
Bose, S. K.
Chatterjee, B. R.
Das, T. P.
Dasgupta, S.
Mazumder, Sandhya
Roy, Bani
Baidya, N. H.
Das, C. C.
Choudhury, Nomita
Halim, Abdul,
Roy, S. C.
Sarkar, A. C.
Sarkar, N. K.
Shastry, S. P.
Zaidi, F. A.
Mahesh Prasad
Awadh, Sah
Neogi, M. M.
Banerjee, D. K.
Bose, D. C.

STENOGRAPHER

Banerjee, A. K.
Chakladar, H.
Ghosh, U. K.
Chakraborty, G. M.
Srivastava, R. C.

JUNIOR STENOGRAPHER

Bhattacharjee, S.
Chatterjee, T
Das, P. K.
Jena, P.
Sinha, R. C. P.
Prasad, P.
Roy, T. K.
Saha, A. K.
Sahoo, D. C.

SENIOR CLERK

Acharjee, D. K.
Baidya, D. N.
Banerjee, J. N.
Halder, S. R.
Kodandraman, I. N.
Mitra, N. K.
Rai, Jagdish
Majumdar, T. K.
Bhowmik, S
Dey Sarkar, D. K.
Mukherjee, B. B.
Patra, J. C.
Pramanick, S. N.
Sarkar, H. L.
Singh, R. C. P.
Subrahamaniam, M.
Mukherjee, B. B.
Nath, H. K.
Ghosh, B. K.
Kar, S. K.
Mishra, L. P.
Singh, Kallu
Majumdar, Biplab
Das, Moloy Kr.
Sinha, S. S.
Mukherjee, R. R.
Nath, H. K
Pramanick, S. K.
Prasad, Keshaw
Sarkar, S. K.
Sreedharan, T. K.
Sutur, H. B.

JUNIOR CLERK

Banerjee, Anita
Behara, A. C.
Behera, R. C.
Bhegirathi, S.
Banerjee, Narayani
Behera Kunja
Bala, M. K.
Biswas, A. B.
Biswas, Manjulal
Bose, Samir Kumar
Chowdhury, Debesh
Das, B. K.
Dutta, P. K.
Ghosh, R. K.
Guriah, W.
Kumar, Surendra
Lahiri, P.
Mahato, R. N.
Mandal, S. P.
Mazumder, Sikha
Mupid, B. S.
Neogi, Anjali,
Nath, Baij
Radhakrishnan, K.
Roy, J.
Roy, S. B.
Shah, Biswanath
Bhattacharjee, Mrinalini
Tikadar, S. K.
Biswas, P. K.
Chatterjee, Dipankar
Chhotey Lal
Das, G. B.
Ghosh, P. K.
Ghosh, Samar Kumar
Kachhap, M.
Kundu, N. R.
Lal, Ambika
Mandal, Bulbul
Manjhi, K.
Moozanappan, S. K.
Murthy, P. B. V. S.
Panda, R. K.
Naik, N. C.
Raina, R. L.
Roy, Samir Kumar
Sarkar, B. K.
Nath, Kalipada
Srivastava, A. K.
Behera, Purnachandra

SUPPORTING GRADE IV

Chakraborty, K. L.
Jally, U. N.
Jally, H.
Burman, G. N.
Naik, J
Das, P. V. N
Mewalal
Biswas, D. N.
Bhuyan, U
Sahu, D
Bose, J. L.
Dalai, B
Samood
Dey, S. K.
Behera, B. N.
Das, K. P.
Dosad, R. B.
Prasad, K
Samal, B.
Singh, D.
Das, C.
Jena, K. C.
Ramdeo
Biswas, J. N.
Gangaram

SUPPORTING GRADE III

Barik, N.
Singh, C.
Varghese, P. V.
Majhi, B.
Shyamal, B. R.
Panda, Lakshmidhar
Das, S. K.
Pandey, C. K.
Bakshiram
Iruthiraj, M.
Behera, K. B.
Raikwar, Ramlal
Biswas, T. K.
Das, H. K.
Bhuloka, D.
Laluram
Munda, Budhram
Das, Antiram
Jana, Natabar
Gopal, K.

Raha, R. N.
Kotaiah, S.
Maranappan, S. K.
Mishra, P.
Naik, B.
Kujur, J. M.
Singh, Meher
Chakraborty, S. K.
Burman, M. S.
Barik, Dija
Prakash, B.
Das, Mosa
Bhoi, B.
Mondal, A. K.
Patra, A. M.
Burman, S. N.
Biswas, R. C.
Routh, H. K.
Baldevsingh, D. N.
Lal, Madan
Rao, Ch. Ganeswar
Bhuyan, N.
Behera, Trailokya
Shyamal, H. K.
Barik, S.
Bahadur, Nar
Sahu, D.
Behera, K. C.
Bahadur, Durga
Paramanik, H. K.
Behera, Alaka
Balmiki, Sitaram
Saha, N. K.
Naik, D
Jally, Khetrabasi
Das, K. K.
Balmiki S. C.
Apparao, B.
Behera, N.
Bose, M. R.
Chand, Mool
Mohanty, N. N.
Patnaik S. R.
Sethi, P. C.
Jally, Aghur

SUPPORTING GRADE II

Boral, S. K.
Kishore, Jugal
Jangli
Maity, S. S.
Parbat, L. K.
Bhanja B.
Singh, S. S.
Narendra, G. C.
Sahoo, D. N.
Sahu, Gangadhar
Burman, S. N.
Tair, R. N.
Das, P. C.
Behera, Khalia
Bahadur, Tek
Pradhan, B.
Singh, Ramdeo
Ramalingam, M.
Singh, C. P.
Jena, N. C.
Mondal, Gokul Chandra
Burman Niranjan Kumar
Burman, Sudhangshu Sekhar
Chakraborty, Saradandu
Mondal, Subal Chandra
Behera, M.
Jadav, S. P.
Barik, D.
Chaki, S. N.
Narasappa, B.
Das. B. B.
Sayalu, P.
Appanna, K
Behera, K. B.
Bhoi, R. C.
Panda, Jagdish
Singh, P.
Bhania, D.
Burman, S. K.
Behera, Keshab
Ram, Japhu
Mondal, Biswanath
Balaraman, M.
Manickyam, P.
Burman, Balaram
Burman, H. S.
Burman Sudhangshu
Ram, Munshi
Samulu, L.
Das, Sitaram
Balmiki, Kishanlal
Srinivssan, V. K.
Sundar, Ram
Manna, L. C.
Yadav, A. L.
Saha, P. C.
Biswas, Jagdish
Santra, Gangadhar
Biswas, S. C.
Mondal, Niranjan Kumar
Raju, Kolludharma
Das, Jhantu Ranjan
Biswas, Hiralal
Balmiki Kartore
Bahadur, Bhim
Das Gunadhar
Shaw, Gulab
Santram
Bhava, C. K.
Burman, H. K.
Dhanuk, Badlu
Nayak, B. K.
Das, Nikunjalal
Dehuri, Basudeb
Lal, Bideshi

SUPPORTING GRADE I

Sahoo, K. M.
Mondal, Bholanath
Mani, N.
Mondal, Kalashashi
Debroy, R. L.
Saha, Mohan Lal
Saha, Manoranjan
Bain, G. C.
Pugalendhi, B.
Bairagi, Suklal
Ghosh Pasupati
Bhoi Shyama
Swain, Raghunath
Bahadur, Surja
Bijali, Amalya
Mallah, Munilal
Kachari, P. C.
Krishnappa, B. N.
Rajaratnam, R.
Mahendran, S.
Dhir, K. K.
Naik, G. C.
Pramanik, G. C.
Karkatta, Joseph
Saha, P. C.
Ray, Pradupta Kishore
Das, Mukti
Bahadur, Lal
Bahadur, Man
Bhoi, M. S.
Choudhury, Panchulal
Das, Balaram
Paria, J
Bhol, R. K.
Das, Giridhari
Bose, Hiralal
Ghosh, A. C.
Bahadur Mina Rani
Ram, Rajendra
Khalko, Joseph
Bose, Sankar
Karmakar Sarbananda
Sethi, P. K.
Biswas, A. K.
Behera Chhakei
Ali Munsur
Bhuyan Dhircndra
Bahadur, Sitaram
Paik, B. C.
Omprakash
Prasad, Lalta
Mahadeva, M.
Palanisamy, R.
Bahadur, Karna
Bahadur, Indra
Bahadur, Asta
Rao, G. Santa
Muchi, R. U.
Arumugam, P.
Khatua, Jadumani
Subbaiyan, K
Bhattacherjee, Ashutosh
Kumhar, Kharban
Ghume, T. H.
Behera, Rama
Naik, Krishna Ch.
Behera, Debahari
Mollick, G. C.
Parida, Fakir
Behera, Rajkishore

Parida Satyananda
Kaliannan, K.
Mallah, Jai Nandan
Biswas, Manindranath
Biswas, Ashoke Kumar
Mondal, Nityananda
Govate, S. T.
Naik, M. B.
Seshanna
Sahni, Aghanu
Burman, Shatendra
Raj, Karam
Halder, L. K.
Jally, Baman
Mallah, Rajdhari
Das, B. C.
Dukhran
Murugesan, A.
Das, B. C.
Karuppannan, P.
Mariappan, V.
Kemparasa, A.
Ram, Paras
Ringh, C. P.
Runadale, G. J.
Satyanarayana, U.
Bhuiya, N.
Parida, Golekha

Sahoo, Lakshmidhar
Krishnan, M. V.
Hazarika, B.
Mondal, Biswanath
Das, Krishori Mohan
Jana, Bibhuti Kr.
Sita
Yasiah, R.
Ramaswamy, A.
Biswas, Sukh Chand
Prasad, Ram
Singh, Maha
Semanta, Narayan Ch.
Mani, K.
Ningegowda, K.
Lakshmi, Ram
Subramani
Biswas, A.
Bez, P. C.
Gowda, Maligc
Gangayya, A
Bind, M. P.
Mukhia, J.
Dhibar, Gunadhar
Choudhusi, Umesh
Paramanik, P. C.
Anjanappa, M.
Subramaniam K.

Jally, Kedar Chandra
Singh, Kuldeep
Subramani, M.
Parida, Sridhar
Mahalick, Antaryami
Das, Rash Bihari
Parida, Judhistir
Barik Basanta Kumar
Behera, Makunda Charan
Rao, Medisethi Chandra
Samal, Chaitanya Charan
Halder, Satyendra Nath
Mondal, Sachindra
Swain, Ramesh Chandra
Das, Parsuram
Bhoi, Bijaya
Das, M. C.
Samanta, Pravansu Sekhar
Balmiki, Khem Chand
Raju, A. Eswar
Dhanuk, Shyamlal
Balmiki, Iswar Ram
Rao, P. Nageswar
Patnaik, B.
Swain, Rajan
Nayak, Sripati
Shree Nath
Ali, S. K. Munsur

Prasad, Shitala
Bendre, S. S.
Boro, Bhabalu
Palai, Duryodhan
Betal, Sasadhar
Das, Jayaram
Jana, Gourhari
Mandal, Kalipada
Samal, Krushna Chandra
Khan, Rahmat
Das, Sudhakar
Gharami, Phani
Halder, Sital Chandra
Swain, Jatadhari
Naik, Sudarsan
Mohd. Yusuf Dar
Govindalal
Ram, Kawal Pati
Das, Dhaneswar
Parameshwar
Jena, Panchanan
Balmiki, Jagadish
Jena, N.
Nayak, P. K.
Swain, Pitamber
Behera, Dhanu
Halder, Hemlata

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APPENDIX I

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
(I. C. A. R.)
BARRACKPORE : WEST BENGAL

Ministry/Department/Office of Central Inland Fisheries Research Institute, Barrackpore, West Bengal.
Statement showing the total number of Government servants and the number of scheduled castes/ tribes amongst them as on 1st January 1980

Class	Permanent Temporary	Total No. of employees	Scheduled Castes	Percentage to total employees	Scheduled Tribes	Percentage to total employees	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Class I	Permanent	69	3	4%	—	—	—
	Temporary	95	8	8.42%	—	—	—
Class II	Permanent	18	1	6%	—	—	—
	Temporary	69	4	6%	1	1%	—
Class III	Permanent	167	38	18%	1	1%	—
	Temporary	113	26	23%	8	8%	—
Class IV	Permanent	164	43	23%	1	10%	—
	Temporary	145	30	20.69%	3	2%	—
Class IV	Permanent	14	14	100%	—	—	—
(Sweeper)	Temporary	5	4	80%	1	20%	—
Total		859	171		15		

ORGANISATION CHART OF
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
BARRACKPORE-743101 WEST BENGAL

DIRECTOR

ESHWATER AQUACULTURE DIVISION
Dhauli P. O. Kausalyagang
(Via) Bhubaneswar, Orissa

- Culture Section
- Culture Section
- c Fish Culture Section
- Control Section
- Chemistry Section
- Culture Section
- Farm Engineering Section
- Pathology Section
- Hybridisation & Genetics Section

RESHWATER AQUACULTURE RESEARCH & TRAINING CENTRE (Dhauli)

- (Matsya)
- Trainers' Training Centre (Fisheries)
- Rahara Research Centre

ESTUARINE FISHERIES DIVISION
47/1, Strand Road
Calcutta-7

- Estuarine Fisheries Section
- Hilsa Fisheries Section
- Water Pollution Section
- Statistical Section
- Plankton Culture Section

CALCUTTA RESEARCH CENTRE

- Bakkhali Research Centre
- Kakdwip Research Centre
- Barrackpore Research Centre
- Madras Research Centre

- Uluberia Survey
- Raidighi Survey
- Port Canning
- Pulicat Survey

RIVERINE & LACUSTRINE FISHERIES DIVISION
24, Pannalal Road
Allahabad 2 (U. P.)

- Riverine Fisheries Section
- Hilsa Fisheries Section
- Reservoir Fisheries Section
- Statistical Section
- Water Pollution Section

ALLAHABAD RESEARCH CENTRE

- Srinagar Research Centre
- Tadepalligudem Research Centre
- Kakinada Research Centre
- Buxar Research Centre
- Bangalore Research Centre
- Bhagalpur Research Centre
- Gauhati Research Centre
- Mans Research Centre, Muzzaffarpur

- Lalgola

ALL INDIA COORDINATED RESEARC

COMPOSITE FISH CULTURE AND FISH SEED PRODUCTION
Dhauli P. O. Kausalyagang
(Via) Bhubaneswar, Orissa

Subcentres

- Kalyani (West Bengal)
- Badampudi (Andhra Pradesh)
- Bhavanisagar (Tamil Nadu)
- Jaunpur (Uttar Pradesh)
- Karnal (Haryana)
- Pune (Maharashtra)
- Ranchi (Bihar)
- Gauhati (Assam)
- *Godhra (Gujarat)
- *Tuticorine (TamilNadu)
- 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)

RESERVOIR FISHERIES
Barrackpore (W

Subcentres

- Nagarjunasagar)
- Nagarjunasagar (Andhra Pradesh)
- Bhavanisagar (Tamil Nadu)
- Rihand (Uttar Pradesh)
- Ranchi (Bihar)
- Bilaspur (Himachal Pradesh)