



CIFRI NEWSLETTER

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• PRAWN • FISH • PADDY

THE NEW TRIO IN INTEGRATED FARMING



RESEARCH HIGHLIGHTS

IMPRESSIVE YIELD FROM SEWAGE-FERTILISED PADDY PLOTS

Giant freshwater prawn, *Macrobrachium rosenbergii* did remarkably well when reared along with paddy utilising sewage as fertiliser. After 12 months of rearing 264 kg/ha of prawn was harvested. Paddy planted along the periphery of the plot provided shelter to prawns and yielded 1,700 kg/ha. And there was a bonus crop, 163 kg/ha of silver carp, stocked for controlling the algal bloom.

The new combination was tried in a 0.4 ha plot at the farm of the Rahara Research Centre of CIFRI. Deep water paddy-*Jaladhi* was planted all along the periphery of the pond (0.02 ha) to provide shelter to the growing prawns especially during the period of high temperature. The pond was initially fertilised with domestic

sewage and diluted with freshwater having normal oxygen concentration in the ratio 1 : 3. Juvenile prawns of the size 70-92 mm. (2.6 g) were stocked at the rate of 10,000/ha. After 12 months of rearing, a prawn yield of 264.0 kg/ha was obtained with a retrieval rate of 65.23%. Apart from the use of sewage effluent to increase

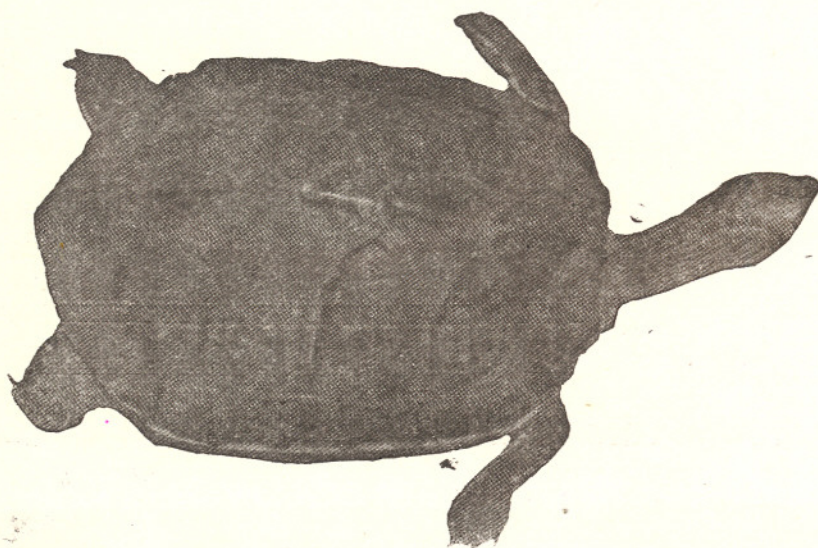
pond fertility the prawns were fed with boiled tilapia @ 1% body weight.

Silver carp was stocked @ 150/ha along with prawns as additional stocking component to control algal blooms consequent to fertilisation. They yielded 163 kg/ha.

Total harvest of paddy was @ 1,700 kg/ha.

This successful experiment adds a new facet to the integrated farming system, blending it with the concept of recycling the wastes. The results obtained are highly encouraging and they may open bright possibilities for large-scale adoption of the technique.

TURTLE AS BIO-AGENT CONTROLLING AQUATIC WEEDS



The turtle *Kechuga tectum* was found to be a potential bio-agent to control a variety of obnoxious weeds. The results of preliminary experiments were highly encouraging. The turtle could clear *Lemna trisulcata* (100%), *Ipomea aquatica* (90%), *Hydrilla verticillata* (77%-100%), *Eichhornia crassipes* (52-85%) and *Ceratophyllum demersum* (90-100%) in one to two days. It is significant that the food spectrum of *Kechuga tectum* ranges from soft weeds like *Hydrilla* to those having hard cuticle such as *Eichhornia*. The per day consumption for a 816 g turtle

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RESEARCH HIGHLIGHTS

for different aquatic weeds was 166.6 g of *Lemna*, 150 g of *Ipomea*, 146 g of *Hydrilla*, 104 g of *Eichhornia* and 70 g of *Ceratophyllum*. Average consumption by the turtle worked out to be 127 g/day/specimen. A total of 19 turtles were used and the trials were conducted in cement cisterns. Six turtles of av. 816 g cleared weeds upto 20.4% of their body weight in a day while smaller

turtles of 161 g consumed upto 35.8% of their body weight.

The intensity of feeding was observed to be more during night than day, indicating their preference for nocturnal feeding. Fishes and turtles when kept together in cisterns were found to be highly compatible. In *Kechuga tectum* lies a potential bioagent to control the aquatic weeds in fishery waters.

MAJOR CARPS BRED AT HIGH ALTITUDE

Induced breeding of Indian major carps, mrigal and rohu was successfully done at Sattal Lake at an altitude of 4000 ft. above MSL.

Sattal Lake lies in the Kumaon Himalayas 11 km west to Bhimtal in Uttar Pradesh. In a recent experiment conducted by the Central Inland Fisheries in collaboration with the State Dept. of Fisheries, Uttar Pradesh, *Cirrhinus mrigala* and *Labeo rohita* were bred in the lake. The Indian major carps normally breed at much lower altitudes.

In four sets of experiments

2,80,000 eggs of mrigal and 80 000 eggs of rohu were produced. Preliminary hormone was injected @4 mg/kg body weight and 8 mg/kg body weight in first and second doses respectively. Breeding occurred 9 hours after the II injection, in the first set while in case of second set it took 11 hrs.

Percentage of fertilisation was 40% to 60% in mrigal and 20% in rohu. Hatching took place 17.30 hrs. after breeding. Water temperature was 26.0°C to 28.0°C, turbidity nil, pH 8.1-8.2 and dissolved oxygen was 8.12 to 8.44 ppm when breeding occurred.

WORLD ENVIRONMENT DAY

SAIL OR SINK WITH NATURE

CIFRI fraternity on the eve of 'World Environment Day', resolved to serve the cause of a healthy environment. Talking to an elite gathering on the occasion, Dr. A. V. Natarajan, Director expressed

the need for an environmental conscience of a higher order. He cited some commonest and clearly visible instances where human infringement into the environment in the name of develop-

ment, threw the built-in balances of nature out of gear. Indiscriminate destruction of green belt, the resultant erosion in catchment areas, adverse effects of industrial and domestic effluents and a host of other factors infused large-scale environmental degradations.

Most of our riverine and estuarine systems were already subjected to the onslaughts of industrial and sewage effluents. Dr Natarajan rightly pointed out the vulnerability of aquatic environment and called for concerted efforts to conserve our diverse and rich aquatic resources. However, he expressed satisfaction that adequate importance was now being given to environment management in our planning. He sought for mass participation in conservation programmes.

Dr. B. I. Sundararaj the noted Zoologist, cautioned against any apathy towards environment. The very survival of life on this planet depends on a balanced environment. The damage inflicted on environment is often irreversible. He cited the precautions taken in the West to protect their flora and fauna.

Dr. Sundararaj and Dr. Natarajan urged the members of CIFRI family to cultivate a high sense of awareness about the environment and to make positive contributions to its improvement. **After all, we have to 'sail or sink' with the nature.**

EXTENSION

Lab to Land Programme

Hundred farm families from 10 villages at Chanditala and Kamar-pukur areas, Hooghly Dt. were benefitted by the Lab to Land Programme. A demonstration on composit fish culture was arranged at Kalyanbati on 15. 7. 83. About 5.3 lakhs spawn of Indian major carps and 4.0 lakhs spawn of Chinese carps was produced under the programme. A group discussion on 'Induced Breeding and Nursery Pond Management' was held at Alipore, Chanditala II Block in which 27 fish farmers of the locality took active part.

Training

A five day training programme was arranged for Dr. O.H. Ayinla

Vice principal, Federal Fisheries School, Lagos, Nigeria under an FAO sponsored scheme. Dr. Ayinla visited the Rahara and Kakdwip Research Centres of the Institute. He also observed the work under Lab to Land Programme at Chanditala. Dr. Ayinla was at CIFRI from 5.5.83 to 9.5.83. □

A one day training was organised for 5 Fisheries Extension Officers under FFDA, U. P. on different aspects of inland aquaculture on 25.6.83. □

Four fish farmers from Arunachal Pradesh were trained in modern methods of aquaculture from 19. 7. 83 to 22. 7. 83. □

Students from 8 educational and training institutions visited the

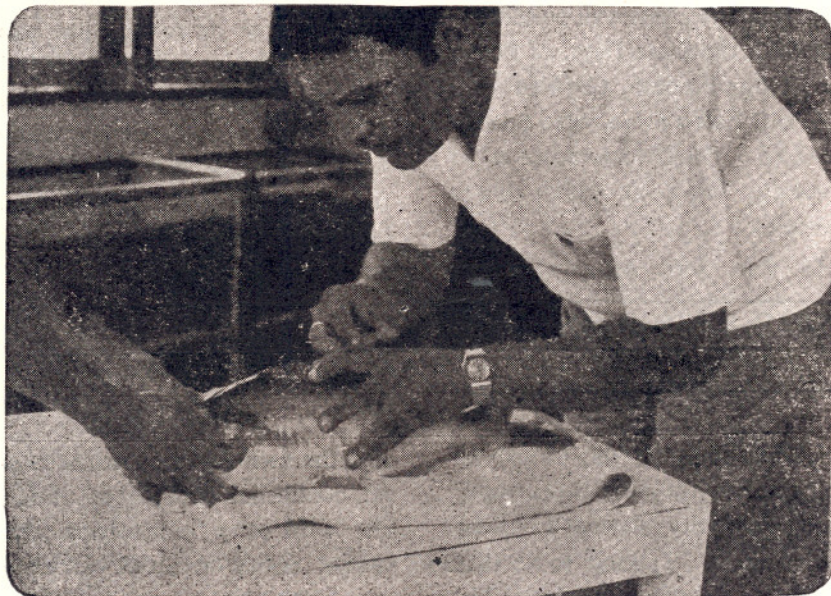
Institute from May to August 1983. A total of about 200 such students were taken round the laboratories and field to apprise them of the latest methods adopted in scientific aquaculture. □

Shri P. K. Pandit, Scientist visited six ponds at the Burdwan University campus on 26. 6. 83 and offered suggestions for better utilisation of the ponds. He suggested ways for preparation of nursery, rearing and stock ponds for obtaining better production. □

S/sri R. N. Pal, P. R. Sen and U. Bhowmick, Scientists attended a seminar on rural reconstruction organised by Ramakrishna Vivekananda Mission, Barrackpore on 13. 6. 83. □

MANPOWER DEVELOPMENT

Dr. N. K. Thakur Scientist and Training Organiser KVK/TTC, Kausalyagang visited Thailand on an FAO/UNDP fellowship programme from 19.5.83 to 20.6.83. Dr. Thakur got acquainted himself with the latest techniques of culture and propagation of *Pangasius sufchi* at the Thai Department of Fisheries. He has also updated his knowledge on *Clarias batrachus*.





Dr. A. K. Mondal, Scientist had been to the Rice University, Houston, Texas as an FAO/UNDP Fellow from 4 April to 3 June, 1983. At Houston, Dr. Mondal worked with Dr. Stephen Subtelny, Professor of Biology on various aspects of frog embryology and genetics. He learned in detail the identification and staging of embryos from the onset of cleavage to the tadpole stage. Other areas covered during the programme were enucleation of fertilised frog eggs by removal of the egg nucleus prior to second polar body formation and production of androgenic haploids. Methods of producing gynogenetic haploids by inactivation of the sperm nucleus using ultraviolet radiation and nuclear transplantation techniques were studied. He also carried out a series of studies on primordial germ cell migration. □



Sri A. V. P. Rao, Scientist of Madras Research Centre has undergone a 5 months training in hatchery management in Malaysia, Indonesia and Thailand. Sri Rao visited Port Dickson, Glugor Malacca, Puchong Jakarta, Jepara Prigi and Bangkok where he has undergone training in hatchery design feeding parasite control etc. He left India on 4th February 1983 on a FAO/UNDP Fellowship and returned on 20th July 1983. □

Sri Kuldip Kumar, Scientist has undergone a 20 days' intensive training at the National Dairy Research Institute, Karnal on the latest techniques of Cryopreservation of fish spermatozoa. The training included composition and ratios of different extenders, cryoprotectants, filling and sealing of straws and handling of cryogenic containers. Sri Kuldip is presently working on a problem entitled 'Cryopreservation of fish spermatozoa' in collaboration with the Department of Zoology, University of Delhi. The project aims to develop suitable extenders and cryoprotectants for long-term storage of fish spermatozoa using cryogenic techniques. □

Dr. H. C. Joshi attended a U. G. C. Seminar on 'Effect of Pesticides on Aquatic Fauna' at MHOW, M. P. from 18-22 June, 1983. He presented a paper 'Dynamics And Impact of Pesticides In Aquatic Environments'. □

STAFF NEWS

PH. D. AWARDED

Mr. M. J. Bhagat, Scientist at Barrackpore was awarded Ph. D. degree by the Ranchi University. Dr. Bhagat's thesis deals with the fishery and biological aspects of two commercially important fishes *Schizothoracichthys esocinus* and *Schizothorax niger* collected from Dal lake. The biological aspects covered the food and feeding habits, maturity and breeding, age and growth etc.



Ph. D.....



DR. R. K. BANERJEE

Mr. R. K. Banerjee, Scientist now posted at the Rahara Centre, West Bengal of CIFRI obtained the degree of Doctor of Philosophy from Patna University. His thesis was based on 'Ecological studies of effluents from certain industrial and municipal sources and of agricultural waste materials'. In his studies, Mr. Banerjee dealt extensively with the efficacy of penicillin mycelium distillary effluents, cotton seed waste, poultry droppings, city refuse and sewage sludge as either fish feed or pond manure. His study revealed that organic matter with high BOD₅ is preferable as pond manure, provided it attains mesosaprobic condition rapidly. Banerjee's study is very pertinent in the context of recent efforts to 'utilise the waste' rather than simply to 'dispose' them off.

NEW PROJECT COORDINATORS



MR. B. V. GOVIND

Dr. M. Y. Kamal and Shri B.V. Govind were appointed as Project Coordinators for the All India Coordinated Projects on Air-breathing Fish Culture, and Ecology and Fisheries of Freshwater Reservoirs respectively. Dr. Kamal took over the charge of his project on 25. 7. 83 at Barrackpore. Shri B. V. Govind joined at Nagarjunasagar as Project Coordinator on 7. 5. 83.



DR. M. Y. KAMAL

SELECTED TO S-3 GRADE



MR. K. K. SUKUMARAN

Dr. K. L. Sehgal and Shri K.K. Sukumaran were recruited as S-3 scientists on the basis of direct selection by Agricultural Scientists Recruitment Board. Dr. Sehgal joined his duties as S-3 at Barrackpore on 11. 7. 83 and Shri Sukumaran at FARTC, Dhauli on 13. 7. 83.



DR. K. L. SEHGAL

PROMOTIONS

The following scientists were promoted to the next higher grade on the basis of five yearly assessment by Agricultural Scientists Recruitment Board.

Name	From	To	w. e. f.
1. Dr. M. L. Bhowmick	S-1	S-2	July 1980
2. Shri A. K. Ghosh	-do-	-do-	-do-
3. „ S. B. Saha	-do-	-do-	-do-
4. „ K. K. Bhanot	-do-	-do-	-do-
5. „ K. L. Shah	-do-	-do-	-do-
6. „ G. R. M. Rao	-do-	-do-	-do-
7. „ D. Kapoor	S	S-1	-do-
8. „ N. P. Srivastava	-do-	-do-	-do-
9. „ B. K. Singh	-do-	-do-	-do-
10. „ V. K. Sharma	-do-	-do-	-do-

Advance increments were granted to the following scientists :—

Name	No. of increments	w. e. f.
Sri S. K. Wishard	one	July 1980
„ V. Kolekar	Three	-do-

The following technical personnel were promoted to the higher grades on the recommendations of selection committee for technical personnel :

Name	From	To	w. e. f.
Shri Kuldip Kumar	T-4	T-5	1.7.83
Shri B. R. Dutta	-do-	-do-	1.1.83
Shri Radheshyam	-do-	-do-	-do-
Shri G. C. Sahoo	T-2	T-I-3	1.7.83
Shri S. C. Bhowmick	-do-	-do-	-do-
Shri S. C. Mondal	T-1	T-2	1.1.83

TRANSFERS

The following transfers were made during May to August 1983 :—

Name	From	To
1. Shri K. K. Ghosh	S-2 Barrackpore	Dhauri
2. Shri S. N. Dutta	S-1 Dhauri	Cuttack
3. Shri N. K. Tripathi	Liaison Officer „	„
4. Shri S. Patnaik	S-2 Cuttack	Dhauri
5. Shri V. Kolekar	S Gauhati	Rihand
6. Shri F. A Zaidi	Assistant Cuttack	Rihand

		From	To	
7.	Sk. Abdul Halim	Sr. Clerk	Cuttack	Dhauri
8.	Shri R. Tarai	Driver	-do-	-do-
9.	Shri D. Tarai	Driver	-do-	-do-
10.	Shri D. Sahoo	SS-IV	-do-	-do-
11.	Shri D. N. B. Singh	-do-	-do-	-do-
12.	Shri U. Bhuyan	-do-	-do-	-do-
13.	Shri Bhikari Naik	SS III	-do-	-do-
14.	Shri P. Mishra	-d-	-do-	-do-
15.	Shri K. C. Behera	-do-	-do-	-do-
16.	Shri P. C. Sethi	-do-	-do-	-do-
17.	Shri S. R. Patnaik	-do-	-do-	-do-
18.	Shri D. Nayak	-do-	-do-	-do-
19.	Shri Bhaskar Pradhan	SS II	-do-	-do-
20.	Shri L. Sahoo	-do-	-do-	-do-
21.	Shri R. N. Swain	-do-	-do-	-do-
22.	Shri Golekha Parida	SS I	-do-	-do-
23.	Shri S. Das	-do-	-do-	-do-
24.	Shri G. C. Nayak	-do-	-do-	-do-

Club Corner

The Annual General Body Meeting of CIF Recreation Club was held on 30th March, 1983 at CIFRI Auditorium. Shri K. C. Roy, Joint Secretary, presented the audited accounts and report for the preceding year. After reviewing the performance during last year the meeting has elected new office bearers for the Club as follows :

President	Dr. A. V. Natarajan
Vice-President	Shri L. M. Nandi
Jt. Secretaries	Shri Amitabha Ghosh & Smt. Bani Roy
Cultural Secretary	Shri T. Chatterjee
„ Sub-Committee	Shri B. C. Dutta Shri D. C. Bose Shri S. Dasgupta Smt. S. Das
Sports Secretary	Shri S. Bahadur
„ Sub-Committee	Shri K. K. Bhanot Dr. V. K. Unnithan Shri P. K. Ghosh Shri J. Banerjee
Library Secretary	Shri H. K. Sen
„ Sub-Committee	Dr. M. J. Bhagat Dr. V. Pathak Smt. Sikha Mazumdar Shri K. P. Nath
Treasurer	Shri S. B. Roy
Auditors	Shri A. N. Mukherjee & Shri K. C. Roy

Dr. Natarajan in Advisory Body to Govt. of U. P.

Dr. A. V. Natarajan, Director of CIFRI, has been nominated by the Government of Uttar Pradesh as a member of the 'Advisory Committee for Agriculture and Allied Sector'. He is already a member of the Council of Science and Technology Government of U. P.

Sushanto back at CIFRI

Shri Sushanto Kumar Saha, S-1 joined at Rahara Research Centre of CIFRI on 9th June, 1983. He was serving as Analyst in Central Water Laboratory, New Delhi.

They called it a day

Shri S. R. Ghosh, Scientist-1 retired voluntarily from the services of ICAR on 12 June, 1983.

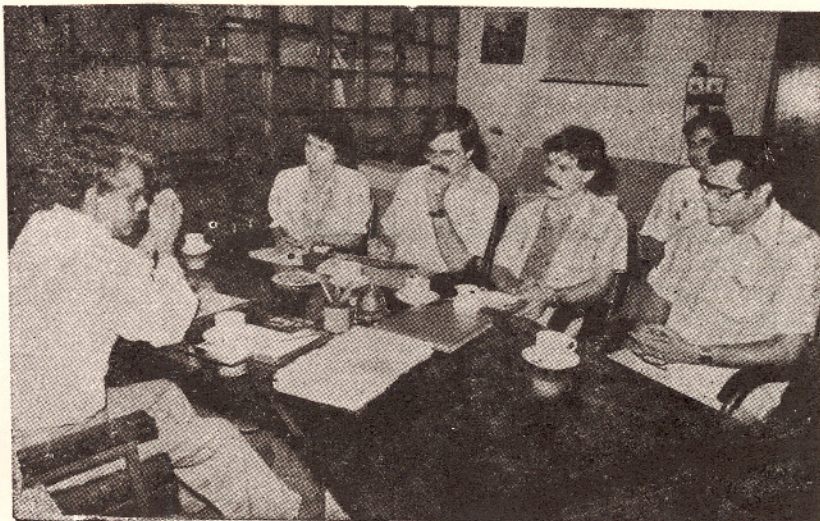
Dr. D. S. Murthy, Technical Officer (T-6) chose to retire from the services voluntarily. He was relieved on 11.5.83.

Shri D. Singh, Supporting staff grade III at Barrackpore retired on 31st May, 1983 on attaining the age of superannuation.

VISITORS

Scientists from Laos

A team of 5 Scientists from Laos, Vientiane under the leadership of Mr. Srubanti visited the Institute on 9. 5. 83. The other members were Mr. Thongphoot, Mr. Sopha, Mr. Somsak and Mr. Bounmy. Four Nigerian visitors called on the Institute on 11.5.83 were Mr. A. D. D. Apunpa, Lagos Mr. Tola Oto, Alkura, Mr. E. O. Opulah, Port Harcourt and Mrs. T. I. Agbalatobe, Lagos.



Mr. Lavarde, Mr. Piloquet and Miss Francois were briefed by the Director at his chamber (above). Later they were taken around the laboratories and the recirculatory filtering system of ponds (below).

French scientists visits the Institute

Three scientists, i. e., Mr. Patric Lavarde, Mr. Jean-Marc Piloquet and Miss Francois Guinard of National Institute of Rural Engineering and Water and Forestry, Paris, France (Ecole Nationale du Genie Rural des Eaux et Forets, Ministere de Lagriculture) had been to Central Inland Fisheries Research Institute, Barrackpore, on 7 July 1983, to acquaint themselves with the research programmes of the Institute in inland fisheries and also methods adopted in the transfer of technologies to practising farmers. Dr. A. V. Natarajan Director, CIFRI, explained to them in detail the various technologies developed by the Institute relating to cold-water fish culture, warmwater fish culture, brackishwater fish culture, sewage fed fish culture integrated fish farming, etc. and



explained to the visitors the roles of KVK/TTC, Lab to Land Programme and demonstration programmes in the transfer of technologies. He also pointed out the

roles of FFDA and IRD in rural development

The visitors also met farmers who had been benefitted from Lab to Land Programme.

LIBRARY

New Additions

Books

- Morris, I. *ed.*
The Physiological ecology of phytoplankton : Studies in ecology, Vol. 7
- Moss, Brian
Ecology of freshwaters
Captain R. Beavan
Handbook of the freshwater fishes of India
- FAO
Modern fishing gears of the world Part II
- Kudo, Richard R.
Protozoology, 5th Edition
- Connell, J. J. *ed.*
Advances in fish science and technology : Papers presented at the Jubilee Conference of the Torry Research Station, Aberdeen, Scotland, 23-27 July, 1979.
- Varley, Margaret E.
British freshwater fishes
- Oren, O. H. *ed.*
Aquaculture of grey mullets—International Biological Programme 26
- Kreier, Julius P. *ed.*
Parasitic protozoa, Volume I : Taxonomy, kinetoplastids and flagellates of fish ; Vol II. : Intestinal flagellates, histomonads, trichomonads, amoeba, opalinids and ciliates and; Vol. III : Gregarines, haemogregarines, Coccidia, Plasmodia and haemoproteids.
- Captain W. H. Perry MRIN
Fishermen's Handbook
- Skinner, F. A. and J. G. Carr *ed.*
Microbiology in agriculture, fisheries and food (The Society for Applied Bacteriology, Symposium Series No. 4)
- Winberg, G. G. *ed.*
Methods for the estimation of production of aquatic animals
Bliss, C. I.
Statistics in biology : Statistical methods for research in the natural sciences, Vol. I
- Brown, E. Evan and John B. Gratzek
Fish farming handbook : Food, bait, tropicals and goldfish
- Mather, Kenneth
Statistical analysis in biology
- Imal, Takeo
Aquaculture in shallow seas : Progress in shallow sea culture
Buchanan, R. E. and Gibbons *ed.*
Bergey's manual of determinative bacteriology, Eighth edition
Union list of current scientific serials in India, December, 1981 (Union Catalogue Series 18)
- Esser, Karl
Cryptograms : Cynobacteria, algae, fungi, lichens
Lockwood, A. P. M. *ed.*
Effects of pollutants on aquatic organisms
Round, F. E.
The ecology of algae

- Kurian, C. V. and V. O. Sebastian
Prawns and prawn fisheries of India. Second revised edition
Prepared and published jointly by A. P. H. A.—A. W. W. A.—W. P. C. F.
Standard methods for the examination of water and wastewater. 15th Edition
Supplement to the Fifteenth Edition of Standard methods for the examination of water and wastewater : Selected analytical methods approved and cited by the United States Environmental Protection Agency.
- Prasher, R. G.
An introduction to reprography
- Ranwell, D. S.
Ecology of salt marshes and sand dunes
- Rheinheimer, G.
Aquatic microbiology, Second edition
- Boyd, Claude E.
Water quality management for pond fish culture (Development in Aquaculture and Fisheries Science, 9)
Indian Institute of Management, Ahmedabad.
- Inland fish marketing in India. Vol. I : Overview : Summary and conclusions ; Vol. II : Fish seed production & marketing ; Vol. III : Freshwater culture fisheries ; Vol. IVa : Reservoir fisheries ; Vol. IVb : Case studies of selected major reservoirs ; Vol. IVc : Profiles of selected reservoirs ; Vol. V : Riverine fish system ; Vol. VI : Brackishwater culture, estuaries, lakes & swamps ; Vol. VII : Markets, cooperatives and corporations ; Vol. VIII : Data base for planning & control.
- Barnes, R. S. K. and K. H. Mann *ed.*
Fundamentals of aquatic ecosystems
- Pennak, Robert W.
Freshwater invertebrates of the United States. 2nd Edition.
- Raychoudhuri, S. P. and D. S. Gupta *eds.*
Proceedings of International Symposium on Environmental Pollution and Toxicology
- Huet, Marcel
Textbook of fish culture ; Breeding and cultivation of fish
- Pillay, T. V. R. and Wm. A. Dill *ed.*
Advances in aquaculture—Papers Presented at the FAO Technical Conference on Aquaculture, Kyoto, Japan, 26th May—2 June, 1976.
- Hutchinson, G. Evelyn
A treatise on limnology Vol. I : Geography, Physics and Chemistry Part—I, Geography and physics of lakes.
Waterman, Talbot H. *ed.*
- The Physiology of crustacea, Vol. I : Metabolism and growth
- Draper, N. R. and H. Smith
Applied regression analysis, Second edition
- Albanese, Anthony A.
Newer methods of nutritional biochemistry with applications and interpretations, Vol. V.
- Cochran, William G. and Gertrude M. Cox
Experimental designs. Second edition
- Laws, Edward A.
Aquatic pollution
- Mitchell, John and Donald Milton Smith
Aquametry Part III. : A treatise on methods for the determination of water. Second edition.
Better farming series/27—Freshwater fish farming
FIRI/T217—Conservation of the genetic resources of fish : Problems and recommendations.
- Malins, D. C. and J. R. Sargent *ed.*
Biochemical and biophysical perspectives in marine biology Vol. I
- Lucky, Zdenek
Method for the diagnosis of fish diseases (Translated from Czechoslovakian)

LIBRARY

- Mithani, D. M.
Introductory economic statistics
Puttaswamaiah, K. *ed.*
Project evaluation criteria and cost benefit analysis
Kuznets, Simon
Modern economic growth—Rate, structure and spread
Plumer, David T.
An introduction to practical biochemistry.
Tonapi, G. T.
Freshwater animals of India (An ecological approach)
Odum, Eugene P.
Ecology : The link between the natural and social sciences. 2nd edition.
Imai, Takeo *ed.*
Aquaculture in shallow seas : Progress in shallow sea culture.
Bridwater, A. V. and C. J. Mumford
Waste recycling and pollution control handbook
Sieburth, John McNeill
Sea microbes
Kyushin, Kenichiro & Ntsers
Fishes of the South China Sea
Nikolskii, George V
Theory of fish population dynamics : As the biological background for rational exploitation and management of fishery resources
Hamilton, Francis
An account of the fishes found in River Ganges and its branches
Day, Francis
The fishes of Malabar
Pearse, A. G. Everson
Histochemistry : Theoretical and applied, Vol. 2, 3rd edition
Morton, J. E.
Molluscs
Benefield, Larry D. and Clifford W. Randall
Biological process design for wastewater treatment
Guilbault, George G.
Enzymatic methods of analysis

Journals

1. AID Research & Development Abstracts, 10 (1/2 & 3/4), 1982.
2. Amazoniana, 7 (3), 1982
3. American Fisheries Society : Special Publication Nos. 12-13, 1980 & 1982.
4. Aquaculture Hungarica, 111, 1982.
5. Aquaculture, 31 (1, 2, 3, 4), 32 (1, 2 & 3/4), 33 (1-4), & 34 (1/2 & 3/4), 1983.
6. Aquatic Botany, 15 (3-4), 1983 and 16 (2-3), 1983.
7. Australian Fisheries, 40 (1), 1981.
8. Australian Journal of Biological Sciences, 35 (6), 1982 and 36 (1), 1983.
9. Australian Journal of Marine and Freshwater Research, 34 (1-2), 1983.
10. Australian Journal of Zoology, 31 (1-2), 1983.
11. BAMIDGEH, 34 (4), 1982.
12. Bibliography on Fishery Technology, 17 (1-12), 1981.

13. Biological Abstracts 74 (8, 11 & 12), 1982 and 75 (1-5), 1983.
14. Biological Bulletin, 164 (1-2), 1983.
15. Biometrics : Journal of the Biometric Society, 38 (3-4), 1982.
16. Bulletin of Marine Science, 33 (1), 1983.
17. Canada Fisheries & Marine Service, Technical Report Nos. 1135, 1139, 1140, 1142, 1143, 1149, 1156, 1157 & 1158, 1982-1983.
18. Canada Fisheries Research Board, Bulletin No. 211, 1983.
19. Canadian Journal of Development Studies, 1 (1-2), 1980 and 3 (2), 1982.
20. Canadian Journal of Fisheries and Aquatic Sciences, 40 (3-7), 1983.
21. CIFNET Newsletter, 3 (2-4), 1983.
22. Commercial Fish Farmer & Aquaculture News, 9 (3-4), 1983.
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24. (A) Current Awareness Bibliography for IDRC—Supported Fisheries Projects, 7 (1), 1983.
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26. California Fish and Game, 69 (1), 1983.
27. Ecological Modelling, 18 (2, 3, 4), 1983 and 19 (1-3), 1983.
28. Enfo : A Quarterly Newsletter of Environmental Sanitation Information Centre, 5 (2), 1983.
29. Environmental Biology of Fishes, 8 (1, 2, 3/4), 1983 and 9 (1) 1983.
30. Environmental Conservation, 9 (4), 1982 and 10 (1), 1983.
31. Environmental Pollution, 30 (1-4) and 31 (1-3), 1983.
32. Environmental Sanitation Abstract, 5(1), 1983.
33. Environment and Ecology, 1 (2), 1983.
34. Environment International : A Journal of Science, Technology, Health, Monitoring and Policy, 8 (1-6), 1982 and 9 (1), 1983.
35. Estuaries : Journal of the Estuarine Research Federation, 6 (1), 1983.
36. FINS : Fisheries News, 14 (1), 1981, 15 (2), 1982 and 16 (1), 1983.
37. Fisheries : A Bulletin of the American Fisheries, 7 (6), 1982.
38. Fisheries Economics Newsletter, Nos. 13, 14, 1982 and 15, 1983.
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