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भाकृअनुप
ICAR

NATIONAL BUREAU OF FISH GENETIC RESOURCES

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Contents

1. INTRODUCTION

1.1 Brief History

In view of the national programmes for improvement and expansion of both inland and marine fisheries of the country, it has been recognised that enhancement of fish production alone is not enough and conservation of the diversity of the natural fish populations is a necessary prerequisite. Appreciating this, the Government of India approved establishment of the Bureau at the end of the Sixth Five Year Plan.

The National Bureau of Fish Genetic Resources was thus sanctioned in December 1983 under the Indian Council of Agricultural Research.

1.2. Mandate

* Collection, classification and evaluation of information on fish genetic resources of the country;

* Cataloguing of genotypes;

* Maintenance and preservation of fish genetic material in co-ordination with other agencies and conservation of endangered fish species; and

* Monitoring the introduction of exotic fish species in Indian waters.

1.3 Organisation

The organisational set up of the Bureau was structured for meeting the objectives. Four centres have been approved in order to take up work on different resources. These are: (i) Freshwater fish genetic resource centre, located at the headquarters of the Bureau (ii) Brackishwater fish genetic resource centre to be located at the headquarters of the Central Institute of Brackishwater Aquaculture (iii) Marine fish genetic resource centre will be located at the Central Marine Fisheries Research Institute at Cochin (iv) Coldwater fish genetic resource centre will be located at the headquarters of the National Research Centre for Coldwater Fisheries.

The following subject matter sections have been set up at the headquarters of the Bureau at Allahabad:

i) Cytogenetics
ii) Biochemical Genetics
iii) Biology
iv) Conservation and Management.

These sections would be elevated to the status of divisions during the VIII Plan period.

1.4 Staff Position

The overall staff position as on 31 March 1993 is given below:

Sl. No.	Category of Posts	Posts sanctioned (No.)	Posts created (No.)	Staff in position	Posts vacant (out of created posts)
1	2	3	4	5	6
1.	Research Management (Director)	01	01	01	—
2.	Scientific	30	30	12	18
3.	Technical	35	18	18	—
4.	Administrative	15	09	09	—
5.	Auxiliary	02	02	02	—
6.	Supporting	29	13	13	—
	Total	112	73	55	18

1.5 Finance

Allocation of fund and expenditure incurred during the year 1992-93.

Budget	Allocation (Rs. in lakhs)	Expenditure (Rs. in lakhs)
Plan	100.00	50.44
Non-Plan	23.00	23.00
Total	123.00	73.44

2. RESEARCH ACHIEVEMENTS

2.1 FB.1 Cataloguing of Fish Genetic Resources of India

P.C. Mahanta, D. Kapoor, S.P. Singh, A.K. Singh, R. Dayal, S.M. Srivastava, R.S. Patiyal, K.D. Joshi, Ajay Kumar Singh and S.K. Paul.

1. Compilation of information of fish germplasm resources of India

(a) The draft checklist on fish species of India has been updated in consultation with experts and also through consultation of libraries in different research institutes like CICFRI, CMFRI, CIBA, ZSI etc. The Indian distribution of the species recorded earlier has been extended to worldwide distribution of Indian species.

The list contains 2200 fin fishes in different ecosystems as given below:

Ecosystem	No. of species	Percentage
Coldwater	73	3.32
Warmwater	544	24.73
Brackish-water	143	6.50
Marinewater	1440	65.45
Total	2200	100.00

(b) The preparation of the catalogue of fish genetic resources of India is in progress. The catalogue incorporates information on taxonomy, morphology, morphometric characters, distribution, habitat, bionomics, life histroy, food and feeding, sexuality, fishery and aquaculture, genetics, conservation status of the fish etc. Information for about 400 fish species including commercially important ones were collected upto the end of the year under report.

(c) Identification of endangered, threatened and rare fishes

The National Seminar on 'Endangered Fishes of India' was held in April 1992 at Allahabad. On the basis of deliberations of the eminent scientists, conservationists, naturalists etc. at the seminar, the tentative list of endangered fishes earlier prepared at this Bureau had been updated. Due to lack of previous data and present quantitative figures the fishes are grouped into two main categories, endangered and indeterminate. The tentative list of the endangered and indeterminate fishes thus prepared consists of 95 fish species as below. However, the list is receiving attention for its finalisation.

Ecosystem	No. of Species		
	Endan-gered	Indeter-minate	Total
Coldwater	6	13	19
Warmwater	15	33	48
Brackish-water	4	9	13
Marine Water	2	13	15
Total	**27**	**68**	**95**

List of Endangered Fishes

Warmwater Ecosystem

	Fishes		Habitat & Distribution
1.	Ailia coila	—	Ganga & Mahanadi river systems
2.	Anguilla bengalensis	—	Bihar, Brahmaputra and Barak river, Assam, Narmada river
3.	Bagarius bagarius	—	Ganga river system, U.P. waters
4.	Eutropichthys vacha	—	Ganga river system, U.P. waters
5.	Labeo dyocheilus	—	Brahmaputra, Mahanadi, Narmada rivers
6.	Notopterus chitala	—	Ganga, Narmada, Chambal and Mahanadi
7.	Ompok pabda	—	Ganga, Brahmaputra, Narmada, Mahi rivers and lakes, tanks of Eastern U.P.
8.	Pangasius pangasius	—	Ganga river system, Mahanadi, Hooghly-Matlah estuary & rivers of East coast
9.	Ompok pabo	—	Ganga, Brahmaputra & Barak river system
10.	Puntius sarana	—	Brahmaputra & Barak river system
11.	Semiplotus semiplotus	—	Brahmaputra & Barak river system
12.	Tenualosa ilisha	—	Ganga above Farakka barrage, Cauvery, Mahanadi, Narmada & Tapti
13.	Thynnichthys sandkhol	—	Krishna and Godavari
14.	Tor khudree	—	Narmada, Westernghats rivers of Travancore, Nagarjun sagar, Mahanadi & Cauvery river system

Coldwater Ecosystem

1.	Schizothorax plagiostomus	—	Raigarh Stream in Pithoragarh distt. (U.P.)
2.	S. progastus	—	Himalayas, Indo-Gangetic
3.	S. richardsonii	—	Himalayas, Indo-Gangetic
4.	Tor putitora	—	Himalayas, North & North East
5.	Tor tor	—	Himalayas, North & North East
6.	Gymnocypris biswasi	—	Himalayas & Westernghats

Brackishwater Ecosystem

1. Etroplus maculatus — Hooghly-Matlah Estuary
2. Lates calcarifer — Chilka Lagoon
3. Odontamblyopus rubicundus — Hooghly Estuary
4. Osteogeniosus militaris — Hooghly-Matla Estuarine system

Marine Ecosystem

1. Rhiniodon typus — Gujrat (Veraval)
2. Platycephalus maculipinna — South-East & South-West Coast

List of Indeterminate Fishes

Warmwater Ecosystem

1. Balitora brucei — Brahmaputra & Barak river system
2. Barbus dukai — Bihar
3. Bengala elonga — Brahmaputra & Barak river system
4. Cirrhinus cirrhosa — Stanley reservoir, Ganga river system
5. Chagunius changunio — Ganga river system, Eastern U.P.
6. Crossocheilus latius — Tapti, Mahanadi rivers, waters of Bihar
7. Gadusia chapra — Lakes, reservoirs, tanks, rivers in Eastern U.P.
8. Glyptosternum maculatum — Brahmaputra & Barak river system
9. Labeo calbasu — Ganga & Indus river system
10. Labeo dero — Indus, Chambal, Mahanadi rivers
11. Labeo dussumieri — Rivers of Kerala
12. Labeo fimbriatus — Ganga, Sabarmati, Tapti, Rivers of Western Ghats, Nagarjun Sagar, Tungbhadra, Bhawani Sagar
13. Labeo gonius — Ganga river system
14. Mastacembelus armatus — Bihar
15. Mystus tengra — Narmada
16. Mystus aor — Bihar, Ganga
17. Nandus nandus — Kuttamand region of Kerala
18. Olysa longicaudata — Brahmaputra & Barak river system
19. Ompok bimaculatus — Brahmaputra river, Ganga river system, Kuttamand region of Kerala
20. Osteobrama belangeri — Ganga basin
21. Psylorhynchus homalopterus — Barak river
22. Puntius carnaticus — Mahanadi, Godavari, Ganga river system.

23.	Puntius conchonius	— Chambal, Mahanadi
24.	Rasbora rasbora	— Barak river, Assam tributaries
25.	Rita rita	— U.P. waters, Bihar, Narmada
26.	Setipinna phasa	— Middle stretch of river Ganga
27.	Silonia childreni	— Nagarjun Sagar, T.B. Reservoir
28.	Silonia silondia	— Ganga river system, Bihar, Narmada, Mahi, Mahanadi
29.	Tor mosal	— Mahanadi, Bihar
30.	Tor mussullah	— Sabarmati, Nagarjun Sagar
31.	Xenentodon cancila	— Lakes, reservoir, tanks, river, stretches in Eastern U.P.
32.	Schistina synensis	— —
33.	Horaglanius krishnai	— Krishna river

Coldwater Ecosystem

1.	Botia almorhae	— Kosi river, Ramganga and Lohawati
2.	Dyptychus maculatus	— Himalayas and Western ghats
3.	Gara gotyla gotyla	— Ramganga in Kumaun hills
4.	Lepidopygopsis typus	— Himalayas and Western Ghats
5.	Nemacheilus rupicola	— Raigarh Stream in Pithoragarh dist. (U.P.)
6.	Nemacheilus elongatus	— North East region.
7.	Puntius chillinoides	— Raigarh tream in Pithoragarh distt. (U.P.)
8.	Psilorhynchus balitora	— U.P. hills streams, rivelated lakes, Himalayas river and stream.
9.	Raiamas bola	— Hill streams of H.P., U.P., Bihar, Assam, West Bengal
10.	Schizothorax kumaoensis	— U.P.
11.	Schizothoraichthys esocinus	— Himalayas and Western ghats
12.	S. longipinnis	— Himalayas and Western ghats
13.	Schizophygopsis stoliczkae	— Himalayas and Western ghats

Brackishwater Ecosystem

1.	Chanos chanos	— Estuaries of India
2.	Etroplus suratensis	— Peninsular Estuary
3.	Liza tade	— estuaries of India
4.	Mystus gulio	— Hooghly-Matlah Estuarine system
5.	Megalops cyprinoides	— Hooghly-Matlah Estuarine system
6.	Mugil cephalus	— Estuaries of India including Hooghly

7.	Plotossus canius	— Matlah Estuary Estuaries of India including Hooghly Matlah Estuary
8.	Setipinna taty	— Estuaries of India
9.	Tachysurus jella	— Hooghly-Matlah Estuarine system

Marine Ecosystem

1.	Lactarius lactarius	— South-West coast
2.	Tachysurus tenuispinus	— Karnataka
3.	Tachysurus thalassinus	— Karnataka
4.	Tachysurus serratus	— Karnataka
5.	Pseudosciaena diacanthus	— Indian Marine waters
6.	Platycephalus heptadactylus	— South-West & South-East coast
7.	Platycephalus indicus	— Gujarat-Maharastra
8.	Polynemus heptadactylus	— Gujarat-Maharastra coast
9.	Pomadasys hasta	— Gujarat-Maharashtra coast
10.	Otolitholides brunneus	— Gujarat Maharashtra coast
12.	Congresox talabanoides	— Gujarat Maharashtra coast
13.	Muraenesox cinereus	— Gujarat Maharashtra coast

(d) Collection of information on Deep pools, Mangroves and Marine Parks

The upstream of Ganga river from Allahabad to Kanpur was surveyed for location and topographical studies of deep pools. Some of the deep pools, as follows, were identified and studied aiming at formulations of conservation measures.

Allahabad Region in U.P.

Kurai : The pool is located about 30 km upstream of Allahabad in Ganga. The minimum length, breadth and depth of the pool was 1.2 km, 100 m and 13 m, respectively, in the month of May 1992. The pool remains disconnected from the main river during the period December-June. While it gets inundated during monsoon months. Fishing is done by the local fishermen using drag net, gill net, cast net, hook & line and scoop net. Fishermen of the adjoining villages depend on fishing in Kurai pool and in the adjoining areas of Ganga river for their livelihood.

The annual production of fish from the pool is 2.2t approximately.

Fish catch data of Kurai Pool

Fish Species available	% Composition
1. Juveniles of Indian Major carps, catfishes & minor carps	13.09
2. Major carps	20.28
3. Minor carps	8.69
4. Catfishes	49.25
5. Others	8.69

Kare : This deep pool is under investigation in collaboration with the Central Inland Capture Fisheries Research Institute. The study on the fish biodiversity of the deep

pool is underway for accruing stresses on the gene pool. A strategy for conservation programme of fishes in the pool as a model one is being considered in consultation with all concerned.

Kanpur/Unnao Region

1. Gangai Khera—This pool is situated in the upstream of Ganga near Kanpur in the district of Unnao in U.P. Length, breadth and depth of the pool is about 6 km, 30 m, 15 m, respectively. The pool is detached from the river in the month of December/ January and gets inundated during monsoon floods. Fishing methods include drag netting and use of hooks and lines catching mainly carps and catfishes. The faunistic survey alongwith other details are in progress.

2. Maraunda Khar—It is situated upstream of Ganga, about 20 km from Kanpur in the Unnao district. It is irregular in shape. Its length, breadth and depth is about 6 km, 30 m, 12 m, respectively. In January/February it gets seperated from the main river and remains as isolated pool allowing indiscriminate fishing till the onset of monsoon floods. Fish catch is constituted mainly of carps, catfishes and miscellaneous varieties. The fishing gears are common in all pools. The detailed survey is in progress.

3. Jajmau Pool—It is located in the upstream of Ganga near Kanpur in the Unnao district. It is circular in shape and the area is about 15 ha with about 15 m depth.

Fishing is usually done by drag net, gill net, cast net, hooks and lines. Fishes caught mainly include major carps, minor carps, catfishes and miscellaneous varieties. More details are being collected.

Pool down stream of Allahabad in Ganga

A reconnaisance survey for locating pools in the river Ganga between Allahabad and Varanasi was undertaken during which the following pools were identified.

Name of the Place	Approx. length of the pool in km.	Approx. depth of the pool in feet
1. Chote Mirzapur	2	35
2. Chunar Ghat	1	45
3. Raj Ghat	2	35
4. Panch Ganga Ghat	1	30
5. Ram Ghat	1	25
6. Assi Ghat	0.5	30
7. Narainpur	2	35
8. Garhwa Ghat	1.5	40

Fishing gears generally used in such pools are gill net, hook & lines, cast net and drag net. Fishing parties generally are local fishermen while migrating fishermen parties also are reported in these pools during summer months. Faunal composition is reported to include *Mystus* spp., *Chela* spp., *Rita rita, Eutropichthys vacha, Catla catla, Labeo rohita, Cirrhinus mrigala, Labeo calbasu.*

Deep Pool in Yamuna river near Allahabad

Baximorha— This deep pool is under investigation in collaboration with CICFRI. The details of its limnology, seasonal fluctuations of fishery, fishing pressure, conservation strategies etc. are under study.

Maintenance of sustainable Fishery in Deep Pools

During post-monsoon seasons, most of the deep pools get disconnected from the main stream and harbour rich fish fauna. Since the adjoining river stretches do not even maintain adequate water, the fishing pressure in such pools is high. The net result, as observed in such pools, is complete exploitation of fishes without leaving any stock for profitable sustainance of fishery in that part of the river.

While legal provisions for maintenance of sustainable fishery exist in the country, the implementation is not that easy as it sounds. Hence, among various types of efforts, the Bureau envisages arousing awareness of the people concerned about the requirement of maintenance of sustainable fishery in such pools.

Further on-going studies in these pools include collection of more information on fishing pressures, methods of fishing, list of fishes caught including their size classes, extent of exploitation and maintenance of sustainable fishery etc.

2.2. FB.2 Conservation of Mahseer in Selected Upland Waters.

D. Kapoor, P.C. Mahanta, S.P. Singh, A.K. Singh, R. Dayal, S.M. Srivastava, R.S. Patiyal, K.D. Joshi, Ajay Kumar Singh & S.K. Paul.

With an ultimate aim of formulating *in situ* strategy for conservation of endangered Mahseer in Northern Hills of the Country, Ladhiya stream was selected as a model.

The Ladhiya river mainly located in district Pithoragarh (U.P.) is a tributary of Kali river which drains into Sharda river and finally in the Ghaghara river system. Ladhiya is a spring-fed river, arises near Mornaula village (district Nainital) about 7,000 feet from sea level on the Southern slopes of the mountain range along which passes the road from Haldwani to Lohaghat in 29^0-26'N latitude and 79^0-49'E longitude. Another major stream arising from Devidhura joins with the river. A considerable tributary of the river is Ratiya Gad which joins at Ritha Sahib—a famous Sikh Gurudwara. Ritha Sahib (about 2700 ft. from sea level) is connected by road from Haldwani and Lohaghat. Another major stream Kuirala joins it on the left bank of

Belkhet. In the lower stretch of river, a large permanent deep pool is located. After traversing about 100 km in the hills, the river joins Kali river near Tunyas. The average annual surface flow of the river estimated near Chalthi is 0.4 million m^3 while that of the Kali river at Pancheswar is about 25 million m^3.

Following important fishes were available in the Ladhiya stream.

Tor tor
Tor putitora
Schizothorax richardsonii
Garra gotyla
Labeo dero
Lebeo dyocheilus
Barilius spp.
Nemacheilus spp.

Scarce large sized prized golden mahseer of the Sharda river.

Breeding grounds in Ladhiya river

It is reported by various researchers that the Mahseer breeds in the flowing shallow water (35-50 cm) with suitable temperature

Engangered Mahseer, Tor putitora caught at Sharda river.

22-23^{0}C on or below the stones, with sandy bottoms having a good amount of oxygen.

Such condition prevails throughout in Ladhiya river system. Some breeding gounds were located as under.

Upper Zone :

1. Near Joshyura village (about 5000 ft from sea level) about 15 km upstream from Ritha Sahib.
2. At Ritha Sahib, about 2-3 km stretch/ upstream in deep pools. Shallow margin of these pools reported to harbour mahseer fingerlings.

Middle Zone :

1. About 2 km downstream of Ritha Sahib,

about 7 pools were surveyed. Fingerlings were seen in these pools.

2. From Chalthi to Amori (15 km stretch) about 9 pools are located having Mahseer seed. The stretch is suitable for mahseer breeding.

Lower Zone :

In the lower zone from Chalthi to its confluence with Sharda river, there exist some breeding grounds (Chalthi, Bisoriya Nala etc.).

During the winter and summer months when the water level of the stream goes down, most of the brood fishes comes down to the Sharda river near the confluence. This is the most sensitive zone where illegal indiscriminate killing of brood fishes are done.

As soon as the monsoon season is over, the water start receeding in the upper stretches of the Ladhiya in the above mentioned places. Post-monsoon season, April-June and September-October, are the most intensive fishing periods of the year and the fishermen starts indiscriminate killing of fishes by barricating and trapping/seiving methods.

Restoration of Mahseer

Considering the alarming decline of Mahseer population, restocking of the streams with the seed of the species is one of the practicable methods, as conceived by the Bureau. Since mahseer breeding facility is not yet abvailable in most places, attempts are being made to develop such facilities in collaboration with other concerned institutes/organisations.

Fishermen's participation in mass awareness programme at Ladhiya river for mahseer conservation.

2.3. CM.3 Development of Fish Spermatozoa Cryopreservation Technique for Gene Banking

A.G. Ponniah, L.B. Singh, P.C. Mahanta, A. Gopalakrishnan, P.K. Sahoo, R. Dayal & Kuldeep Kumar Lal

Under the project on gene banking, further studies of cryopreservation of milt of endangered *Tor putitora* and the Indian major carp *Labeo rohita* were carried out.

Labeo rohita

Fertility trials were carried out with cryopreserved milt using an extender containing sodium citrate, sodium chloride and DMSO with and without egg-yolk. The results indicate that the extender without egg-yolk is a better one. The maximum hatching percentage achieved without egg-yolk was 44.24%. Percentage of hatching

was less in fertility trials with cryopreserved milt that had been collected from the second stripping compared to milt cryopreserved from the first stripping from the same set of males. For example, lot of eggs which gave a hatching percentage of 44.25% when fertilized with milt from first stripping, the hatching rate using the cryopreserved milt from second stripping was only 2.29%.

Studies on the ionic composition of normal milt showed that except glucose which showed a decline in repeated stripped samples of milt, Na, K and Ca did not show significant variations.

Another set of experiments were carried out to determine whether the addition of additives would enhance the hatching percentage. To the sodium citrate-chloride-DMSO extender, different additives were added. The six sets tested were (A) 1% PVP, (B) 0.1% glucose, (C) 0.4% albumin, (D) glycerol, (E) 0.1% glucose, 0.4% albumin, 0.05% $CaCl_2$ and 0.15% KCL, (F) No additives added. Compared to less than 3% hatching in F, addition of 5% glycerol gave a hatching percentage of 16.5%. The best additive was the combined set tested (E) which gave a hatching percentage of 23.9%.

Trials were carried out to determine the use of fertilising solutions when cryopreserved and normal milt were used. These indicated that Dexter solution enhances the hatching percentage. In some trials, no hatching was observed with cryopreserved milt but when used in combination with Dexter solution, 4.7% hatching was observed.

Tor putitora

Fertility trials were carried out with milt of *Tor putitora* cryopreserved with two cryoprotectants, glycerol and DMSO under three equilibration times of 60, 120 and 180 minutes. Each set was tested with three females. Viable hatchlings (0.53 to 2.17%) were produced from one year old cryopreserved milt under the three conditions. However, not much differences could be detected between the cryoprotectants and different equilibration times.

In the second set of experiments, six extenders were tested. The six extenders used were (1) sodium chloride 0.75%, potasium chloride 0.038%, glucose 0.1% and sodium bicarbonate 0.2% (2) sodium chloride 0.4% and sodium citrate 0.8% (3) Extender 2 with 2% glucose (4) Extender 2 with 10% egg yolk (5) sodium chloride 0.65%, potasium chloride 0.3%, sodium bicarbonate 0.02%, calcium chloride 0.03% (6) 6.3% glucose. The highest percentages of hatching observed in one of the replicates was 7.9 compared to the control of 17.6%. A low percentage of hybrids could be produced by fertilizing eggs of *T. putitora* with cryopreserved milt of *Tor khudree.*

2.4 CM.4 Methodology development for Cryopreservation of Eggs and Embryos of Indian Major Carps and Endangered Species for *Ex Situ* conservation

A.G. Ponniah, A. Gopalakrishnan, P.K. Sahoo, A. Barat & Kuldeep Kumar Lal

For developing methodology for cryopreservation of fish eggs and embroyos following studies were carried out.

The chorion collapses on freezing, thereby limiting the survival of the embroys. Experiments were crried out to determine the stage of embryo that would survive and develop after removal of egg membrane. Two stages of embryo namely, morula and tail bud stage were tested. From the same lot of eggs, one set (intact egg) served as control and in another set consisting of three replicates in each the egg membrane was removed manually. Isolated morula stage of *Labeo rohita* survived for only 6-7 hours. At the tail bud stage, all the isolated individuals fully developed without abnormalities and hatched.

Toxicity studies

For toxicity studies, both intact tail bud state embryos and those isolated from chorion manually were used. Three cryoprotectants (DMSO, PROH & MeOH) were tested in combination with 0.5% PVP. The embryos were treated with methonol alone and methanol in combination with DMSO or glycerol. The treatments were (1) 1.5 M DMSO + 0.5% PVP (2) 1.5 M PROH + 0.5% PVP (3) 1.0 MeOH + 1.0 M DMSO + 0.5% PVP (4) 1.5 M MeOH + 0.5% PVP (5) only 1.5 M MeOH (6) 1.0 M MeOH + 1.0 M glycerol + 0.25 and 0.5 M sucrose for 10 min. each. All the sets were exposed to cryoprotectants for one hour and then transferred to normal water. Hatching percentage was calculated from two replicates in each treatment to determine the toxicity of the tested cryoprotectant.

Methanol when used alone was the least toxic among the treatments with hatching of 54.8%. PROH and Methanol in combination with glycerol was the most toxic treatment with 100% mortality. Treatment of embryos with sucrose prior to addition of cryoprotectants was detrimental to the survival in most treatments. The hatching percentage was only 40% in intact tail bud stage pretreated with sucrose and exposed to only methanol while without sucrose pretreatment, it was 54.8%.

Vitrification

For vitrification, the tail bud stage embryos of *Labeo rohita* were first treated with 0.25 M and then 0.5 M sucrose for 10 minutes each. Then they were transferred to vitrification solution and approximately 2 embryos were loaded into each straw. The embryos were exposed to a high concentration of cryoprotectants for 2 minutes before being plunged into liquid nitrogen. The six concentrated cryoprotectants used were (A) 3.0 M MeOH, (B) 3.0 M DMSO, (C) 6.0 M MeOH, (D) 4.5 M DMSO, (E) 3.0 M glycerol, (F) 4.5 M PROH and (G) a cocktail of 1.5 M MeOH, 1.5 M DMSO, 1.0 M Glycerol & 1.0M PROH. To all the cryoprotectants 0.5 M sucrose was added. On thawing, the vitrified embryos did not survive. All the thawed embryos were microscopically examined to determine their morphological integrity. Since in all cryoprotectant sets

except PROH, the thawed embryos had lost their physical shape, PROH was assumed to be the best cryoprotectant.

Slow cooling

For the slow cooling method, a double-walled container with an aluminium outer wall and a inner wall of thermocole with glasswool in between was fabricated to give a gradient in temperature when liquid nitrogen was held at the bottom. The straws were kept on a free moving gauze rack which could be held at different depths inside the container. The cryoprotectants tested were (1) 1.5 M DMSO & 0.5% PVP (2) 1.5 M PROH & 0.5% PVP (3) 1.0 M MeOH + 1.0 M DMSO + 0.5% PVP, (4) 1.5 M MeOH + 0.5 PVP (5) 1.5 M MeOH alone, (6) 1.0 M MeOH + 1.0 M glycerol + 0.5% PVP. After 35 minutes equilibration of embryos in the cryoprotectants, the straws were transferred to the metal rack at a known depth. At this depth, they were held for 25 minutes and manually ice seeded. After 10 minutes, the straws were lowered to another depth. After 20 minutes, one set of embryos was removed. The rest were kept in stage 3 for 20 minutes for freezing at the vapour phase and then plunged into liquid nitrogen. Both the set of straws (after ice seeding + after immersion in liquid nitrogen) were tested after thawing. No surviving embroyos were observed. A rapid thawing at 25^{0}C for 30 seconds was superior to thawing at 4^{0}C for 1 minute as the embryos thawed rapidly were more intact than those thawed at 4^{0}C. Among the cryoprotectants tested, embryos exposed to PROH has a better physical integrity than the embryos vitrified in other cryoprotectants.

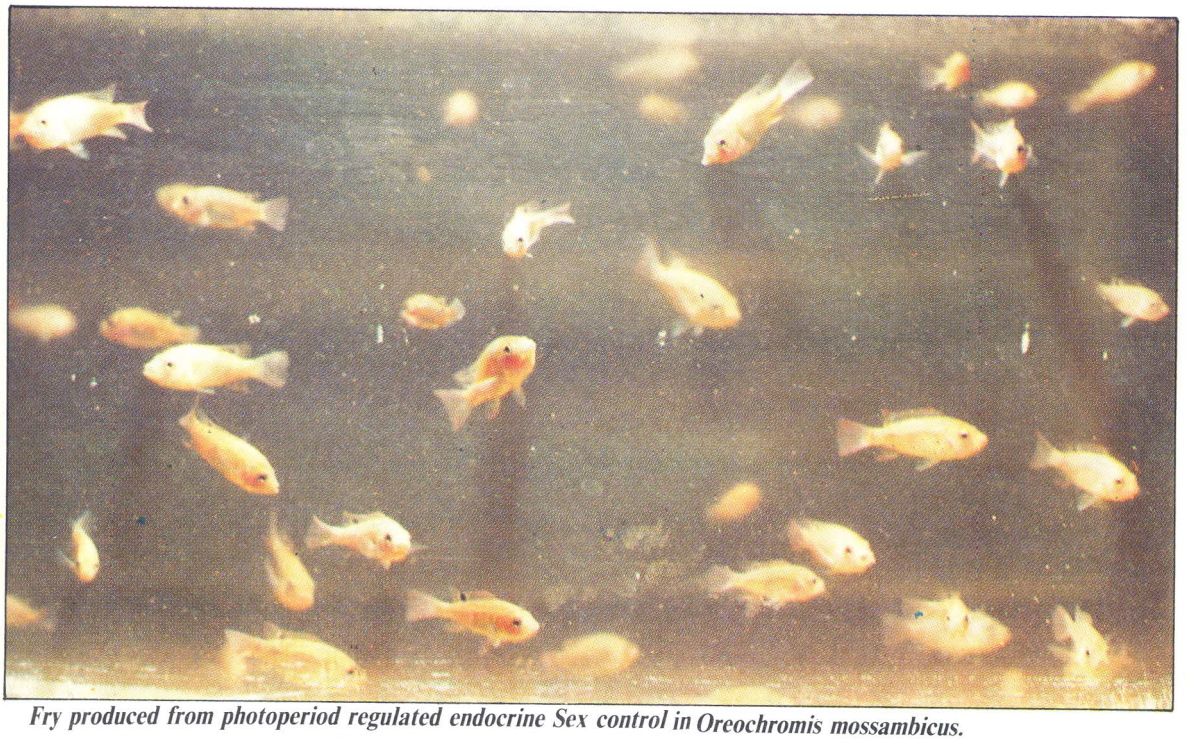
2.5 CM.5 Standardisation of Techniques for Production of Monosex and Sterile Population of Exotic Fish Species

A.K. Singh & N.S. Nagpure

In earlier experiments on sex reversal of tilapia, *Oreochromis mossambicus*, a considerable percentage of male population was achieved by feeding the hatchlings with 17α methyltestosterone (17αMT) for 60 days immediately after yolksac resorption stage.

However, for achieving the absolute monosex population, studies related to the gonadal manipulation through oral administration, 17α MT were intensified taking up photoperiod as additional parameter. Thus, the experiments were designed where hatchlings were fed with 17αMT incorporated diet (35 mg/kg feed) under different photoperiod regimes (18L:6D; 16L:8D) and normal day light condition. The growth, survival and sex ratio of the androgenized fishes were recorded throughout the experimental period.

For our experiments, seven day old swim-up fry raised by incubating yolk sac fry collected from the mouth of one of the brooding females of *Oreochromis mossambicus* were employed. The hatchlings were divided in three groups in equal numbers (40 each X five replicates). The first group of fishes received normal diet while the next group was given hormone added diet under



Fry produced from photoperiod regulated endocrine Sex control in Oreochromis mossambicus.

normal day light conditions. At the same time the third group was fed on 17α MT incorporated diet under long photoperiod (16L:8D) to satiation. The initial as well as final wet weight were recorded at different intervals. The sex ratio was also ascertained through gonadal examinations.

Our results demonstrate that feeding of *O. mossambicus* hatchlings with 17α MT under long photoperiod (16L:8D) imparted excellent growth and survival. The growth rate of fishes under 16L:8D photoperiod was more than two folds (5.63g) in contrast to those reared only on 17α MT incorporated diet under normal day light conditions where the growth was only 2.38g at two months of age. The survival rate also enhanced from 67% to 98-100% under long photoperiods. So far as sex reversal is concerned, the sex ratio is 1:1 in normal population while MT treatment increased the percentage of males reaching upto a 100% male population when the fishes were fed hormone incorporated diet under long photoperiods (16L:8D).

Observations are suggestive that combining 17α MT treatment with long photoperiod may give consistent result of 100% masculinization besides enhanced growth and survival in *Oreochromis mossambicus* which may have a promising application in aquaculture.

2.6 CG.6 Cytogenetic Variations in Natural Population of Indian Major Carps, Selected Air-breathing Fishes and Endangered Species.

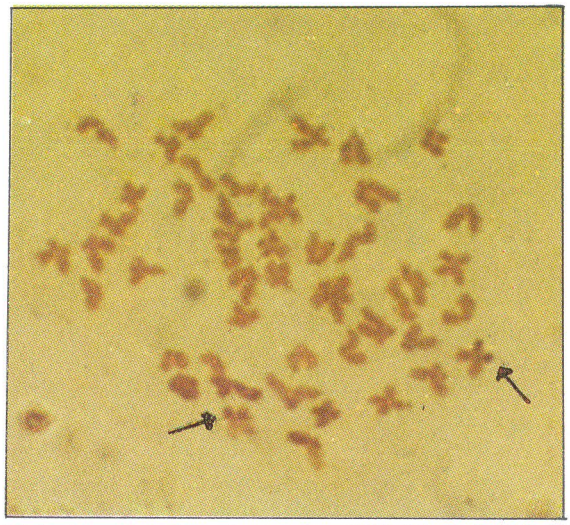
O.P. Pandey, N.S. Nagpure, Peyush Punia & A. Barat

Studies are aimed to (i) identify and catalogue cytogenetic variations in populations of selected species of fish and (ii) to study intraspecific variations, if exists, in populations.

For carrying out the karyomorphic studies, samples from different species were collected as under.

Sl. No.	Name of Fish Species	No. of Fish Specimen
1.	*Labeo rohita*	31
2.	*Labeo calbasu*	02
3.	*Cirrhinus mrigala*	03
4.	*Schizothorax richardsonii*	07
5.	*Noemacheilus* spp.	04
6.	*Garra gotyla*	02
7.	*Cyprinus carpio*	01
	Total	50

Under karyotypic studies, specimens of *Labeo rohita*, *L. calbasu* and *Cirrhinus mrigala* were collected from riverine and hatchery populations of Allahabad. The specimens were kept in well-aerated aquarium for acclimatization. After few days of acclimatization, the specimens were injected intramuscularly with 0.05% colchicine 1ml/100 gm of body weight. After 2-3 hrs fishes sacrificed and kidney and gill tissues were processed for metaphase spreads. Slides were prepared according to citrate-air drying technique for chromosome preparations. Results of the karyotypic studies revealed the existance



Metaphase complements showing NOR (Marked with arrow) in Labeo calbasu.

of 50 chromosome in the specimen studied. The diploid chromosome number (2n) confirmed to be 50 in the species under investigation.

NOR Studies—In addition to these studies, Ag-NOR technique following Howell and Black (1980) have been applied to find out variations in population on the basis of location of NOR on the chromosome. NOR has been localized in one pair of submetacentric chromosome in *Labeo rohita, L. bata* and *L. calbasu.* However, no intraspecific variation in the location of NOR have been observed so far. Similar studies have been carried out in hill-stream fishes viz., *Tor putitora* and *Schizothorax richardsonii.* In a preliminary observation, *Schizothorax richardsonii* revealed an indication of variation in the NOR bearing chromosome in two different populations of Kumaun hill streams. However, further detailed studies are required for confirmaiton.

Metaphase complements showing NOR (marked with arrow) in Labeo bata. The photomicrograph also depicts the presence of nucleoli in interphase nuclei.

Pilot Studies—Preliminary experiments on banding of fish chromosomes using mammalian chromosome banding techniques viz., C and Q with slight modifications inthe protocols have been initiated to find out variation in location of different bands. Few trials for standardisation of sister chromatid exchange (SCE) in fish chromosomes have also been undertaken.

Supplementary Studies

2.6 CG.6.1 Chromosomal Status in Fish Species of Different Habitats

L.B. Singh, N.S. Nagpure, S.P. Singh & O.P. Pandey

Main objective of the study was (i) to delineate the karyotypic differences between the fish species inhabiting different ecosystems specially in respect of (a) chromosome number and (b) chromosome structure; (ii) to study the pattern of distribution of the fish species within habitats and (iv) the possible equittence of adaptive and evolutionary significance, if any.

The information about chromosomes in the study were gathered through compilation of published records.

A. Evaluation of Chromosomal variation in Indian Marine Fishes

The studies are aimed at finding out (i) the prevalence of diploid number of chromosomes among marine fish species; (ii) the frequency pattern of marine fish species between chromosomal groups, and (iii) within group.

In India, there are 2200 fin fish species. Majority of which about 71.95% come from marine and brackishwater habitats. In

the last few years scientists are getting attracted towards fish cytogenetic studies. Most of them are virtually limited to karyotypic studies based on a few number of specimen collected from isolated places. Entire studies indicate that a large number of fish species have chromosome number (2n) 50 or 48. However, no attempt seems to have been made to exactly assess and elaborate the chromosome number and chromosome type predominantly prevailing in species exclusively from marine habitat. This study is an effort in that direction. The conventional method of nomenclature adopted by the International System for Human Cytogenetic Nomenclature (1978) have been followed. Informations regarding chromosome as reported by various workers in different species were collected for this study. Out of the fish species reported so far, 124 species could be compiled and included in this study. Since model chromosome number (2n) is reported to be 48 or 50, the species initially were grouped in four different classes viz., fishes having chromosome number (i) less than 48, (ii) 48, (iii) 50 and (iv) more than 50, for further analysis.

Results of initial analysis showed that 21.77%, 29.03%, 25.0% and 24.19% of the species included in this study belong to these categories or groups, respectively. The maximum number (29.03%) come from the group with $2n = 48$ chromosome. Further analysis revealed that the marine species constitute more than 69% of this group (species with 48 chromosomes) (Table 1). Subsequently only marine and brackishwater species were analysed and result are shown in the Table II.

Results presented in the Table I indicate the distribution of marine and brackishwater fish species within chromo-

Table I Distribution of Marine and Brackishwater Fish Species Within Chromosomal Group

Chromosome Number	Species						
	Marine		Brackishwater		Others		Total
	No.	%	No.	%	No.	%	No.
< 48	9	33.33	9	33.33	9	33.33	27
48	25	69.44	4	11.11	7	19.44	36
50	3	9.68	1	3.23	27	87.10	31
> 50	2	6.67	—	0.00	28	93.33	30

somal group whereas Table II indicates the distribution of these fish species (marine & brackishwater) in different chromosomal groups. It reveals that over 87% of the marine and over 92% of the brackishwater species have 48 or < 48 chromosomes. Only few marine and brackishwater species (about 13% &7%) tend to have chromosome more than 48 (50 or more) whereas other species (other than the marine and brackishwater species) have just the reverse.

Further analyses indicate that over 76% of the marine species included in this study have telocentric chromosome only. However, further detail study is being undertaken.

2.7 BG.7 Population Genetics of Major Carps, Endangered Species and other Groups through Biochemical Genetic Studies

A.G. Ponniah, A. Gopalakrishnan, P.K. Sahoo, S.K. Srivastava & Kuldeep Kumar Lal

For detailed genetic characterisation, biochemical genetic investigations were carried out on the following lines.

Biochemical genetic parameters

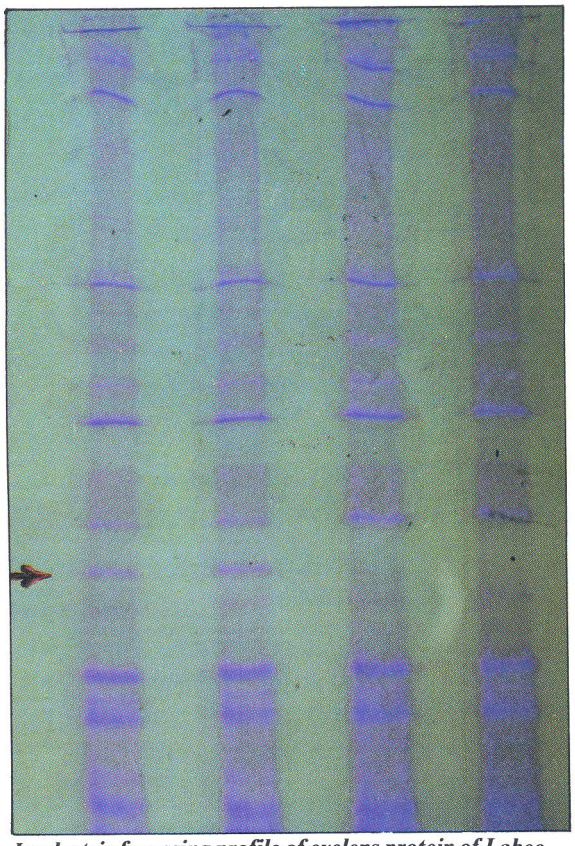
From Rapti river, 32 samples of *Labeo rohita* were collected and screened with 22 enzyme system and isoelectric focussing (LEF) of eye lens (EL) protein. Among the enzyme systems screened, the results on ten

Table II Distribution of Marine and Brackistwater Fish Species Between Chromosomal Group

Chromosome Number	Species					
	Marine		Brackishwater		Others	
	No.	%	No.	%	No.	%
< 48	9	23.08	9	64.29	9	12.68
48	25	64.10	4	28.57	7	9.86
50	3	7.69	1	7.14	27	38.03
> 50	2	5.13	—	0.00	28	39.44
Total	39		14		71	

Source of data :

1) Indian Journal of Animal Sciences, 61 (3): 342-349, March, 1991.
2) Data recorded at NBFGR, Allahabad.



Isoelectric focussing profile of eyelens protein of Labeo rohita showing the polymorphic bands (marked with arrow).

liver enzymes: Alcohol dehydrogenase (ADH), Idetol dehydrogenase (IDDH), Aldehyde dehydrogenase (ADH), Glycerol-3 phosphate dehydrogenase (G3PDH6), Glucose-6 phosphate dehydrogenase (G6PDH), Isocitrate dehydrogenase (IDHP), Hexokinase (HK), Fructose biphosphate aldolse (FBALD), Aconitate hydrase (AH), Glucophosphate isomerase (GPI) and three muscle enzyme (G6PDH), Maleic enzyme (ME) & FBALD are not included in this report due to non repeatability or low samples tested. Among the nine scorable enzyme (n = 20 to 32), for muscle enzymes Lactate dehydrogenase (LDH), G3PDH, Malate dehydrogenase (MDH) and liver enzyme G6PGD, the band pattern in all individuals were similar indicating that these enzymes were monomorphic in the sample examined. At the liver Esterase (ET) and LDH, there were indications of polymorphism. Polymorphism could be detected in the liver enzymes Xanthine dehydrogenase (XDH), Phosphoglucomutase (PGM), Superoxide dismutase (SOD) and one band of IEF-EL. (Plate). While in SOD, a three banded heterozygote pattern was observed, in other enzymes two bands were observed in heterozygotes. For all systems, in the homozygotic condition, one band was observed in the place of two or three bands in heterozygotes. Due to the large number of bands observed in PGM and the small difference in mobility between XDH alleles, screening with large sample with modified method is essential for calculating allele frequencies of these two enzymes. The IEF-EL was highly polymorphic and in SOD the variation was minimal. The percentage of heterozygous individuals for SOD were 9 while that for IEF-EL were 74.2%. The percentage of homozygotes were 91 and 25.8% for SOD and IEF-EL, respectively.

Hatchery & Natural Seed

Seed of *Labeo rohita* collected from hatchery (n = 22) and wild (n = 14) were screened with five enzyme system (AHD, SOD, PGM, IDHP & EST) and IEF-EL. Due to the inconsistent pattern observed in AHD, IDHP and EST, scoring in terms of allele frequencies could not be carried out. At SOD and IEF-EL, the allele frequencies

could be scored for the two sources of seed. The percentage of heterozygotes were 22.7 in hatchery seed and 50 in wild seed. The frequency of the most common allele of IEF-EL was 0.89 in hatchery seed and 0.75 in natural seed. The results are indicative that the genetic structure of both hatchery and wild was different.

Non-invasive and minimum-invasive sampling

To sample endangered fishes and valuable broodstock at resource centres for genetic characterisation, there is a need to develop techniques of non-invasive and minimum-invasive sampling. A preliminary screening was carried out in *Heteropneustes fossilis* using mucus as a test tissue for non-invasive sampling. The presence of G6PD, XDH, PGM, AAT (Aspartate amino transferase), EST, SORDH, GPI and HX activity in mucus were scored. Among the tested enzymes, activity of SORDH and HX could not be detected in mucus. All trials were carried out in duplicate. For standardising minimum invasive sampling, barbels, fins, gills and serum were screened using the same seven enzyme systems. Other than serum in all the other tissues, the activity of all the tested enzyme were observed. In serum the activity of HX and GPI could not be detected. Further studies are being carried out to confirm the above results and to expand the study to cover more enzymes and species.

Coldwater species

Comparative biochemical genetic profile of the endangered mahseer *Tor putitora* (n = 21) and *Schizothorax richardsonii* (n = 14) were carried using the enzyme systems: G6PD, GPI, PGM, IDHP, AAT, SOD and G3PDH. In all runs, samples of *L. rohita* was run as an internal control. Except in G6PD, in all the other tested enzymes rohu exhibited a faster mobility. The banding pattern observed in the muscle loci of G6PD, liver and muscle loci of GPI for all the three species were similar with no differences in the mobility of bands. In PGM & ICD while all the three species exhibited similar mobility under one buffer system, with an alternate buffer system the three species had difference in mobility. *S. richardsonii* exhibited a faster mobility than *T. putitora* for AAT and LDH muscle loci. For SOD & LDH liver loci, *T. putitora* exhibited a faster mobility.

Testing for hybrids

Fry produced from fertilization of rohu eggs with cryopreservation milt mixture of rohu and mrigal were screened with genetic markers AAT, ME-2 and SOD to determine, if any, rohu-mrigal hybrids had been produced. All the fry had the band pattern of rohu and the mixed pattern of rohu-mrigal hybrid was not observed. The result indicates that in the presence of rohu milt, mrigal milt did not fertilizer the rohu eggs.

3. COLLABORATION

3.1 National

1. Central Inland Capture Fisheries Research Institute, Barrackpore, West Bengal.

2. Central Institute of Brackishwater Aquaculture, Madras, Tamil Nadu.
3. Central Marine Fisheries Research Institute, Cochin, Kerala.
4. National Research Centre on Coldwater Fisheries, Haldwani, U.P.
5. Department of Fisheries, Govt. of Uttar Pradesh, Lucknow.
6. Directorate of Fisheries, Govt. of Himachal Pradesh, Bilaspur.
7. Zoological Survey of India, Madras, Tamil Nadu.
8. Nature Conservators, Muzaffarnagar, U.P.

3.2 International

Under the USAID Sub-Project on 'Animal Genetic Resource Conservation' collaborative programme including training of Indian Scientists in USA, the American Scientists' visit to India on consultancy service and provision of scientific equipments and books for the Bureau continued.

Under this Sub-Project Dr. Buddy L. Jensen, Director, Hatchery for Endangered Species, Dexter, USA visited the Bureau during 24 April to 2 May, 1992 and had discussions with the Director and Scientists of this Bureau on Fish Genetic Resources Conservation and offered necessary suggestions and recommendations. He also attended the two day 'National Seminar on Endangered Fishes of India' held on 25-26 April, 1992 at this Bureau and had presented the paper entitled 'Fish refugia and captive propagation—a viable aid to conservation and restoration'.

Dr. Jensen presented several useful books and publications on fish genetics, conservation of fish genetic resources and aquaculture to the NBFGR Library.

4. MANPOWER DEVELOPMENT

4.1 Scientific and Technical

The following personnel had undertaken study tour/undergone training in the respective fields:

— Dr. A.K. Singh, Assistant Farm Manager (T-6), had undergone the short-term training Course on the 'Use and Application of Bioindicator Technology, in the Monitoring and Conservation of Biodiversity' at the Dr. M.S. Swaminathan Research Foundation, Madras during 4th to 25th May 1992.

— Shri S.P. Singh, Scientist, had undergone the Summer Short-Term Course on "PC Based Computerized Management and use of Farm-Data in Amimal Improvement" at NDRI, Karnal from Ist July to 10th July, 1992.

— Dr. A.K. Singh, Asstt. Farm Manager (T-6) had undergone the Short-Course on "Aquaculture and Environment" at Central Institute of Fisheries Education, Bombay from 20th July to 3rd August, 1992.

— Dr. A.G. Ponniah, Senior Scientist had attended the workshop on "Planning for Agricultural Research

System" at NAARM, Hyderabad from 12th to 16th October, 1992.

— Dr. A.K. Singh, Asstt. Farm Manager (T-6), attended the workshop on "Technological Forecasting in Agricultural Research" at NAARM, Hyderabad from 18th to 21 November, 1992.

— Dr. A Gopalakrishnan, Scientist attended the National Convention on "Agricultural Policy & Intellectual Property Rights in Agriculture' organised by A.R.S. Scientists' Forum at IARI, New Delhi from 16th to 18th November, 1992.

4.2 Honours and Awards

— Dr. P. Das, Director was elected as a Fellow of the Zoological Society (FZS) of Calcutta.

— Dr. P. Das, Director was elected as a Fellow of the Bioved Research Society (FBRS) of Allahabad.

— Dr. P. Das, Director was elected as the President of Nature Conservators (NATCON), Muzaffarnagar for the period December 1992 to December 1995.

— Dr. P. Das, Director was elected as the President of the Society of Ethologists, Allahabad for the period 1992-93 & 1993-94.

— Dr. P. Das, Director inaugurated the Symposium as the Chief Guest of the IV South East Asian Conference on Odonatology organised by Dept. of Zoology, CMP Degree College, Allahabad during 10-12 October, 1992.

— Dr. P. Das, Director became the Member of the Advisory Board of the Institute of Environmental Research & Management and International Society for Environmental Protection, Gorakhpur.

— Dr. P. Das, Director became the Member of the Advisory Committee of Inland Fisheries Society of India, Barrackpore.

— Dr. P. Das, Director became the Member of the Editorial Board of the Journal 'Advances in Biosciences'.

— Dr. A.K. Pandey, Scientist, was conferred with the Bioved Merit Award for oral paper presentation on the occassion of the National Symposium on Prospects and Problems of Biotechnology (19-20 February 1993) organised by the Bioved Research Society, Allahabad.

— Scientists of the NBFGR were honoured by the prestigious Dr. V.G. Jhingran Memorial Gold Medal Award for 1992-93 by the Society of Nature Conservators (NATCON), Muzaffarnagar, U.P. for development of the technique for long-term cryopreservation of fish milt which would lead to the country's first Fish Gene Bank.

5. TRANSFER OF TECHNOLOGY

5.1. Advisory Services

Fish farmers as well as others interested in fisheries visited the Bureau frequently for getting technical know-how on aquacultural aspects. Necessary advice on various aspects of both fin and shell fish culture were rendered. Technical advise was also offered to interested persons during the visit of the scientists to villages. The broad aspects included polyculture, induced breeding avoiding genetic constriction, prophylactic measures for fish diseases, renovation of old ponds and construction of fish farms for pisciculture.

5.2 Other Activities

— 23 B.F. Sc. students from the College of Fisheries, University of Agricultural Sciences, Mangalore visited the Bureau on 4 April 1992 and were appraised of the research activities going on in the various sections.

— Dr. Sarangi, Senior Scientist, Central Agricultural Research Institute, Port Blair was trained on certain aspects of Cytogenetics and Biochemical Genetics during 29 May,-6 June 1992.

— Dr. P. Das, Director delivered a lecture on 'Matsya Palan-atit aur vartman' on 3 August 1992 to the farmers at Motilal Nehru Farmers Training Institute, Phulpur, Allahabad.

— Dr. A.K. Singh gave a radio talk on 'Common Carp Palan' on 9 December 1992.

— 14 trainees from the Inland Fisheries Training Centre, Central Institute of Fisheries Education, Barrackpore visited the Bureau on 16.01.1993. They were appraised of the research activities of the Bureau.

— Shri P.C. Mahanta and Dr. A.K. Singh gave lectures and suggestions to the Fish Farmers during their visit to Ghazipur alongwith the team of Extension Scientists of the Indian Agricultural Research Institure, New Delhi. The team visited the district during 18 February 1993 to 21 February 1993 for exploring the possible avenues of paddy-cum-fish culture.

— 30 B.F.Sc. students from the College of Fisheries, University of Agricultural Sciences, Mangalore visited the Bureau on 20.3.1993, Lectures were organised for them in various Sections.

6. LIBRARY AND DOCUMENTATION SERVICE

6.1 Library Services

The objective of the library is to provide a comprehensive information service to NBFGR and to the fish genetic resources community. The library supports NBFGR projects by providing literature-based information, primary documents and

bibliographic data. It has now built up a good collection of 1095 books, over 3000 volumes of journals and serials, 665 publications, 1026 reprints and photocopies and 105 maps and charts to meet the needs of its users.

128 new books, 206 publications, 690 reprints and photocopies, maps and charts were acquired during the year. The library subscribed to 55 National and International journal titles and received 61 titles on exchange and as gratis. It has a collection of six selected databases loaded in floppy diskette and in printout form. The total expenditure incurred by the library during the year was Rs. 4,53,590.00.

6.2 Exchange Services

The library maintained exchange relationship with 60 leading International and National Research Institutes, Organisations and Agricultural Universities by mailing Annual Report, reprints of papers of the Scientists and other publications. Besides, the library has set up 9 fresh relationship for exchange of publications.

The library continued free mailing of Bureau's publications to various Research Organisations, Universities, State Departments, Fish Farmers Development Agencies and to Fish Farmers. Besides, it provided services to the scientific personnel of research institutions, university personnel, research scholars, students and individuals through inter-library loan services and reading room facilities.

6.3 Information Services

Current awareness tools, bibliographic research service document supply and reference services including selected databases are offered by the library to its users. The library supplied approx. 850 photocopies of scientific papers to NBFGR Scientists, Technical staff and to externals on request. A database on library books is being compiled on PC hard-disk.

6.4 Technical Reports

Technical reports on the progress of research activities of the Bureau were compiled and sent to ICAR. 33 review and research papers of the Director and scientists were communicated to various national and international journals and Symposia/Seminars/Conferences for presentation and publication.

Technical queries regarding the activities of the Bureau from various quarters of the country and abroad were attended to by the section. Bio-data sheets in respect of the Scientists were compiled and mailed to 12 organisations for inclusion in different year-books and directories.

6.5 Reprography Services

The Section maintained active reprography services by producing departmental publications. The Section also provided cyclostyling and comb-binding facilities for departmental publications.

6.6 General Publications

The following publications were brought out by the Bureau during the year :

1. Sixth Meeting of the Committee on Introduction of Exotic Aquatic Species, 24 April 1992.
2. Abstracts: National Seminar on *'Endangered Fishes of India'*, 25-26 April, 1992.
3. Report on National Seminar on Endangered Fishes of India at Allahabad during 25-26 April, 1992.
4. Memorandum for Expenditure Finance Committee – Eight Five Year Plan, 1992-1997.
5. Seventh Meeting of the Committee on Introduction of Exotic Aquatic Species, 24 August, 1992.
6. Fourth Meeting of the Management Committee, 23 March, 1993.
7. Third Meeting of the Third Technical Committee to select site for permanent location of the NBFGR, 27th March, 1993.

7. CONFERENCES, SYMPOSIA, ETC

7.1. Seminar Organised

A two day National Seminar on Endangered Fishes of India was held on 25-26 April, 1992 at NBFGR, Allahabad. It was jointly organised by the NBFGR and the Nature Conservators, Muzaffarnagar.

The Seminar was inaugurated by the Hon'ble Union Minister of State for Agricultural Research and Education, Shri K.C. Lenka and was presided by the Director General, ICAR and Secretary to the Govt. of India, DARE Padma Bhushan Prof. V.L. Chopra.

Hon'ble Union Minister of State (ARE) Shri K.C. Lenka (R) with Dr. P. Das (L) arriving at the inaugural function of the seminar.

The Deputy Director General (Fisheries), ICAR, Dr. P.V. Dehadrai had delivered the key note address while the Director, NBFGR, Dr. P. Das welcomed the guests. The Director, Hatchery for Endangered Species, Dexter, USA Dr. Buddy L. Jensen delivered his speech as the Guest. The Secretary, NATCON, Dr. S.R. Verma offered the vote of thanks.

The emphasis of the Seminar was on the endangered, vulnerable and rare fishes including their habitats with a special focus on listing of endangered species and development of strategies for their conservation.

More than 100 top fisheries experts and scientists from all over the country participated at the Seminar and delivered their views on the protection of endangered

fish species in India.

The Seminar comprised of three Sessions – Inaugural Session, Scientific Sessions and Plenary Session.

Gist of Scientific Sessions

The First Session dealt with the criteria for determining the status of threatened categories of fishes and measures for their rehabilitation. In the Second Session, papers relating to conservation of fishes of estuarine and marine ecosystems were covered. The speakers indentified various threatened marine species viz. whale shark, *Rhiniodon typus,* catfish *Tachysurus* spp., *Lactarius lactarius, Platycephalus maculipinna*, Sea Cow, *Dugong dugong,* molluscan shells, *Trochus spp., Turbo spp.,* pearl oyster , *Pinctata fucata,* king crab, *Tachypleus gigas* and the robber crab, *Birgus latro.* In the estuarine/brackishwater sector, species such as *Lates calcarifer, Mugil cephalus, Odontamblyopus rubicundus, Macrobrachium rosenbergii* were identified by speakers as threatened ones those need immediate steps for conservation. Session Third dealt with the conservation status of fishes of Ganges, Indus and Brahmaputra river systems. The threatened species listed from these major systems include *Ompok pabda, Ompok pabo, Ailia coila, Sicamugil cascasia , Anguilla bengalensis, Bagarius bagarius, Puntius sarana, Labeo dero, Osteobrama belangeri, Notopterus chitala* and *Pangasius pangasius.* The conservation status of fishes of Peninsular India was covered in Session

Hon'ble Shri K.C. Lenka delivering his Inaugural lecture.

Dr. P.V. Dehadrai, DDG (Fy.) delivering his key note address.

Dr. P. Das, Director NBFGR addressing the seminar.

Dr. B.L. Jenson, Director, Endangered Fish Hatchery, Dexter, USA delivering his special lecture.

Professor V.L. Chopra, Director General, ICAR (Centre), Chairing the Technical session. Co-Chairpersons were Professor C.S. Singh (right) and Dr. V.D. Singh (left).

A view of Registration counter of the seminar. L to R : Dr. A Gopalakrishnan, Mrs. S. Das, Mrs. P.K. Sahoo & Shri R.S. Patiyal.

A view of a Technical session

Participants of the Technical Sessions.

Dr. S.R. Verma, Secretary General , NATCON proposing vote of thanks.

Dr. S.N. Dwivedi Officer on Special Duty, ICAR, presenting a point during the Technical Session.

Four. The threatened list included species like *Labeo dussumieri, Puntius dubius , P. carnaticus, Tor mussullah, Tor tor, Tor neilli, Cirrhina cirrhosa, Labeo kontius, Tor mosal, Puntius pulchellus, Horaglanis krishnai, Horabagrus brachysoma* and *Travancoria jonesi.* In the conservation status of coldwater and sport fishes, which was covered in Session Fifth, *Tor putitora, Raimas bola, Tor tor, Psilorhynchus balitora* and *Schizothorax kumaonensis* were identified those need immediate attention.

The various conservation strategies for endangered fishes were discussed in the Sixth Session. Biochemical, Biotechnological, Cytogenetic and Molecular genetic techniques aiding the conservation measures of threatened fishes were covered. The leading role played by NBFGR in the cryopreservation of fish gametes and population genetic studies and also the steps taken by other research organisations like CMFRI and CICFRI in repopulating threatened species such as *Pinctada fucata, Hilsa ilisha* and *Penaeus semisulcatus* were highlighted.

Plenary Session and Summary of Recommendations.

The recommendations of the National Seminar were presented in this Session. The important recommendations include finalising a list of threatened aquatic species, urgent

Dr. G.P. Dubey, Fisheries Consultant, Indore, presenting his paper at the seminar.

steps to be taken to conserve the threatened species on a regional basis, effective restoration of aquatic habitats, maintaining minimum water levels in all natural water bodies, revision of Indian Fisheries Act, mass breeding of threatened species, creation of more fish sanctuaries and the mass awareness drive in all conservation programmes. The various co-ordinating and participating agencies for effective implementation of each of the recommendations were also identified.

Dr. P.S.B.R. James, Director, CMFRI, participating in discussions during the Technical Session.

7.2 Important Meetings

The following meetings were organised by the Bureau during April 1992 to March 1993.

— The Sixth Meeting of the Committee for 'Introduction of exotic aquatic species' conducted at the Bureau on 24 April 1992 and important decisions were taken.

— The SRC Meeting was conducted on 22 May 1992 for review of the ongoing projects and future research projects.

— Meeting of newly formed Land Selection Committee held on 20 July 1992 under the Chairmanship of Prof. U.S. Srivastava, Member National Academy of Sciences, Allahabad.

— The Seventh Meeting of the Committee for 'Introduction of Exotic Aquatic Species' conducted on 24 August 1992 at CMFRI, Cochin.

— The half-yearly Staff Research Council meeting conducted on 23 November 1992.

— A meeting-cum-site visit of Land Selection Committee for selection of site for NBFGR's permanent infra-structure held on 30.11.92 & 1.12.92.

— Meeting of the Management Committee held on 23 March 1993 at NBFGR.

— Third meeting of the third Technical Committee for selecting site for permanent location of the Bureau held on 27 March 1993 and followed by field visit.

Meeting on the "Introduction of Exotic Aquatic Species" in progress.

7.3 Participation

The Scientist and Technical staffs of the Bureau participated in the following Conferences/Symposia/Meetings etc.

Sl. No.	Conferences/Sympo-sia/Seminar etc.	Organised by	Title of the paper and author (s)	Name of the Participants
1.	World Fisheries Congress, 3-8 May, 1992	American Fisheries Society held at Standium of Peace and Friendship, Athens, Greece	Exotic fish species in India and their effects on indigenous fishes —Dr. P. Das	—
2.	Seminar on Environmental Protection and Developing Countries, 12th May, 1992.	Parliament House, New Delhi.	Aquatic habitat destruction causing havoc to fish genetic resources —Dr. P.Das	—
3.	All India Seminar on Zoology and Human Welfare, 28-30 June, 1992	Department of Zoology, K.S. Saket Post-Graduate Collage, Awadh University, Faizabad, U.P.	Role of pineal gland in adaptation of environmental impacts in fishes —A.K. Singh	Dr. A.K. Singh
4.	Fourth National *Fish Seed Congress*, 30 August and 1 October, 1992.	U.P. Matsya Vikas *Nigam Ltd. &* Ministry of Agriculture, Government of India, held at Lucknow		Dr. P. Das was *Chairman of a* Session
5.	Workhop on Planning and Utilization of Scientific	National Academy of Agricultural Research Management,	—	Dr. A.G. Ponniah

	Manpower in Agricultural Research System, 12-16 October, 1992.	Hyderabad		
6.	IV South Asian Symposiam of Odonatology, 10-12 October, 1992.	Department of Zoology, Chaudhary Mahadev Prasad (C.M.P.) College, Allahabad, U.P.	—	Dr. P. Das inaugurated the Symposium & Chaired as Chief Guest.
7.	Third Asian Fisheries Forum, 26-30 October, 1992	Asian Fisheries Forum, Department of Zoology,National University of Singapore & ITP Services (Pte) Ltd., Singapore, held at World Trade Centre, Singapore	Fish germplasm diversity and their conservation in India—Dr. P. Das	—
8.	Tenth National Conference of Agricultural Research Statisticians, 2-4 November, 1992.	Indian Agricultural Statistics Research Institute, New Delhi, held at Indian Veterinary Research Institute, Izatnagar, U.P.	Some aspects of research and application of statistics in the area of genetics, resource estimation and conservation of fish in the country— S.P. Singh	—
9.	National Convention on Agricultural Policy & Intellectual Property Rights in Agriculture, 16-18 November, 1992.	Agricultural Research Service Scientists Forum, IARI,. New Delhi.	Fish germplasm resources of India- present status and future plan	Dr. P. Das, Dr. A. Gopalakrishnan

10. XV National Seminar of the Indian Association of Special Libraries and Information Centres (IASLIC) 26-29 Dec. 1992.	Annamalai University Library, Annamalainagar Childambaram, Tamilnadu.	—	Shri P. Chithamparam
11. Eightieth Indian Science Congress Association, 3-8 January, 1993.	National Institute of Oceanography and University of Goa, Dona Paula.	Biochemical changes during oogenesis in grey mullet, Mugil cephalus—Dr. A. Gopalakrishnan –Hypothalamic involvement during gonadal manipulation in *Oreochromis mossambicus*—A.K. Singh —*In vivo* use of lectin a mitogen in preparation of fish chromosome—A. Barat & G. John —A study of plasma, haemoglobin and transferrin pattern in two intergeneric hybrids of *Labeo rohita, Cirrhinus mrigala and Catla catla* (Fam, Cyprinidae) –P.K. Sahoo.	Dr. A.K. Singh Mrs. S. Das Dr. A. Barat Dr. P.K. Sahoo Dr. K.D. Joshi

		—Seasonal variation in gonosomatic index of a hillstream fish, *Puntius dukai* (Day)— K.D. Joshi & P.C. Joshi —Implication of calcitropic hormones in cataract formation—S.K. Srivastava — Dr. P. Das	
14. Indo—British Workshop on Biodiversity, Wetlands Ecosystems: Issues and Options, 8-9 February, 1993.	British Council Division of the British Deputy High Commission, Calcutta.		
15. National Symposium on Prospects and Problems of Biotechnology, 19-20 February 1993.	Bioved Research Society, Allahabad, U.P.	India's fish genetic resource conservation— Dr. P. Das	Dr. P. Das Dr. A.K. Pandey Dr. A. Barat Dr. A.K. Singh Mrs S. Das
		Cytogenetic characterisation of Indian fishes— P. Das & A. Barat Fish phermones: their possible application in aguaculture and fishery management— A.K. Pandey Histopathological	

		changes in gill, kidney and liver of an estuarine mullet, *Liza parsia*, induced by sublethal exposure to mercuric chloride— A.K. Pandey, M. Peer Mohamed & K.C. George Application of tissue culture techniques in monitoring the ichthyobiodiversity.—A.K. Singh	
16. Forty-Sixth Annual Conference of Indian Society of Agricultural Statistics, 20-22, February 1993.	Orissa Agricultural University, Bhubaneswar, Orissa	Comparative study of some farming systems— S.P. Singh	Shri S.P. Singh
17. Indaqua : India's first Aquaculture Show, 19-23 March, 1993.	The Marine Products Export Development Authority, Cochin, held at Congress Grounds, Teynampet, Madras.	—	Dr. P. Das

8. VISITORS

A good number of distinguished personalities visited the Bureau during 1992-93.

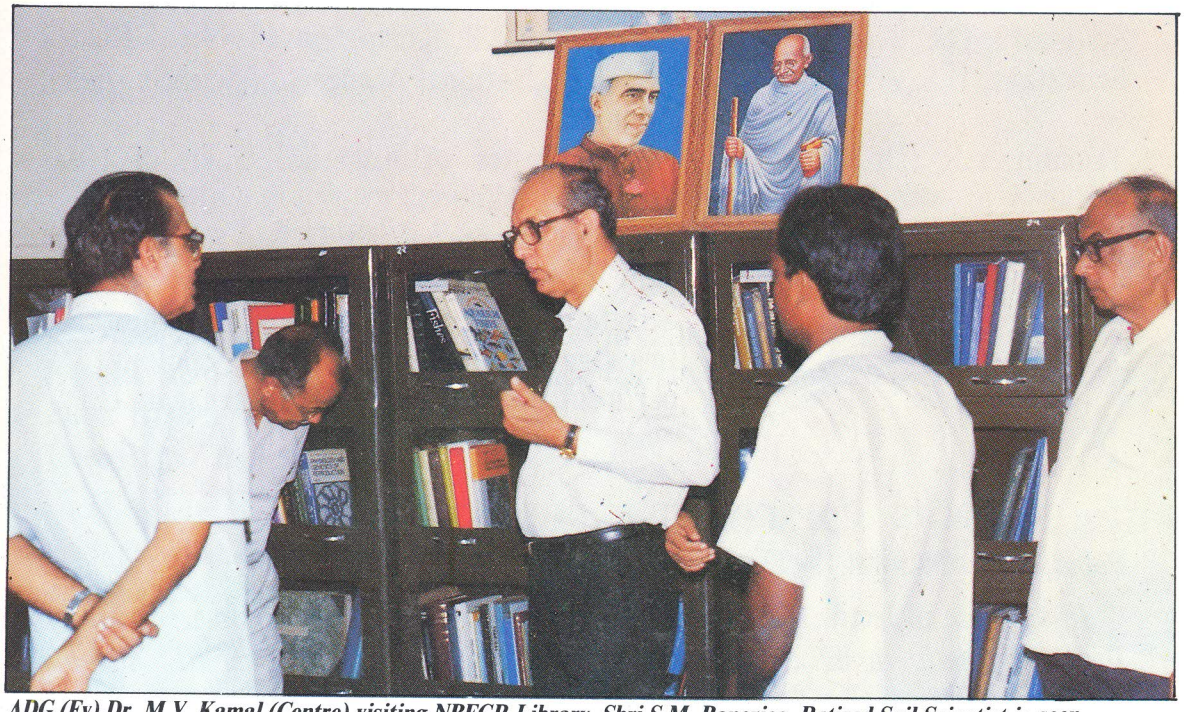
Armantrout, Neil B. (Dr.)	U,S, Fish & Wildlife Service, P.O. Box 10582, Eugene, OR 97440, U.S.A.
Bhatia, Kanta (Ms)	South Asian Bibliographer, University of

	Pennsylvania, Philadelphia PA, U.S.A.
Chaturvedi, J. (Dr.)	Principal, KVK, Mathura.
Dehadrai, P.V. (Dr.)	Dy. Director General (Fisheries), ICAR, New Delhi.
Desai, V.R. (Dr.)	Director, CICFRI, Barrackpore, West Bengal.
Dwivedi, S.N. (Dr.)	Officer on Special Duty, ICAR, Krishi Bhavan, New Delhi.
Gupta, J.K. (Dr.)	Sr. Pathologist, Kamala Nehru Hospital, Allahabad.
Jafri, A.K. (Dr.)	Professor of Fishery Science, Department of Zoology, Aligarh Muslim University, Aligarh, U.P.
Jain, R.K. (Mr.)	Chief Engineer, Northern Railway, Chanakyapuri, New Delhi.
Jensen, Buddy L. (Dr.)	Director, Dexter Fish Technology Center, P.O. Box 219, Dexter, New Mexico-88230, U.S.A.
John, George (Dr.)	Director (Animal Biotechnology), Deptt. of Biotechnology, Government of India, New Delhi.
Johri, V.K. (Mr.)	Managing Director, U.P. Fisheries Corporation, Lucknow.
Kamal, M.Y. (Dr.)	Asstt. Director-General (Fisheries), ICAR, New Delhi.
Kumar, Kuldip (Dr.)	Chief Warden of Fisheries, Himachal Pradesh, Shimla.
Manna, G.K. (Prof.)	Emer. Prof. & INSA Sr. Scientist, Dept. of Zoology, University of Kalyani, Kalyani, West Bengal.
Menon, A.G.K. (Dr.)	Emer. Scientist, Z.S.I., Madras.
Narain, Abhilash (Mr.)	Sr. Reporter, The Pioneer, Civil Lines, Allahabad.
Pandey, K.D. (Mr.)	Director of Fisheries, U.P., Lucknow.
Pathak, S.C. (Dr.)	Dy. General Manager (Fisheries), NABARD, Bombay.
Rao, Y. Rama (Dr.)	Director, CICFRI, Barrackpore.
Sahai, R. (Dr.)	Director, NBAGR NIAG, Karnal.
Singh, C.S. (Prof.)	Professor & Head, College of Fisheries, G.B. Pant University of Agricultural & Technology, Pantnagar, U.P.
Sinha, M. (Dr.)	Adviser (Fishery) North Eastern Council, Shillong.

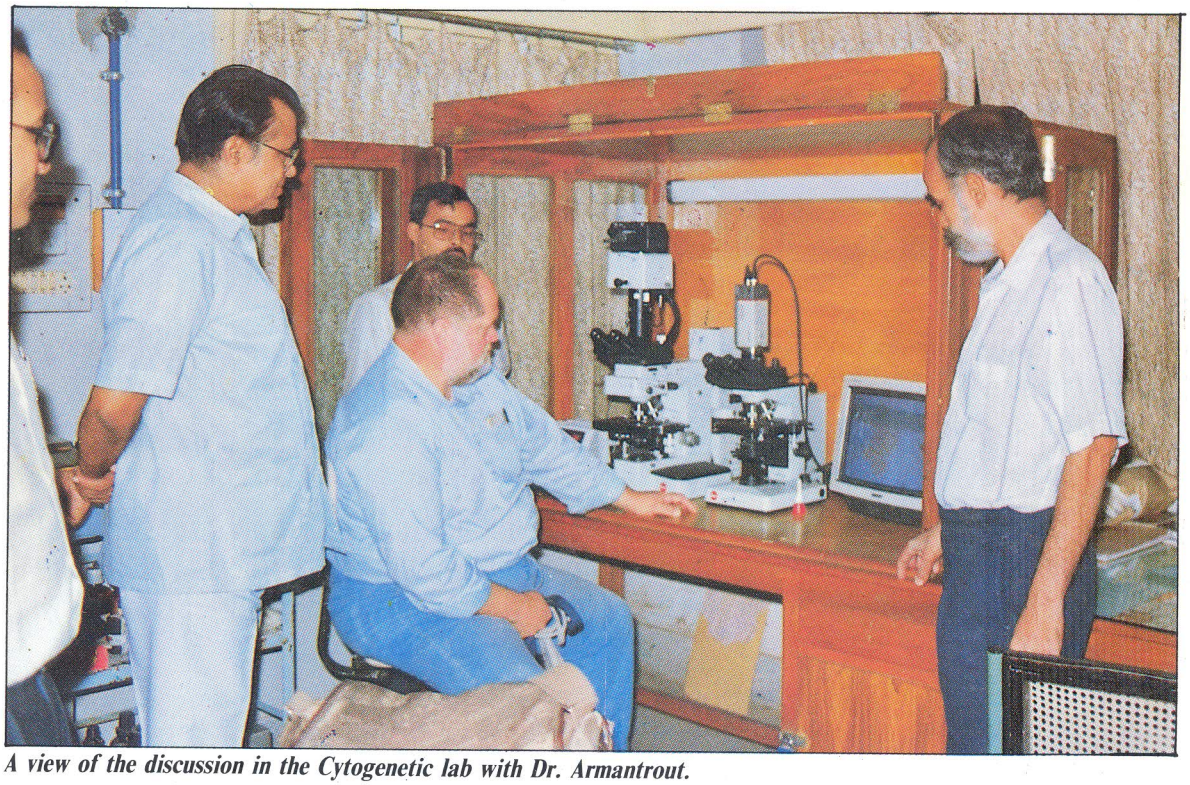
Visit of Dr. S.C. Pathak to Conservation and Management laboratory.

Visit of Dr. G.C. Srivastava, Secretary, ICAR to NBFGR Cytogenetic Laboratory.

Dr. Neil B. Armantrout (Centre) of US Fish & Wildlife Services in the NBFGR Library



ADG (Fy) Dr. M.Y. Kamal (Centre) visiting NBFGR Library. Shri S.M. Banerjee, Retired Soil Scientist is seen in the extreme right.



A view of the discussion in the Cytogenetic lab with Dr. Armantrout.

Srivastava, G.C. (Dr.)	Secretary, ICAR, Krishi Bhavan, New Delhi.
Srivastava, U.S. (Prof.)	President, National Academy of Sciences, India, Allahabad.
Tripathi, Y.R. (Dr.)	Retd. Director of Fisheries, Govt. of Uttar Pradesh, Lucknow.
Vass, K.K. (Dr.)	Principal Scientist, CICFRI Barrackpore, West Bengal.
Verma, S.R. (Prof.)	Secretary General, Nature Conservators & Investigator-Incharge P.R.R.L., Zoology Department, DAV Collage, Muzaffarnagar, U.P.

9. SCIENTIFIC PUBLICATIONS

Barat, A. & G. John, 1993.

In vivo use of lectin, a mitogen in preparation of fish chromosome. *Abstract). Proc. Eightieth Annual Session of the Indian Sci. Cong. Ass., Part III: Advance Abstracts, Section IX: Zoology, Entomology & Fisheries, No.* 12 : 9.

Das, P., 1992.

Exotic fish species in India and their effects on indigenous fishes. (Abstract). Accepted for *World Fisheries Congress* (Poster Session), held on 3-8 May,1992 in Athens.

Das, P., 1992.

Mahseer germplasm resource conservation. *Punjab Fish. Bull.*, January-June, 1992, *16* (1) : 49-50.

Das, P., 1992.

Strategies for conserving endangered fishes. *In Abstracts: National Seminar on Endangered Fishes of India, 25-26 April, 1992, Allahabad, Organized by NBFGR, Allahabad and Nature Conservators, Muzaffarnagar, pp. 67-68.*

Das, P., 1993.

Fish Stock improvement through genetic manipulations. (*Abstract*). *In*: National Symposium on Prospects and Problems of Biotechnology, Abstracts, 19-20 Feb. 1993; Organised by BIOVED Research Society, Allahabad, ed. by B.K. Dwivedi & ors., p. 31.

Das, P., and A.G. Ponniah, 1992.

Research needs on fish breeding and genetics in aquaculture for the year 2000. *In* Aquaculture Research Needs for 2000 AD, New Delhi, Oxford & IBH Pub. Co. Pvt. Ltd., pp. 181-195.

Das, P., and K.D. Joshi, 1992.

Fish in troubled waters. *Indian Fmg., May, 1992, 42* (2) : 19-26.

Das, P., & K.D. Joshi, 1992.

Conservation of fish germpalsm in India. *In* Aquatic Environment, by Ashutosh Gautam, New Delhi, Ashish Pub. House, 1992, pp. 106-111.

Das, P., & W.S. Lakra 1992.

Conservation of fish genetic diversities in India. *In Sustainable Management* of Natural Resources, eds. by T.N. Khoshoo & Manju Sharma, New Delhi, Malhotra Publ. House, 1992, pp. 285-299.

Das, P., & Ors., ed. 1992.

Abstracts : National Seminar on Endangered Fishes of India, 25-26 April, 1992 held at Allahabad, organised by National Bureau of Fish Genetic Resources, Allahabad & Nature Conservators, Muzaffarnagar, p. 86

Das, P. & A.Barat, 1993.

Cytogenetic characterisation of Indian fishes. *(Abstract). In*: National Symposium on Prospects and Problems of Biotechnology, Abstracts, 19-20 Feb. 1993: Organised by BIOVED Research Society, Allahabad, ed. by B.K. Dwivedi & ors., p.6.

Das, P. and K.D. Joshi, 1993.

Impact of habitat degradation on fish genetic resources of India. *In*: Environmental Impact on Aquatic and Terrestrial Habitats, by V.P. Agarwal & ors., published by Society of Biosciences, Muzaffarnagar, 1993 : 343-350.

Das, Sukla & P. Chithamparam, 1991.

Indentification of core journals for fish genetics research library. *IJALIS, 19* (1991) : 41-45.

John, G, A. Barat & W.S. Lakra, 1992.

Application of chromosome banding techniques in charecterisation of endangered species. *In* Abstracts : National Seminar on Endangered Fishes of India, 25-26 April, 1992, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, p. 83.

Joshi, K.D. & R.S. Patiyal 1992

Vanishing ichthyofauna of Raigarh system in Pithoragarh district. *In* Abstracts : National Seminar on Endangered Fishes of India, 25-26 April, 1992, Organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, P. 68.

Joshi, K.D. & P.C. Joshi, 1993.

Seasonal variation in the gonosomatic index (GSI) of a hill-stream fish, *Puntius dukai* (Day). (*Abstract*). *Proc. Eightieth Session of Indian Sci. Cong., Goa, 1993, Part III* (Advance Abstracts) : Section of Zoology, Entomology & Fisheries, No. 71 : 42.

Joshi, K.D.,D. Kapoor & R. Dayal, 1992.

Endangered mahseer of Kumaun hills (U.P.) *In* Abstracts : National Seminar on Engangered Fishes of India, 25-26 April, 1992, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, pp. 80-81.

Lakra, W.S., 1992.

Fish gamete and embryo cryopreserva-tion research in India. (Abstract). *In* Workshop on Gamete and Embryo Storage and Cryopreservation in Aquatic Organisms, 30 March-2 April, 1992 organised by Institute National de la Jeunsse et de I Education Populaire, MARLY le Roy/ France, Programme, Abstracts & List of Participants, p. 16.

Lakra, W.S., George John & A. Barat, 1992.

Genetic approach to mahseer conservation. *In* Abstracts : National Seminar on Endangered Fishes of India, 25-26 April, 1992, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, pp. 72-73.

Mahanta, P.C. & D. Kapoor, 1992.

Endangered, vulnerable and rare carp species of Ganga river system and the warmwater of Indus river system. *In* Abstracts : National Seminar on Endangered Fishes of India, 25-26 April, 1992, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, p. 10.

Mahanta, P.C., R. Dayal & S.M. Srivastava, 1992.

Ompok species-a drastically declining group of fishes in Assam. *In* Abstracts : National Seminar on Endangered Fishes of India, 25-26 April, 1992, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, p.20.

Pandey, A.K., 1993.

Fish pheromones : their possible application in aquaculture and fishery management. (Abstract). *In* : National Symposium on Prospects & Problems of Biotechnology, Abstracts, 19-20 Feb. 1993, organised by BIOVED Research Society, Allahabad, ed. by B.K. Dwivedi & ors., p. 48.

Pandey, A.K., M. Peer Mohamed & K.C. George, 1993.

Histopathological changes in gill, kidney and liver of an estuarine mullet *Liza parsia* induced by sublethal exposure to mercuric chloride. (Abstract); *In*: National Symposium on Prospects & Problems of Biotechnology, Abstracts, 19-20 Feb. 1993, Organised by BIOVED Research Society, Allahabad, ed. by B.K. Dwivedi & ors., P. 47.

Ponniah, A.G. & A. Gopalakrishnan, 1992.

Biotechnological strategies for conserving fish genetic diversity. *In* Abstracts: National Seminar on Endangered Fishes of India, 25-26 April, 1992, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, pp. 71-72.

Ponniah, A.G., P.K. Sahoo & S.K. Srivastava, 1992.

Biochemical genetic studies for the development of conservation strategies for fish germplasm. *In* Abstracts: National Seminar on Endangered Fishes of India, 25-26 April, 1992, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, pp. 70-71.

Ponniah, A.G., W.S. Lakra & S.N. Ogale, 1992.

Study on cryopreservation of mahseer milt. *Punjab Fish Bull.*, January-June, 1992, *16* (1): 51-53.

Sahoo, P.K., 1993.

A study of plasma, haemoglobin and transferrin hybrids of *Labeo rohita, Cirrhina mrigala* and *Catla catla* (Family : Cyrinidae). *(Abstract). Proc. Eightieth Session of Indian Sci. Cong., Goa, 1993, Part III (Advance Abstracts): Section of Zoology, Entomology & Fisheries,* No. 72: 43.

Singh, A.K., 1992.

Environmental effects on hilsa fishery and its conservation. *In* Environment and Biodegradation, by V.P. Agrawal & S.V.S. Rana, Muzaffarnagar, Society of Biosciences, 1992, pp. 275-280.

Singh, A.K., 1993.

Application of tissue culture techniques in monitoring the ichthyobiodiversity. (Abstract). *In*: National Symposium on Prospects & Problems of Biotechnology, Abstracts, 19-20 Feb. 1993, Organised by BIOVED Research Society, Allahabad, ed. by B.K. Dwivedi & ors., p. 25.

Singh, A.K., 1993.

Hypothalamic involvement during gonadal manipulation in *Oreochromis mossambicus. (Abstract).* Proc. Eightieth Session of Indian Sci. Cong., Goa, 1993, Part III (*Advance Abstracts*) : Section of zoology, Entomology & Fisheries, No. 65 : 38-39.

Singh, A.K. & P.C. Mahanta, 1992.

Some drastically declined fishes of eastern Uttar Pradesh. *In* Abstracts : National Seminar on Endangered Fishes of India, 25-26 April, 1992, Allahabad organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, p. 13.

Singh, A.K. & S.K. Srivastava, 1992.

Observations on environmental and pathological correlation in Epizootic Ulcerative Syndrome (EUS) in fishes. *J. NATCON., 4* (1) : 83-87.

Singh, A.K., D. Kapoor & P.C. Mahanta, 1992.

Ichthyofaunal decline in and around Allahabad (U.P.)—a report. *In* Abstracts : National Seminar on Endangered Fishes of India, 25-26 April, 1992, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, p. 12.

Srivastava, S.K., 1993.

Implication of calcitropic hormones in cataract formation. *(Abstract). Proc. Eightieth Session of Indian Sci. Cong., Goa, 1993. Part III (Advance Abstracts) : Section of Zoology, Entomology & Fisheries,* No. 67 : 40.

Srivastava, S.M., P.C. Mahanta, D. Kapoor & R. Dayal, 1992.

The decline of a sport fish *Labeo dero* (Hamilton) in Assam. *In* Abstract : National Seminar on Endangered Fishes of India, 25-26 April, 1992, Allahabad, organised by NBFGR, Allahabad & Nature Conservators, Muzaffarnagar at Allahabad, p. 63

10. PERSONNEL

10.1 List of Personnel

Dr. P. Das—Director

Scientific

1. Dr. L.B. Singh — Principal Scientist
2. Dr. D. Kapoor — Senior Scientist
3. Dr. George John — Senior Scientist (on deputation to the Deptt. of Biotechnology)
4. Dr. A.G. Ponniah — Senior Scientist
5. Shri P.C. Mahanta — Scientist (Sr. Scale)
6. Shri S.P. Singh — Scientist
7. Dr. A. Gopalakrishnan — Scientist
8. Dr. O.P. Pandey — Scientist
9. Dr. A.K. Pandey — Scientist
10. Dr. N.S. Nagpure — Scientist
11. Sri Peyush Punia — Scientist
12. Dr. Kuldeep Kumar Lal — Scientist

Technical

1. Dr. A.K. Singh — Asstt. Farm manager (T-6)
2. Smt. Sukla Das — Librarian, T-5
3. Shri A.K. Mishra — Electrical Foreman, T-5
4. Dr. A. Barat — Senior Laboratory Technician (Cytogenetics), T-4
5. Dr. (Mrs) P.K. Sahoo — Senior Laboratory Technician (Biochemical Genetics), T-4
6. Shri Babu Ram — Farm Engineering Asstt., T-4
7. Shri Rajesh Dayal — Field Surveyor, T-4
8. Shri S.M. Srivastava — Field Surveyor, T-4
9. Shri R.S. Patiyal — Farm Assistant, T-4
10. Dr. K.D. Joshi — Senior Laboratory Technician (Fish Biology), T-4
11. Shri P. Chithamparam — Library Assistant, T-II-3
12. Shri A.K. Singh — Junior Survey Assistant, T-2
13. Shri S.K. Paul — Junior Survey Assistant, T-2
14. Shri B.K. Rao — Sample Sorter, T-1
15. Shri R.K. Shukla — Sample Sorter, T-1

16. Shri Bhola Nath Pathak — Gestetner Operator, T-1
17. Shri Ved Prakash — Library Attendant, T-1
18. Shri R.S. Sah — Dark Room Assistant, T-1

Administrative

1. Shri R.C. Srivastava — Asstt. Finance & Accounts Officer
2. Shri A. Sah — Superintendent
3. Shri R.C.P. Sinha — Stenographer
4. Shri K.P. Nath — Assistant
5. Shri A.K. Srivastava — Senior Clerk
6. Shri Panchoo Lal — Senior Clerk
7. Shri Mohan Tiwari — Junior Clerk
8. Smt. Chanda Tiwari — Junior Clerk
9. Shri Navin Kumar — Junior Clerk

Auxiliary

1. Shri Samarjit Singh — Driver
2. Shri Om Prakash — Driver

Supporting

1. Shri Sree Ram — Fieldman, SSG-III
2. Shri Madan Lal — Fisherman, SSG-II
3. Shri Raj Bahadur — Laboratory Attendant, SSG-II
4. Shri Swapan Debnath — Laboratory Attendant, SSG-II
5. Shri K.K. Singh — Fieldman, SSG—II
6. Shri Ram Baran — Fisherman, SSG-I
7. Shri Laxchman Prasad — Fisherman, SSG-I
8. Shri Dukhi Shyam Deo — Fisherman, SSG-I
9. Shri Inderjit Singh — Messenger, SSG-I
10. Shri Anil Kumar — Safaiwala, SSG-I
11. Shri Prahlad Kumar — Safaiwala, SSG-I
12. Shri Chhote Lal — Fisherman, SSG-I
13. Shri Vinay Kumar Srivastava — Laboratory Attendant, SSG-I

10.2 Appointments

1. Dr. N.S. Nagpure, Scientist joined on 25.7.92
2. Shri Peyush Punia, Scientist joined on 11.1.93

3. Dr. Kuldeep Kumar Lal, Scientist joined on 11.1.93

New Assignment

1. Dr. George John, Senior Scientist has joined as Director (Animal Biotechnology), Department of Biotechnology, Ministry of Science and Technology, Government of India, New Delhi (relieved on 2.4.92)

10.3. Promotion

Sl. No.	Name	Designation	Date of Confirmation
Technical (Category-II)			
1.	Smt. Sukla Das	Technical Officer (Librarian, T-5)	12.3.1993
2.	Shri A.K. Mishra	Technical Officer (Electrical Foreman, T-5)	12.3.1993
3.	Dr. A. Barat	Senior Laboratory Technician (Cytogenetics) T-4	12.3.1993
4.	Dr. (Mrs.) P.K. Sahoo	Senior Laboratory Technician (Biochemical Genetics) T-4	12.3.1993
5.	Shri Babu Ram	Farm Engineering Assistant T-4	12.3.1993
Technical (Category-I)			
1.	Shri Ved Prakash	Library Attendant, T-1	12.3.1993
2.	Shri R.K. Shukla	Sample Sorter, T-1	12.3.1993
3.	Shri B.N. Pathak	Gestetner Operator, T-1	12.3.1993
Administrative			
1.	Shri A. Sah	Superintendent	12.3.1993
2.	Shri K.P. Nath	Assistant	12.3.1993
3.	Shri R.C.P. Sinha	Stenographer	12.3.1993
4.	Shri A.K. Srivastava	Senior Clerk	12.3.1993

5.	Smt. Chanda Tiwari	Junior Clerk	12.3.1993
6.	Shri Mohan Tiwari	Junior Clerk	12.3.1993

Auxiliary

1.	Shri Samarjit Singh	Driver	12.3.1993

Supporting (SSG-III)

1.	Shri Sree Ram	Fieldman	12.3.1993

Supporting (SSG-I)

1.	Shri Madan Lal	Fisherman	12.3.1993
2	Shri Raj Bhadur	Laboratory Attendant	12.3.1993
3.	Shri Swapan Debnath	Laboratory Attendant	12.3.1993
4.	Shri K.K. Singh	Fieldman	12.3.1993

10.4 Transfers

10.4.1. Transfers from NBFGR, Allahabad

1. Dr. M. Sinha, Principal Scientist on deputation as Adviser (Fisheries), North Eastern Council Secretariate, Shillong, joined Central Inland Capture Fisheries Research Institute, Barrackpore on 31.7.1992.
2. Dr. W.S. Lakra, Scientist, transferred from NBFGR, Allahabad to CIFE, Bombay (relieved on 27.4.1992).

10.4.2. Transfers from other institutes to NBFGR, Allahabad

1. Dr. O.P. Pandey, Scientist joined NBFGR, Allahabad on 29.06. 1992 on transfer from IVRI, Izatnagar.
2. Dr. A.K. Pandey, Scientist joined NBFGR, Allahabad on 01.01.1993 on transfer from CMFRI, Cochin.

11. MANAGEMENT COMMITTEE

The Bureau's Management Committee, as below, has been functioning during the year under report :

1. The Director, NBFGR, Allahabad	Chairman

2.	The Assistant Director General (Inland Fisheries), ICAR, New Delhi	Member
3.	Director of Fisheries Govt. of U.P., Lucknow	Member
4.	Dr. C.S. Singh Prof. & Head, College of Fisheries, G.B. Pant University of Agriculture and Technology, Pantnagar, U.P.	Member
5.	Shri P.C. Chakraborty, Jt. Director of Fisheries, Govt. of West Bengal, Calcutta.	Member
6.	Shri Mohammad Akil, Secretary, Matsya-Jiwi Sehkari Samiti Ltd., Allahabad, U.P.	Member
7.	Shri Narendra Kumar Nishad, Lawyer Representative, National Association of Fisherman, Allahabad, U.P.	Member
8.	Dr. L.B. Singh, Principal Scientist, NBFGR, Allahabad	Member
9.	Dr. A.G. Ponniah, Sr. Scientist, NBFGR, Allahabad	Member
10.	Dr. D. Kapoor, Sr. Scientist, NBFGR, Allahabad	Member
11.	Shri P.C. Mahanta, Scientist (Sr. Scale) NBFGR, Allahabad	Member
12.	Shri R.C. Srivastava, A.F. & A.O., NBFGR, Allahabad	Member
13.	Shri A. Sah, Superintendent NBFGR, Allahabad	Member Secretary

During the year under report one meeting was held on 23.03.93.

12. STAFF WELFARE ACTIVITIES

12.1. Institute Joint Staff Council

The Institute Joint Staff Council as below considers matters of common interest concerning the staff.

Official Side

1.	Dr. P. Das, Director	Chairman
2.	Dr. L.B. Singh, Principal Scientist	Member
3.	Dr. D. Kapoor, Senior Scientist	Member
4.	Shri P.C. Mahanta, Scientist (Sr. Scale)	Member
5.	Shri R.C. Srivastava, A.F. & A.O.	Member
7.	Shri A. Sah, Superintendent	Secretary

Staff Side

1.	Shri A.K. Mishra, T-5	Secretary
2.	Shri Ved Prakash, T-1	Member
3.	Shri K.P. Nath, Assistant	Member
4.	Shri P. Lal, Sr. Clerk	Member
5.	Shri Ram Baran, Fisherman	Member
6.	Shri K.K. Singh, Fieldman	Member

12.2 Grievance Cell

There exists also a Grievance Cell to look into the staff's grievances concerning official matters. The members of the grievance cell are as below:

Nominees of the Director

1.	Dr. L.B. Singh, Principal Scientist	Chairman
2.	Dr. A.G. Ponniah, Senior Scientist	Member
3.	Shri R.C. Srivastava, A.F. & A.O.	Member
4.	Shri A. Sah, Superintendent	Member Secretary

Elected staff representatives

1.	Shri S.P. Singh, Scientist	Scientific
2.	Shri A.K. Mishra, T-5	Technical
3.	Shri K.P. Nath, Assistant	Administrative
4.	Shri Madan Lal, Fisherman	Supporting

प्रमुख उपलब्धियां

एफ०बी०-1 भारत के मत्स्य अनुवांशिक संसाधनों का कैटलाग तैयार करना

इस अध्ययन का मुख्य उद्देश्य भारतवर्ष के समस्त मत्स्य अनुवांशिक संसाधनों सम्बन्धित सूचना एवं ज्ञान को एकत्र कर कैटलाग तैयार करना है। इन सूचनाओं का निम्नवत् संकलन किया गया।

(अ) भारतीय मत्स्य संसाधनों की चेकलिस्ट :

विभिन्न शोध संस्थानों जैसे केन्द्रीय मत्स्य प्रगहण शोध संस्थान, बैरकपुर; केन्द्रीय अलवण जल उत्पाद संस्थान, भुवनेश्वर; केन्द्रीय लवण जल उत्पाद संस्थान, मद्रास; केन्द्रीय मत्स्य शिक्षा संस्थान, बम्बई तथा केन्द्रीय समुद्री मत्स्यकीय अनुसंधान संस्थान, कोचीन तथा ख्यातिप्राप्त वैज्ञानिकों से विचार-विमर्श के बाद उपलब्ध सूचनाओं का समायोजन किया गया। विभिन्न वातावरण में रहने वाली २,२०० मत्स्य प्रजातियों की जानकारी चेकलिस्ट में समाहित की गयी।

वातावरण	मत्स्य प्रजातियों की संख्या	प्रतिशत
शीत जल	73	3.32
गरम जल	544	24.73
खारा जल	143	6.50
समुद्री जल	1440	65.45

(ब) कैटलाग :

भारत की समस्त मछलियों का कैटलाग बनाने का कार्य प्रगति पर है। इसमें 400 व्यवसायिक रूप से महत्वपूर्ण मत्स्य संसाधनों के बारे में जैसे उनकी पहचान, वर्गीकरण, आवासीय वातावरण, उपलब्धता, जीवन-चक्र, पैदावार, अनुवांशिकी तथा संरक्षण सम्बन्धी जानकारी को एकत्र किया गया है।

(स) लुप्तप्राय, लुप्तोन्मुख एवं दुर्लभ मत्स्य प्रजातियों को सूचीबद्ध करना :

ब्यूरो में राष्ट्रीय सेमिनार "इन्डेन्जर्ड फिसेस आफ इण्डिया" का आयोजन अप्रैल 1992 में किया गया। विभिन्न ख्यातिप्राप्त वैज्ञानिकों एवं संरक्षणविदों से विचार-विमर्श के बाद इन प्रकार की मछलियों की सूची तैयार की गयी है। परिमाण सम्बन्धित आंकड़ों के अभाव में प्रभावित लुप्तोन्मुख मत्स्य प्रजातियों को दो मुख्य वर्गों—(i) इन्डेन्जर्ड तथा (ii) इनडिटरमिनेट में बांटा गया है। इस सूची को अंतिम रूप दिये जाने का प्रयास किया जा रहा है।

वातावरण	**मत्स्य प्रजातियों की संख्या**		
	इन्डेन्जर्ड	**इनडिटरमिनेट**	**योग**
शीत जल	6	13	19
गरम जल	15	33	48

खारा जल	4	9	13
समुद्री जल	2	13	15

(द) डीप पूल

मत्स्य संरक्षण के विभिन्न आयामों को ध्यान में रखकर गंगा तथा यमुना नदियों में इलाहाबाद तथा कानपुर मंडल के मध्य गहन तलों (डीप पूल्स) का अध्ययन किया गया।

इलाहाबाद परिक्षेत्र :

कुरई जलाशय :

यह जलाशय (डीप पूल) गंगा नदी की जलधारा के विपरीत दिशा में इलाहाबाद से 30 किमी की दूरी पर स्थित है। इसकी ल० 1.2 किमी, चौ० 100 मील तथा गहराई 13 मीटर है। यह जलाशय मुख्य नदी से दिसम्बर से जून माह तक अलग रहता है जबकि मानसून मौसम में यह पानी से डूबा रहता है। इस जल प्रगहण क्षेत्र में स्थानीय मछुआरों द्वारा खींचा जाल, फांसा जाल, फेंका जाल, घेरा जाल तथा बशी एवं कांटे का प्रयोग किया जाता है। इस डीप पूल का वार्षिक उत्पाद लगभग 2.2 टन है जिसमें मुख्यतया इंडियन मेजर कार्य तथा माइनर कार्य एवं कैटफिस के बच्चे 13.00%, मेजर कार्प्स 20.28%, माइनर कार्प्स 8.69%, कैटफिसेज 49.25% तथा अन्य 8.69% रहती हैं।

करे जलाशय :

इस डीप पूल का विस्तृत अध्ययन केन्द्रीय मत्स्य प्रगहण शोध संस्थान, बैरकपुर के इलाहाबाद स्थित नदी प्रभाग के सहयोग से किया जा रहा है। मत्स्य विविधता के विभिन्न आयामों को ध्यान में रखकर संरक्षण हेतु समन्वित रणनीति तैयार की जा रही है।

कानपुर/उन्नाव परिक्षेत्र :

गंगई खेरा :

यह डीप पूल कानपुर से धारा की विपरीत दिशा में गंगा नदी में उन्नाव जिला में स्थित है। इसकी लम्बाई लगभग 6 किमी०, चौड़ाई 30 मीटर तथा गहराई 15 मीटर है। यह डीप पूल नदी की मुख्य धारा से दिसम्बर-जनवरी महीने में कटा रहता है तथा मानसून के मौसम में डूबा रहता है। इस जलाशय में खींचा जाल, फांसा जाल, फेंका जाल तथा बंशी एवं कांटे की सहायता से कार्प तथा कैटफिसेज पकड़ी जाती हैं। इस डीप पूल का विस्तृत अध्ययन जारी है।

मरौन्दा खार :

यह डीप पूल कानपुर से 20 किमी० धारा के विपरीत दिशा में उन्नाव जिले में स्थित अनियमित आकृति वाला है। इसकी लम्बाई 6 किमी०, चौड़ाई 20 मीटर तथा गहराई 12 मीटर है। यह डीप पूल जनवरी-फरवरी में मुख्य धारा से अलग हो जाता है जिसमें मानसून प्रारम्भ होने तक अविवेकपूर्ण ढंग से मछलियों का शिकार किया जाता है।

जाजमउ पूल :

यह जलाशय गंगा नदी में कानपुर से प्रवाह के विपरीत दिशा में उन्नाव जिले में स्थित है। यह गोलाकार है तथा इसका क्षेत्रफल 15 हे० है। इसकी गहराई 15 मीटर है। इसमें शिकारगाही हेतु खींचा जाल, फांसा जाल, फेंका जाल तथा बंशी एवं कांटे का प्रयोग किया जाता है। पकड़ी गयी मछलियों में मेजर कार्प्स, माइनर कार्प्स तथा कैटफिसेज मुख्य हैं।

इलाहाबाद के गंगा नदी में जल अनुप्रवाह की दिशा में डीप पूल :

प्रारम्भिक सर्वेक्षण के दौरान इलाहाबाद तथा वाराणसी के बीच निम्न डीप पूल्स निर्धारित किये गये।

स्थान का नाम	गहनतल की अनुमानित लम्बाई (किमी० में)	गहनतल की अनुमानित (गहराई फीट में)
छोटे मिर्जापुर	2	35
चुनारघाट	1	45
राजघाट	2	35
पंचगंगा घाट	1	30
रामघाट	1	25
असीघाट	0.5	30
नरायनपुर	2	35
गड़हवाघाट	1.5	40

इन जलाशयों में मछली पकड़ने हेतु फांसा जाल, फेंका जाल, खींचा जाल तथा बंशी एवं कांटे का प्रयोग किया जाता है। स्थानीय मछुआरों के अलावा बाहरी मछुवे भी इन डीप पूलों में ग्रीष्म ऋतु में शिकारगाही करते हैं। पकड़ी गयी मछलियों में टेंगर, रीता, वाचा, रोहू, भाकुर, नयन तथा कालबासु मुख्य हैं।

यमुना नदी के गहन जल तल :

बक्शीमोरा :

इस गहन तल का विस्तृत अध्ययन केन्द्रीय मत्स्य प्रगहण शोध संस्थान के सहयोग से किया जा रहा है ताकि मानव जनित दबाव से प्रभावित मत्स्य प्रजातियों के संरक्षण हेतु उपयुक्त रणनीति तैयार की जा सके।

डीप पूलों में वहनीय मत्स्यकी का अनुरक्षण

मानसून मौसम के बाद गहन जल क्षेत्र सामान्यतया मुख्य धारा से अलग हो जाते हैं। चूंकि साथ लगी नदी में पर्याप्त जल स्तर न होने के कारण तथा डीप पूलों में मत्स्य जीव समूहों का बहुतायत होने के कारण उनमें अविवेकपूर्ण शिकारगाही होती है तथा मत्स्य संसाधनों का सम्पूर्ण दोहन हो जाता है।

जबकि मत्स्य जीवों के वहनीय अनुरक्षण हेतु कानूनी व्यवस्था है लेकिन उनका क्रियान्वयन इतना आसान नहीं है। अतः ब्यूरो ने वहनीय मत्स्य अनुरक्षण हेतु सम्बन्धित जन साधारण का जागरण करने पर विचार कर रहा है।

एफ०बी० 2. चयनयित उच्च जलक्षेत्रों में महाशेर का संरक्षण

लुप्तप्राय महाशेर मछली के इनसीटू संरक्षण हेतु उत्तरी पर्वतीय क्षेत्र में लदिया नदी को प्रयोग स्तर पर चुना गया है। यह काली नदी की सहायक है तथा समुद्र तल से 6,000 फीट की ऊंचाई पर स्थित नैनीताल जिले के मोरनौल गांव से निकलती है। इस नदी का मुख्य भाग पिथौरागढ़ जिले में स्थित है तथा लगभग 100 किमी० पहाड़ी क्षेत्र में आड़ी-तिरछी बहने के बाद तुनियास नामक स्थान पर यह काली नदी में मिल जाती है। लदिया नदी में टोर टोर, टोर पुटिटोरा, साइजोथोरेम्स रियर्डसोनी, गारा गोटाइला, लेबिओ डेरो, लेबिओ डायोकाइलस, बरेलियस तथा निमाकाइलस प्रजातियों की मछलियां पायी जाती हैं।

लदिया नदी में महाशेर मछली का प्रजनन स्थान

प्रकाशित शोधपत्रों के अवलोकन से यह पता चला कि महाशेर मछली बहते हुए छिछले पानी (गहराई 35-50 सेमी०), तापमान लगभग 22.2-23°C तथा रेतीली तल जहां आक्सीजन की प्रचुरता रहती है, में प्रजनन करती है। यूं तो ऐसा वातावरण सम्पूर्ण लदिया नदी में मिलता है तथापि नदी के ऊपरी क्षेत्र में जोशीयूरा गांव और रीठा साहेब, मध्य क्षेत्र में रीठा साहेब से 2 किमी० प्रवाह की दिशा में चलती और अमोरी के बीच 15 किमी० तथा निम्न परिक्षेत्र में चलती से शारदा नदी में मिलने तक महाशेर प्रजनन स्थानों का

निर्धारण किया गया है।

शीत एवं ग्रीष्म ऋतुओं में जब नदी में पानी का तल कम हो जाता है, परिपक्व मछलियां शारदा नदी के संगम पर एकत्र हो जाती हैं। यह स्थान अति संवेदनशील प्रक्षेत्र है जहां पर परिपक्व मछलियों की अवैधानिक अंधाधुंध शिकारगाही होती है।

महाशेर मछली की संख्या में खतरनाक अवनत देखते हुए ब्यूरो ने मत्स्य बीज पुनःसंग्रहण की व्यावहारिक प्रणाली अपनाने पर विचार किया है।

सी०जी० 6. प्रकृति में पाये जाने वाली लुप्तप्राय (इन्डेन्जेर्ड), भारतीय मुख्य कार्प्स एवं चयनयित वायुश्वासी मत्स्य प्रजाति समुदायों में कोशिकानुवंशीकीय विभेद सम्बन्धी अध्ययन :

कोशिकानुवंशीय विभेद अध्ययन हेतु रोहू, कालबासु, नयन, साइजोथोरेम्स रिचर्डसोनी, निमाकाइलस, गारा गोटाइला तथा कामन कार्प को चुना गया। गुणसूत्रीय अध्ययन के लिए रोहू, कालबासु तथा नयन को इलाहाबाद की हैचरी तथा नदीय वातावरण से एकत्र करके प्रयोगशाला में पर्यनकूलन किया गया। कुछ दिनों पश्चात् 0.05% कोलचीसीन का 1 मी०ली०/ 100 ग्राम वजन की दर से अंतक्षेप किया गया तथा विकसित तकनीक द्वारा माइटोटिक सूचांक को बढ़ाया गया। परिणामों के आधार पर इन मत्स्य प्रजातियों में द्विगुणित (डिप्लायड) गुणसूत्रों की संख्या 50 रही।

एनओआर बैण्ड की स्थिति जानने के लिए होवेल और ब्लैक (1980) की तकनीक का प्रयोग किया गया तथा ये बैण्ड रोहू तथा कालबासु के एक जोड़े सबमेटासेन्ट्रिक गुणसूत्रों पर पाये गये। ऐसा ही अध्ययन टोर पूटीटोरा तथा साइजोथोरेम्स रिचर्डसोनी में भी किया गया तथा कुमाऊं पहाड़ी नदियों में पायी जाने वाली साइजोथोरेम्स रिचर्डसोनी में एनओआर धारण गुणसूत्रों में विभेद पाया गया।

सी०जी० 6-1. विभिन्न वातावरण में रहने वाली मत्स्य प्रजातियों के गुणसुत्रों की स्थिति :

इस अध्ययन का मुख्य उद्देश्य विभिन्न वातावरण में रहने वाली मत्स्य प्रजातियों में निहित गुणसूत्रों की संख्या तथा संरचना में विभेद तथा उनका अनुकूली एवं विकासात्मक प्रक्रिया में महत्व पर प्रकाश डालना है।

भारतीय समुद्री मत्स्य प्रजातियों में गुणसूत्रीय विभेद का परिगणन :

भारत की 2,200 मत्स्य प्रजातियों में 71.95% समुद्री तथा लवणीय जल में पायी जाती हैं। 124 प्रकाशित गुणसूत्रीय अभिलेखों के अवलोकनोपरांत इन मत्स्य प्रजातियों को चार वर्गों में बांटा गया : (अ) जिनमें गुणसूत्रों की संख्या 48 से कम, (ब) जिनमें गुणसूत्रों की संख्या 48 (स) जिनमें गुणसूत्रों की संख्या 50 तथा (द) जिनमें गुणसूत्रों की संख्या 50 से अधिक है।

परिणामों के आधार पर यह निष्कर्ष निकाला गया कि 87% समुद्री तथा 92% लवण जल मत्स्य प्रजातियों में गुणसूत्रों की संख्या 48 या उससे कम है। केवल कुछ समुद्री (13%) तथा लवण जल (7%) मछलियों में 50 या ज्यादे गुणसूत्र पाये गये। अग्रेतर 76% समुद्री मत्स्य प्रजातियों में मात्र टिलोसेन्ट्रिक गुणसूत्र ही पाये गये।

सी०एम०-3 जीन बैंक हेतु हिम परिरक्षण तकनीक का विकास :

इस जीन बैंकिंग परियोजना के अन्तर्गत लुप्तोन्मुख (इंडेन्जर्ड) टोर प्यूटीटोरा तथा भारतीय मुख्य कार्प लिवियो रोहिता मत्स्य प्रजातियों पर शुक्राणु हिम परिरक्षण अध्ययन किये गये।

लेबियो रोहिता :

हिम परिरक्षित शुक्राणुओं पर सोडियम साइट्रेट, सोडियम क्लोराइड और डी०एम०एस०ओ० धारित प्रसारकों द्वारा अंडपीतक के साथ तथा अंडपीतक रहित स्थिति निषेचन सम्बन्धी प्रयोग किये गये। अध्ययन से ज्ञात हुआ कि अंडपीतक रहित प्रसारक बेहतर रहे तथा सर्वाधिक अंडोद्गमन दर 44.24% प्राप्त हुआ। एक ही सेट के द्वितीय स्ट्रिपिंग संग्रहीत शुक्राणुओं में प्रथम स्ट्रिपिंग की अपेक्षा अधिक अंडोद्गमन दर पायी गयी।

एक सेट के द्वितीय स्ट्रिपिंग संग्रहीत शुक्राणुओं द्वारा अंडोद्गमन दर 44.25%, प्रथम स्ट्रिपिंग संग्रहीत शुक्राणुओं के

अंडोद्गमन दर 2.29% से अधिक रही।

स्ट्रिपिंग प्रक्रिया को बार-बार दुहराकर शुक्राणु अवयवों पर इसका प्रभाव देखा गया। ग्लूकोज में गिरावट देखी गयी तथा सोडियम, पोटाश एवं कैल्शियम पर इसका कोई विशेष प्रभाव नहीं पड़ा।

एक अन्य प्रयोग में प्रसारकों में विभिन्न पदार्थों को मिलाकर अंडोद्गमन दर पर इसके प्रभाव का अध्ययन किया गया। सोडियम साइट्रेट-क्लोराइड डी०एम०एस०ओ० प्रसारकों में निम्न 6 उपचार किये गये (i) 1% डीएपी (ii) 0.1% ग्लूकोज (iii) 0.4% अल्वून्यूमिन (iv) ग्लिसराल (v) 0.1% ग्लूकोज, 0.4% अल्वून्यूसिन, 0.05% कैल्शियम क्लोराइड 0.15% पोटैशियम क्लोराइड (vi) बिना कुछ सिकाये। उपचारक (iv) द्वारा सर्वाधिक अंडोद्गमन दर 23.1% पायी गयी।

हिम परिरक्षित शुक्राणु एवं सामान्य शुक्राणुओं पर भी प्रयोग किये गये तथा यह देखा गया कि हिम परिरक्षित शुक्राणुओं में डेक्सटर घोल मिलाने से अंडोद्गमन दर में वृद्धि होती है। कुछ प्रयोगों में डेक्सटर मिलाने पर शून्य की अपेक्षा अंडोद्गमन दर 4.7% पायी गयी।

टोर प्यूटीटोरा :

टोर प्यूटीटोरा के हिम परिरक्षित शुक्राणुओं पर निषेचन प्रयोग किये गये। शुक्राणु परिरक्षण के लिए, ग्लिसराल और डी०एम०एस०ओ० हिम परिरक्षक, 60, 120 एवं 180 मिनट साम्यीकरण अवधि के लिए प्रयोग किये गये। प्रत्येक सेट शुक्राणु का परीक्षण तीन मादा मछलियों के साथ किया गया। तीनों अवस्थाओं में एक वर्ष पुराने हिम परिरक्षित शुक्राणुओं द्वारा 0.53% से 2.17% तक जीवित जीरी का उत्पादन देखा गया। हिम परिरक्षकों एवं साम्यीकरण अवधि के प्रभावों में कोई विशेष अन्तर नहीं पाया गया।

एक अन्य परीक्षण में छः प्रसारकों पर परीक्षण किया गया जो कि इस प्रकार है। (1) सोडियम क्लोराइड 0.75%, पोटैशियम क्लोराइड 0.038%, ग्लूकोज 0.1% और सोडियम बाइकार्बोनेट 0.2% (2) सोडियम क्लोराइड 0.4%, सोडियम साइट्रेट 0.8% (3) प्रसारक (2) के साथ 2% ग्लूकोज (4) प्रसारक (2) के साथ 10% अंडोपीतक (5) सोडियम क्लोराइड 0.65%, पोटैशियम क्लोराइड 0.3% सोडियम बाइकार्बोनेट 0.02%, कैल्शियम क्लोराइड 0.03% (6) 6.3% ग्लूकोज। इस परीक्षण में अधिकतम अंडोद्गमन दर 7.9% जबकि नियंत्रित उपचार में दर 17.6% रही। टोर खुदरी के हिम परिरक्षित शुक्राणु द्वारा टोर प्यूटीटोरा के अंडों के निषेचन से संकर प्रजाति का उत्पादन दर अत्यन्त कम देखी गयी।

सी०एम०-4 भारतीय मुख्य कार्य एवं लुप्तप्राय मछलियों के अंडों एवं भ्रूणों के हिम परिरक्षण पद्धति का विकास

मछलियों के अंडों एवं भ्रूणों की हिम परिरक्षण पद्धति विकास हेतु अध्ययन किये गये।

हिमकरण होने पर कोरियन निर्जीव हो गये तथा केवल भ्रूण ही जीवित रहे। अंडे की झिल्ली समापन के बाद भ्रूणों की उपयुक्त जीवन विकासावस्था निर्धारण हेतु परीक्षण किये गये। इस अध्ययन के किए मोरुला तथा टेल-बड अवस्था का चुनाव किया गया। तुलनात्मक अध्ययन के लिए एक नियंत्रित उपचार भी शामिल किया गया। लीवियो रोहिता भ्रूण मोरुला अवस्था में मात्र 6 से 7 घंटे तक जीवित रहे। टेल-बड स्थिति में सभी भ्रूणों का विकास पूरी अंडोद्गमन तक सामान्य रूप से हुआ।

अविषालुता अध्ययन :

अध्ययन हेतु टेल-बड एवं कोरियन दोनों भ्रूण अवस्थाओं पर परीक्षण किये गये। तीन हिम परिरक्षकी डी०एम०एस०ओ०, पी०आर०ओ०एच० तथा एमईओएच को तथा उनके साथ 0.5% पी०वी०पी० मिश्रण को प्रयोग में लाया गया। सभी सेट को विभिन्न हिम परिरक्षिक के साथ एक घंटे उपचारित करने सामान्य पानी में स्थानान्तरित कर दिया गया। अंडोद्गमन दर उपचारक के अनुसार निकाला गया। इसके आधार पर परीक्षण में प्रयुक्त हिम परिरक्षकों की अविषालुता अध्ययन किये गये। मेथेनाल अधिकतम अंडोद्गमन दर 54.8% के साथ सबसे कम विषाक्त पाया गया। पी०आर०ओ०एच०, मेथेनाल तथा ग्लिसराल मिश्रित उपचार के

मृत्यु दर शत प्रतिशत के साथ सबसे अधिक विषालु देखा गया। सुक्रोज से पहले उपचारित सेटों में जीवन दर अधिक रही।

विट्रीफिकेशन :

इस परीरक्षण हेतु लेबियो रोहिता के टेल-बड अवस्था के भ्रूण को सुक्रोज 0.25% एम० तथा 0.5 एम० में क्रमशः 10 मिनट तक उपचारित किये गये। तत्पश्चात विट्रीफिकेशन घोल में स्थानान्तरित कर दिया गया प्रत्येक स्ट्रा में दो-दो भ्रूण रखे गये। द्रव नत्रजन में से जाने से पूर्व भ्रूणों की उच्च सान्द्रता हिम परिरक्षका में 2 मिनट के लिए प्रवाहित किया गया। प्रयुक्त हिम परिरक्षकी की संख्या 6 थी प्रत्येक हिम परिरक्षक में सुक्रोज 0.5 एम० मिलाया गया। पी०आर०ओ०एच० हिमपरिरक्षक के अतिरिक्त सभी हिम परिरक्षकों में हिमद्रवन के बाद भ्रूणों के आकार विकृत पाये गये। पी०आर०ओ०एच० सर्वोत्तम हिमपरिरक्षक पाया गया।

मन्द शीतलन :

इस परीक्षण हेतु एक विशेष प्रकार का पात्र प्रयोग में लाया गया। इस पात्र की बाहरी दीवाल अल्यूमिनियम तथा भीतरी दीवाल थर्मोकोल की थी दोनों दीवालों के बीच ग्लासवूल था हिमपरिरक्षकों में भ्रूणों के 35 मिनट साम्यीकरण के बाद उन्हें धातु वाले रैक में स्थानान्तरित करके निश्चित गहराई में रखा गया। दस मिनट के बाद और नीचे ले जाया गया। 20 मिनट तक इस स्थिति में रखने के बाद भ्रूण सेट को अलग कर दिया गया। तत्पश्चात अन्य सेट को 20 मिनट के हिमकरण के बाद द्रव नत्रजन में रख दिया गया। सभी परीक्षण सेटों में हिमद्रवन के बाद भ्रूण मृत पाये गये। परीक्षण अवधि के परीक्षणों से पी०आर०ओ०एच० हिम परिरक्षकों अन्य की तुलना में बेहतर देखा गया।

सी०एम०-5 विदेशी मत्स्य प्रजातियों की एर्कालगी और निर्जीवायुक (स्टेराइक) समुदाय उत्पादन की तकनीक का प्रमाणीकरण :

इस अध्ययन के अन्तर्गत तिलापिया की ओरियोक्रोमिस मोसाम्बिकस प्रजाति में 17 एमटी भोजन के साथ जीरों की 60 दिन तक देने से अच्छे दर पर नर मत्स्य उत्पादन प्राप्त किया जा चुका है।

सम्यक नरलिंगी मत्स्य उत्पादन हेतु ओरियोक्रोमिस मोसाम्बिकस प्रजाति अध्ययन किये गये। पूरे परीक्षण में 7 दिन के जीरे को 3 भागों में बांटा गया और प्रत्येक उपचार में 40 जीरो के सेट पांच प्रतिवर्तन (रेप्लीकेट) में रखे गये। प्रथम भाग को सामान्य भोजन दिया गया, दूसरे भाग को हार्मोनयुक्त भोजन के साथ सामान्य दिन के प्रकाश में उपचारित किया गया। तीसरे भाग में जीरे को 17α एम डी 35 मिग्रा। प्रति किग्रा भोजन 3 विभिन्न प्रकाशावर्तन अवस्था में दिया गया। यह तीनों अवस्थाएं 18 एल : 6 डी, 16 एल : 8 डी तथा सामान्य सूर्य के प्रकाश या परीक्षण काल में उनकी बढ़वार, जीवन्तता तथा लिंग अनुपात सम्बन्धी आंकड़े एकत्र किये गये।

परिणामों से पता चलता है कि 17α एम टी 16 एल : 8 डी प्रकाशावर्तन के साथ उचारित वर्ग की मछलियों की बढ़वार, जीवन्तता तथा लिंग परिवर्तन दर में बढ़ोत्तरी देखी गयी। इसी वर्ग के नर लिंग उत्पादन दर शत प्रतिशत तक भी पायी गयी।

बी०जी०-7 मुख्य कार्प, लुप्तप्राय तथा अन्य मत्स्य प्रजातियों में तुलनात्मक जैव रसायनिक आनुवंशिकीय अध्ययन :

प्रकृति में पायी जाने वाली मत्स्य समुदायों की विभिन्न प्रजातियों में तथा प्रजाति के भीतर आनुवंशिकीय विभेद निर्धारण हेतु राप्ती नदी से रोहू मछली के 32 नमूने लिये गये तथा 22 इन्जाइम पद्धति एवं समविद्युत विभव केन्द्रीकरण (आइसो-इलेक्ट्रिक फोकसिंग) आई०ई०एफ० विधि द्वारा अध्ययन किया गया। 9 गणना योग्य इन्जाइम में पेशीय इन्जाइम लैक्टेट डीहाइड्रोजिनेज (एल०डी०-एच०), ग्लूकोज 3 फास्फेट डीहाइड्रोजिनेज, मैलेट डीहाइड्रोजिनेज तथा यकृत जी 6 पी०जी०डी० में सभी मत्स्य प्रजातियों के बैन्ड में एक समता पायी गयी। यकृतीय एस्टरेज (ई०एस०टी०) तथा एल०डी०एच० में अनेकाकृति (पाली मारफिजम) के संकेत मिले हैं। यकृत के एक्स०डी०एच०, फास्फोग्लूकोम्यूटेज (पी०जी०एम०) सुपर आक्साइड डाइम्यूटेज (एस०ओ०डी०) तथा आंख की लेन्स प्रोटीन के एक बैण्ड में बहुलता (पालीमार्फिज्म) का पता चला है। एस०ओ०डी० हेतु हेटरीजाइगस मत्स्य प्रजातियों का प्रतिशत 9 है। जबकि आंख की लेन्स प्रोटीन में 74.2% पाया गया है। एस०ओ०डी० तथा आई०ई०एफ० में समयुग्मजों की प्रतिशतता क्रमशः 91 तथा 2.5 रही है।

हैचरी तथा प्राकृतिक मत्स्य बीज में रोहू के बीज प्राकृतिक तथा हैचरी से एकत्र किये गये तथा पांच इन्जाइम पद्धति ए०एच०डी०, एस०ओ०डी०, पी०जी०एम०, आई०डी०एच०पी० तथा ई०एस०टी० द्वारा जांच किया गया। परिमाण के आधार पर पाया गया कि हैचरी तथा प्रकृति में पाये जाने वाले मत्स्य बीजों में आनुवंशिकीय विभेद है।

नान-ईन्वैसिव तथा न्यूनतम इनवैसिव प्रतिचयन :

लुप्तप्राय तथा बहुमूल्य परिपक्व मछलियों के आनुवंशिकीय चरित्र-चित्रण हेतु नान-इन्वैसिव तथा न्यूनतम इन्वैसिव प्रतिचयन तकनीकी विकास की आवश्यकता है। नान-इन्वैसिव प्रतिष्ठान के लिये सिधीं मछली के श्लेषम (म्यूकस) का परीक्षण किया गया जिसमें जी० 6 पी०डी०, एक्स०डी०एच०, पी०जी०एम०, ए०ए०टी०, ई०एस०टी०, एस०ओ०आर०डी०एच०, जी०पी०आई० एवं एच०एक्स० इन्जाइमों की क्रियाशीलता का अध्ययन किया गया। परिक्षित इन्जाइमों में एस०ओ०आर०डी०एच० तथा एच०एक्स० की क्रियाशीलता श्लेष्म में नहीं पायी गयी।

शीतजल मछलियां :

तुलनात्मक जैव रसायनिक आनुवंशिकीय विभेदीय अध्ययन हेतु लुप्तप्राय टोर प्यूटीटोरा तथा साइजोथोरैक्स रिचर्डसोनी में जी 6 पी०डी०, जी०पी०आई०, पी०जी०एम०, आई०डी०एच०पी०, ए०ए०टी०, एस०ओ०डी० तथा जी 3 पी०डी०एच० इन्जाइम का परीक्षण किया गया। इस दिशा में शोध कार्य-प्रगति पर है।

वर्णशंकर परीक्षण :

रोहू के अण्डों को रोहू तथा नैन के हिमशीतित शुक्राणुओं से निषेचित कर जीरा प्राप्त किया गया तथा उनका परीक्षण आनुवंशिक चिह्नों जैसे ए०ए०टी०, एम०ई० 2 तथा एस०ओ०डी० द्वारा रोहू नैन वर्णशंकर निर्धारण हेतु किया। समस्त जीरा में रोहू का ही बैण्ड प्रतिमान पाया गया तथा रोहू-नैन वर्णशंकर नहीं पाये गये।

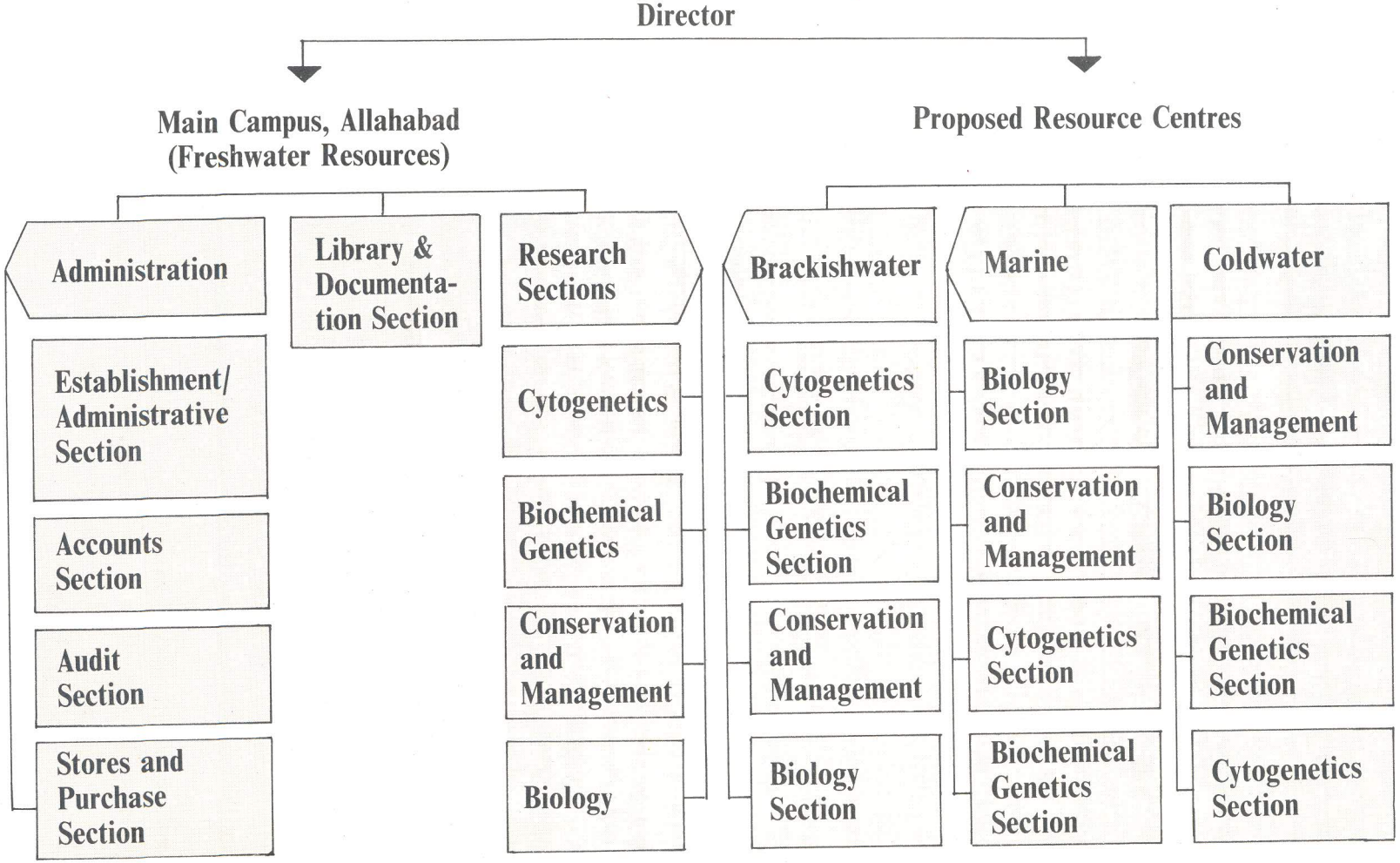
Appendix—I

Statement showing the total number of employees and member of the Scheduled Castes and Scheduled Tribes amongst them as on 31.3.93.

Group/Class	Total No. of Employees	Scheduled Castes	Percentage of S.C.	Scheduled Tribes	Percentage of S.T.
Group 'A' (Class-I)					
1. Director	1	—	—	—	—
2. Principal Scientist	1	—	—	—	—
3. Senior Scientist	3	—	—	—	—
4. Scientist (Sr. Scale)	1	—	—	—	—
5. Scientist	7	—	—	—	—
6. Asstt. Farm Manager (T-6)	1	—	—	—	—
Total	14	—	—	—	—
Group 'B' (Class-II)					
1. Asstt. Finance Accounts Officer	1	—	—	—	—
2. Technical Officer (T-5)	2	—	—	—	—
3. Superintendent	1	—	—	1	100%
Total	4	—	—	—	—

Group/Class	Total No. of Employees	Schedu-led Castes	Percen-tage of S.C.	Schedu-led Tribes	Percen-tage of S.T.
Group 'C' (Class-III)					
1. Technical T-4	7	1	14.2%	1	14.2%
2. Technical T-II-3	1	—	—	—	—
3. Technical T-2	2	—	—	—	—
4. Technical T-1	5	2	40%	1	20%
5. Stanographer	1	—	—	—	—
6. Assistant	1	—	—	—	—
7. Sr. Clerk	2	1	50%	—	—
8. Jr. Clerk	3	1	33.3%	—	—
9. Driver	2	1	50%	—	—
Total	24	6		2	
Group 'D' (Class-IV)					
1. Fisherman	5	1	20%	1	20%
2. Lab. Attendant	3	—	—	—	—
3. Fieldman	2	1	50%	—	—
4. Messenger	1	—	—	—	—
5. Safaiwala	2	2	100%	—	—
Total	13	4		1	

Appendix-II Organisational Chart



The Research Sections would be elevated to Research Divisions when adequate number of scientists come in position during the VIII Plan period.