ANNUAL REPORT
1990-1991

NATIONAL RESEARCH CENTRE ON COLDWATER FISHERIES
(I C A R)

Roop Nagar, Near Shilwa Hills Nursery
Haldwani - 263 139

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1. BRIEF HISTORY

The research on Coldwater Fisheries commenced with the establishment of Coldwater Fisheries Research Centre of erstwhile Central Inland Fisheries Research Institute (CIFRI) in 1963 as a scheme under III Five Year Plan. The research programme at the centre commenced on borrowed facilities provided by the States of Himachal Pradesh and Jammu and Kashmir. This centre, for the first time, enriched the knowledge on resource management, biological productivity of torrential rivers, streams, brooks, lakes, reservoirs etc. both in the Himalayan and Deccan Plateau regions. The centre monitored the seed resources of commercially important coldwater species particularly schizothoracids and mahseers in N.W. Himalayan regions. The fishery biology of important coldwater fishes has been studied. In the field of aquaculture, technologies of production of common carp, trout and mahseer were standardised with the sole aim of increasing fish yield per unit of water area. For the first time, formulation of dry pelletized practical feeds met with glowing success in brown and rainbow trouts. Monitoring of fish health in coldwater hatcheries and farms and their remedial measures resulted in controlling the losses of commercial species which otherwise took heavy toll. Inspite of the great strides made in research leading to development of coldwater fisheries, the centre lacked in its own infrastructure facilities. This constraint resulted in lack of proper thrust in priority areas of research. The working group on Agricultural Research and Education for the VII Five Year Plan suggested that the research on Coldwater Fisheries be strengthened by having a separate National Research Centre on Coldwater Fisheries (Item 4, page 9 of the Document). The sanction to establish the NRC on Coldwater Fisheries was accorded by the ICAR in December, 1986 and the centre came into existence at Haldwani in September, 1987. The location of headquarters of the NRC was decided on the basis of the recommendations made by the Site Selection Committee of the ICAR. The Committee recommended that the permanent campus of the NRC on Coldwater Fisheries be established with a fish farm and laboratory facilties at Champawat. Till such facilities come up at Champawat, the

Committee approved of its location at Haldwani. It was further decided by the Council that the erstwhile establishment of the Srinagar Research Centre of CIFRI be merged with NRC on Coldwater Fisheries. This was completed in 1988.

2. MANDATE

The mandate of the NRC on Coldwater Fisheries is (i) to conduct research on assessment and mangement of coldwater fishery resources (ii) to study and monitor factors affecting them (iii) to develop technologies for their improvement and (iv) to conduct training and extension programmes.

3. ORGANISATIONAL SET-UP

To develop the infrastructural facilities for accomplishment of research programmes on coldwater aquaculture, flat land measuring 3.3 hectare at Champawat in kumaon Himalaya (Distt. Pithoragarh) as recommended by Site Selection Committee was negotiated and purchased in April, 1988. The site is now being developed for research laboratories and farm complex. During 1990-91, the Central Public Works Department completed fencing of the area to prevent encroachment, laying of approach road to the farm complex from the National Highway and a small store shed. The CPWD also awarded the execution of works on construction of hatchery building, raceways, outdoor nurseries, storage tank, indoor circular nurseries, water intake structure for the whole farm and pelletizing, feeding and milling rooms. These works are near completion. To monitor these works, a small office has been set up at Champawat with a Scientist (Selection Grade) assisted by one Technical and three supporting staff. The site for locating office-cum-laboratory building is due to be seen by the chief Architect. Northern Circle, CPWD. The matter is being persued.

4. BUDGET

The position of budget estimates and revised estimates for 1990-91 under plan and non-plan of NRC-CWF is as under : (Rs. in lacs)

Budget Head		*Budget estimates*		*Revised estimates*	
		Plan	*Non-plan*	*Plan*	*Non-plan*
i)	Estt. Charges	6.50	11.85	6.00	5.60
ii)	T.A.	1.00	1.25	0.90	1.20
iii)	Other charges (including equipment etc.)	8.00	5.00	8.80	5.20
iv)	Works	13.50	-	11.30	-
v)	Others	1.00	-	-	-
	Total	30.00	18.10	27.00	12.00

5. RECRUITMENT

Out of 31 sanctioned posts under plan, the recruitment of 23 posts viz; scientific, technical, administrative, auxillary and supporting has been completed. Recruitment action for filling 8 scientists is pending with ASRB/Council.

6. CONFERENCES/SYMPOSIA/SEMINARS ATTENDED

S.No.	*Subject*	*Organisers*	*Papers presented*	*Authors/participants from the Institute*
1.	National Work-shop-cum-Semi-nar on fish pro-duction techno-logy	FRTC, G.B. Pant Krishi Evam Prodhyogik Vishwavidyalaya, Pantnagar (Nainital)	State-of-art of mahseer Fisheries in India	Dr. K.L. Sehgal

2.	-do-	-do-	Trout farming in India	Dr. H.S. Raina
3.	Course on Administrative and Financial Management for senior Executives.	National Academy of Agricultural Research Management, Hyderabad	Nil	Dr. K.L. Sehgal
4.	Workshop of Asian Fisheries Society	Asian Fisheries Society, Mangalore	-	Shri Madan Mohan

7. MEETINGS ATTENDED

Dr. K.L. Sehgal, Project Director attended the following important meetings during the period under report :

6-7th May, 1990	Meeting convened by the Director of Fisheries, U.P. on DOD Project at Lucknow
14th June, 1990	Meeting at DOD, New Delhi
17th-21st Sept. 1990	Meeting convened by DOD, New Delhi on mahseer project.
14th-23rd Feb. 1991	IVth Review Committee Meeting at DOD, New Delhi
18th-19th March 1991	Vth Review Committee Meeting on Hi-tech Aquaculture at DOD, New Delhi

Shri Baldev Singh, T-2 nominated member of NRC-CWF attended Central Joint Staff Council Meeting at National Dairy Research Institute, Karnal (Haryana) from 16.2.91 to 18.2.91.

8. LIBRARY AND DOCUMENTATION SERVICE

The role of library and documentation in a research institute is extemely important. Being a newly established institute, stress on acquiring essential books, peridocials is being given as a part of library building activity. The library of the centre, in a short span, has acquired about 550 scientific books and 470 scientific journals.

About 25 foreign and Indian periodicals/journals were subscribed and 250 periodicals including newsletters and reports from various Institutes/ICAR were received as gift.

Shri Baldev Singh, T-2 was sent to the Central Library of IVRI, Izatnagar (UP) to undergo training in basic/modern aspects of library and documentation maintenance from 10.9.90 to 15.9.90.

9. INFORMATION AND REPROGRAPHY SERVICES

The technical and non-technical querries received from various agencies were attended to by this section. The reports on progress of research were compiled and sent to ICAR from time to time. The following departmental publication was brought out.

1. Artificial propagation of the golden mahseer, *Tor putitora* (Ham.) in the Himalayas by K.L. Sehgal. *NRC-CWF. sp. Bull.* No. 2 : pp 12

10. ONGOING PROJECTS

The Kumaon Himalayas has large number of streams and lakes where fish catches have declined owing to environmental degradation of aquatic ecosystem and human interference. The fish catches in these water bodies have declined sharply thus affecting the economic conditions of fishermen who were depending on subsistence fishery. As a part of fulfilment of mandate of the Institute for management of fishery resources of coldwaters, eco-based investigations of one lake and two streams to assess their biological productivity and steps required to increase fish yield were continued. A new flow-through system facility for propagation of golden mahseer has been established at Bhimtal. The progress made in research projects is summarized as below :

PROJECT NRC-CWF.1

ECO-BASED INVESTIGATIONS OF KHURPATAL LAKE FOR INCREASING FISH YIELD.

Location	:	Haldwani
Duration	:	1989-92
Personnel	:	Shri Madan Mohan, Scientist, S-3
		Dr. H.S. Raina, Scientist, S-2
		Dr. Shyam Sunder, Scientist, S-2
		Sh. A. Mukhopadhyay, T-1

The project is being executed in lake Khurpatal located near Nainital. The lake has minimum human interference and has been undertaken under a MOU with the Forest Department UP. The objectives of the project is to develop a model for obtaining sustainable yield of fish in mountain lakes of Kumaon, based on the principles of ecological parameters-cum-stocking and capturing of fish. The lake has a total area of 13.0 ha and is located in Nainital District (Lat. 29°25' N and long. 79°21'E) at an elevation of 1600 m above msl. It is a warm monomictic water body remaining stratified from March to November. The source of water for the lake is mainly the in-flow from catchment area and underground seepage. The rocks in the catchment area are predominantly dolomitic type. The hydrobiological observations were undertaken at three sampling sites viz; (i) Site No. (SN) 1 near the village temple to the south bank of the lake (ii) Site No. (SN) 2 towards the road side to the north bank of the lake; and (iii) Site No. (SN) 3 on the village side to the east bank of the lake.

Water quality

The abiotic parameters of the lake water at three sampling sites ranged as follows: water temperature 13.5 - 25.5°C; seechi disc reading 1.75 - 3.50 m; pH 7.6-8.4;

dissolved oxygen 8.5-12.0 mg/1; free carbondioxide 0.0-1.0 mg/1; total alkalinity 54-156 mg/1; chlorides 9.0-16.5 mg/1; magnesium 2.0-3.0 mg/1; calcium 26.0-57.0 mg/1; DOM 26.0-34.0 mg/1; specific conductivity 280-365 μ mhos and oxgyen saturation, 110-150%.

Primary production

The gross primary production of the lake water as estimated by 'light and dark bottle' method ranged between 72.5- 135.7 mg Cm^{-3} hr^{-1}.

Plankton

The density of phytoplankton ranged as follows : 1.27×10^4 - 15.84×10^4 units/1 at SN. 1; 1.91×10^4 - 15.26×10^4 units/1 at SN. 2 and 1.60×10^4 - 12.32×10^4 units/1 SN.3. The minima of phytoplankton were recorded during August at all the three sampling sites whereas the maxima were observed during January-March. The major groups of phytoplankton communities recorded at three sites (Nos. 1-3) ranged as follows : Dinophyceae, 55-100%, 66-100% and 63-99%; Bacillariophyceae, 0.0-44%, 0.0-39%, 1-27% and chlorophyceae, 0.0-4.00%, 0.0-8.00% and 0.0-10.00%. The dominant forms recorded were *Sphaerodinium cinctum, Glenodinium quardridens, Peridinium palatinum, Certatium, hirudinella, Navicula, Cymbella, Spirogyra and Cosmarium punctulatum.*

In the littoral zones of the lake, the density of zooplankton varied between 36 and 315 units/1 at SN. 1, 36 and 198 units/1 at SN. 2 and 21 and 282 units/1 at SN.3. The values of major zooplankton groups available at three respective sites averaged as follows : Protozoa, 5.76%, 6.32% and 41.00% Rotifera, 23.28%, 22.89% and 23.75%, Cladocera, 5.86%, 4.96% and 40.78% and Copepoda, 65.11%, 65.82% and 65.5%. The maximum concentration of zooplankton was recorded during March-April (182-212 units/1) and minimum (36-58 units/1) during July-August. The predominant taxa recorded were *Anuraeopsis fissa, Keratella valga, Brachionus falcatus, Cepadella*

ovalis, Trichocerca similis, Chydorus, gibba, Mesocyclops leuckarti, Eucyclops serrulatus and Cyclops vicinus.

Benthic macro-invertebrates :

The macro-benthic fauna at three sampling sites of the lake varied between 45 and 1,555 ind/m^2 and their wet biomass fluctuated between 1.480 - 63.350 g/m^2. Numerically, the maxima of the benthic fauna was recorded during summer (756-1,555 ind/m^2) and minima during monsoon (400-533 ind/m^2). The major benthic groups recorded at three respective sampling sites (1-3) averaged as follows ; Oligochaeta, 10.20%, 10.18% and 18.68%; Hirudinea, 4.09%, 7.65% and 9.08%; Ephemeroptera, 13.61%, 3.39% and 13.04%; Odonata, 31.46%, 32.00% and 23.19%; Coleoptera, 5.77% nil and nil; Hemiptera; 1.59%, 4.78% and 2.35%, Diptera, 9.20%, 18.28% and 27.17%, Mollusca, 19.76%, 23.83% and 6.49% and miscellaneous forms, 4.75% nil and nil. The predominant forms recorded were *Pristina bilongata, Tubifex tubifex, Limnodrilus hoffmesterii, Nais, Coenagrion, Gomphus, Octogomphus, Ophigomphus, Ranatra, Chironomus, Chaoborus, Caenis, Heptagenia, Haliplus, Hydrophilus, Lymnaea, Gyraulus* and leeches.

Fish :

The experimental gill net fishing in the lake was carried out during July. Three nets (75m x 8 m, mesh size 12.5cm) were operated during night (1800-0600 hrs). A total of 12 specimens of *Tor putitora* (T.L. 305-427 mm and weight, 240-595 g) were caught with a total biomass of 4.500 kg revealing 1.5 kg fish catch/net. The lake was stocked with fingerlings of golden mahseer and common carp in the ratio of 1:6 at a stocking density of about 250 fingerlings/ha.

Fish biology :

Studies on food and feeding habits of golden masheer, *Tor putitora* caught by gillnets during July revealed that 58% fishes were with 1/4 full guts, 33% with 1/2 full

guts and 9% with full guts. The food of the species broadly comprised of animal matter (50.00%), plant matter (20.17%) and decayed organic matter (17.50%). Animal matter included youngones of aquatic insects and their parts (24.27%), cladocerans (28.27%), turbellarians (9.0%), fish eggs (6.91%), semidigested fish parts (5.27%), rotifers (4.00%) copepods (1.56%), ostracods (1.45%), semidigested platyhelminths (0.91%) and molluscs (.027%). The major phytoplankton components forming the fish food comprised Bacillariophyceae (71.00%), Cyanophyceae (15.22%), Dinophyceae (13.11%) and Chlorophyceae (0.67%). Among aquatic plants mainly *Vallisneria* and *Ceratophyllum* were observed in the fish guts. About 83% female fishes were recorded in spent and 83% male specimens in mature condition (IV stage of maturity). The remaining fishes were found to be in maturing condition (III Stage of maturity) in both the sexes.

PROJECT NRC-CWF 2.

STUDIES ON THE BIO-ECOLOGY OF A MOUNTAIN RIVER IN KUMAON

Location	:	Haldwani
Duration	:	1989-91
Personnel	:	Dr. Shyam Sunder, Scientist S-2
		Dr. H.S. Raina, Scientist S-2
		Sh. Madan Mohan, Scientist S-3
		Sh. Baldev Singh, T-2

The Gaula river (29°17'-29°27' : 79°49'-79°26') is wholly a lesser Himalayan stream draining 600 km^2 watershed in the South-Central part of Kumaon and located at an elevation from 500-2610 m above msl. After flowing westwards, it takes a turn towards South from where it again meanders towards western side and receives Nalena nadi from Nainital at Ranibagh. From here, the river flows in a southward direction. At

Kathgodam, a barrage has been constructed to meet the requirements of irrigation and drinking water at the 'Bhawar' area of Tarai region. The river receives its major share of water as a result of monsoon. At Jamrani, a multipurpose dam is proposed to be constructed to utilize this run-off about 15 km up-stream of the present barrage. The primary objective of undertaking the project is to assess the hydrobiological productivity of R. Gaula and possible ways to enhance fish stocks.

The present investigations have been made at three sampling sites *viz* : (i) Site No. (SN) 1, near the proposed Jamrani dam site (ii) Site No. (SN)2, 2 km upstream of HMT Watch Factory and (iii) Site No. (SN) 3, 3 km downstream of the same.

Water quality :

The abiotic parameters of R. Gaula recorded at three sampling sites included depth 0.5-1.4 m; rate of flow 0.7-2.2 m/sec; water temperature, 16.0-25.5°C; pH 7.8-8.4; dissolved oxygen 9.6-11.8 mg/1; free carbondioxide 0.0-0.25 mg/1; total alkalinity 52-110 mg/1; calcium 38-56 mg/1; magnesium 2.2-3.0 mg/1; and specific conductivity 158-284 μ mhos. The substratum of the river ranged from boulders to stones, gravel and sand.

Plankton

The density of plankton population ranged betwen 38 and 1,494 units/1 at SN.1; 54 and 1,154 units/1 at SN.2 and 62 and 1,050 units/1 at SN.3, the bulk of which comprised phytoplankton communities (95-100%) at all the sampling sites. The major groups among phytoplankton at respective sites (Nos. 1-3) comprised Bacillariophyceae, 86.67-100.00%, 75.0-95.14% and 75.41-100.00%; Chlorophyceae, 0.0-11.11%, 0.0-12.82% and 0.0-13.24% and Cyanophyceae, 0.0-7.61%, 0.07-69% and 0.01-11.47%. The average maxima of the phytoplankton was recorded during summer (1,010-1,204 units/1) and minima during monsoon months (72-100 units/1). The predominant phytoplankters recorded in the river were *Fragilaria, Naivcula, Amphora,*

Synedra, Cymbella, Ulothrix, Zygnema, Spirogyra, Oscillatoria, Anabaena and *Rivularia*. The contribution of zooplankton was insignificant varying between 0-36 units/1. Protozoa (62.90-100.00%) and Rotifera (0.0-21.18%) were the dominant groups at the three sampling sites. The predominant zooplankton recorded were *Arcella, Difflugia, Centropyxis, Keratella* and *Monostyla*.

Micro-benthic biota :

The total organisms growing over the substratum stones of the Gaula bed varied from 4.88×10^4 - 35.48×10^4 units/cm^2 at SN.1; 2.58×10^4 - 39.44×10^4 units/cm^2 at SN. 2 and 6.2×10^3 - 31.58×10^4 units/cm^2 at SN.3. The composition of micro-benthic biomass was comprised primarily by the micro-benthic algae (79-100%).

The density of micro-benthic algae fluctuated between 3.60×10^4-35.28×10^4 units/cm^2 at SN.1, 2.22×10^4 - 38.54×10^4 units/cm^2 at SN.2. and 6.2×10^3 - 30.88×10^4 units/cm^2 at SN.3. Their maxima were observed during spring (26.3×10^4 - 33.7×10^4 units/cm^2) while the minima during monsoon months (2.4×10^4 - 4.9×10^4 units/cm^2). The contribution of major groups recorded at three respective sampling sites (Nos. 1-3) averaged as follows : Bacillariophyceae, 73.5%, 74.75% and 73.72%; Chlorophyceae, 14.68%, 14.20% and 9.70% and Cyanophyceae, 11.73%, 11.05% and 16.58%. The concentration of micro-benthic plants was recorded maximum (14.6×10^4 units/cm^2) at SN.1, while minimum (10.3×10^4 units/cm^2) at SN.3. The predominant taxa recorded during the study period were *Navicula, Cymbella, Amphora, Amphipleura, Flagilaria, Synedra, Cocconeis, Diatoma, Diatomella, Gomphoneis, Spirogyra, Zygnema, Tribonema, Schizogonium, Cladophora, Schizothrix, Oscillatoria, Rivularia* and *Anabaena*.

The contribution of micro-benthic animals varied from 392-12,800 units/cm^2 at SN.1, 1,131-6,785 units/cm^2 at SN.2 and 298-5,600 units/cm^2 at SN.3. Their maxima were recorded at SN.1 (9,767 units/cm^2) and the minima at SN.3 (3,884 units/cm^2). The major groups of micro-benthic fauna recorded at three respective sampling sites

averaged as follows : Protozoa, 55.90%; 73.08% and 89.52%; Rotifera 23.65% nil and nil; nymphs and larvae of aquatic insects, 1.81%, 2.09% and 1.45%. The predominant zooplankters recorded were *Epistylis plicatilis, Vorticella, Keratella, Ascomorpha, Cephalodella, Chironomus, Pentaneura, Epeorus* and *Chaoborus.*

Macro-benthic fauna :

The macro-benthic fauna of the river Gaula fluctuated between 14-82 ind/m^2 at SN.1, 4-57 ind/m^2 at SN.2. and 4-47 ind/m^2 at SN.3. Their respective biomass ranged between 1.410-6.980 g/m^2, 3.110-8.980 g/m^2 and 2.530-10.230 g/m^2. The macro-benthic invertebrates did not show any regular pattern in their monthly occurrence. However, their maxima were observed during winter (41 ind/m^2) and minima during monsoon (7 ind/m^2). Moreover on an average, the total number of benthic invertebrates were recorded highest at upstream SN.1 (37 ind/m^2) and lowest at downstream SN.3 (25 ind/m^2). The principal benthic invertebrate groups available at three respective sampling sites (Nos. 1-3) averaged as follows : Ephemeroptera 35.59%, 23.83% and 35.86%; Odonata 3.29%, 23.83% and 2.99%; Plecoptera 2.20% , 1.27% and 0.22%; Coleoptera 6.18%, 1.58% and 5.99%, Trichoptera 38.98%, 44.52% and 32.74%; Diptera 11.56% 5.75% and 11.85% and miscellaneous items 2.20%, 18.68% and 10.35%. The predominant taxa recorded were *Baetis, Epeorus, Rithrogena, Heptagenia, Chloroperla, Elmis, Dytiscus, Rhyacophila, Hydropsyche, Philopotamus* and crabs (*Paratelphusa masonina*).

Fish and fisheries :

The estimates of fish density at each sampling site was made by experimental 50 castings with a cast net (mesh size, 2.5 cm knot to knot) operated approximately in one km stream length. The subsistence fishery in R. Gaula is contributed principally by the golden mahseer (*Tor putitora*) and the snowtrout (*Schizothorax richardsonii*). The other miscellaneous species which came in cast net catches were *Garra gotyla, Barilius bendelisis, Nemacheilus rupicola* and *Glyptothorax pectinopterus* By and large, the

average fish catch per unit effort at three sampling sites of R. Gaula varied between 55-950 g/man/hr. The average species composition consisted of *S. richardsonii* (35.2%), *Tor putitora* (24.6%), *Garra gotyla* (31.0%), and *Barilius bendelisis* (8.5%).

At SN.1 catch per unit effort (CPUE) ranged between 0.0-2,822 g/man/hr comprising *S. richardsonii* (0.0-92.2%, T.L. 120-250 mm and weight, 110-120 g) and *Tor putitora* (0.0-62.2%, T.L. 150-340 mm and weight 50-250 g). The CPUE values at SN. 2. ranged between 25-525 g/man/hr and the predominant species being *S. richardsonii* (0.0-80%, T.L. 100-150 mm, weight 70-100 g) and *T.putitora* (0.0-100%, T.L. 150-350 mm and weight 45-250 g). At SN.3, CPUE values varied between nil-425/man/hr contributed by *Garra gotyla* (0.0-100%, T.L. 120-165 mm, weight, 25-50 g) and *Barilius bendelisis* (0.0-100%, T.L. 90-130 mm, weight 25-30 g).

Fish biology :

Snow-trout (*Schizothorax richardsonii*)

Investigations on food and feeding habits of *S. richardsonii* caught from R. Gaula revealed 2.2% empty guts, 2.2% 1/4 full guts, 34.8% 1/2 full guts, 13.0% 3/4 full guts and 47.8% full guts. The fish seems to subsist mainly on Bacillariophyceae (89.19%), Cyanophyceae (11.84) and Chlorophyceae (0.25%). On the whole, about 52% fishes were observed in maturing stage, 41% in ripe stage and 70% in spent stage. Ripe and mature fish specimens of either sex were available in the ecosystem in appreciable quantity during December-January. Sex ratio between male and female fishes was estimated as 1:0.44. The fecundity of the ripe specimens ranged between 35,730-66,888 ova/kg body weight.

PROJECT NRC-CWF.3

ESTIMATION OF CARRYING CAPACITY OF CHIRAPANI STREAM.

Location : Champawat

Duration : 1990-91

Personnel : Dr. C.B. Joshi, Scientist S-2

Shri B.C. Tyagi, Scientist S-2 (upto December, 1990)

Shri Ravinder Kumar T-1

The Chirapani stream originates from a spring near Chirapani village (long. 80°07' N; Lat., 29°30' E and 1620 m above msl) and flows through the dense forest for first 3 km and comes out in open at Tarakeshwar near Coldwater Fisheries complex. After meandering through the agricultural fields and green pastures in its middle stretch for about 11 km, it joins R. Lohawati near Gauri Power House. Most part of the stream is generally shallow, narrow and sluggish, having stones pebbles and sand at the substratum. For bio-ecological studies, two sampling sites, one in the upper reaches of Tarkeshwar and the other in the middle stretch at Dapteshwar were selected.

During the period under report, the abiotic parameters at the two sites ranged as follows : water temperature 6.5-23.5°C; water flow 4-8 1/sec; pH 7.2-8.2; dissolved oxygen 7.8-11.5 mg/1; free carbon-dioxide nil - 1.2 mg/1; and total alkalinity 24-34 mg/1.

The population of macro-benthic invertebrates in the stream varied between 3-43 ind/m^2 dominated by Ephmeroptera (33.57-64.94%) followed by Trichoptera (13.26-27.27%), Plecoptera (0.23-26.57%), Diptera (11.19-11.45%) and miscellaneous items (1.10-1.40%).

Sample fishing done quarterly with standard cast net and fish collected by gamchha cloth in the stream revealed the fish composition as follows : *Schizothorax* spp. (92.4%), *Barilius* sp. (3.8%), *Nemacheilus* sp. (3.6%) and *Botia birdi* (0.2%) by number. Further in a sample survey, 1.260 kg fish was collected in 50 castings by cast net in the middle stretch of 2 km stream length.

ADHOC RESEARCH PROGRAMME

ARITIFICIAL PROPAGATION OF GOLDEN MASHSER, *TOR PUTITORA* (HAM.) AT BHIMTAL (KUMAON HIMALAYAS)

Location	:	Bhimtal
Duration	:	1990-1991
Personnel	:	Dr. K.L. Sehgal, Project Director
		Sh.D.S. Malik SRF

For rearing of mahseer (*Tor putitora*), standard mahseer seed production unit has been installed at Bhimtal, which includes lifting of water, a series of overhead tanks, water supply, distribution system, flow-through hatching troughs/trays, aerating device like providing showers, flow-through type fry rearing units with air-lift water system. Each unit is arranged under a thatched shed having roof cover of dried grasses. In addition a small shed is provided to house the compressor and a generator.

During August-September, 1990 twenty two mahseer brooders (females : T.L. 410-540 mm, wt, 600-1400 g and males : T.L. 310-535 mm and wt. 300-1500 g) were netted out by operating standard gillnets (75 x 8m) from Bhimtal and Naukuchiatal lakes. The eggs were stripped from the females and fertilized by milt from the male specimens by 'dry method'. The rate of fertilization ranged between 89-96%. The average number of eggs/kg of body weight was 3,585. In total 76,900 eggs were fertilized.

The fertilized eggs were kept in hatching trays (50x30x10 cm) @ 5,000/tray. The incubation period ranged between 92-100 hours at a water temperature of 22.5-23.8°C. The hatching rate ranged between 93.0-97.0%. Yolk absorption was completed in 10-12 days. The cumulative survival obtained from fertilized eggs to swim-up fry was 84.75%.

The newly-emereged swim-up fry were shifted to nursery tanks (120x70x40cm)

@ 8000-10,000/tank. These were fed on emulsified yolk of hen's egg every two hourly from sun-rise to sun-set @ 10% body weight for about a forthnight. The flow-rate of water was maintained at 2-3 1/min. The fry attained a length of 10-12 mm (wt. 0.006-0.010 g) with a survial rate of 78.80%.

After size grading, the mahseer fry were stocked in flow-through large tanks ($2m^2$) @ 5,000-8,000/tank. The water flow was kept at 3-4 1/min. The fry were fed with laboratory formulated dry feed. The ingredients of the feed were soybean meal, Casein, starch, fish oil and vitamin pre-mix. This feed contained 45.5% crude protein. The rate of feeding ranged 5-8% body weight at 10-18°C. and 10-12% body weight at 20-25°C. In period of 90-100 days, the fry attained a size of 21-30 mm having weight range of 0.295-0.320 g. The rate of survival recorded was 66.0-72.6%. The fry was again size-graded. In another rearing for 120 days with the same diet, the fry attained a size of 50-65 mm (0.975-1.35 g). The feeding was done @ 10-12% body weight at the 21.4-26.5°C water temperature. The rate of survival ranged between 86-90%. Subsequently, about 500 fingerlings were stocked in lake Khurpatal and the remainder in Jhingri nallah at Bhimtal to enhance the natural stocks.

The water quality parameters during the rearing period ranged as follows : water temperature 10.5-26.5°C; pH 7.1-7.9; dissolved oxygen 8.2-11.5 mg/1; free carbondi-oxide nil -1.8 mg/1; total alkalinity 60-140 mg/1; total suspended solids 10.8-27.8 mg/1; total hardness 86.2-198.5 mg/1; B.O.D. 2.8-4.7 mg/1; C.O.D. 4.4-5.3 mg/1; chlorides 3.5-8.5 mg/1; silicates 1.4-4.5 mg/1; phosphates nil-0.02 mg/1; and sulphates 12.6-25.0 mg/1.

11. PUBLICATIONS

Joshi, C.B. Mahseer fishery of some hill streams in western Himalayas. *Indian J. Fish*, 35 (4) : 327-29.

Sehgal, K.L. State-of-Art of mahseer fisheries in India. *In Workshop-cum-Seminar on*

Fish Production, G.B. Pant University of Agriculture and Technology, Pantnagar Nainital, June, 1990 : 1-15.

Sehgal, K.L. Coldwater Fisheries and its future scope in India. *In Workshop-cum-Seminar on Fish Production Technology, G.B. Pant Univesity of Agriculture and Technology, Pant Nagar*. 1991 : 1-7.

Sehgal, K.L. Aquaculture of *Tor putitora* vis-a-vis stock enhancement and management of fisheries in the Himalayas. *In Workshop on Mahseer, Tata Electric Companies, Lonavala, Pune*, 1991 : 1-10.

Sunder, Shyam. Studies on some aspects of biology and fishery of *Schizothorax curvifrons* Heckel from R. Jhelum, Kashmir and its bearing on conservation. *J. Inland. Fish. Soc. India.* **22** (122) : 80-85.

12. PERSONNEL

The following personnel rendered their services to the centre during the peiod under report :

Dr. K.L. Sehgal	Project Director

Scientific:

Shri Madan Mohan	Scientist S-3
Dr. C.B. Joshi	Scientist S-2
Dr. Shyam Sunder	-do -
Dr. H.S. Raina	-do -
Shri B.C. Tyagi	-do-

Administrative

Shri S.C. Roy	AAO/Asstt. Accts. & Fin. Officer (on deputation)
Shri G.C. Joshi	Assistant (on deputation upto 16th February'91)
Shri K.V.V.S. Narayana	Steno to Director
Shri R.L. Raina	Senior Clerk

Shri Manni Lal	Junior Clerk
Shri Harish Ram	-do-
Miss Khilawati Sayana	-do-

Technical

Shri R.B. Girdhari	Tech-4 (From 8th Feb. '91)
Shri Soumitra Roy	Tech T-II-3
Shri Baldev Singh	Tech-T-II
Shri A. Mukhopadhyay	Tech-T-I
Shri Ravinder Kumar	Tech-T-I

Auxillary

Shri Bakshi Ram	Driver
Shri Bhagwan Singh	-do-

Supporting staff

Shri Madan Lal	SS Gr IV
Shri Japhu Ram	SS Gr III
Shri Sant Ram	SS Gr II
Shri Hansa Datt	SS Gr I
Shri J.C. Bhandari	SS GR I
Shri Gopal	SS Gr I
Shri Ravinder Kumar	SS Gr I
Shri Om Raj	SS Gr I
Shri M.S. Rana	SS Gr I
Shri R.K. Arya	SS Gr I
Shri H.S. Chauhan	SS Gr I
Shri P.C. Tiwari	SS Gr I
Shri H. S. Bhandari	SS Gr I

13. APPOINTMENT

The following appointmnent was made at the centre during the period under report :

Name	Designation	w.e.f.
Shri Hansa Singh Bhandari	SS Gr I	26th March '91

14. PROMOTION

The following promotion was made at the centre during the period under report.

Name	From	To	w.e.f.
Shri R.L . Raina	Sr. Clerk	Assistant (adhoc)	18.2.91

15. TRANSFERS

The following members of the NRC on Coldwater Fisheries were transferred.

Personnnel	Designation	From	To
Shri Japhu Ram	SS Gr III	Champawat	Haldwani
Shri J.C. Bhandari	SS Gr I	Champawat	Haldwani
Shri Madan Lal	SS Gr IV	Haldwani	Champawat
Shri R.K. Arya	SS Gr I	Haldwani	Champawat

16. WELFARE ACTIVITIES

(i) For the recreation of staff members of NRC-CWF, the activities of staff Recreation Club, constituted in the previous year, were continued. Due to limited space and other constraints, facilities to play Badminton and Carom only could be provided. Some cultural activities were organised on 15th August, 1990 and 26th January, 1991. The families of staff were invited to witness the same.

ii) During 1990-91, the meetings of the Joint Council of NRC-CWF were held periodically and matters pertaining to welfare activities etc. of the staff were discussed and decisions taken were implemented from time to time.

iii) The Advisory Committee of NRC-CWF has been constituted vide ICAR O.O. No. 8(9)/89/I.VI dt. 31.10.91. The first meeting of this committee was held in the third week of December, 1990 under the Chairmanship of Project Director, NRC-CWF, Haldwani.

17. IMPLEMENTATION OF OFFICIAL LANGUAGE POLICY

As per Council's letter No. 2(11)/90-Hindi dt. 31-1.91, a Hindi implementation Committee (Hindi Karyanvayan Samiti) was constituted at the Institute comprising of 7 members headed by project Director. The meetings are held quartely under the Chairmanship of Project Director and decisions taken are sent to the Council. Every possible effort is being made to implement the official language policy of the Government of India at this Institute.