SUSTAINABLE AQUACULTURE DEVELOPMENT FOR POVERTY ALLEVIATION AND IMPROVED NUTRITION IN BANGLADESH

Grant No. LAG-4111-g-00-3038-00

QUARTERLY PROGRESS REPORT

(01 January - 31 March 1994)

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1. INTRODUCTION

This is the third quarterly report of the project. The major highlights of the project activities during the quarter are: (i) organisation of two important national workshops on (a) Technology transfer through NGOs and feedback to research and (b) Broodstock management and opportunities for genetic improvement of cultivated fish species; (ii) continuation of farmer participated research for development of sustainable, low-cost aquaculture practices, with supporting on-station studies; (iii) strengthening of GO-NGO relations and initiation of technolgy transfer program in 35 thanas through out the country; (iv) importation of wild germplasm of silver barb (*Puntius gonionotus*) from Thailand and Indonesia, for improvement of stocks through selective breeding and line crossing; (v) studies on integration of aquaculture with irrigated rice farming in conjunction with integrated pest management; (vi) initiation of collaborative activities with other developmental projects; and (vii) development of capabilities of national scientists through on the job training.

The project continued to provide assistance to the Fisheries Research Institute (FRI) in planning and implementation of on-station aquaculture research programs. Details of work undertaken during the quarter are detailed.

2. ACTIVITIES AND ACHIEVEMENTS

2.1 Development of low-input, low-cost aquaculture practices

On-station studies: Supplementary feed forms a major component of operating cost in fish culture. Small-holder farmers use rice bran as supplementary feed and able to meet their requirement partly from on-farm resources, while the rest is purchased from the market. In view of this, studies were undertaken on-station, to study the efficacy of duckweed (*Lemna* spp.) as supplementary feed for short-cycle species such as silver barb (*Puntius gonionotus*) and tilapia. Ponds were stocked with silver barb, silver carp (*Hypophthalmichthys molitrix*) and mirror carp (*Cyprinus carpio*), in the ratio of 20:1:1, at a density of 22,000/ha. While two ponds received rice bran, the other two ponds received duckweed as supplementary feed. All ponds were fertilized with cattle manure. After six months rearing, gross production from ponds fed with duckweed amounted to 2,049 kg/ha, while it was 2,613 kg/ha in case of ponds fed with rice bran. While the growth of silver barb was more or less same from both feeds, there was discernable difference in growth of silver carp and mirror carp fed on both the feeds. Silver carp and mirror carp reached average weights of 394 and 230g respectively with duckweed, while they attained 562 and 406g with rice bran. Feed conversion was 10.8:1 in case of duckweed (wet weight), while it was 4.8:1 in case of rice bran.

Studies were also undertaken with nile tilapia (*Oreochromis niloticus*) and red tilapia in monoculture. A mixture of rice bran and duckweed was given as supplementary feed. While red tilapia was able to completely feed on duckweed given daily at 2-3% of biomass, nile tilapia could consume only half the quantity. At the end of six months rearing, gross productions from nile and

red tilapia culture ponds were 3,387 and 3,229 kg/ha respectively. These studies clearly indicated that rice bran can be partly or fully replaced by duckweed and farmers could save on cost of supplementary feed, if duckweed is avialable and could be collected from nearby rice fields/natural waters.

On-farm studies: Farmer participated on-farm research undertaken in Mymensingh district aimed at increasing fish production through use of on-farm inputs, lowering the cost of production and lessening the risks of loss, showed encouraging results. From seasonal ponds, where rearing period ranged from 3-8 months depending on water retention in the ponds, farmers were able to obtain fish productions ranging from 1,040 to 4,881 kg/ha, depending upon input use and rearing period. Farmers culturing fish in perennial ponds obtained fish productions of 1,768 to 5,857 kg/ha in 5-11 months rearing. The most interesting observation in all these studies is the very low-cost of production (including on-farm inputs valued at prevailing market prices) which amounted to Tk. 4.23-11.18 per kg of fish produced in case of seasonal ponds and Tk. 2.97-10.00 in case of fish from perennial ponds, as against farm gate price of Tk.35-50 per kg of fish.

Impact studies: Research was initiated in 1990 for integrating aquaculture with agriculture at seven places representing different agroecological zones, by the FRI in collaboration with Bangladesh Agricultural Research Institute (BARI), Bangladesh Jute Research Institute (BJRI)and Bangladesh Sugarcane Research Institute (SRTI). Studies were initiated during the quarter to assess the impact of the research undertaken at these centres on farmers' adoption of integrated systems and on fish production and households' income. Impact survey using a structured questionnaire (Annex 1a and 1b) has been completed at Tangail, which represents Brahmaputra and

Jamuna floodplain, with relatively low rainfall and high risk of flooding. The survey revealed that due to risk of flooding, only 8% of the ponds in the area were used for fish culture, that too traditional methods, in which fingerlings of Indian carps were stocked and harvested without any management, while the rest were derelict. The farmers were not aware of culture of chinese carps, silver barb and tilapia. They were, on an average, getting fish productions of 292 kg/ha. Subsequent research undertaken resulted in all farmers (against 8% during pre-intervention period) taking to aquaculture and fish productions increased on an average to 1,958 kg/ha (average of seasonal and perennial ponds), using mostly on-farm, agricultural wastes and byproducts. Seeing the benefits of integrating aquaculture with agriculture, many farmers have excavated new ponds (as opposed to 92% of existing ponds lying in derelict condition during pre-intervention period) in their homestead or rice fields. The data collected is being analysed and details will be reported next quarter.

2.2. Improvement of fish stocks

Silver barb, culture practices for which were developed by the project, is becoming very popular among the fish culturists in the country. One of the drawbacks is that the species is susceptible to epizootic ulcerative syndrome. With a view to develop a strain which could be fast growing and resistant to disease, through selective breeding and line crossing techniques, wild germplasm of the species was brought to the country from Thailand and Indonesia. In all 100 pairs of broodfish have been brought from these countries and selective breeding of these stocks and the Bangladesh stock, will be initiated from the next quarter.

There is high demand for fingerlings of silver barb, because of its popularity among fish culturists and consumers. Inspite of

high production of hatchlings of the species in hatcheries, there is shortage of fingerlings, apparently due to high mortality in nurseries. In view of the high demand and shortage of seed, the project undertook a survey of hatcheries and nurseries in different parts of the country, using a structured questionnaire (Annex 2 and 3), to identify the reasons for shortage of seed and problems involved if any in nursing the species. In all, 58 hatcheries and 113 nurseries from 15 districts have been covered by the survey. The data is being analysed.

2.3 Integrated agriculture-aquaculture farming

Farmer participated studies have been initiated in 11 thanas, for integrating agriculture with aquaculture, in *boro* (irrigated) rice farming season. A total of 100 farmers are participating in this study. Farmers have stocked their plots with fingerlings of either silver barb (*Puntius gonionotus*) or mirror carp (*Cyprinus carpio*) or nile tilapia (*Oreochromis niloticus*) or a combination of silver barb and mirror carp. Additional water required for integrating aquaculture with irrigated rice farming and the costs involved, are being studied. Since farmers normally use more pesticides/insecticides during *boro* crop as compared to *aman* (rainfed) crop, pesticide used (quantity/quality) and their affect if any, on fish survival and production, are being monitored.

Studies were also initiated in collaboration with IPM program of FAO, at Central Extension Resources Development Institute (CERDI), to study the impact of integrating fish culture with *boro* (irrigated) rice farming, on the incidence/control of pests. For the purpose, six rice plots were transplanted with BR3 variety rice seedlings. Of these, two plots are kept as controls, wherein farmers' practices of controlling pests with pesticides will be used, two plots are under

integrated pest management (IPM) and in two plots, aquaculture has been integrated. These are being used as demonstration plots and for training Agriculture Extension Officers.

2.4 Development of institutional linkages between NGOs and Government Organisations

As stated in earlier reports, the project initiated a program "Technology Transfer Through NGOs", with a view to: (i) develop closer linkages between Government research and development organisations and NGOs, (ii) transfer of aquaculture practices/technologies developed through research, to farmers through out the country, and (iii) provide feedback to research from the field. The program is being jointly implemented by the Fisheries Research Institute, the Department of Fisheries (DOF) and the Bangladesh Agricultural Research Council (BARC), in collaboration with NGOs. The program this year will be implemented by five NGOs: Bangladesh Rural Advancement Committe (BRAC), Proshika, Jagorani Chakra, Tengamara Mohila Sobuj Sangha (TMSS) and Bachte Sekha, the last two being women's organisations. Under the program, a total of 1,000 demonstrations of technologies developed through the project will be undertaken in 38 thanas (administrative sub-units), covering 20 districts (administrative units), which represent different agroecological zones of the country (Fig. 1) and one hundred NGO extension workers will be trained as Trainers. The extension workers in turn will train over 2000 farmers and organise a large number of farmers' rallies.

In this connection, a two day workshop entitled "Technology transfer through NGOs and feedback to research", was organised at the FRI, during 20-21 March, with the objective of developing technology transfer programs for different regions of the country, taking into consideration the available aquaculture technologies, agroecology of the area, the socioeconomic

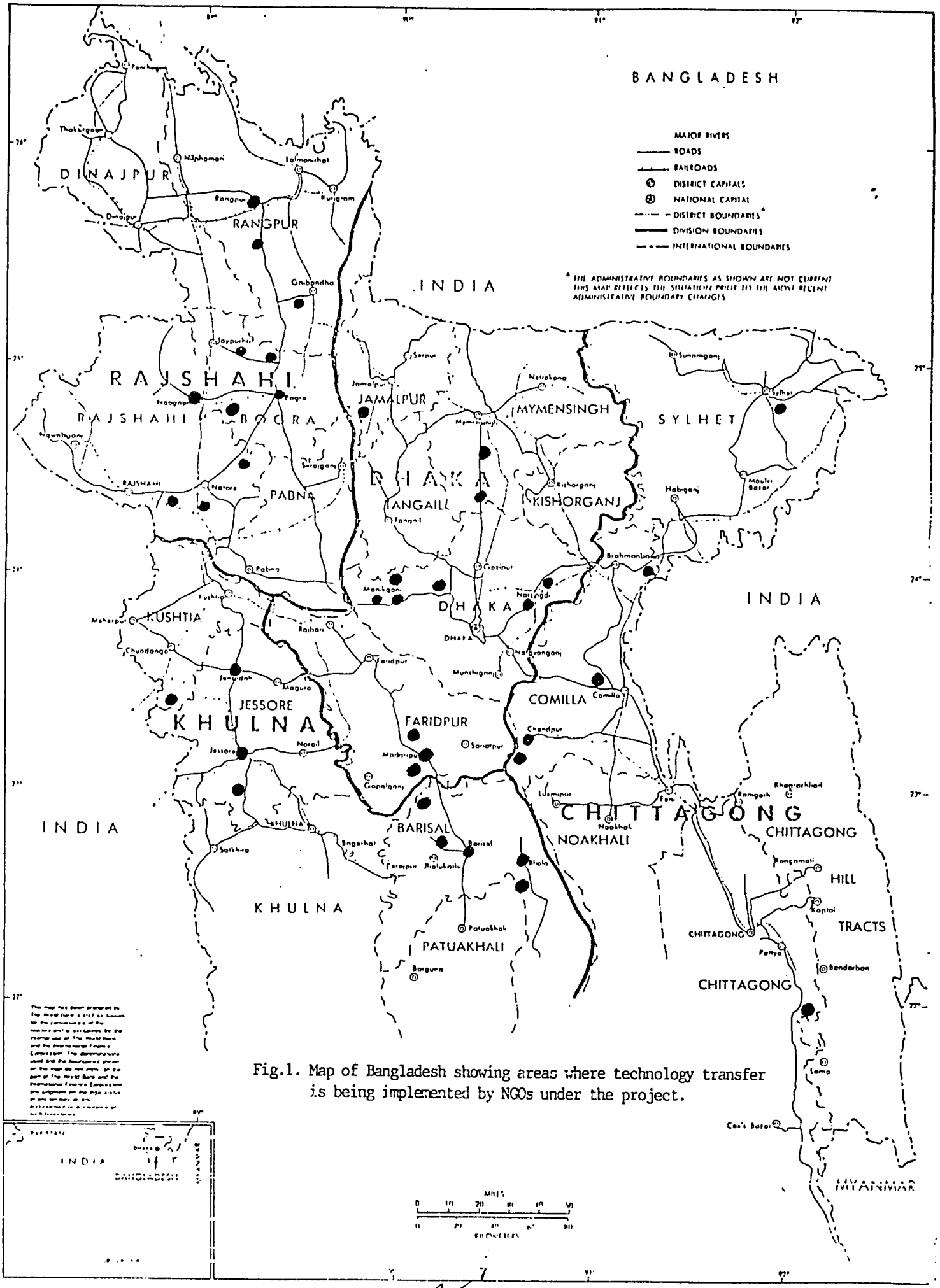

Fig.1. Map of Bangladesh showing areas where technology transfer is being implemented by NGOs under the project.

condition of target groups and availability of inputs, through joint discussions between the Government extension workers (Thana Fishery Officers), NGO extension workers and the researchers. A total of 74 persons from FRI, DOF, BARC, Association of Development Agencies in Bangladesh (ADAB) and ICLARM, participated in the workshop (Plates 1 & 2)). The workshop identified the following as some of the constraints for the development of aquaculture in the target area: (i) non-availability of fingerlings at required time, (ii) shortage of fingerlings of silver barb, due to high mortality in nursery ponds, (iii) lack of knowledge of aquaculture management practices to farmers, due to inadequate extension services, (iv) large number of *khas* (Government) ponds lying in derelict condition as present Government policies do not allow these to be leased by NGOs for their farmer groups, and (v) lack of hands-on training to field workers of NGOs. Ways and means for addressing these constraints were discussed. The participants discussed in detail the available technologies and finalised technical aspects of each technology for implementation in different regions of the country, taking into consideration characteristics of each of the region and modifying technologies as and where necessary to suit the conditions in that particular region. "Pond books" developed by the project will be provided to all farmers and extension workers to record input-output data, which will be analysed at the end of the season, to evaluate the performance of different technologies and sustainability by the farmers. Detailed proceedings of the workshop is in Annex-4.

2.5 Development of capabilities of national scientists

On the job training has been provided to the scientists in research planning, implementation of various on-station and on-farm aquaculture research programs and data analysis.

Plate 1. Workshop on "Technology transfer through NGOs and feedback to research being inaugurated by Mr. A.K. Ataur Rahman, Director-General, Department of Fisheries.

Plate 2. A technical session of the workshop in progress.

3. TRAINING

Thirty one Subject Matter Officers (SMOs) and 13 Trainers of the Department of Agricultural Extension (DAE) were trained in integrated rice fish farming.

Curriculum has been developed and arrangements have been finalised for training one hundred extension workers of NGOs in different aspects of low-cost, integrated aquaculture-agriculture production practices. A Trainers' Training Manual is being prepared.

4.WORKSHOPS

During the quarter under report, two workshops were organised. Details of the workshop on "Technology transfer through NGOs and feedback to research" is given under section 2.4.

There are over 300 hatcheries in the country, producing over 75% of fish seed required for culture operations and for stocking open waters. In recent years, farmers are observing decline in growth of certain species of carps in aquaculture operations, which they envisage is due to inbreeding in hatcheries. A survey undertaken of some hatcheries in Jessore and Comilla regions indicated that the hatcheries are facing a number of problems including mass mortality of seed of some species, to which the Hatchery Managers do not have solutions. Also, some of the hatcheries were observed to use the fingerlings left over in nurseries at the end of the season (which happen to be slow-growing), for raising broodstock and use fish as small as 400g in weight, for breeding.

Taking into consideration, the importance of quality seed for increasing fish production, a workshop on "Broodstock Management and Opportunities for Genetic Improvement of Cultivated Fish Species" was organised during 30-31 March, with the objectives: (i) to provide a forum to discuss problems/constraints common to hatcheries, identify causative factors and find solutions to problems; (ii) to understand probable causes for reported decline in growth of cultured fish stocks; (iii) to brief the Hatchery Managers of basic concepts of genetics (selection and breeding) in relation to routine broodfish management; and (iv) to develop a simple genetic improvement program that could be undertaken by the Hatchery Managers with their available resources. The workshop was attended by Managers of private and government hatcheries, scientists and planners, 38 in all (Plates 3 & 4). During the workshop, the Hatchery Managers presented reports of broodstock management practices followed by them and a wide range of problems they are facing. Many Hatchery Managers reported mass mortality of 4-5 day old hatchlings of rohu (*Labeo rohita*) during June-July months. The resource persons provided solutions to the problems faced by the Hatchery Managers. In the absence of primary data, it was not possible to identify the causative factor(s) for mass mortality of rohu hatchlings, and in view of this, FRI will make investigations during this year's breeding season and make suggestions. The workshop revealed that while some hatcheries are careful in selection and maintenance of their broodstocks, practices followed by others result in inbreeding and use of deteriorated stocks. Taking case studies of procedures followed by different hatcheries, participants were shown how positive selection could be made and how negative selection is taking place due to wrong procedures followed by some hatcheries. Participants were given guidelines for broodstock management, which when followed will lead to improved stocks and production of quality seed, leading to better growth

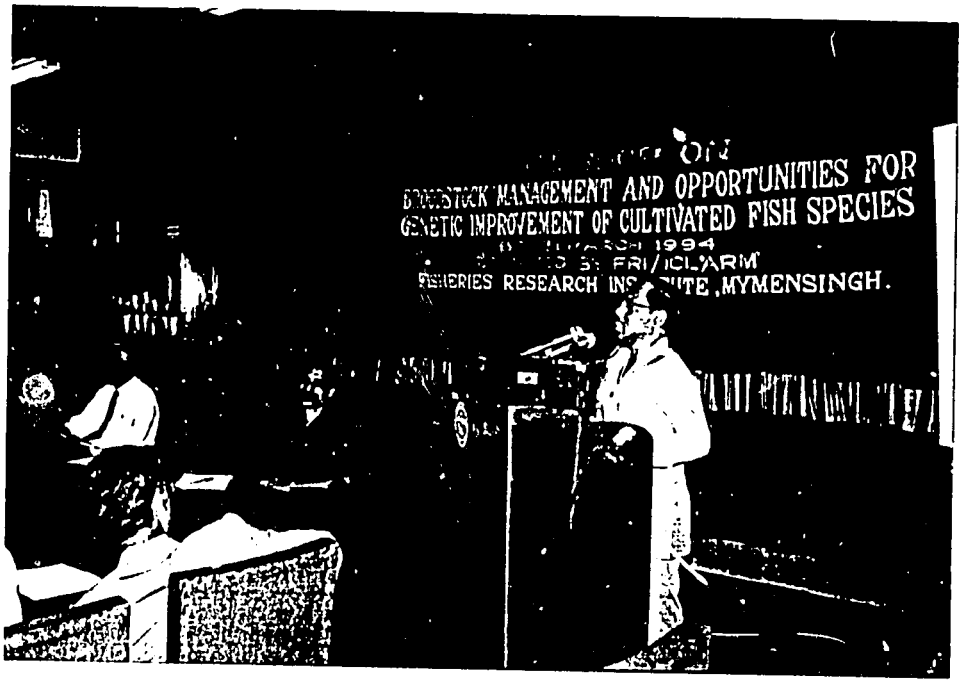

Plate 3. Workshop on "Broodstock Management and Opportunities for Genetic Improvement of Cultured Fish Species", being inaugurated by Prof. Shah M. Farouq, Vice-Chancellor of Bangladesh Agricultural University.

Plate 4. A technical session of the workshop in progress.

of fish and increased production. After two days of intensive discussions, the workshop recommended that: (i) for maintaining quality broodstock by hatcheries, Government should impose minimum size of fish to be used for breeding (minimum size for different species has been suggested by the Workshop); (ii) causative factors for mass mortality of rohu hatchlings in hatcheries should be investigated immediately by the scientists and remedial measures suggested to hatcheries, and (iii) Government should take action for making available in market needed inputs such as rotenone, dipterex and phostoxin, which are presently not available in market. The participants suggested that workshop like this, between private sector producers and public sector research and development agencies should be held atleast once a year. Detailed proceedings of the workshop are in Annex-5.

5. COLLABORATION WITH OTHER DEVELOPMENT PROJECTS

Technology for culture of short-cycle species in seasonal ponds developed by the project is becoming very popular among the fish culturists. To demonstrate the benefits in terms of low-inputs needed, low-cost of production and high returns, the project has taken up joint programs in collaboration with other developmental projects. In collaboration with the Aquaculture Extension Project implemented by the Department of Fisheries and funded by DANIDA, one hundred demonstrations will be held in Mymensingh district and the data collected will be analysed to compare with other culture systems which are complex as compared to the one developed by the project.

ANNEX-1

INTEGRATION OF IMPROVED AQUACULTURE PRACTICES INTO THE FARMING SYSTEM OF BANGLADESH : AN IMPACT EVALUATION

I. RESPONDENT'S IDENTITY

Name of the farmer : _____ Research site :_____

Village : _____ Thana :_____ District :_____

Research site code : _____ |__|__| 1-2

Serial number of the respondent : _____ |__|__|__| 3-5

Age : _____ |__|__| 6-7

Principal occupation:_____ |__| 8

Secondary occupation:_____ |__| 9

[Occupation code : Farmer-1, Farm labour-2, Non-farm labour-3, Housewife-4, Service-5, Smalltrader-6, Fishermen-7, Rickshaw/Van driving-8, Others (specify)-9]

Education :
(Code : Illiterate-1, Can read-2, Primary-3, Secondary-4 Higher secondary-5) |__| 10

Sex (Male-1, Female-2) |__| 11

Family size : Male : _____ |__| 12
Female : _____ |__| 13

II. HOUSEHOLD SOCIO-ECONOMICS

1) Land holding of the household (in decimal) :

Land owned :

Homestead	: _____	|__|__|__|__| 14-17
Cultivable (crop)	: _____	|__|__|__|__| 18-21
Orchard/forest	: _____	|__|__|__|__| 22-25
Fallow land	: _____	|__|__|__|__| 26-29
Pond/ditch	: _____	|__|__|__|__| 30-33

Cultivated land :

Own land	: _____	|__|__|__|__| 34-37
Share/leased in	: _____	|__|__|__|__| 38-41
Share/leased out	: _____	|__|__|__|__| 42-45

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2. Household annual income :

a) Annual farm income (Tk)

Crops	: _____	|__|__|__|	46-48
Cash crops	: _____	|__|__|__|	49-51
Vegetables	: _____	|__|__|__|	52-54
Fruits	: _____	|__|__|__|	55-57
Forest	: _____	|__|__|__|	58-60

b) Other annual non-farm income

i)	Annual lease/share income (Tk)	: _____		
ii)	Annual interest earning from savings (Tk)	: _____	|__|__|__|	61-63
			|__|__|__|	64-66
iii)	Annual income from other sources (Tk.)	: _____	|__|__|__|	67-69

Type of work	Income		
Wage labour	: ----------	|__|__|__|	70-72
Petty trading	: ----------	|__|__|__|	73-75
Business	: ----------	|__|__|__|	76-78
Service	: ----------	|__|__|__|	79-81
Rickshaw pulling	: ----------	|__|__|__|	82-84
Cart driving	: ----------	|__|__|__|	85-87
Bamboo and cane works	: ----------	|__|__|__|	88-90
Driving	: ----------	|__|__|__|	91-93
Boat plying	: ----------	|__|__|__|	94-96
Others (specify)	: ----------	|__|__|__|	97-99

III. UTILIZATION OF RESOURCES IN FARM PRODUCTION ACTIVITIES

1. Labour Use (Man-days per year) :

	Own	Purchased			
Crops	-----	------	|__|__|__|	|__|__|__|	1-6
Cash crops (jute, sugar-cane, wheat)	-----	------	|__|__|__|	|__|__|__|	7-12
Vegetables	-----	------	|__|__|__|	|__|__|__|	13-18
Pulses/Oil seeds	-----	------	|__|__|__|	|__|__|__|	19-24
Potato/Arum	-----	------	|__|__|__|	|__|__|__|	25-30
Condiments	-----	------	|__|__|__|	|__|__|__|	31-36
Fruits	-----	------	|__|__|__|	|__|__|__|	37-42
Forest	-----	------	|__|__|__|	|__|__|__|	43-48
Betel leaf	-----	------	|__|__|__|	|__|__|__|	49-54
Others (specify) : _____	-----	------	|__|__|__|	|__|__|__|	55-60

Livestock :				
Cattle	-----	------	___	61-66
Poultry	-----	------	___	67-72

2. Cowdung Use (kg)

	Own	Purchased		
Crops	-----	-------	____ ____	1-8
Cash crops	-----	-------	____ ____	9-16
Vegetables	-----	-------	____ ____	17-24
Pulses/Oil seeds	-----	-------	____ ____	25-32
Potato/Arum	-----	-------	____ ____	33-40
Condiments	-----	-------	____ ____	41-48
Fruits	-----	-------	____ ____	49-56
Forest	-----	-------	____ ____	57-64
Betel leaf	-----	-------	____ ____	65-72
Fuel	-----	-------	____ ____	73-80
Others (specify) :_____	-----	-------	____ ____	81-88

3. Use of Rice Bran (kg)

House maintenance	-----	-------	____ ____	1-8
Cattle feed	-----	-------	____ ____	9-16
Poultry feed	-----	-------	____ ____	17-24
Fish feed	-----	-------	____ ____	25-32
Others (specify):_____	-----	-------	____ ____	33-40

4. Use of Poultry Droppings

Crops	-----	-------	__ __	41-44
Cash crops	-----	-------	__ __	45-48
Vegetables	-----	-------	__ __	49-52
Pulses/Oil seeds	-----	-------	__ __	53-56
Potato/Arum	-----	-------	__ __	57-60
Condiments	-----	-------	__ __	61-64
Fruits	-----	-------	__ __	65-68
Forest	-----	-------	__ __	69-72
Betel leaf	-----	-------	__ __	73-76
Cattle	-----	-------	__ __	77-80
Poultry	-----	-------	__ __	81-84
Fish seed	-----	-------	__ __	85-88
Others (specify): _____	-----	-------	__ __	89-92

IV. POND INFORMATION :

1. Waterbody area (in decimal) during :

   monsoon : _____
   dry season : _____

   |__|__|__|__| 1-4
   |__|__|__|__| 5-8

2. Depth of the waterbody in the dry season (feet) : _____ |__|__| 9-10

3. Number of months retain water at least (3 feet) : _____ |__|__| 11-12

4. Ownership type : |__| 13

   - owned by household(s) 1
   - institutional 2
   - Khas 3
   - leased 4

5. If owned by households, number of owners : _____ |__|__| 14-15

6. Type of the waterbody : |__| 16

   - excavated 1
   - natural depression 2
   - roadside ditch 3

7. Purpose for which the waterbody was dug ? : _____ |__| 17

   - fish culture 1
   - house building 2
   - bathing/washing 3
   - road construction 4
   - others (specify): _____ 5

8. Condition of the waterbody |__| 18

   - broken dykes 1
   - fully/partially shaded 2
   - flood prone 4
   - good condition 8

9. Other uses of pond (other than fish culture) |__|__| 19-20

- bathing and washing 1
- drinking 2
- irrigation 4
- jute retting 8
- others (specify) : _____ 16

IV. FISH CULTURE STATUS BEFORE FSRE INTERVENTION

1. Use of the waterbody before FSRE intervention |__|__| 21-22

- fish culture 1
- bathing/washing 2
- irrigation 4
- jute retting 8
- stocking water hyacinth for animals 16
- others (specify) :_____ 32

2. Did you culture fish before 1990 (i.e. before intervention of FSRE) (Yes-1, No-0) : _____ |__| 23

3. If question 2 is 'yes', type of species stocked ? : _____ |__|__| 24-25

- Indian carps 1
- exotic carps 2
- nile tilapia 4
- sharputi 8

4. At what interval did you stock fingerlings ? |__|__| 26-27

- one year 1
- two year 2
- irregular 3

5. Did you use any fertilizer ? (Yes-1, No-0) : _____ |__| 28

6. If question 5 is 'yes', what type of fertilizer did you apply ? : _____ |__|__|__| 29-31

- cowdung 1
- inorganic fertilizer 2
- chicken manure 4
- others (specify) _____ 9

7. If question 5 is 'yes' no. of times fertilizer was used in a year : _____ |__|32

8. Did you use any feed ? (Yes-1, No-0) : _____ |__|33

9. If answer to question 8 is 'yes', what feed did you use ? : _____ |__|__|__|34-36

- rice bran 1
- duck weed 2
- oil cake 4
- others (specify): _____ 8

10. If question 8 is 'yes' at what intervals did you apply feed ? : _____ |__|37
(daily-1, weekly-2, irregular-3)

11. If question 2 is 'no', what factors were responsible for not culturing fish ? _____ |__|__|__|38-40

- lack of knowledge 1
- lack of capital 2
- non-availability of fingerlings 4
- natural harvest was abundant 8
- non-cooperation of shareholds 16
- flooding of ponds 32
- jute retting 64
- others (specify) _____ 128

12. Production obtained during last one year (1990-91) before fish culture started under FSR extension services (for cooperator farmers) :

- Cultured fish (kg) : _____ |__|__|__|41-43
- Natural fish (kg) : _____ |__|__|__|44-46
- Total (kg) : _____ |__|__|__|__|57-50

13. Disposable pattern :

- Self consumption (kg) : _____ |__|__|__|__|51-54
- Sold out (kg) : _____ |__|__|__|__|55-58
- Given away to relatives : _____ |__|__|__|__|59-62

VII. IMPACT OF FISH CULTURE EXTENSION

1. Farmer type : |__| 63

-	Cooperator in 1990-91	1
-	Cooperator in 1991-92	2
-	Cooperator in 1992-93	3
-	Cooperator in 1993-94	4
-	Cooperator during 1990-92	5
-	Cooperator during 1990-93	6
-	Cooperator during 1991-93	7
-	Non-cooperator	8

2. If the farmer is non-cooperator, when did he start fish culture _____ years. |__|__|__|__| 64-67

3. Pond Preparation (1992-93) :

Inputs	Quantity	Price/wage per unit		
Own source :				
Labour (days)	-------	---------	__ __	__ __ 1-4
Cowdung (kg)	-------	---------	__ __	__ __ 5-8
Chicken manure (kg)	-------	---------	__ __	__ __ 9-12
Compost (kg)	-------	---------	__ __	__ __ 13-16
Kitchen waste (kg)	-------	---------	__ __	__ __ 17-20
Purchased resources :				
Lime (kg)	-------	---------	__ __	__ __ 21-24
Urea (kg)	-------	---------	__ __	__ __ 25-28
TSP (kg)	-------	---------	__ __	__ __ 29-32
Piscicide (kg)	-------	---------	__ __	__ __ 33-36
Cowdung (kg)	-------	---------	__ __	__ __ 37-40
Chicken manure (kg)	-------	---------	__ __	__ __ 41-44
Compost (kg)	-------	---------	__ __	__ __ 45-48
Carrying cost		---------		__ __ 49-50

4. Species stocked :

Species		Number	
Catla	:	_____	51-53
Rohu	:	_____	54-56
Mrigal	:	_____	57-59
Silver carp	:	_____	60-62
Common/Mirror carp	:	_____	63-65
Grass carp	:	_____	66-68
Bighead	:	_____	69-70
Sharputi	:	_____	71-73
Tilapia	:	_____	74-76
Others (specify)	:	_____	77-79

5. Size of fingerlings stocked (in inches) : _____ 80-81

6. Month of stocking : _____ 1-2

7. Cost of fingerlings (Tk.) :_____ 3-4

8. Cost of fingerling transport (Tk.) : _____ 5-7

9. Principal source of fingerling supply :

- purchased from NGOs 1
- purchased from private vendor 2
- purchased from Govt. farm 4
- purchased from private farm 8

8

10. Fertilizers and Feed Applied :

Fertilizer/ Feed	Quantity	Price per unit		
Own source (kg) :				
Cowdung	-------	-------		9-13
Rice bran	-------	-------		14-18
Oil cake	-------	-------		19-23
Wheat bran	-------	-------		24-28
Waste/cooked rice	-------	-------		29-33
Poultry droppings	-------	-------		34-38
Compost	-------	-------		39-43
Duck weed	-------	-------		44-48
Others (specify)	-------	-------		49-53

Purchased (kg) :

Lime	-------	-------	|___|___|	54-58
Urea	-------	-------	|___|___|	59-63
TSP	-------	-------	|___|___|	64-68
Cowdung	-------	-------	|___|___|	69-73
Poultry droppings	-------	-------	|___|___|	74-78
Duck weed	-------	-------	|___|___|	79-83
Rice bran	-------	-------	|___|___|	84-88
Wheat bran	-------	-------	|___|___|	89-93
Oil cake	-------	-------	|___|___|	94-98
Others (specify)	-------	-------	|___|___|	99-103

11. Problems faced in fish production :

a) Was the waterbody affected by flood ? |__|1
(Yes-1, No-0) : _____

b) If yes, was it possible to protect from flood ? |__|2
(Yes-1, No-0) : _____

c) If yes, how did you protect from flood ? |__|3

- by making fence with jute sticks 1
- by making fence with bamboos 2
- by strengthening of dykes 4

d) Did you lose any fish due to flooding ? |__|4
(Yes-1, No-0) : _____

e) How much cost of bamboo/jute ? : _____ |___|5-7

f) Were the fish affected by disease ?
(Yes-1, No-0) : _____ |__|8

12. Harvesting and Disposal

a) Date (month) of harvesting:_____ |___|9-10

b) Harvesting method : |__|11

- netting 1
- dewatering 2
- angling 4

c) Cost of harvesting (if harvested by fishermen) : _____

i) Share of fish (kg) : _____ |__|__|__| 12-14
ii) Cash (Taka) : _____ |__|__|__| 15-17

d) Disposal pattern of harvested fish (kg)

Self consumed : _____ |__|__|__| 18-20
Given away : _____ |__|__|__| 21-23
Sold : _____ |__|__|__| 24-26
Total production : _____ |__|__|__| 27-29

e) Selling price per kg (Tk.) : _____ |__|__| 30-31

13. Labour used (mandays) :

a) Dyke repairing and cleaning : _____ |__|__| 32-33
b) Duck weed collection : _____ |__|__| 34-35
c) Making fence to protect from flood : _____ |__|__| 36-37
d) Harvesting : _____ |__|__| 38-39
e) Marketing : _____ |__|__| 40-41

V. FARMER ASSESSMENT AND ATTITUDE TOWARDS FISH CULTURE

Note : Farmers should not be prompted. Mark farmers' reasons against list.

1. How did you manage additional rice bran for aquaculture ? : _____ |__|__| 42-43

Stopped indigenous use of rice bran	1
Generated surplus by giving less feed to animals	2
Generated surplus by less feed to poultry	4
Increased production of rice bran by selling processed rice instead of paddy	8
Purchased from market/neighbours	16

2. How did you manage additional cowdung for aquaculture ? : _____ |__|__| 44-45

Stopped/decreased household use of cowdung	1
Increased production by adding more animals	2
Reduced cowdung use in other farm enterprises	4
Collected from grazing ground	8
Purchased from others	16

3. How did you manage additional poultry droppings for aquaculture : _____ |__|46

Preserved own poultry droppings	1
Started poultry rearing in cages rather than free range grazing	2
Collected from neighbours	4

4. Do you think that labour utilization has increased due to aquaculture practices ? Yes _____ No_____ |__|47
(Yes-1, No-0)

5. If answer to question no. 4 is 'yes', how did you manage excess labour required for aquaculture ? |__|48

From family labour force	1
Increasing working hour	2
Hired labour	4

6. Did you have to give up any occupation/enterprise in order to devote time and resource to aquaculture ? |__|49
(put tick) Yes :_____ No: _____
(Yes-1, No-0)

7. If yes, what did you give up ? (put tick) |__|__|50-51

Cultivation of crops	1
Plant nursery	2
Orchard	4
Horiculture in homestead	8
Others (specify) : _____	16

8. What was your annual net income from foregone occupation or enterprise ? Tk. _____ |__|__|__|__|52-55

9. Did you have to stop any of the previous uses of pond after adoption of aquaculture ? (put tick) |__|56
Yes : _____ No. _____
(Yes-1, No.0)

10. If yes, mention those uses : |__|57

Bathing and washing	1
Irrigation	2
Jute retting	4
Irrigation	8

11. Difficulties faced by farmers |__|__|__| 58-60

a)	Inadequate supply of fingerlings	1
b)	Non availability of credit	2
c)	Non availability of feed other than rice bran	4
d)	Insufficient water in the pond	8
e)	Small size of pond	16
f)	Flood prone	32
g)	Problems of harvesting	64
h)	Risk of theft	128
i)	Risk of disease	256

12. Benefits derived from fish culture by farmers ? |__|__|__|__| 61-64

a)	Fish for self consumption	1
b)	Source of cash income	2
c)	Help improve economic status	4
d)	Rapid return	8
e)	Low investment	16
f)	Fast growth of fish	32
g)	Simple technology	64
h)	Better social relationship	128
i)	Utilization of ditch for other purpose after fish culture	256
j)	Increased utilization of untouched resources	512

13. Farmer's attitude towards future involvement in fish culture : _____ |__| 65

Continue	1
Expand	2
Discontinue	3
Undecided	4

14. Remarks : _____

_____

_____

_____

Signature of data collector

Date : _____

Signature of the verifier

Date : _____

26

SMALL WATERBODY SURVEY QUESTIONNAIRE

Respondent's identity :

Name : _____

(To be asked to the person under whose disposal the waterbody is presently held. In case of multiple operators, ask the dominant/active operator)

Father's/Husband's name : _____ Para _____

Village : _____ Union : _____

1. Waterbody identification number : |__|__|__|__|__|__| 1-6
   (Pond-1, Ditch-2)

2. Waterbody property type : |__| 7

a)	Singly owned	:	1
b)	Jointly owned (2-5 owners)	:	2
c)	Jointly owned (6-9 owners)	:	3
d)	Jointly owned (above 10)	:	4
e)	Institutional	:	5
f)	Khas (Govt)	:	6
g)	Others (specify)	:	7

3. Operator's/Farmer's status |__| 8

a)	Single owner operator	:	1
b)	Joint owner operator	:	2
c)	Single-lease operator	:	3
d)	Joint-lease operator	:	4
e)	Other (specify)	:	5

4. Area of the waterbody (in decimal)

   a) Area including bank (decimal) |__|__|__|__| 9-12

   b) Area excluding bank (decimal) |__|__|__|__| 13-16

5. Is there at least 3-4 feet water available in the waterbody during dry season ? (Yes - 1, No - 0) |__| 17

6. Is the waterbody newly excavated (after 1991) ? (Yes-1, No-0)

7. If yes, purpose of excavation ?

-	Fish culture	1
-	Home construction	2
-	Bathing/washing	3
-	Others (specify)	4

8. Culture status of the waterbody |___| 18

a) Cultured : 1
b) Culturable : 2
c) Derelict : 3

9. If the waterbody is culturable or cultured what improvement is needed ? |___|___| 19-20

a) Only cleaning of aquatic vegetation 1
b) Only repairing of dikes 2
c) Both repairing of dikes and cleaning of aquatic vegetation 4
d) No improvement is needed 8
e) Others (specify) 16

10. If the waterbody is culturable, what factors are responsible for not culturing fish (Yes-1, No-0).

a) Lack of adequate water during dry season |___| 21
b) Extreme turbidity of water |___| 22
c) Natural harvest is abundant |___| 23
d) Shareholders are unwilling to invest |___| 24
e) Risk of theft |___| 25
f) Lack of availability of fry fingerling and other inputs |___| 26
g) Lack of adequate cash |___| 27
h) Others (specify) |___| 28

11. If the waterbody is derelict, what reforms will be needed to bring it cultivation. |___| 29

a) Major earthwork 1
b) Re-excavation (including major earthwork) 2
c) Others (specify) 3

12. Except fish culture, other uses of waterbody (Yes-1, No-0).

a) Bathing and washing |___| 30
b) Drinking |___| 31
c) Irrigation |___| 32
d) Jute retting |___| 33
e) Stocking water hyacinth for animals |___| 34
f) Others (specify) |___| 35

13. From which year fish culture started in the waterbody ? (If the waterbody is under culture) |___| 36

Before	1989	1
	1990	2
	1991	3
	1992	4
	1993	5

14. Who advised you to culture fish in the waterbody ? |___| 37

- Thana Fisheries Officer 1
- NGOs 2
- Officer of ISRE site 3
- Neighbours 4
- Others (specify) 5

Name of the interviewers

Date :

Name of the verifier

Date :

ANNEX-2

SURVEY OF RAJPUTI (*PUNTIUS GONIONOTUS*) HATCHERIES

I. Identification :

Name of the hatchery : _____

Name of the owner : _____

Location: Village:_____ Thana_____ District_____

District code : _____ |__|__| 1-2

Serial no. : _____ |__|__|__| 3-5

Educational background of owner : _____
(Illiterate-1, Primary-2, Secondary-3,
Higher secondary and above-4) |__| 6

Year hatchery was established:_____ |__|__|__|__| 7-10

2. Hatchery details :

a) Size of hatchery :

Total no. of ponds	: _____	|__|__|	11-12
Brood fish	: _____	|__|__|	13-14
Nursery	: _____	|__|__|	15-16
Others (specify)	: _____	|__|__|	17-18

b) Size of ponds (decimal) :

Maximum	: _____	|__|__|__|	19-21
Minimum	: _____	|__|__|__|	22-24

c) Total area of ponds (decimal) : _____ |__|__|__|__| 25-28

d) Breeding tanks :

Number	: _____	|__|__|	29-30
Size (m^3)	: _____	|__|__|	31-32

e) Hatching tank details :

Circular No. : _____ |__|__| 33-34

Size :
Diameter (feet) : _____ |__|__| 35-36
Depth (feet) : _____ |__|__| 37-38

Bottles No. : _____ |__|__|__| 39-40
Size (l capacity) : _____ |__|__|__| 41-43
Tray No. : _____ |__|__| 44-45
Size (m^2) : _____ |__|__| 46-47

3. Breeding details :

a) Do you breed rajputi ? (Yes-1, No-0) : _____ |__| 48

If answer is 'yes', how many years you have been breeding rajputi ? : _____ |__| 49

b) Original source of rajputi spawners ? : _____

c) For breeding purposes, where from you get rajputi spawners ? (own ponds-1, purchased-2, both-3) : _____ |__| 50

d) Quantity of rajputi breeders hatchery maintains :

Number : _____ |__|__|__| 51-53

Size (g) :
Maximum : _____ |__|__|__| 54-56
Minimum : _____ |__|__|__| 57-59

e) How do you raise rajputi: spawners ? (separately-1, along with carps-2, both-3) : _____ |__| 60

f) Do you have any disease problems ? (Yes-1, No-0) : _____ |__| 61

If 'yes', specify what type of disease _____

g) Do you have any other problems in : _____
raising rajputi brood stock ? |___|62
(Yes-1, No-0)

If answer is 'yes', specify problems : _____

_____

_____

_____

_____

h) Spawn produced during 1993 (kg) :

Catla	: _____	|___|___|___|63-65
Rohu	: _____	|___|___|___|66-68
Mrigal	: _____	|___|___|___|69-71
Grass carp	: _____	|___|___|___|72-74
Silver carp	: _____	|___|___|___|75-77
Bighead carp	: _____	|___|___|___|78-80
Common carp	: _____	|___|___|___|81-83
Rajputi	: _____	|___|___|___|84-86
Magur	: _____	|___|___|87-88
Others (specify)	: _____	|___|___|89-90

i) Spawning season (Month) :

From ___ |___|91 To ___ |___|92 Peak ___ |___|___|___|93-95

(January-1, February-2, March-3, April-4, May-5,
June-6, July-7, August-8, September-9, October-10,
November-11 and December-12)

j) Rajputi breeding period (Month) :

From ___ |___|96 To ___ |___|97 Peak ___ |___|___|___|98-100

k) Has rajputi spawn production increased
over years (Yes-1, No-0) _____ |___|101

If 'yes', what are the reasons : _____
|___|102

1) increased demand : _____
2) better management : _____
3) others (specify) : _____

l) What was production of rajputi spawn during (kg) :

1990	: _____	103-105
1991	: _____	106-108
1992	: _____	109-111
1993	: _____	112-114

m) Breeding techniques used for rajputi :

No. of injections	: _____	115
Interval between injections (hrs)	: _____	116-117
Harmones used (Pituitary-1, HCG-2, Both-3)	: _____	118

Dose :

Pituitary	:	
First dose (mg/kg)	: _____	119-120
Second dose (mg/kg)	: _____	121-122
HCG (IU/kg)	: _____	123-126
Spawning success (%)	: _____	127-128
Fertilization rate (%)	: _____	129-130
Hatching rate (%)	: _____	131-132

n) No.of times same rajputi spawned in the season : _____ 133

o) Interval between spawnings in same season (days) : _____ 134-135

p) Type of hatching facilities used for rajputi (Circular tanks-1, Jars-2, both-3) 136

q) Problems in breeding rajputi if any : _____

_____

_____

_____

4. Production and sale :

a) Buyers of rajputi spawn: _____ |__|__| 137
(Government farms-1, Private nurseries-2, both-3)

b) How many people bought rajputi spawn during 1993 ? _____ |__|__|__| 138-140

c) Sale price of spawn (Tk/kg):

Maximum : _____ |__|__|__|__| 141-144
Minimum : _____ |__|__|__|__| 145-148

d) From which districts are the nursery operators

District	No.
--------	-----
--------	-----
--------	-----
--------	-----
--------	-----

e) Were you able to meet the demand for spawn ? (Yes-1, No-0) _____ |__| 149

If answer is 'no', how much more you could sell (kg) ? ____ |__|__|__| 150-152

f) Were nursery operators satisfied with quality of spawn ? (Yes-1, No-0) |__| 153

If the answer is 'no', what were their complaints: _____

_____

_____

5. Rajputi spawn production plans for 1994

a) Targetted production (kg) : _____ |__|__|__| 154-156

b) Spawn production starting : _____ |__| 157
(month)

c) Are any problems envisaged ? : _____ |__|158
(Yes-1, No-0)

If 'yes' specify problems : _____

_____

_____

6. **Culture :**

a) Do you think rajputi has good potential for culture ? (Yes-1, No-0) : _____ |__|159

If 'yes', specify why ?

1) _____

2) _____

3) _____

4) _____

If 'no', specify why ?

1) _____

2) _____

3) _____

4) _____

6. **Additional comments/remarks :**

_____

_____

_____

_____

Date of survey

Name of Surveyor

ANNEX-3

SURVEY OF RAJPUTI (*PUNTIUS GONIONOTUS*) NURSERIES

I. Identification :

Name of operator : _____

Village :_____ Thana :_____ District : _____

District Code : _____ |__|__|__| 1-2
Serial No : _____ |__|__|__| 3-5
Educational background of owner : _____ |__| 6
(Illiterate-1, Primary-2, Secondary-3,
Higher secondary and above-4)

1. Pond details :

a) No. of nursery ponds : _____ |__|__| 7-8

b) Area of ponds (decimal) :

Maximum : _____ |__|__|__| 9-11
Minimum : _____ |__|__|__| 12-14
Total : _____ |__|__|__| 15-17

c) How many years you have been involved in nursery operation ? : _____ |__| 18

d) Did you have any training in nursery pond management (Yes-1, No-0) ? : _____ |__| 19

If 'yes' specify from where : _____ |__| 20

NGOs : 1
Govt.extension officers : 2
Private hatchery owners : 3
International funded projects : 4

e) Do you think that training was useful ? (Yes-1, No-0) :_____ |__| 21

If answer is 'no', specify reasons : _____

_____

_____

_____

2. Fingerlings production :

a) What is the source of your spawn ? (Government hatchery-1, Private hatchery-2, Own-3) : _____ |__|22

b) What is the source of rajputi spawn ? (Government hatchery-1, Private hatchery-1, Own-3) : _____ |__|23

c) Name of hatchery for rajputi spawn : _____

Place : _____

d) How much spawn did you buy (100' gms)

1990	: _____	|__|__|__| 24-26
1991	: _____	|__|__|__| 27-29
1992	: _____	|__|__|__| 30-32
1993	: _____	|__|__|__| 33-35

e) Of this, how much was rajputi (100' gms) during

1990	: _____	|__|__|__| 36-38
1991	: _____	|__|__|__| 39-41
1992	: _____	|__|__|__| 42-44
1993	: _____	|__|__|__| 45-47

f) Price of rajputi spawn during 1993 (Tk/kg)

Maximum	: _____	|__|__|__|__| 48-51
Minimum	: _____	|__|__|__|__| 52-55

g) Did you have any problems in: _____ procuring rajputi spawn ? (Yes-1,No-0) |__|56

If 'yes' specify problems : |__|57

1) non-availability : 1
2) high price : 2
3) high mortality : 3
4) others (specify) : 4

3. Nursery practices followed for rajputi :

a) Nursery stages (single-1, double-2, both-3):___ |__|58

b) Do you dry the pond (Yes-1, No-0) _ |__|59

c) Do you use piscicides for eradication of predators ? (Yes-1,No-0) : _____ |___|60

If 'yes' what piscicides do you use ?

Name :_____

Dose (g/dec) : _____	___	61-63
Dose (ml/dec) : _____	___	64-66

d) Fertilizer use for pond preparation :

Single stage :

Cattle dung(kg/decimal) : _____	___	67-69
Chicken manure (kg/dec) : _____	___	70-72
Mustard oil cake (kg/dec): _____	___	73-75
Urea (g/decimal) : _____	___	76-78
TSP (g/decimal) : _____	___	79-81
MP (g/decimal) : _____	___	82-84

Double stage :

Primary :

Cattle dung(kg/decimal) : _____	___	85-87
Chicken manure (kg/dec) : _____	___	88-90
Mustard oil cake(kg/dec) : _____	___	91-93
Urea (g/decimal) : _____	___	94-96
TSP (g/decimal) : _____	___	97-99
MP (g/decimal) : _____	___	100-102

Secondary :

Cattle dung(kg/decimal) : _____	___	103-105
Chicken manure (kg/dec) : _____	___	106-108
Mustard oil cake (kg/dec): _____	___	109-111
Urea (g/decimal) : _____	___	112-114
TSP (g/decimal) : _____	___	115-117
MP (g/decimal) : _____	___	118-120

e) Do you use insecticide before stocking spawn ? (Yes-1, No-0) : _____ |___|121

If 'yes' specify insecticide used : _____

Dose (g/decimal) : _____	___	122-124
Dose (ml/decimal) : _____	___	125-127
Doses (tablets/decimal) : _____	___	128-129

f) What is the spawn stocking density you practice (g/decimal) ?:_____ |___|___|___| 130-132

Single stage :

Spawn (g/decimal) : _____ |___|___|___| 133-135

Double stage :

Primary :
Spawn (g/decimal) : _____ |___|___|___| 136-138

Secondary :
Dhani ('000s/decimal) : _____ |___|___|___| 139-141

g) Frequency of feeding (daily-1, weekly-2, irregular-3) |___| 142

h) Feed used (kg/decimal/feeding) :

Single stage :

Mustard oil cake	_____	|___| 143
Rice bran	_____	|___| 144
Wheat bran	_____	|___| 145
Fish meal	_____	|___| 146
Others (specify)	_____	|___| 147

Double stage :

Primary :

Mustard oil cake	_____	|___| 148
Rice bran	_____	|___| 149
Wheat bran	_____	|___| 150
Fish meal	_____	|___| 151
Others (specify)	_____	|___| 152

Secondary :

Mustard oil cake	_____	|___| 153
Rice bran	_____	|___| 154
Wheat bran	_____	|___| 155
Fish meal	_____	|___| 156
Others (specify)	_____	|___| 157

i) Fertilization subsequent to spawn/dhani stocking :
Frequency (Weekly-1, fortnightly-2, irregular-3)

Single stage : _____ |__|158

Double stage :
Primary : _____ |__|159
Secondary : _____ |__|160

Fertilization (per application) :

Single stage :

Cattle dung (kg/decimal) : _____	|__|__|__|	161-163
Chicken manure (kg/dec.) : _____	|__|__|__|	164-166
Mustard oil cake(kg/dec) : _____	|__|__|__|	167-169
Urea (g/decimal) : _____	|__|__|__|	170-172
TSP (g/decimal) : _____	|__|__|__|	173-175
MP (g/decimal) : _____	|__|__|__|	176-178

Double stage :

Primary :

Cattle dung (kg/decimal) : _____	|__|__|__|	179-180
Chicken manure (kg/dec.) : _____	|__|__|__|	181-183
Mustard oil cake(kg/dec) : _____	|__|__|__|	184-186
Urea (g/decimal) : _____	|__|__|__|	187-189
TSP (g/decimal) : _____	|__|__|__|	190-192
MP (g/decimal) : _____	|__|__|__|	193-195

Secondary :

Cattle dung (kg/decimal) : _____	|__|__|__|	196-198
Chicken manure (kg/dec.) : _____	|__|__|__|	199-201
Mustard oil cake(kg/dec) : _____	|__|__|__|	202-204
Urea (g/decimal) : _____	|__|__|__|	205-207
TSP (g/decimal) : _____	|__|__|__|	208-210
MP (g/decimal) : _____	|__|__|__|	211-213

j) How many days rearing is done before harvesting :

Single stage :

Fingerlings : _____ |__|__|214-215

Double stage :

Dhani : _____ |__|__|216-217
Fingerlings : _____ |__|__|218-219

k) Do you harvest all Dhani at one time (Yes-1, No-0)

|___|220

If 'no', how many times you harvest : _____ |___|221

l) Size of Dhani at harvest (cm) : _____ |___|222

m) Size of fingerlings at harvest (cm): __ __ |___|___|223-224

n) Do you harvest all fingerlings
at one time ? (Yes-1, No-0) : _____ |___|225

If 'no' how many times do you harvest :
fingerlings ? : _____ |___|226

o) What is the survival of spawn in your ponds (%) ?

Upto dhani : _____ |___|___|227-228
Upto fingerlings : _____ |___|___|229-230

p) What is the survival of fingerlings
from dhani (%) : _____ |___|___|231-232

q) Do you stock spawn after partial
harvesting of dhani (Yes-1, No-0) :_____ |___|___|233-234

If 'yes', after how many days of
first stocking of spawn : _____ |___|___|235-236

r) Do you stock dhani after partial harvesting
of fingerlings (yes-1, No-0) : _____
|___|237

If 'yes', after how many days of first
stocking of dhani ? :_____
|___|___|238-239

s) Do you follow the same management practices
for carp nurseries also ? : _____ |___|240
(Yes-1, No-0)

t) If answer 'no', what is the difference (s) ? _____

_____

_____

u) How many fingerlings did you produce in 1993 (lakh) ?

Catla	: _____	___	241-243
Rohu	: _____	___	244-246
Mrigal	: _____	___	247-249
Silver carp	: _____	___	250-252
Grass carp	: _____	___	253-255
Bighead	: _____	___	256-258
Common carp	: _____	___	259-261
Mirror carp	: _____	___	262-264
Rajputi			
Dhani	:		
for own stocking	: _____	___	265-267
for sale	: _____	___	268-270
Fingerlings	: _____	___	271-273
Others (specify)	: _____	___	274-276

(N.B : In case of species other than rajputi, combine dhani and fingerlings production)

v) Are you satisfied with production of dhani/ fingerlings of rajputi ? (Yes-1, No-0): _____ |___| 277

If answer is 'no', what are the reasons : _____

_____

_____

w) Do you have disease problem in nurseries? (Yes-1, No-0) : _____ |___| 278

If 'yes', specify disease problem _____

_____

x) Do you have any other problems in nursing rajputi ? (Yes-1, No-0) : _____ |___| 279

If 'yes' specify problems :

1) _____

2) _____

3) _____

4) _____

y) Who buy fingerlings from you ?

Individual farmers (Yes-1, No-0) : _____ |__|270
Hawkers (Yes-1, No-0) : _____ |__|281
Middlemen (yes-1, No-0) : _____ |__|282

z) Do you encounter problems in selling ?
(Yes-1, No-0) : _____ |__|283

If 'yes' specify problems :

1) _____

2) _____

3) _____

4) _____

aa) Do you think there is more demand for fingerlings than you can meet ? (Yes-1, No-0) : _____ |__|284

bb) Are you planning to increase production of rajputi fingerlings ? (Yes-1, No-0) : _____ |__|285

cc) If you are buying dhani, what is the price you pay (Tk/1000) :_____ |__|__|__|__|286-289

dd) What is the price of fingerlings you sell (Tk/1000) : _____ |__|__|__|__|290-293

ee) What is the price of dhani you sell (Tk/1000) :_____ |__|__|__|__|294-297

ff) Do you need any assistance in improving your system ? (Yes-1,No-0) : _____ |__|298

If 'yes' specify :

1) _____

2) _____

3) _____

4) _____

gg) Have you any security problems (like stealing and theft) ? (Yes-1, No-0) : _____ |__|299

hh) Did you get any loan or credit from Bank ? (Yes-1, No-0) : _____ |__|300

4. Additional comments/remarks :

_____

_____

_____

_____

_____

Date of survey

Name of Surveyor

ANNEX-4

Annex-4

PROCEEDINGS OF THE WORKSHOP ON "TECHNOLOGY TRANSFER THROUGH NGOS AND FEEDBACK TO RESEARCH"

20-21 MARCH 1994

Organized by FRI/DOF/BARC/ICLARM

The Fisheries Research Institute (FRI) with technical assistance of International Center for Living Aquatic Resources Management (ICLARM) is implementing a program entitled "Technology Transfer Through NGOs and Feedback to Research", in collaboration with the Department of Fisheries (DOF) and Bangladesh Agricultural Research Council (BARC). The program is funded by the United States Agency for International Development (USAID). The program was initiated in 1992 and is being continued during 1994. Five NGOs namely, Proshika Manobik Unnayan Kendra, Bangladesh Rural Advancement Committee (BRAC), Thengamara Mohila Sobuj Sangha (TMSS), Jagoroni Chakra and Banchte Shekha are implementing the program during 1994 in 35 thanas covering 20 districts, representing different agroecological zones of Bangladesh (Appendix-1).

Under the program, during the year 1994-'95, a total of 1000 technology demonstrations - 500 in seasonal ponds, 400 in perennial ponds and 100 in nursery ponds will be organized by the participating NGOs. Four training programs of 6 days duration each will be organized, starting from 4 April 1994 at FRI, for a total of 100 extension workers. The extension workers will be trained as Trainers in different low-cost aquaculture technologies and management practices that would be suitable for implementation by resource poor farmers. The trained extension workers will in turn undertake pond site training of 2000 farmers and organize 100 farmers' rallies.

The main objective of the workshop (program is in Appendix 2) was to bring together the Government extension workers (Thana Fishery Officers) and NGO extension workers from the project area (35 thanas) and researchers of FRI, to discuss and finalize the technical program for implementation in different parts of the country, taking into consideration the available aquaculture technologies, the socio-economic condition of target groups, availability of inputs and agroecosystem of the area. A total of 74 persons from FRI, DOF, BARC, Bangladesh Agricultural University (BAU), different NGOs, USAID, Association of Development Agencies in Bangladesh (ADAB) and ICLARM participated the workshop (list of participants is in Appendix-3).

During the inaugural session, Directors of FRI and DOF, Member-Director (Fisheries), BARC and ICLARM Senior Aquaculture Specialist stressed the need for closer collaboration and

linkages between the Government agencies and the NGOs, for development and dissemination of aquaculture technologies that could be integrated into the farming systems and sustained by resource poor rural farmers.

The workshop started with presentation by FRI scientists, of low-cost aquaculture technologies available for seasonal, perennial and nursery ponds and integrated rice-fish farming.

Subsequent to this, NGOs Extension Officers and Thana Fisheries Officers (TFO) from each of the project area, presented in detail the agroclimatic condition of the area, socio-economic conditions of the farmers they are involved with, aquaculture dissemination programs they are presently undertaking and the constraints for aquaculture development that need to be addressed. There were sharp differences of opinion between Government and NGO extension workers, as to who should be the target group for extension of technologies and selection of demonstration ponds. The Government extension workers felt that demonstrations should be organized in ponds of financially sound farmers who could strictly follow the suggested management practices and also suggested that management practices should be more scientific (e.g. farmers to fertilize ponds and adjust fertilization rates based on secchi disc reading, etc.). The NGO extension workers explained that their target group farmers are very poor and illiterate and hence suggested technologies have to be low-cost and simple if they are to be sustained by the resource poor farmers. A Thana Fishery Officer pointed out that under some projects, they (Thana Fishery Officers) have been asked to follow rigidly management practices such as, species for stocking, stocking densities and quality and quality feeds, which the farmers are not accepting and the Government Extension Officers are facing problems. At this juncture, the ICLARM Senior Aquaculture Specialist clarified that the target group under this program are resource poor farmers and in many cases new to aquaculture and hence suggested technologies should be low-cost and simple to adopt. The technologies given should be guidelines only and farmers will follow to the extent possible with their resources. This was appreciated by all present. Some of the constraints for aquaculture development identified by the participants were:

i) Non-availability of appropriate sized fingerlings of required species at times required for stocking the ponds.

ii) Culture of rajputi (*Puntius gonionotus*) has been widely accepted by the farmers in Rajshahi, Dhaka and Khulna divisions. But the supply of fry is unpredictable and uncertain, due to high mortalities in nursery ponds. The extension workers/farmers need knowledge on nursery practices for rajputi.

iii) Farmers are not aware of aquaculture technologies and management practices that could lead to increased productions and hence there is need for more extension services.

iv) Many 'khas' (Government owned) ponds are lying in derelict condition. NGOs are interested to lease these 'khas' ponds for landless/marginal farmer groups. But the present Government policies are not allowing this.

v) Farmers in Rajshahi, Khulna and Barishal Divisions prefer to culture rajputi, while farmers in Chittagong Division have accepted and been culturing tilapia instead of rajputi.

vi) Lack of hands-on training to NGOs field extension workers on different improved aquaculture technologies, which is deterring the dissemination of technologies.

Subsequent to general discussion, characteristics of each of the regions where the program will be implemented was discussed and technical programs that could be suitable for each of the regions was discussed and finalized. While finalizing the program, availability of fingerlings of different species and market demand for different species has been taken into consideration. The technical program agreed by the participants, is in pages 5 to 11.

The Senior Aquaculture Specialist of ICLARM briefed participants on the necessity for proper monitoring and evaluation of aquaculture practices undertaken by the farmers under the program, benefits (financial and nutritional) obtained by farmers, constraints in implementation of technology if any, and provide feedback to researchers. In this connection, to monitor, pond book's will be developed in consultation with the NGOs, in which input - output data will be maintained by extension workers and farmers.

The workshop came up with the following additional recommendations :

1. To ensure easy availability of fry/fingerlings, mini carp hatcheries need to be established in the areas under the technology transfer program. Similar to what has been tried by BRAC, fingerling banks may be established to meet the timely need of required size fingerlings;

2. The NGOs will give prior information to FRI about the farmers' training they will be undertaking for suggestions/modifications. FRI will send resource person(s) to help the NGO extension workers/trainers in conducting farmers' training;

3. NGO and DOF extension workers (TFO) and FRI scientists will maintain a strong linkage in implementing the technology transfer program. NGOs will record field-data according to the pond books to be supplied and send these at the end to FRI for analysis as well as to find out the ways and means for further improvement of the technologies;

4. Monthly meetings will be held at different program areas with the participation of concerned persons from FRI, DOF, BARC, ICLARM, NGOs and farmers;

5. Possibility of increasing the number of training officers to be recruited under the program from two to four be explored, for smooth functioning and monitoring of the program. ICLARM is requested to provide financial assistance in this matter. Of the four training officers to recruited, one should be stationed at ICLARM office in Dhaka; one at BRAC

training centre/divisional office of DOF in Comilla; one at TMSS office/DFO office in Bogra and one at Jagorani Chakra in Jessore;

6. Special training course on rice-cum-fish farming should be organized for the farmers of Barishal region;

7. A revolving fund should be formed by the NGOs to sustain the program in future on their own;

8. NGOs should be very careful and regular in submitting financial reports to FRI for timely disbursement of fund; and

9. The Government's existing policy for leasing 'khas' ponds (less than 3 acres in area) is hampering the aquaculture development. DOF and FRI may take up the issue with the competent authorities in the Government.

The workshop ended with the comments by the Thana Fishery Officers and representatives of different NGOs, that this was the first time the Government and NGO extension workers could sit together and discuss in depth and agree aquaculture extension approaches and hoped that these dialogues will continue in future.

TECHNICAL PROGRAM SUGGESTED BY THE WORKSHOP FOR DIFFERENT REGIONS

A. RAJSHAHI DIVISION

1. Fish culture in seasonal ponds

Pond preparation :

- Liming - 1.0 kg/decimal
- Fertilization - organic manure - 4 kg/decimal.

Species stocking density (No./decimal*) :

Rajputi	48
Silver carp	6
Mirror carp	6
Total	60

Feeding :

Duck weed, aquatic/terrestrial weeds and
Rice bran @4-5% body weight daily.

Fertilization :

Organic : 4 kg cattle dung/decimal/15 days.
Inorganic : 100 g Urea + 200 g TSP/decimal/15 days.

Disease prevention :

Application of lime in ponds in November @1.0 kg/decimal.

2. Fish culture in perennial ponds

Pond preparation :

- Draining of ponds/application of piscicide
- Liming - 1.0 kg/decimal
- Fertilization :
  i) Organic - 8 kg cattledung/decimal
  ii) Inorganic - 100 g Urea + 100 g TSP/decimal

* decimal = 40 m^2

Species stocking density (No./decimal) :

Silver carp	7
Catla	3
Rohu	5
Mrigal	6
Common carp	1
Grass carp	2
Rajputi	10
Total	34

Feeding :

Rice bran @ 2-3% body weight daily.
Aquatic/terrestrial weeds

Fertilization :

Organic : 4 - 6 kg cattle dung/decimal.
Inorganic : 100 g Urea + 100 g TSP/decimal.
Aquatic/terrestrial weeds

Harvesting : Rajputi in November.

Disease prevention :

Pond liming in November @1.0 k g/decimal.

B. DHAKA DIVISION

1. Fish culture in seasonal ponds

Pond preparation :

- Liming - 1.0 kg/decimal
- Fertilization - organic manure - 4 kg/decimal.

Species stocking density (No./decimal) :

i)	Rajputi	48		ii)	Macrobrachium	15
	Silver carp	6	Or		Silver carp	10
	Mirror carp	6			Rohu	5
	Total	60				30

Feeding :
- Duck weeds, terrestrial/aquatic weeds and
- Rice bran @4-5% body weight daily.

Fertilization :
- Organic : 4 kg cattle dung/decimal/15 days.
- Inorganic : 100 g Urea + 200 g TSP/decimal/15 days.

Disease prevention :
- Pond liming in November @1.0 kg/decimal.

2. Fish culture in perennial ponds

Pond preparation :
- Draining of ponds/application of piscicide
- Liming - 1.0 kg/decimal
- Fertilization :
  i) Organic - 8 kg cattledung/decimal
  ii) Inorganic - 100 g Urea + 100 g TSP/decimal

Species stocking density (No./decimal) :

	Shallow ponds	Deeper ponds
Silver carp	7	12
Catla	3	3
Rohu	5	3
Mrigal	6	3
Common carp	1	4
Grass carp	2	3
Rajputi	10	12
Total	34	40

(If Rajputi not available, Macrobrachium will be stocked @7-10/decimal instead of Rajputi).

Feeding :
- Rice bran @2-3% body weight daily.
- Aquatic/terrestrial weeds

Fertilization :
- Organic : 4 - 6 kg cattle dung/decimal.
- Inorganic : 100 g Urea + 100 g TSP/decimal.

Harvesting : Rajputi in November.

Disease prevention :
- Pond liming in November @1.0 kg/decimal.

C. CHITTAGONG DIVISION

1. Fish culture in seasonal ponds

Pond preparation :

- Liming - 1.0 kg/decimal
- Fertilization - organic manure - 4 kg/decimal.

Species stocking density (No./decimal) :

i)	Rajputi	48		ii)	Tilapia	60
	Silver carp	6	Or		Silver carp	6
	Mirror carp	6			Common carp	6
	Total	60				72

Feeding :

- Duck weeds and/or terrestrial/aquatic weeds,
- Rice bran @4-5% body weight daily.

Fertilization :
- Organic : 4 kg cattle dung/decimal/15 days.
- Inorganic : 100 g Urea + 200 g TSP/decimal/15 days.

Disease prevention :
- Pond liming in November @1.0 kg/decimal.

2. Fish culture in perennial ponds

Pond preparation :

- Draining of ponds/application of piscicide
- Liming - 1.0 kg/decimal
- Fertilization :
  - i) Organic - 8 kg cattledung/decimal
  - ii) Inorganic - 100 g Urea + 100 g TSP/decimal

Species stocking density (No./decimal) :

In general

Silver carp	9
Catla	2
Rohu	6
Mrigal	7
Common carp	2
Grass carp	3
Bighead carp	5
Total	34

For Bashkhali only :

i)	Catla	14	or ii)	Catla	14
	Mrigal	7		Macrobrachium	15
	Common carp	2		Grass carp	3
	Grass carp	3		Rohu	8
	Rohu	8			40
		34			

Feeding :

- Rice bran @2-3% body weight daily.
- Aquatic/terrestrial weeds

Fertilization :

- Organic : 4 - 6 kg cattle dung/decimal.
- Inorganic : 100 g Urea + 100 g TSP/decimal.

Harvesting : Rajputi in November.

Disease prevention :

- Pond liming in November @1.0 kg/decimal.

D. KHULNA AND BARISHAL DIVISION

1. Fish culture in seasonal ponds

<u>Pond preparation</u> :

- Liming - 1.0 kg/decimal
- Fertilization - organic manure - 4 kg/decimal.

<u>Species stocking density (No./decimal)</u> :

i)	Rajputi	48		ii)	Macrobrachium	15
	Silver carp	6	Or		Silver carp	10
	Mirror carp	6			Rohu	5
	Total	60				30

iii)	Rajputi	39
	Silver carp	6
	Macrobrachium	15
	Total	60

Feeding :

- Duck weeds, terrestrial/aquatic weeds and
- Rice bran @4-5% body weight daily.

Fertilization :

- Organic : 4 kg cattle dung/decimal/15 days.
- Inorganic : 100 g Urea + 200 g TSP/decimal/15 days.

Disease prevention :

- Pond liming in November @1.0 kg/decimal.

2. Fish culture in perennial ponds

Pond preparation :

- Draining of ponds/application of piscicide
- Liming - 1.0 kg/decimal
- Fertilization :
  i) Organic - 8 kg cattledung/decimal
  ii) Inorganic - 100 g Urea + 100 g TSP/decimal

Species stocking density (No./decimal) :

Shallow ponds		Deeper ponds
Silver carp	7	12
Catla	3	3
Rohu	5	3
Mrigal	6	3
Common carp	1	4
Grass carp	2	3
Rajputi	10	12
Total	34	40

(If Rajputi not available, Macrobrachium will be stocked @7-10/decimal instead of Rajputi).

Feeding :

- Rice bran @2-3% body weight daily.
- Aquatic/terrestrial weeds

Fertilization :

- Organic : 4 - 6 kg cattle dung/decimal.
- Inorganic : 100 g Urea + 100 g TSP/decimal.

Harvesting : Rajputi in November.

Disease prevention :

- Pond liming in November @1.0 kg/decimal.

Appendix-1

AREAS WHERE TECHNOLOGY TRANSFER THROUGH NGOs AND FEEDBACK TO RESEARCH PROGRAM WILL BE UNDERTAKEN DURING 1994-'95

FRI/DOF/BARC/ICLARM/USAID PROJECT

District	Thana
Brahmanbaria	Akhaura
Faridpur	Kalkini Bhanga
Barisal	Barishal Sadar Gournadi Ujirpur
Bogra	Shibganj Bogra Sadar Khahalu Nandigram Gobindaganj
Jaipurhat	Kalai
Chittagong	Bashkhali
Bhola	Bhola Sadar Borhanuddin
Mymensingh	Bhaluka Trishal
Rangpur	Mithapukur Rangpur Sadar
Rajshahi	Putia
Natore	Bonpara

Jamalpur	Sharishabari
Sylhet	Golapganj
Chandpur	Chandpur Sadar Motlab
Comilla	Chandina
Narsingdi	Narsingdi Sadar Shibpur
Dhaka	Dhamrai
Manikganj	Gheor Manikganj Sadar
Jessore	Monirampur Jessore Sadar Chaugacha
Jhenaidah	Jhenaidah Sadar
Manikganj	Saturia
Madaripur	Sadar
Naogaon	Sadar

Appendix-2

WORKSHOP ON
TECHNOLOGY TRANSFER THROUGH NGOs AND FEEDBACK TO RESEARCH
20-21 MARCH 1994

JOINTLY ORGANIZED BY FRI/DOF/BARC/ICLARM

VENUE : FRI AUDITORIUM

PROGRAM

Date/Time	Events	
20 March 1994		
90.00 - 10.00	Registration Inaugural Session Chairman :	Dr. M.A. Mazid Director, FRI
	Welcome address :	Dr. M.G. Hussain, CSO (cc), FRI
	Theme of workshop :	Dr. M.V. Gupta Senior Aquaculture Specialist ICLARM
	Speech by special Guests:	Dr. A.K.M. Nuruzzaman Member-Director (Fisheries) BARC
		Prof. Dr. Somen Dewan BAU, Mymensingh
		Mr. Kevin Mullaly, USAID
	Speech by Chief Guest :	Mr. A.K. Ataur Rahman Director, DOF
	Speech by the Chairman :	Dr. M.A. Mazid Director, FRI

	Vote of thanks :	Dr. M.J. Alam Senior Scientific Officer, FRI

TECHNICAL SESSION-I

	Chairman :	Mr. A.K. Ataur Rahman Director, DOF
	Rapporteurs :	Mr. Muhammad Zaher Senior Scientific Officer, FRI
		Mr. Md. Yahia Mahmood Scientific Officer, FRI

11.15 - 12.45	**Technologies for dissemination under the project**
11.15 - 11.25	Fish culture in perennial ponds Mr. Md. Shahab Uddin, Senior Scientific Officer, FRI
11.25 - 11.35	Fish culture in seasonal ponds Mr. A.H.M. Kohinoor, Scientific Officer, FRI
11.35 - 11.45	Integrated rice-fish farming Mr. Md. Aminur Rahman, Scientific Officer, FRI
11.45 - 11.55	Nursery pond management Mr. Md. Shahab Uddin, Senior Scientific Officer, FRI
11.55 - 12.15	Monitoring and evaluation procedures Dr. M.V. Gupta, Senior Aquaculture Specialist ICLARM
12.15 - 12.45	General discussion
12.45 - 13.45	LUNCH

TECHNICAL SESSION II

	Chairman :	Dr. A.K.M. Nuruzzaman Member-Director (Fisheries), BARC

Rapporteurs : Mr.Md. Shahabu Uddin
Senior Scientific Officer, FRI

Mr. Shaymal Chandra Mahata
Scientific Officer, FRI

13.45 - 17.00 **Presentation and discussion of program by region**
Dr. M.G. Hussain, CSO (cc), FRI

21 March 1994

TECHNICAL SESSION III

Chairman : Dr. M.A. Mazid
Director, FRI

Rapporteurs : Mr. Md. Shahab Uddin, SSO, FRI
Mr. Shaymal Chandra Mahata, SO, FRI

09.30 - 12.45 **Presentation and discussion of program by region**
Dr. M.G. Hussain, CSO (cc), FRI

12.45 - 13.45 LUNCH

TECHNICAL SESSION IV

Chairman : Dr. M.A. Mazid
Director, FRI

Rapporteurs : Mr. Muhammad Zaher
Senior Scientific Officer, FRI

Mr. Md. Shahab Uddin
Senior Scientific Officer, FRI

13.45 - 14.15 **Adoption of recommendations**
Dr. M.V. Gupta, Senior Aquaculture Specialist, ICLARM

14.15 - 16.00 Discussion and finalization of program

16.00 - 16.30 Concluding remarks by the Chairman and closing ceremony

Appendix-3

LIST OF PARTICIPANTS

Non-Government Organizations (NGO)

1. Md. Mokarram Hossain, Sector Specialist (Fisheries) BRAC
2. Md. Tofazzal Hossain, P.O (Fisheries), BRAC.
3. Md. Enamul Haque Anwar, P.O (Fisheries), BRAC.
4. Shahjahan, P.O (Fisheries), BRAC.
5. Md. Abdur Rahman, P.O (Fisheries), BRAC.
6. Md. Asad Ali, P.O (Fisheries), BRAC.
7. Subhas Chandra Ghose, P.O (Fisheries), BRAC.
8. A.K.M. Fouhad Kabir, P.O (Fisheries), BRAC.
9. Ashoke Kumar Das, P.O (Fisheries), BRAC.
10. Md. Fazlul Huq, P.P.C. Proshika
11. Md. Abdur Rahman, P.C.(Fisheries), Proshika.
12. Swapan Kumar Das, Associate Program Coordinator, Proshika.
13. Md. Altaf Hossain, Associate Program Coordinator, Proshika
14. S.M. Bakhtiar Firoz. D.W. Proshika.
15. Paritosh Kumar Sarker, J.P.O (Fisheries), Proshika.
16. Sk. Ali Afzal, J.P.O.Ag., Proshika.
17. Mohoshinuzzaman (HENA), Area Coordinator, Proshika.
18 Md. Golam Mostofa, FTW, Proshika.
19. M.A. Razzou, FTV
20. H.M. Edris, F.F., TMSS.
21. Md. Ataur Rahman, Fisheries Officer, TMSS.
22. Md. Badrul Alam, Trainer (Fisheries), Jagorani Chakra.
23. Francisco Noble, IVS Fisheries Advisor, ADAB.

Department of Fisheries

24. Mr. A.K. Ataur Rahman, Director
25. Md. Mosharraf Hossain, Thana Fisheries Officer, Baraigram, Natore.
26. Md. Shafiul Alam, Thana Fisheries Officer, Kalliani, Madaripur.
27. Md. Saidur Rahman, Thana Fisheries Officer, Shibgonj, Bogra.
28. Md. Azizur Rahman Sardar, Thana Fisheries Officer, Rangpur Sadar, Rangpur.
29. Md. Anwarul Haq, Thana Fisheries Officer, Gournadi, Barisal.
30. Md. Rafiqul Islam, Thana Fisheries Officer, Dhamrai, Dhaka.
31. Md. Abdul galie, Thana Fisheries Officer, Akhama, B. Baria.
32. A.N.M. Taher Noon, Thana Fisheries Officer, Banskhali, Chittagong.
33. Md. Shahidul Islam, Thana Fisheries Officer, Jessore Sadar.

34. Nusjer Chandra Das, Thana Fisheries Officer,, Kahalo, Bogra.
35. Ranjit Kumar Paul, Thana Fisheries Officer,, Sharishabari, Jamalpur
36. Mrs. Zazma Begum, Thana Fisheries Officer,, Chandina, Comilla.
37. Md. Mojibor Rahman, Thana Fisheries Officer, Trishal, Mymensingh.
38. A.S.M. Roshedul Haque, Thana Fisheries Officer, Bogra Sadar, Bogra.
39. Syed Sazzad Zahir, Thana Fisheries Officer, Monirampur, Jessore.
40. Timir Baran Mondal, Thana Fisheries Officer, Jhenaidah Sadar, Jhenaidah.
41. Md. Sharaf Uddin, Thana Fisheries Officer, Bhaluka, Mymensingh.
42. Azizul Haque, Thana Fisheries Officer, Wasinpure, Barisal.
43. Md. Motaher Hossain, Thana Fisheries Officer,, Chandpur Sadar, Chandpur.
44. Abdur Rashid Dhali, Thana Fisheries Officer, Narsingdi Sadar, Narsingdi.
45. Md. Rafiqul Islam, Thana Fisheries Officer, Nandigree, Bogra.

Fisheries Research Institute, Mymensingh

46. Dr. M.A. Mazid, Director.
47. Shah Md. Ershaduzzaman, Additional Director.
48. Dr. M.G. Hussain, Chief Scientific Officer.
49. Md. Abdur Rahman, Deputy Director.
50. Dr. M.J. Alam, Senior Scientific Officer.
51. Md. Abul Hossain, Senior Scientific Officer.
52. Md. Shahab Uddin, Senior Scientific Officer.
53. M.A. Zaher, Senior Scientific Officer.
54. Md. Zahirul Haque, Senior Scientific Officer.
55. Md. Aminur Rahman, Scientific Officer.
56 Yahia Mahmud, Scientific Officer.
57. Mohosena Begum Tanu, Scientific Officer.
58. A.H.M. Kohinoor, Scientific Officer.
59. Shayamal Chandra Mahata, Scientific Officer.
60. Goutam Buddha Das, Scientific Officer.
61. Masud Hossain Khan, Scientific Officer.
62. Md. Anwarul Islam, Scientific Officer.
63. M. Nurullah, Scientific Officer.
64. Md. Younus Mia, Scientific Officer.
65. Md. Kamruzzaman, Administrative Officer.
66. Durin Akhtar Jahan, Scientific Officer.

Bangladesh Agricultural Research Council (BARC)

67. Dr. A.K.M. Nuruzzaman, Member-Director(Fisheries), BARC.

Bangladesh Agricultural University

68. Prof. Dr. Manwar Ahmed, Director, BAURES.
69. Prof. Dr. Somen Dewan, Professor, Department of Fisheries.
70. Dr. Gias Uddin Ahmed, Asosciate Professor, Department of Fisheries and Limnology.

Food and Agriculture Organization (FAO)

71. Dr. Esmail Aghasadeh, Socio-economics Consultant.

United States Agency for International Development (USAID)

72. Mr. Latifur Rahman, Program Specialist.

International Center for Living Aquatic Resources Management (ICLARM)

73. Dr. M.V. Gupta, Senior Aquaculture Specialist
74. Dr. Eric Worby, Post-Doctoral Fellow.

ANNEX-5

Annex-5

PROCEEDINGS OF THE WORKSHOP ON BROODSTOCK MANAGEMENT AND OPPORTUNITIES FOR GENETIC IMPROVEMENT OF CULTIVATED FISH SPECIES

30-31 March 1994

Organized by
Fisheries Research Institute
and
International Center for Living Aquatic Resources Management

Aquaculture has been given priority in Bangladesh Government's efforts for increasing fish production, to meet the demands of increasing population. The major input required for any aquaculture operation or enhancement of fisheries, is the 'fish seed' or hatchlings/fry/fingerlings. In the past, fish seed for aquaculture operations, was collected from rivers. With the adoption of induced breeding technology in early 1970, a large number of hatcheries, estimatedly over 300, have been established in different parts of the country. These hatcheries are presently contributing nearly 75% of the total spawn (hatchlings) production in the country, the other 25% coming from rivers. In recent years, reduction in growth and reproduction performance, increased incidence of disease and morphological deformities have been reported from hatchery bred stocks. There is widespread concern that this may be due to inbreeding of cultured carp stocks.

In view of these concerns which will have a profound bearing on the aquaculture development in the country, a two day workshop on the subject matter was organized during 30-31 March 1994 at the Fisheries Research Institute (FRI), Mymensingh, which was attended by Managers of Government and Private hatcheries, Scientists and Planners - 38 in all (program and list of participants are in Appendix 1 and 2). Prior to the workshop, a number of hatcheries in Jessore and Comilla were visited by a team of researchers from FRI and ICLARM, to gather information pertaining to the practices followed by the hatcheries for broodstock management.

The workshop was divided into two technical sessions, one to discuss broodstock management in hatcheries and growth performance in grow out ponds and the second to discuss genetic improvement of cultured stocks.

The Chief Guest for the inaugural session of the workshop Prof. Shah M. Farouq, Vice-Chancellor of the Bangladesh Agricultural University, stressed the need for increasing fish production to meet the protein requirements of the country's population and the role of quality seed to achieve this. The Chairman of the inaugural session Dr. M.A. Mazid, Director of Fisheries Research Institute said that closer linkages between the researchers and producers are essential for the producers to know of the research results which they can apply for increasing production (quality and quantity) and at the same time researchers could know of the problems of producers and prioritize their research. FRI is striving to develop these linkages between the public and private sector and this workshop organized by FRI/ICLARM is probably the first of dialogues between researchers and commercial producers and hoped that these dialogues will continue in future.

Dr. M.V. Gupta, Senior Aquaculture Specialist of International Center for Living Aquatic Resources Management (ICLARM) while explaining the theme of the workshop, informed the participants that in recent years, farmers are observing decline in growth of certain species of carps in aquaculture operations and they are apprehensive that it is due to inbreeding of fish in hatcheries. Also, hatcheries have been encountering problems of mass mortality of seed of some species. Taking into consideration the importance of quality fish seed for increasing fish production through aquaculture and enhanced fisheries and the problems the sector is facing, the workshop was organized with the objectives : (i) to provide a forum to discuss problems/constraints common to hatcheries, identify causative factors and find solutions to problems; (ii) to understand probable causes for reported decline in growth performance of cultured fish stocks; (iii) to brief the hatchery managers of basic concepts of genetics (selection and breeding) in relation to routine broodfish management; and (iv) to develop a simple genetic improvement program that could be undertaken by the hatchery managers with their available resources.

The first technical session was devoted to broodfish management in hatcheries and growth performance of carps in grow-out ponds. Government and Private Hatchery Managers presented reports as to how they manage broodstock in their hatcheries, problems they are facing in hatchery production and requested guidelines for reducing mortality of seed and broodstock management practices for production of quality seed. The presentations brought out the following issues :

i) A wide range of stocking densities of broodfish are followed by hatcheries, which are very high in some cases;

ii) Disease, mainly 'argulosis' is prevalent in broodfish ponds and Dipterex, a pesticide used for controlling *Argulus* is presently not available in the market. Locally available pesticides such as "Sumithion" and "Nogos" are being used and these chemicals are probably retarding the maturity of broodfish;

iii) Some hatcheries breed same fish 2-3 times in a season; what should be the optimum number of times the same brood fish could be bred in one season, without affecting quality of seed produced;

iv) How to achieve early maturity in carps;

v) Remedial measures for controlling high iron content in tubewell water;

vi) Difficulties in attaining maturity in certain species of carps;

vii) What should be the ideal feed for broodstock;

viii) Lack of knowledge for water quality management to hatchery staff; etc.

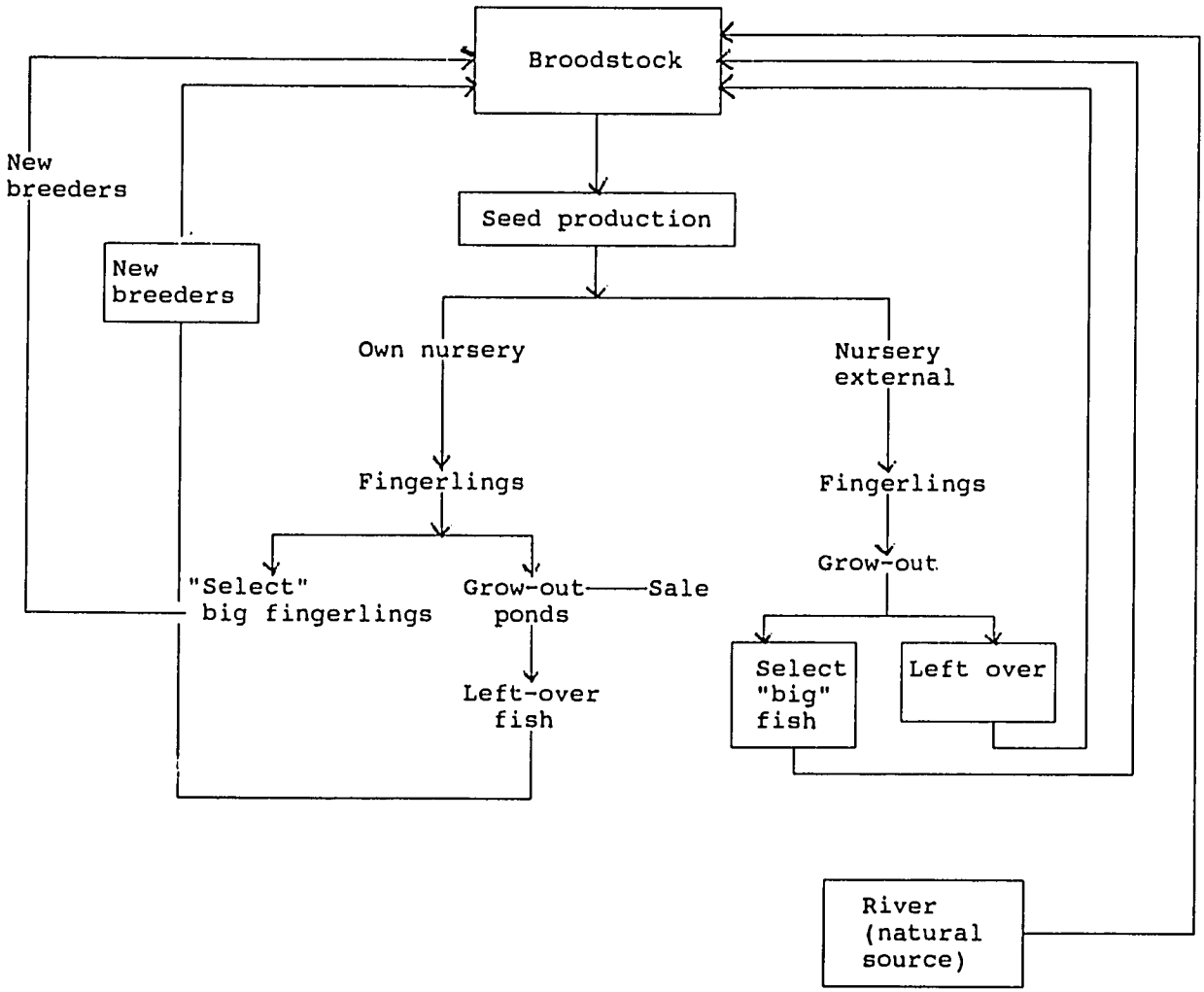
These issues were discussed in detail and suggestions were made by the resource persons present. Another important issue raised by the Hatchery Managers, specially from Jessore, where a large number of hatcheries are located and contribute a substantial portion of the fish seed produced in the country, is that, some hatcheries use very small size broodfish, even less than 500 g each in weight and whether this will have any affect on the quality of seed produced, and if so, what measures need to be taken for quality control.

Many hatchery producers from Jessore area reported mass mortality of 4-5 days old rohu (*Labeo rohita*) spawn in incubation jars and hapas, during June - July months. Before June, they do not encounter any problems and achieve high spawn production. Probable causative factors such as high stocking densities, poor water quality and sanitation, disease, condition of broodfish, etc., were discussed, but it was not possible for the resource persons to pinpoint the causative factor(s) in the absence of first hand information. In view of this, it was agreed that a Scientist of FRI will visit hatcheries in Jessore and undertake investigations during June - July 1994. Many Hatchery Managers came forward to provide space and facilities to the scientist.

During the second technical session, Dr. M.G. Hussain, Chief Scientific Officer, Fisheries Research Institute, presented details of initiatives undertaken by FRI, for genetic improvement of aquaculture stocks, which include : (i) induction of gynogenesis and clonal lines in rohu (*Labeo rohita*); (ii) stock improvement through selective breeding and line crossing techniques and production of all female populations in case of rajputi (*Puntius gonionotus*); (iii) production of all male population by sex reversal techniques, and induction of genetically sterile populations in case of nile tilapia (*Oreochromis niloticus*); (iv) development of homozygous red mutant tilapia; (v) stock improvement by cross breeding and hybridization and production of genetically sterile populations in case of catfish (*Clarias sp.*); and (vi) gene pool conservation for endangered species - Pabda (*Ompok bimaculatus*), Gulsha (*Mystus cavasius*) and Mahaseer (*Tor putitora*).

This was followed by Dr. A.E. Eknath, Senior Scientist, ICLARM explaining and intiating discussion on indirect selection and inbreeding during routine broodstock management in hatcheries. The discussions focussed on origin of founder stocks (broodstock during the first year of a hatchery), general broodstock management practices and methods of replacement of breeders. Majority of the hatcheries have built their founder stocks by procuring breeders from grow-out ponds in their area. Method of replacement of breeders followed by hatcheries is presented schematically in Fig. 1. The hatcheries have been replenishing their stocks from (i) internal sources (from their hatcheries itself or from nurseries that received spawn from that

FIG.1. BROODSTOCK REPLACEMENT PRACTICES FOLLOWED BY HATCHERIES



particular hatchery), or (ii) external sources (collecting fingerlings/breeders from grow-out ponds which have received fingerlings from other hatcheries or from natural riverine sources), or (iii) mixed sources (from internal and external sources). There has been "unconscious" negative selection in some hatcheries. Some hatcheries collect fish from grow-out ponds after relatively bigger (and hence fast growing) individuals have been sold and collect smaller (and hence slow growing) fish for broodstock build-up. Negative selection is also resulting when hatcheries inadvertantly use left-over fingerlings (after selling fast growing, hence "good" fingerlings) from nursery ponds, for broodstock raising. In a given spawning season, it is generally the bigger breeders that are induced to spawn during the early part of the spawning season and relatively smaller individuals are spawned during later part of the season. If the seed produced early in the season from bigger broodfish (probably faster growing) are sold and seed produced in the later part of the season from smaller broodfish (probably slow growing) are retained for broodstock build-up by the hatcheries, it will result in negative selection.

The hatchery managers have been advised to avoid inbreeding through: (i) selection of fingerlings or broodstock when they are young and fast growing, (ii) set a minimum size of breeders for use during breeding, (iii) exchange of stocks between hatcheries, and (iv) keeping few fingerlings (fast growing ones) from as many broodfish as possible, for eventual replenishment of broodstocks. It is also essential that the hatchery managers monitor and receive periodic feedback from grow-out farmers who are using the seed produced from their hatcheries, about performance of stocks in their ponds. In case the grow-out farmers report slow growth of fish, the hatcheries should replace breeders with fish from unrelated stocks.

After two days of extensive discussions, the workshop came up with the following recommendations :

1. To control the use of inferior quality broodfish for seed production by hatcheries, the Government should impose restrictions on minimum size of fish used for breeding. Since size of fish also depends on age, the size of fish at first maturity used for breeding should be as below :

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Catla	: > 3kg
Rohu	: > 1kg
Mrigal	: > 1kg
Grass carp	: > 2kg
Silver carp	: > 1.5kg
Bighead carp	: > 2kg
Common/Mirror carp	: > 1kg
Rajputi	: > 150g

2. Mass mortality of spawn of rohu and some other species in Jessore hatcheries, is causing heavy losses and need to be investigated. FRI should station a scientist in Jessore during next spawning season, to investigate causes for mass mortality and suggest remedial measures.

3. In view of the importance of Jessore in seed production, FRI should consider establishing a sub-station in Jessore.

4. Some of the inputs needed for seed production such as rotenone, dipterex and phostoxin are not available in the market. Government may take necessary action for easy availability of these inputs.

5. "Secufon" is available as substitute for Dipterex, to control 'argulosis' in broodfish ponds. FRI may take necessary studies to determine the effective dosage of "Secufon" for control of *Argulus*.

6. There should be such annual conferences in future involving FRI scientists, DOF extension workers and private sector producers, to discuss problems and exchange ideas/knowledge. It is preferable to hold the future meetings in February, before the onset of fish breeding season.

Appendix-1

WORKSHOP ON
BROODSTOCK MANAGEMENT AND OPPORTUNITIES FOR GENETIC IMPROVEMENT OF CULTIVATED FISH SPECIES

Organized by FRI/ICLARM
30-31 March 1994

Venue : Fisheries Research Institute, Mymensingh

Participants : Private and Govt. Fish Hatchery Managers and Fish Culturists

March 30, 1994

10.00 - 10.30 **Inaugural Session**

Chairman : Dr. M.A. Mazid
Director, FRI

Chief Guest : Prof. Shah M. Farouq
Vice-Chancellor, BAU

10.30 - 11.00 Tea break

11.00 - 16.30 **Technical Session I :**

Broodstock management and growth performance of carps in hatcheries and grow-out ponds

Chairman : Dr. N.M. Miah
Head, Rice Breeding Division
BRRI

11.00 - 13.00 Presentation of experience reports by Hatchery/Farm Managers and grow-out pond culturists.

13.30 - 14.30 Lunch

14.30 - 16.30 Round table discussion :

Identification of causes for problems in hatcheries and decreased growth performance of aquaculture stocks.

Moderator : Dr. M.V. Gupta
Senior Aquaculture Specialist
ICLARM

March 31, 1994 :

09.00 - 13.00 **Technical Session II :**

Genetic improvement and broodstock management

Chairman : Mr. M.A. Mazid
Director, FRI

09.00 - 09.30 Approaches to genetic improvement and FRI's initiatives.

Dr. M.G. Hussain
Chief Scientific Officer (cc)
FRI

09.30 - 10.30 Indirect selection and inbreeding during routine broodstock management in hatcheries.

Dr. A.E. Eknath
Senior Scientist, ICLARM

10.30 - 11.00 Tea break

11.00 - 13.00 Discussion on approaches to maximize genetic potential of aquaculture stocks and for initiating a simple genetic improvement program.

13.00 - 14.00 Lunch

14.00 - 16.00 **Technical Session III : Recommendations and closing**

Chairman : Dr. M. A. Mazid
Director, FRI

Appendix-2

LIST OF PARTICIPANTS

1. Md. Shahidullah Bhuiyan, Farm Manager, Fish Seed Production Farm, Mandary, Laxmipur.
2. Md. Nazrul Islam, Farm Manager, Department of Fisheries, Mashkanda, Mymensingh.
3. Md. Abul Hossain Miah, Farm Manager, Department of Fisheries, Malatinagar, Bogra.
4. Washidun Wabi Chowdhury, Principal, Department of Fisheries, Faridpur.
5. Md. Iskander Ali, Farm Manager, Department of Fisheries, Sadar, Jessore.
6. Md. Muklesur Rahman Chowdhury, Farm Manager, Department of Fisheries, Comilla.
7. Md. Nurul Islam, Hatchery Manager, Maskanda, Mymensingh
8. Kapil Prasad Chowdhury, Hatchery Manager, Jhalak Hatchery, Gouripur, Mymensingh
9. Abdus Samad, Hatchery Manager, Alamdhigi Hatchery, Bogra
10. Raki Ahmed (acchu), Hatchery Manager, Rafi Fish Farm, Bogra
11. Hasan Iman, Hatchery Manager, Rupali Fish, Comilla
12. Md. Mofizur Rahman, Hatchery Manager, Gopalnagar Hatchery, Comilla
13. Md. Rezaul Islam Khan, Hatchery Manager, Sagor Fish Breeding Farm, Bogra
14. Khaza Khairuzzaman (Shyamal), Hatchery Manager, Jonaki Fish Breeding Farm, Bogra
15. Md. Ali Shanowar (Shazu), Hatchery Manager, Swarna Fish Seed Production Farm, Bogra
16. Md. Saifuzzaman Manju, Hatchery Manager, Small Fish Culture Project, Jessore
17. Shekh Khalid Saifullah, Hatchery Manager, Sonali Fish Culture Project, Jessore
18. Shekh Md. Shahabuddin, Hatchery Manager, Bismillah Fish Farm, Jessore
19. Sree Amal Barman, Hatchery Manager, Mili Fish Farm & Hatchery, Jessore
20. Md. Younus Ali, Hatchery Manager, Mymensingh
21. Iftekhar Aziz, Managing Director, Dhaka Fisheries Ltd.
22. A.T.M. Quamrul Islam, Technical Director, Modern Fish & Hatchery Complex
23. Dr. M.A. Mazid, Director, FRI
24. Shah Md. Ershaduzzaman, Additional Director, FRI
25. Dr. M.G. Hussain, Chief Scientific Officer, FRI
26. Muhammad Zaher, Senior Scientific Officer, FRI
27. Shahab Uddin, Senior Scientific Officer, FRI
28. Md. Abul Hossain, Senior Scientific Officer, FRI
29. Yahia Mahmud, Scientific Officer, FRI
30. Md. Shahidul Islam, Scientific Officer, FRI
31. Md. Younus Mia, Scientific Officer, FRI
32. Shyamal Mahata, Scientific Officer, FRI

33. Mohosenu Begum Tanu, Scientific Officer, FRI
34. M. Nurullah, Scientific Officer, FRI
35. Dr. N.M. Miah, Head, Research Breeding Division, BARI
36. Prof. S.M. Fruque, Vice-Chancellor, BAU
37. Dr. A.E. Eknath, Senior Scientist, ICLARM
38. Dr. M.V. Gupta, Senior Aquaculture Specialist and Team Leader, ICLARM