

## Discussion Groups

### Introduction

Three groups were selected to discuss: (i) strategies for genetic management and improvement; (ii) the role of institutions in genetic management and improvement; and (iii) the role of exotic cyprinids in aquaculture. Each group was selected to include participants with a variety of relevant experience. Participants were asked to bear in mind the main species and geographical focus of the workshop, i.e. Chinese carps in aquaculture in Bangladesh, but to broaden their discussion if appropriate (for example if experience from other species or countries was relevant, or if some points applied to indigenous as well as exotic species). All of the discussion was in the context of the main developmental goal, i.e. how can genetic management/improvement of fish stocks reach and benefit the livelihoods of the poor?

### Discussion Group 1: Strategies for Genetic Management and Improvement

This group was asked to consider the technical aspects of genetic management and improvement, including aspects such as “top-down” v’s “bottom-up” strategies, centralised v’s decentralised strategies and different types of technologies, with the focus on the poor as the target group.

#### *Group members:*

MG Hussain (BFRI, chair)	GC Mair (AIT, rapporteur)
BK Barman (ICLARM/IOA/DOF)	A Bart (AIT)
TK Das (NFEP, DOF)	Hameed (BINA, BAU)
M Islam (NFEP, DOF)	MN Islam (FTEP, DFID)
MI Khan (private hatchery owner)	MY Mia (BFRI)
MS Shah (Kulna University)	S Sharia (BRAC)

#### *Major issues:*

- Lack of management in the hatcheries and understanding of genetics leads to inbreeding, introgression and negative selection (e.g. size biased selection of broodstock)
- There exists a need for shorter term and long term programmes for improvement and conservation of germplasm, including training
- Traits for selection should include growth and disease resistance

#### Discussion Groups

- There is a lack of feedback from farmers to seed producers so impact of current management practices are not known. Misconceptions about quality of seed are passed on to farmers through nurseries
- Priority species for poor farmers and consumers, suited to low input aquaculture include:
  - Silver carp
  - Common carp
  - Silver barb
  - Tilapia

#### ***Hybridization issues:***

- Scientific literature on hybridisation in carps suggests that it is unlikely that there are any major benefits from its application, particularly given the absence of heterosis for commercially important traits in most cases. The very limited incidences where hybrids have been adopted for commercial aquaculture appears to reinforce this view.
- Potential disadvantages of hybridisation relate to problems it creates in maintaining purity of broodstock and the loss of the benefits from distinct ecological niches occupied by pure species which forms the basis for composite fish culture (polyculture). Also the discrete nature of improvement may limit scale of impact (only those with access to parental strains would be able to produce improved hybrid seed).
- Hybridisation is done to address constraints existing within hatcheries, NOT in response to demand. Constraints include:
  - Male bighead carp mature later than the females (females mature in April, males in May in NW Bangladesh) meaning that males are not available early in the breeding season.
  - The demand is higher bighead carp as they grow faster. However silver carp females are more fecund so produce more fry. Hybrids are thus produced using silver carp females with bighead males but fry are often sold as bighead.
- Hybridisation should be discouraged and the following measures could be taken to achieve this.
  - Raise awareness of the issue through training and extension
  - Address constraints directly, e.g. through making cryopreserved sperm available early in the breeding season or including time of maturation as a trait in breeding programmes
  - Legislate through certification and application of genetic markers although doubts exist whether such legislation would be enforceable.

***Genetic improvement approaches – longer term:***

- Emphasis should be on selection, initially with mass selection as the most realistic technique
- Responsibility for quality should reside with research institutions, Government hatcheries and selected NGOs. There is a need to formulate policy on this issue (see Group 2 report)
- The risk remains that some hatcheries may remain outside of centralised systems of seed supply and this issue needs to be addressed, possibly through the greater inclusion of NGOs.
- Certification and monitoring systems are needed to ensure adequate quality control in the production and dissemination of improved fish breeds
- The selection environment should be representative of culture systems (particularly low-input systems) and ideally stakeholders (farmers) should be involved in setting breeding goals (and where feasible also in the process of selection)

***Training needs:***

- Formal training in technical aspects of broodstock management and development should be targeted at:
  - Selected hatcheries with the necessary resource base
  - Government employees within various agencies
  - Trainers of trainers (TOT) including DOF staff and extension agents
- Awareness of best practices in broodstock management should be raised through a variety of media, focusing on hatchery operators, nurseries and seed traders
- Cross-visits between scientists to different countries where advances in genetics are occurring would help researchers in maximizing the practicality and efficiency of breeding programmes.

***Gene banking:***

- It was reported by some participants that up to 90% of seed production of silver and bighead carps uses artificial fertilization, although this figure is much lower for other carp species. This creates the opportunity for the utilisation of cryopreserved sperm which requires artificial fertilization.
- There may be a demand from private hatcheries for cryopreserved sperm from good quality broodstock
- The potential appears to exist for using cryopreserved sperm to distribute quality germplasm and address constraints which give rise to the use and misuse of hybridisation
- It was thought by participants that use of cryopreserved sperm could be economically viable but this would need to be investigated.

#### Discussion Groups

- There may be some risk in the widespread use of cryopreserved sperm if sperm quality is not assured
- A pilot research study was advised and a proposal should be developed for such a study
- It was noted that there is also a demand for gene banking for conservation of threatened species

#### ***Alternative management/improvement technologies:***

In a discussion on alternative and shorter term genetic improvement strategies, three priority research areas were identified.

- Continue with development and promotion of monosex silver barb
- Development of genetic markers for detection of introgression for all carps
- Respond to the growing demand for monosex tilapia through sex reversal and GMT technologies

#### **Discussion Group 2: The role of institutions**

This group was asked to look at how different institutions could work together to manage, improve and disseminate stocks of carps in ways which would reach and benefit the poor.

#### ***Group members:***

MA Mazid (BFRI, chair)

MA Sattar (NFEP)

MG Rabbani (NFEP)

MTH Farhaji (MOFL)

F Rajts (4<sup>th</sup> FP)

BJ McAndrew (IOA, rapporteur)

Y Basavaraju (UASB)

MR Azam

M Hossain (BRAC)

The attached figure shows a model devised by the group for the potential roles of different institutions in genetic management and breeding programmes for the different species of carps that are important in hatchery-dependant aquaculture and fisheries in Bangladesh. This centres around “*lead broodstock centres*” and addresses the role of different institutions in management of these stocks, dissemination, training and research. Staff in these lead broodstock centres would need to be “genetically aware”, i.e. to have sufficient knowledge of genetics to manage these core stocks.

It should be noted that some of the elements of this already exist. For example, wild-origin stocks of Chinese carps are held at the NFEP campus in Parbatipur, BFRI

maintains stocks of several species (including a selective breeding programme for silver barb and landraces of major carps) and BRAC has a selective breeding programme for major carps (with scientific advice from BFRI). Realistically, it is beyond the capacity of any single institute to hold and properly manage stocks of all of the carp species that are important to aquaculture and enhanced fisheries in Bangladesh (an additional factor is that it is generally considered that separate hatcheries should be established to produce fish for aquaculture and restocking, since in the former it is desirable to select for improved performance in culture while in the latter the emphasis is generally on minimising any changes from wild characteristics).

In addition to the lead broodstock centres, it would be necessary to have “*broodstock multiplication centres*” in different parts of the country to act as focal points for the multiplication and dissemination of quality broodstock from the lead centres in each geographical division of Bangladesh. These broodstock multiplication centres would need to have staff who were trained in appropriate aspects of genetic management of broodstock. These would probably be DOF hatcheries, although it is possible that NGO hatcheries could take up this role. There may be a need for additional nurseries to rear these seed to fingerling or larger stages before dissemination to the existing hatcheries (mostly private, also NGOs, some DOF) which account for mass seed production in Bangladesh.

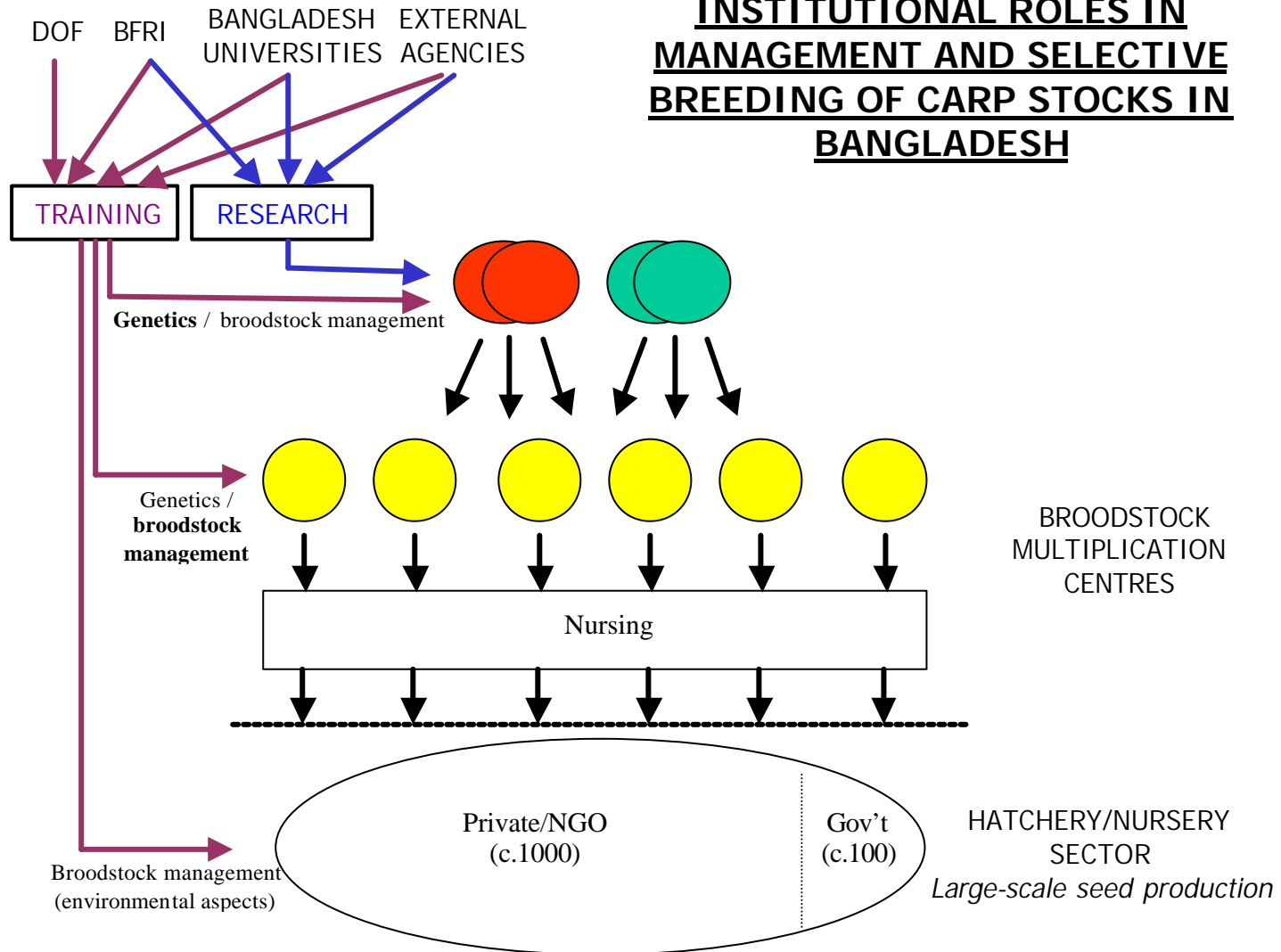
The figure shows how different organisations would contribute to research and training. The policy for such a scheme would be largely determined by DOF and BFRI, and initiation would have to be taken up by the DG’s of these two organisations. Training was identified as a key requirement: within the core of the scheme this would include 2-3 PhD’s (for the lead broodstock centres), 46 MSc’s and approximately 30 short course training places for hatchery managers.

The GEF may be able to organise some of the training (see Discussion following these presentations).

Note added during editing: cross-programme DFID funds have been allocated to study the role of genetic management in fisheries enhancement in Bangladesh (Ian Payne/BJM).



# INSTITUTIONAL ROLES IN MANAGEMENT AND SELECTIVE BREEDING OF CARP STOCKS IN BANGLADESH



**Discussion Group 3: the role of exotic carps**

This group was asked to examine the role of Chinese and other exotic carps in aquaculture, fisheries and sustainable livelihoods in Bangladesh - species, trends, priorities and problems associated with the use of exotic species - and to consider whether the silver x bighead carp hybrid does have a role in aquaculture here.

**Group members:**

K Ahmed (BARC, chair)

MS Islam (BFRI)

MA Rahman (BFRI)

AK Sarker (FFP)

MS Alam (BAU, rapporteur)

AHM Kohinoor (BFRI)

M. Shazu (private hatchery owner)

A Woynarovich (MAEP)

**Species and trends:**

- Silver carp accounted for 25% of carp production in Bangladesh in 1999 according to FAO figures. Participants thought that this may be decreasing
- Bighead carp did not appear in the 1999 FAO figures – may be decreasing?
- Grass carp (10% of carp production in Bangladesh in 1999)
- Black carp (not listed in 1999 figures) – not widely accepted
- Silver barb (not listed in 1999 figures) – increasing, widely accepted
- Common carp (10% of carp production in Bangladesh in 1999) – stable

**Priorities:**

- A greater understanding of market-driven production is required. Production of different species changes very rapidly in Bangladesh in response to e.g. small changes in market prices, leading to rapid rises and falls in production levels (e.g. recent boom and bust in *Pangasius* production).
- Research supporting production, e.g. on broodstock propagation (including unplanned hybridization), nursery and table fish production.
- Training and extension.

**Problems:**

- Decreasing growth performance of silver and bighead carps is widely reported
- Competition exists between bighead carp and other zooplankton feeders (principally catla)
- Competition for farm resource allocation exists between cattle and macrophagous exotic fish species (grass carp, silver barbs)
- Disease susceptibility (e.g. silver barbs)
- Non-availability of required size fingerlings (e.g. silver barbs)



#### Discussion Groups

- Marketing of exotic species

The question of whether there is a role for the silver x bighead carp hybrid requires further evaluation and detailed study.

#### **General discussion after summary of group presentations**

This discussion took place following a presentation of a summary of the group presentations by D. Penman (the final version of this is included in the workshop Summary and Recommendations). The names of those who made the contributions to this discussion (below) were not recorded.

#### ***Main points raised in discussion:***

- The genetic study on silver carp, bighead carp and hybrids should be broadened to look at intraspecific variation and morphological aspects such as length of gut (longer in silver carp), gill morphology and pectoral fin length (no overlap with pelvic fin base in silver carp, overlap present in bighead carp).
- Genetic studies should be broadened to indigenous species. This will not happen under the present project, but the human resource development suggested by this meeting should apply to all species.
- Aquaculture in Bangladesh has already benefited from movements of exotics (e.g. Chinese carps, silver barb, Nile tilapia): this should be supported within a responsible framework (quarantine, etc).
- Hybridization could perhaps be avoided by using cryopreserved sperm when there is a lack of mature males to fertilise eggs?
- Although the present project focuses on exotic species (since it is more difficult to obtain wild or new stocks of such species), it was suggested that appropriate management/improvement measures should also be put into place for endemic species, before problems of availability of wild stocks arise.
- There may be a need for periodic upgrading of stocks of exotic species.
- Mechanisms and funding sources need to be identified which can support training and the upgrading of laboratory facilities.
- The role of different institutions in genetic management/improvement should be explicitly stated in the workshop recommendations.
- The project should be able to leave visible, sustainable outputs behind after it is finished. To do so, synergy between different projects, institutions, etc is needed for human resource development, upgrading institutional capacity, information networking, etc. It was pointed out that it is sometimes difficult to find out about all of the different projects in Bangladesh. The project organisers will attempt to

ensure maximum availability of the proceedings, both as a hard copy proceedings and by placing it on the DFID AFGRP website (<http://www.dfid.stir.ac.uk>).

- Silver carp and bighead carp contribute individually to aquaculture in Bangladesh, but we need more information about what is happening in the field – especially hybridization.
- Market-driven production – Bangladesh has a very sensitive and rapidly changing market. Appropriate training, i.e. teaching farmers the principles of aquaculture, not simply “recipes”, should allow them to adapt their aquaculture practices more rapidly to respond to changing trends. Training in genetic aspects would make farmers more capable of avoiding poor quality seed. It is best if such pressure can come from buyers (farmers), although certification could perhaps help.
- The role of exotics in fisheries was not discussed, since there was nobody in the group with the relevant expertise. This was put to the meeting for comments from outside of group 3. It was suggested that there is certainly a role for the silver carp in aquaculture in Bangladesh, since here are no suitable endemic species which consume phytoplankton. The silver carp does not do well in rivers during the rainy season due to suspended silt, and it is also highly migratory. A review of the open water stocking programme with silver carp did not support the yields initially claimed. The common carp may compete with endemic species, but does not appear to have established yet. The common carp does well in e.g. flooded rice stubble – it can grow to 2-3 kg after 5-6 months of the flood season, and has better growth potential than comparable endemic species e.g. mrigal (200-300 g over the same period). Turning to non-cyprinid exotic species, there seems to have been little establishment of the Nile tilapia in Bangladesh, and this may also be true of the African catfish, although this has not been studied in enough depth.
- It was suggested that the bighead carp should be banned from Bangladesh, due to its competition with catla and hybridization with the silver carp.

***Future actions:***

- The AFGRP cannot fund training (except in some cases as part of research projects), but recommendations from a workshop such as this may help to obtain such funding from other sources. The 4<sup>th</sup> Fisheries Programme may be able to provide some training, but this has not been decided yet.
- The Bangladesh Universities, IOA and AIT all expressed willingness to carry out training in genetics at various levels.
- There is a need for collaboration between the Bangladesh Universities, BFRI, DOF, etc on training of staff for developmental and implementation agencies.
- NGO's and the private sector should also be included in programmes such as that suggested by discussion group 2, where they can have competency. Different

#### Discussion Groups

institutions are already involved in genetic management/improvement of different species (NFEP, DOF – Chinese carps; BFRI – silver barb, GIFT tilapia and others; BRAC – major carps)

- Trained staff also need to be given the appropriate opportunities to use their expertise. This is often a constraint. There is a need to use trained staff in effective ways.