Broodstock Management of Chinese Carps and Dissemination Strategy at NFEP, Parbatipur

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Abstract

Advancement of aquaculture in the Northwest region of Bangladesh is due to the success of induced breeding and development of public sector and private sector hatcheries and nurseries. During the recent years there has been a growing concern of the availability of good quality fish seed by the producers for sustainable fish production. Management of broodstock has, therefore, to be taken into consideration. This paper will firstly highlight the Passive Integrated Transponder (PIT) tagging technique and Genetically Improved Broodstock Replacement Programme in use at NFEP. A comparative growth trial of old, crossbred and new (imported from China) silver carp was conducted. The new silver carp stock demonstrated better performance in growth and survival compared to the old and crossbred ones. Secondly, dissemination strategies have been implemented for imported Chinese carp stocks at Parbatipur through provision of training and distribution of quality fingerlings to private and public hatchery operators from the project. A future plan of broodstock management is also highlighted for the development of more effective improved broodstock with newly approved project support.

Introduction

The Northwest Fisheries Extension Project (NFEP) was a bilateral project implemented by the Department of Fisheries (DoF), Government of Bangladesh and the Department for International Development (DFID) of the United Kingdom The overall objective of NFEP was to increase fish production and income of the poor farmers in the northwest region of Bangladesh. The following strategies were adopted to achieve these objectives:

- Development and execution of broodstock strategy for improved quality seed supply
- Testing and development of fish culture methodologies suitable for the low and middle income fish farmers in the locality
- Testing and development of effective extension and training methodologies appropriate for the needs of the poor
- Implementing Training of Trainers course to develop trainers in aquaculture in both public and private sectors

The existing Chinese carps populations in Bangladesh are all based upon 2 or 3 introduction of small numbers of fish from Nepal which were of unknown genetic quality. In 1994, in collaboration with the Network of Aquaculture Centres in Asia (NACA), NFEP imported Yangtze River silver, bighead and grass carp fry from China. 740 of those imported fingerlings were given away to 4 Government hatcheries (Kotchandpur, Kurigram, Ishwardi and Natore). The value of these fish has already been lost because the 4 farms mixed the pure Chinese fish with their old existing stock. With increasing international restrictions future importation will be difficult. It is vital therefore to at least maintain the genetic diversity and aquaculture performance of exotic stocks presently in the country.

The programme for broodstock development and dissemination started in 1994 after the importation of the fingerlings, with their management for making them as quality broodstock in keeping them in separate ponds. The breeding programme started when they matured in the 1997 breeding season and after that the dissemination programme started. The programme was conducted by using a tagging technique with support from a genetic advisor, Dr. Brendan MacAndrew of the University of Stirling. The advisor provided practical training to the hatchery staffs for successful implementation of the program. In between the hatchery officer also received overseas training at Stirling to make the programme more effective. Based upon gained knowledge, the hatchery staffs provided training to the private and Government hatchery operators on maintenance of quality broodfish in their farms for the production and supply of quality fingerlings.

This paper briefly highlights the overall methodology for effective management of broodstock and their replacement. Dissemination of broodstock management techniques and the distribution of imported quality Chinese carps fingerlings to private and public farms are described. Finally, the outcomes of on-station trials on the comparative performance of newly imported silver carp, old silver carp and cross bred fingerlings is mentioned.

Farm and Hatchery: physical and biological resources

Parbatipur farm complex covers an area of 50 acres and comprises a renovated old farm. This now contains a modern farm and hatchery with administration building, training room and library, dormitories, staff accommodation, fry traders temporary accommodation and a 175 decimal rice-fish trial plot facility (see Table 1). The total water area is 24 acres (10 hectares), with 42 ponds (1,801 decimals), 15 trial ponds (30 decimals), 3 borrow pits (555 decimals) and 2 drainage canals (125 decimals).

To attain sustained production by the producers, the availability of quality seed is vital. Realizing the importance of quality seeds for sustained fish production, NFEP has been selected as one of the brood development centres in the northwest. As stated earlier, NFEP imported pure strain fry of Silver carp, Bighead carp and Grass carp from the Yangtze River, China. The new stocks have been managed and reared separately to maintain pure strains of the imported Chinese carps. Table 2 shows the number and weight of Chinese carps kept and maintained by the NFEP to produce genetically improved seeds.

Table 1. NFEP physical and biological resources.

Pond Type	Number	Area (m^2)	Area (decimals)	Area (hectares)
Broodstock	13	280908	723	2.88
Broodstock replacement	5	23,662	592	2.37
Hatchling nursery	7	5,644	141	0.56
Fingerling nursery	14	25,758	644	2.58
Polyculture	1	4,280	107	0.43
Training	3	3,104	78	0.31
Trial				
Grand Total	60	95,452	2,386	9.54

Table 2. Pure broodstock of Chinese carps at NFEP.

Species	New broodstock (Number)	New brood stock Total Weight (kg)
Silver carp	486	625
Big head carp	399	950
Grass carp	155	387

Methodology of Broodstock Management and Replacement

It is important to note that as in other parts of the country, silver carp hatchlings are the major species produced by the NFEP. Due to rapid growth and better performance compared to native Indian major carp species, the demand for silver carp in particular in this region is high. It is also noted that the major production in the pond based aquaculture systems comes from silver carp. In addition, there is greater risk of hybridization between silver carp and bighead carps and eventually deterioration of the quality of the original strain. To maintain the genetic quality, maximisation of the effective breeding number (Ne) is necessary. (Ne = effective breeding number which is the number of parents that produce offspring that are represented in the next generation of breeders).

NFEP adopted the Trovan electronic tagging system to individually identify all genetically improved brood stock.. NFEP will implement techniques that will ensure the long term genetic viability of these stocks.

Tagging Technique

In 1997, NFEP piloted an electronic tagging system (PIT tagging) to address the problems encountered using external suture tags. For the technically minded the Trovan LID-500 system uses a passive transponder (the ID tag), consisting of a microchip connected to a small induction coil wrapped around a graphite antenna, sealed inside a glass capsule (1.5mm in diameter and 12mm long). Following anesthetisation of the fish in a Benzocaine solution, the tag is inserted intra-muscularly into a small scalpel incision between the lateral line and dorsal fin, or alternatively into the body cavity. The incision is then immediately sealed with a mixture of surgical adhesive and antibiotic powder. Since the glass case is biologically inert there is little risk of rejection or fouling. 200 fish can be tagged comfortably per day by a skilled team and tags can be re-used if dead fish can be retrieved.

A hand held tag reader emitting a low frequency electromagnetic field causes the tag (transponder) to give off a unique 10-digit ID code which is read by the reader .The hand held reader can collect and store over 1000 tag codes which can be downloaded to a computer data base. In addition the reader can be programmed to search for specified tag numbers which will be extremely useful for broodstock selection during the spawning season. This system is the most reliable method of identifying individual fish to date and will be invaluable to fish breeding centres (DFID Fisheries Bangladesh, 1997).

Broodstock Replacement Technique

A simple protocol was developed to ensure that all females contribute genetic material to the next generation of brood fishes. At the time of breeding, all tagged fish are mated in single pair crosses to ensure equal numbers of male and female fish, the PIT tag numbers are recorded for each pair. 10-20 grams of fertilised eggs from each pair are put it into a separate incubation jar while the rest of the eggs are put in the main production jar. This is done batch wise to maximise the effective population size (Ne: Tave, 1993) in the whole breeding season. All tag numbers and crosses are recorded in each cycle. It is important to ensure during the broodstock replacement programme that each pair of fish spawned contributes once only to the next generation: if spawned again the hatchlings are sold to the farmers and not added to the replacement pool.

For the replacement programme, each batch of hatchlings is put in a separate nursery pond, nursed for 4 weeks and 1000 fingerlings randomly selected (to minimise the negative selection) from each batch and put into the brood replacement pond. The main idea of this programe is to maximise the Ne as much as possible. Ne>50 gives inbreeding of less than 2%. By aiming to set Ne at 50-100, this should effectively limit inbreeding to a level which is acceptable. This is being done by having each pair of fish contribute an equal number of fingerlings to broodstock replacement. The total production % of pure strain Chinese carp fry/fingerlings at NFEP is presented in Fig. 1.

As part of the genetic improvement and maintenance programme, a number of trials were conducted. It was seen that the growth performance of new silver carps was significantly higher than that of the old and cross bred ones (Fig. 2: NFEP, 2000). However, the new stock fingerlings were larger at the start of this trial.

Fig : 1 % of production of pure strain Chinese Carps

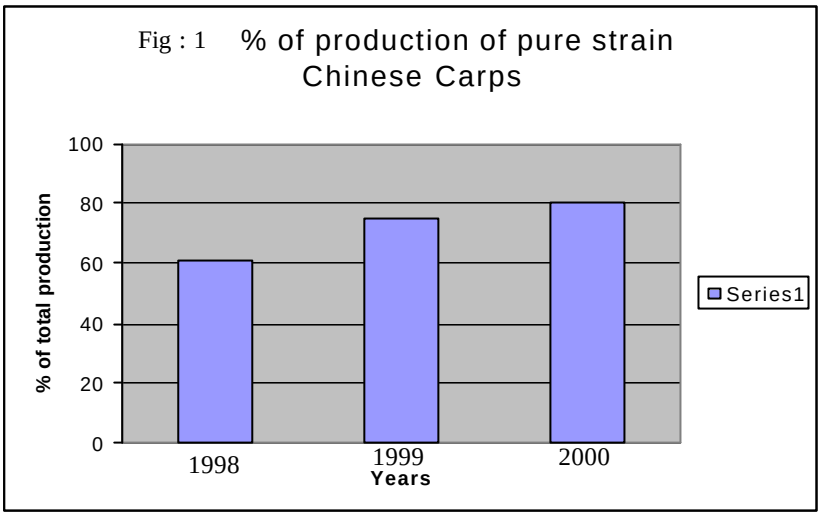
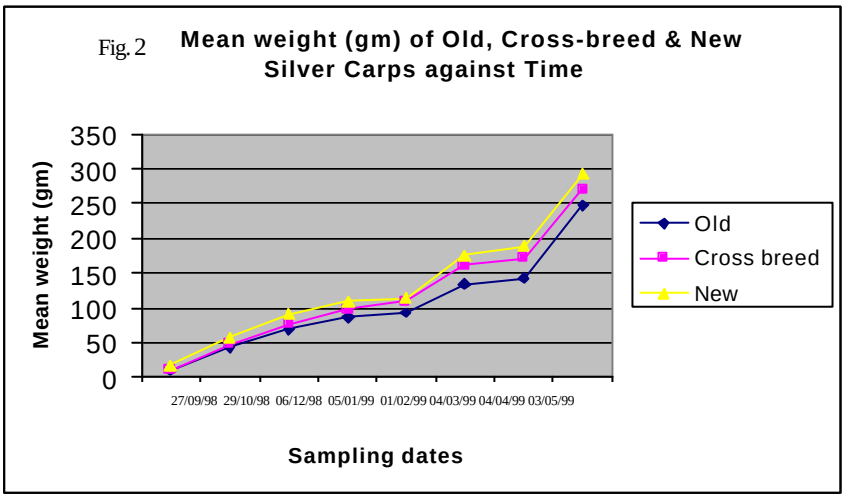


Fig. 2 Mean weight (gm) of Old, Cross-breed & New Silver Carps against Time



Dissemination Strategy

NFEP has been involved in the distribution and dissemination of pure broodstock in the northwest region, in particular. The project has been producing and distributing good quality fish seeds for future broodstock for both public and private sector. Since the implementation and maintenance of pure broodstock about 30,000 pure quality

Chinese carp seeds was distributed to 8 DoF farm, Bangladesh Fisheries Research Institute (BFRI), Mymensingh, Faculty of Fisheries, Bangladesh Agricultural University, and NGOs such as Bangladesh Rural Advancement Committees (BRAC), CARITAS, Grammen Matshya Foundation (GMF) and Rangpur Dinajpur Rural Service (RDRS), and private sector hatchery operators from Parbatipur for future broodstock development. Systematic monitoring is yet to be conducted to know about how the farms/hatchery operators are maintaining their broodfish. We have been informed that many of them are managing their stocks and producing quality fingerlings.

The project has also organised training programme on maintenance of genetically improved pure quality seeds and replacement of broodstock for those involved in fish breeding and fingerling production. The objective was to provide insight and practical skills so that they are able to maintain genetic pools for future development and maintenance of broodstock in their hatcheries. In addition, 12 private hatchery managers from Dinajpur, Rangpur, Gaibandha and Bogra district received 3-day intensive residential hands on practical training on genetic maintenance of broodstock for quality seed production and on broodstock replacement strategy.

Future plans

The Government of Bangladesh has approved a collaborative project (DoF and University of Stirling) for genetic improvement strategies for production of exotic carps for low input aquaculture. The project will continue till March 2004. In future, attempts will be made to maintain as large an effective number of fish in the hatchery to minimize inbreeding within the imported Chinese carp species. In addition, testing and development of broodstock management strategies will continue and appropriate broodstock management techniques will be recommended and disseminated.

Conclusions

Management of broodstock is providing two-fold benefits. Firstly good quality broods can be recruited and secondly higher production from the aquaculture system can also be achieved. Farmers /hatchery operators already reported better growth performance of fry/fingerlings of new strain Chinese carps. What NFEP did up to till now may serve as an initiative to solve the major problems related to quality seed production and supply. But to solve the problems throughout the country we should take long term initiatives in a planned manner and in that NFEP initiatives may be an example.

Recommendations

1 For maintenance of quality broodfish it is important to take long term programme with provision of financial as well as logistic support.

2 Similar programmes can be applied to other important species (Indian major carps of riverine source and tilapia) as well to maintain good quality broods.

3 Monitoring of the hatcheries which have received quality fingerlings for broodstock management is needed.

4 Legal support for quality seed producers in the form of licensing from the government should be initiated.

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