Quality Seed – Primary determinant for sustainable Aquaculture

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Abstract

Through the implementation of induced breeding technology into farming condition, fish production from inland sector increased substantially from 0.9 million tones in 1977-78 to 1.54 million tones in 1990-91, as the major hatcheries in Bengal has come up in 1980, s. Within very short period of introduction of technology, the ignorant farmers started practicing improper breeding practices like mixed spawning, use of small number of breeding population and indiscriminate hybridization for their profit and convenience. Mixed spawning leads to hybridization inadvertently and ultimately affect the native gene pool. Maintenance of small number of founder population leads to inbreeding and the obvious genetic consequences are the increased fry deformities (37.6%), decreased food conversion efficiency (15.6%) and fry survival (19%). Again the undesirable hybrids when find their way into natural system results in "genetic intermixing" and affects the genetic biodiversity of the native fish fauna of Bengal. Along with these the fish breeders are introducing alien fishes almost every year without maintaining any code of practice. This alien introduction and repeated use of unauthorized drugs and feeds (composition totally unknown) severely affecting the native biodiversity and unless checked early it may lead to the extinction of some of the prized fishes of Bengal.

INTRODUCTION

Indian carps are seasonal breeders and gonadal recrudescence in these fishes occur after vernal equinox i.e. on 22nd March prior to breeding seasons. These fishes develop eggs but cannot shed them in captivity. To overcome the demerits of natural collection of spawn, the techniques of induced breeding otherwise known as hypophysation was developed in experimental condition. The technique later transferred to field condition, which revolutionised the fish seed production and trade in Bengal in particular.

It is observed that Bengal fish seed producer's/hatchery owners, being illiterate and totally unaware of the scientific basis of the technology, inadvertently use the technology only for profit making purpose. In most cases the farmers learn the technology from the neighbouring farmers and there is complete absence of any institutional transfer or training programme and follow-up action. The Bengal farmers adopted the technology very well and shouldered the responsibility to produce more than 70% fish seed requirement of the country. At the sometime, the farmers modified and refined the technology time to time with their innovative approach.

Now, with the standarisation of the technology and entry of more and more entrepreneurs and business sector, a competitive approach developed among the fish seed producers. This led the farmers to adopt some unfair means and use the technology for profit making purpose. This includes mixed spawning, indiscriminate hybridization and introduction alien species from neighbouring countries. Added to this the farmers out of ignorance never considered potency of the gland and started using immature fishes due to scarcity

of brooders during breeding seasons. All these phenomena resulted in serious genetic consequences like inbreeding, genetic introgression etc. The obvious consequences are the negative impact on stock integrity and genetic biodiversity of the native fish fauna. Target oriented research programme need to be initiated to check the further loss in biodiversity and maintaining sustainability.

Materials & Method

The study conducted involving the leading hatchery owners in some of the major seed producing districts of West Bengal. A questionier schedule was prepared and detailed field information was accounted based on the schedule. Fish breeders were interrogated and detained information were documented regarding the present mode of the application of the technology. The data were compiled and presented in the text. The photographs presented in the text were taken during the field study.

Results & Discussion

Inducing Agents

Almost all the fish breeders use pituitary extract as the only inducing agent though there are several other synthetic inducing agents like Ovaprim, Ovatide and Wova-FN. The fish breeders use the pituitary extract only, as its cost is six times less than that of the synthetic products. Potency of the gland never considered, as the farmers are totally unaware about how varied potency may cause reduction in ovulation in female brood fishes, which ultimately resulted in decreasing in population size (Padhi et. al, 1994). Again, most of the fish breeders use the crude pituitary extract instead of supernatant produced by centrifugation. As we know that the fish breeders received the supply of gland from gland-collectors who in turn collect the gland from dead fishes from the market. Often, batches of these glands are rotten and fall short of desired potency. Again, the crude extract contains pathogenic microorganisms causing infection to fishes. Moreover, pituitary GTH is a glycoprotein, which is very much sensitive to temperature denaturation (S. Bhattacharya, 1991). The farmers select the glands, which are light brown in colour for extract preparation.

Mixed Spawning:

Induced breeding of carps, generally, undertaken in breeding pool. During breeding season, the fish breeders perform breeding operation of three Indian carps in same breeding pool, as it is not possible to provide such huge masonary structure for individual species. The fish breeders adopt ‘mixed spawning’ for sake of their convenience and profit. Mixed spawning leads to hybridization inadvertently and as a result interspecific and intergeneric hybrids are produced as in nature (Natarajan, et.al, 1976). Natural hybridization in fishes may be attributed to genomic plasticity and external fertilization (Padhi, B. K., 1987). These hybrids are then distributed to different geographical region as well as in natural habitat.

Purposeful Hybridization:

Besides mixed spawning, the fish breeders also undertake indiscriminate hybridization only for profit, convenience and to compromise with the demand from farmers. The nonavailability of brood fish may be the one reason but many a times knowingly the fish breeders consciously adopt hybridization, as the hybrids are more potent to overcome the shock of transportation. By supplying these hybrids, they not only befouled the farmers but inviting alarming genetic consequences on native fish fauna. This type of inadvertent hybridization of Indian major carps and backcrossing of F_1 hybrids with parent would certainly invite genetic introgression and contamination in gene pool of these native fish fauna. Genetic introgression already demonstrated in the hybrids of tilapia (ICLARM, 1991) and Cutthroat Trout (Gyllensten et.al, 1985). One sad experience of purposeful hybridization is of the domestic Common Carp (*Cyprinus carpio*) with its wild living ancestor, wild carp. These resulted in contamination and deterioration of economically important traits of in both (Kirpichnikov, V.S., 1981). Another such example is the hybridization of *Acipensor sturio* (giant sturgeon or beluga) with *Acipensor ruthenus* (Starlet). Though F_1 hybrid inherited useful cultural traits from both the parents (Nikoljukin, N.I., 1971) but the hybrids cause considerable contamination of the sturgeon stocks (Kirpichnikov, V.S., 1981).
Till date the following hybrids (interspecific, intergeneric, etc.) are produced in farming situation.

Fig.1: Fig.1. Hybrids of Rohu male× Catla female

Rohu male × Catla female – Nadeem (Fig. 1)
Rohu male × Mrigal female – Bullet
Silver Carp male × Bighead female – Siluri
Bata female × Mrigal male - Hybrid appears like Bata
Japani Punti male × Common carp female – Hybrid morphologically Common carp like

Fig.2. Hybrids of Rohu female× Mirror carp male

Rohu female × Mirror carp male – Mouth and body Rohu like
- Growth rate less than Rohu
- One middle row of scale
- Blackish in colour (Fig. 2)
- Fertile

Fig.3. Hybrids of Catla female× Mirror carp male

Catla female× Mirror carp male – Mouth and body Catla like
- One middle row of scale (Fig. 3)

Out of the said hybrids only 'Nadeem' hatch some culturable traits but other hybrids are not much useful from cultural point of view.

Inbreeding and Genetic Drift:

As already mentioned the modern hatcheries are virtually closed to genetic exchange with wild stock (Eknath, A.E. et.al, 1990). This is because due to want of brooders the fish breeders use the same founder population and the offspring raised from it for successive breeding programme. This type of brother-sister and parent-offspring mating resulted in inbreeding. Though a detailed study on the extend of inbreeding is not available but it ranged 2-17% in some carp hatcheries in Southern India (Eknath, A.E. *et.al*, 1990). Inbreeding is a cumulative phenomenon and continuous inbreeding results in homozygosity. It produces homozygous stocks of dominant and recessive genes and

eliminates heterozygosity from inbreeding population. This would have resulted in loss of variability as well as depression in economically important traits and increased fry deformities (Fig. 4).

Fig.4: Early Deformities in spawn due to inbreeding

Another genetic consequence of maintaining small number of inbreeding population is the loss of some alleles resulting in genetic drift, which ultimately reduces genetic variance in a gene pool (Padhi *et. al*, 1994). Loss of genetic variance due to genetic drift has already been demonstrated in AU-Ivory Coast strains of *Tilapia nilotica* and Channel cat fish (*Ictalurous punctatus*).

Loss in Genetic Biodiversity

The inbred homozygous hybrid seeds are transported to different geographical territories and through ranching and other natural phenomenon enter into natural system. The farm raised fishes (culture stock) and hybrids hybridized with native fish fauna result in genetic intermixing which may leads to genetic **homogenization** in the long run.
It is well known that Indian aquaculture activity is practically untouched by the relevant scientific approach of programme and not supported by extension activities and or follow up action. General ignorancy and illiteracy on the part of the fish breeders led them to adopt such improper breeding practices, the outcome of which is the series of genetic consequences posing threat to the very existence of prized fishes of Bengal. Now, there is need for objective study. The genetic consequences of mixed spawning and indiscriminate hybridization should be assessed under experimental condition. The problems of contamination should be assessed by using modern techniques like isozyme tool and DNA polymorphism (Bentzen et.al, 1991).

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