Dr. Nihar Ranjan Chattopadhyay is now attached to West Bengal University of Animal & Fishery Sciences as Professor in Aquaculture and is actively engaged in fisheries education, research and extension in West Bengal, India. He has developed some innovative technology and various reports in the field of fish culture and standardization of techniques for the breeding and larval rearing of Pangasius sutchi.

Fish breeding in captivity - some innovative adaptations of technology by Bengal farmers

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Fish breeding in captivity was introduced in India with the intension to make sufficient quantities of quality seedstock available to support farming. This technology offers many advantages in fish culture practice including reduced mortality during transport and production of hybrid vigor through hybridization. After the discovery of induced breeding techniques during the late 1950's the expertise was initially transferred to field conditions through extension workers on a relatively small number of farms. Later, the technology was transferred more widely through contact from one farmer to another. Innovative adaptation of this technology by Bengal farmers has enabled them to establish a positive role in producing a quality and dependable seed supply. This is evident by the fact that Bengal farmers contribute to 70% - 80% of the total seed produced in India.

A field survey conducted in the year 2000 revealed that through successive years farmers have modified the base technology from time to time and that these modifications have made it more meaningful in contributing to the seed supply for the country. Some of the major farmer-led modifications are listed below.

Extension of Breeding Period

Initially the breeding season for inducing fish in captivity was restricted to June to August. However, farmers have managed to extend this period by three months with the season now running from April until September. In the case of magur sometimes farmers can undertake breeding in winter by making use of the bottom water in the pond. This obviously indicates the farmer's skill in broodstock management.

Figure 1: Male pangasid catfish receives a dose of pituitary extract to help initiate spawning

Figure 2: Low-cost overhead tanks are built on piles of earth excavated during pond construction

Repeated use of broodstock

Initially the broodstock were used only once per season for breeding purposes. Now, with the more understanding about broodstock management, maturation and spawning techniques, the farmers of Bengal can now use the same broodstock two or three times per season at an interval of 45 days for both Indian major carps and exotic carps. This knowledge has established Bengali farmers as the leading seed producers in the country.

Alteration in the time and dose of injection

Initially farmers used to give the first dose of pituitary extract after sunset at around 6-7 in the evening with a second injection given 6 hours later at around 11- 12pm. Bengal farmers have since shifted the time for first injection to 9-10am in the morning followed by a second injection at 3-4pm. This ensures better fertilization and hatching rates as it occurs in the early morning when the environmental temperatures range between 20-25C. This time frame for injection also gives better fertilization and hatching percentage when stripping is adopted. Farmers find better fertilization and hatching rates can be achieved on cloudy days by advancing the time of the second injection by one hour.

Dosage of injection (pituitary extract)

Field trials indicate that administration of a low preliminary 'priming' dose followed by a higher effective dose after 4-6 hours is more successful than use of a single 'knock-out dose'. From my studies in this area, I recommend the following standardized doses for these species commonly cultured in Bengal:

For Thai magur

- Summer dose — 8mg/kg body weight
- Winter dose — 10mg/kg body weight

For Indian major carp

- Female- 1st dose - 1-2 mg/kg body weight
- 2nd dose- 5-8 mg/kg body weight
- Male - Single dose 1-2 mg/kg body weight

For exotic carp

- Female - 1st dose 2mg/kg body weight
- 2nd dose 9mg/kg body weight
- 10mg/kg body weight (Grass Carp)

For minor carp

- Single dose 1.25 - 2.5mg/kg body weight

For pangasid cat fish

- Female - 1st dose - 1.5mg/kg body weight
- 2nd dose - 6mg/kg body weight
- Male single dose — 1mg/kg body weight (Fig. 1).

Low cost technology for construction of overhead tanks

During surveys I have found that the farmers have developed a very effective low cost technology for construction of overhead tanks that would otherwise involve a huge expenditure that they could not afford.

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Figure 3: Farmers are opting for Chinese-style hatcheries, often within the grow out pond

A survey of Nellore district (Andhra Pradesh) which has 31 giant freshwater prawn culture ponds and several shrimp culture facilities[16] has revealed that farmers are using both water and feed probiotics. The water probiotics contain multiple strains of bacteria like *Bacillus acidophilus*, *B. subtilis*, *B. licheniformis*, *Nitrobacter* sp., *Aerobacter* sp. and *Saccharomyces cerevisiae* etc. and feed probiotics contain *Lactobacillus* sp., *Bacillus* sp. or *Saccharomyces cerevisiae*. The farmers claim that these probiotics improve the growth of shrimp larvae in initial period up to 50 days of culture. Survival of larvae is also reported to be better[11].

Regular use of probiotics in feed of fish, in U. K. and other European countries has been reported to have several health benefits. In shrimp hatcheries it is reported to have controlled the high incidence of diseases in larvae and led to dramatic improvement in shrimp health. Atlantic Salmon fed with probiotics enjoyed increased survival and reduced mortality caused by Vibriosis, Furunculosis and Enteric Redmouth diseases. Moreover, fish showed enhanced appetite, grew better and had lessr problems with fin and tail rot. *Vibrio alginolyncus* introduced in larval rearing tanks caused a reduction in the incidence and severity of luminous vibriosis caused by *Vibrio harveyi* and improvement in growth of shrimp larvae[17].

Indian fish pathologists are also looking at probiotics as a potentially useful disease prevention measure in aquafarms and active research is continuing. The Cochin University of Science and Technology, Kochi, Kerala has taken lead in the research on probiotics. Other National Institutes like Central Marine Fisheries Research Institute, Kochi, College of Fisheries, Mangalore, Kamataka, National Institute of Oceanography, Goa, Central Salt and Marine Chemicals Research Institute, Bhavnagar, Gujrat and some universities are also involved in research on potential probiotics.

In nutshell, we can say that there are many positive reports about the use of probiotics, particularly in feeding of larvae from first feeding onwards. Probiotics are a welcome addition to the armament of disease prophylaxis in aqua-farms although the technology and science behind it is still very much in a developmental phase. It seems likely that the use of probiotics will gradually increase and that success of aquaculture in future may be synonymous with the success of probiotics, which, if validated through rigorous scientific investigation and used wisely, may prove to be a boon for the aquaculture industry.

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Farmers stack the soil while excavating pond in the farm site and then, when it is high enough, they construct the overhead tank on the stack. This is an effective way to reduce the cost considerably as it does not involve construction of any tower or pillar. (Fig. 2).

Rejection of the breeding pool concept

A survey on 2000 to assess the current status of hatcheries in Bengal, revealed that the farmers have totally rejected the breeding pool approach and instead both breeding and hatching is done in Chinese-style hatcheries. The farmers are of the opinion that the sloping towards central outlet prevents the total mixing of milt and egg and there by reduces fertilization rate. Better fertilization rates are achieved when spawning is done in Chinese hatcheries as the floor surface is plain, which permits easy mixing of milt and eggs.

In some farms that I have observed the hatcheries are located within the grow out pond. This not only requires less supply of water to hatcheries but also reduces the cost of supplying a constant flow to hatcheries. (Fig. 3).