

Breeding of “Foli” for the Socio-economic Upliftment of Rural Fish Farmers

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Foli, *Notopterus notopterus* (Family: Notopteridae) has been successfully bred in Bangladesh through induced spawning by a group of researchers led by Prof. Dr. Md. Idris Miah of the Bangladesh Agricultural University in Mymensingh, Bangladesh under their project on “Induced breeding, larval rearing and culture management techniques of Foli.” The experience of Dr. Miah and his group could also be adapted in the Southeast Asian countries where the “foli” fish is found and could be cultured as means of uplifting the socio-economic conditions of the region’s rural fish farmers.

Foli (*Notopterus notopterus*), also known as Asiatic knifefish or bronze featherback fish, is an economically important freshwater fish in South and Southeast Asia, specifically in Bangladesh, India, Cambodia, Indonesia, Malaysia, Myanmar, Thailand and Vietnam. The fish is called by different names in these countries. Known as foli in Bangladesh, the notopterid fish is called “Trey slat” in Cambodia, “Kapirat” in Indonesia, “Belida” in Malaysia, “Nga-pe” in Myanmar, “Pla cha lat” in Thailand, and “Cá thát lát” in Vietnam. Its relative, the *Notopterus kapirat* is known as “kanduli” in Assamese, although the Philippine “kanduli” (*Arius* spp.) is known to belong to the Ariidae family.

Significance of the Project on Artificial Breeding of the “Foli” Fish

According to the International Union for Conservation of Nature (IUCN) in 2000, out of 266 living fish species (freshwater and brackishwater fish species) in Bangladesh, 12 are critically endangered, 28 are endangered and 12 are vulnerable and more are under increasing threat for sustainability (Mazid, 2002; Ahmed and Wahab, 2003). Foli is one of the endangered freshwater fishes in Bangladesh, and considering its economic importance, Prof. Dr. Idris Miah assisted by Md. Mokhlesur Rahaman, S.M. Farid, Md. Sayeed Harun, Harun Ar Rashid, Nasimul Islam, and Azadul Islam conducted studies on the induced breeding, larval rearing and culture management techniques for the “foli” fish at the Bangladesh Agricultural University in

Mymensingh, Bangladesh with funding support from the University Grants Commission. Their efforts led to the first successful induced breeding of the “foli” fish in Bangladesh in 2007.

Bangladesh is one of the richest countries of the world in terms of aquatic biodiversity, where many indigenous fish species are found in its natural water bodies such as in haors (natural depressions on floodplains), boars (or Oxbow lakes are formed by loops of zigzagging waters cut-off by floods when the river adopts a shorter route), beels (natural depressions), rivers, canals, flood plains, etc. The country’s indigenous fish species, e.g. the foli fish, are part of the cultural tastes of the Bangladeshi considering their nutritional value. In 2006, Bangladesh produced 2.3 million mt of fish where almost 80% comes from inland fisheries, of which 46% was contributed by aquaculture and 52% from capture fisheries (Table 1). The inland capture fisheries sub-sector contributes 4.92% to the country’s GDP where about 2 million people are engaged in inland capture fisheries, either fulltime or part time.

However, reports have indicated that the inland freshwater fish stocks have been lost due to over-exploitation, indiscriminate destructive fishing activities, ecological imbalance, soil erosion, siltation, breeding ground destruction and other factors caused by human development activities. Recent estimates suggested that worldwide 20% of all freshwater fish species have become extinct or endangered (Moyle and Leidy, 1992). The main objectives of the project are to develop suitable technology for the artificial propagation of the “foli” fish and develop methods for larval rearing and culture. Specifically, the project aims to study the complex breeding biology and breeding techniques of this fish species; breed the “foli” using pituitary gland (PG) extract and HCG hormone; determine the fertility and hatching rate of eggs in relation to varying temperature and time; study the embryonic processes; assess the growth performance and yield of the species under monoculture system; and develop a sound and economically viable technology package for large-scale culture of the “foli” fish.

Table 1. Fisheries production of Bangladesh (in metric tons)

| Source of production | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|--------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Inland capture fisheries | 688,920 | 688,435 | 709,333 | 732,067 | 859,269 | 956,686 |
| Marine capture fisheries | 379,497 | 415,420 | 431,908 | 455,207 | 474,597 | 479,810 |
| Aquaculture | 712,640 | 786,604 | 856,956 | 914,752 | 882,091 | 892,049 |
| Total | 1,781,057 | 1,890,459 | 1,998,197 | 2,102,026 | 2,215,957 | 2,328,545 |

Source: Fishstat Plus (2008)

Commercial and Economic Value of the “Foli” Fish

Bangladesh has the potentials for culturing freshwater fishes considering the countries 43.10 million hectares of inland waters (BBS, 1994). Many indigenous fishes are becoming endangered, and being economically and nutritionally important to the country, these fishes are now being conserved through artificial propagation. One of the most important freshwater fishes is the “foli” (*Notopterus notopterus*). A biochemical study conducted by Kamal et al (2007) showed that the “foli” fish is a rich source of protein having a protein content of 19.8% and lipid content of about 5.0%. Considering the present per capita annual fish consumption in Bangladesh which is 14 kg/year compared to the recommended minimum requirement of 18 kg/person/year, there is a need to improve the country’s fish consumption (FAO, 2005). Grown under natural conditions maintaining the original text and texture, and consumed in fresh as well as dried state, “foli” fish could therefore contribute to the supply of protein to the peoples of Bangladesh. However, its sustainable culture should be further ensured.

In the Southeast Asian region, SEAFDEC (2008) reported that the 2005 production of miscellaneous freshwater fishes that include the Asiatic knifefishes was 497,000 mt valued at USD 49,305,000 from inland fisheries; and 920,659 mt valued at USD 566,356,000 from aquaculture (Table 2). Under the International Standard Classification of Aquatic Animals and Plants (ISSCAAP) developed by FAO, knifefishes have been grouped under miscellaneous freshwater fishes. ISSCAAP has been used by SEAFDEC in reporting fisheries statistics in the Southeast Asian region (SEAFDEC, 2008a).

In many Southeast Asian countries, specifically in Myanmar inland freshwater resources have been considered as important areas for freshwater fish fauna in terms of

diversity and endemism (Chavalit *et al*, 2005). Situated in the intermediate zone of the Indian Sub-continent and mainland Southeast Asia, Myanmar shares the fish taxa of both sub-regions. One of the most economically important freshwater fishes found in Myanmar is the notopterids. “Nga-pe” (in Burmese) is one of the smallest featherback spars with shorter jaws with its body having long anal fin and small dorsal and pelvic fins (Chavalit et al, 2005).

Breeding of the “Foli” Fish (*Notopterus notopterus*)

The fish has plain brown color with slightly concave dorsal head. The juveniles are silvery-white having dark bars on their whole body and numerous fine grey spots on body and head. The adult male is smaller than the adult female. The dorsal fin is short, situated slightly nearer to the snout tip than to the base of the caudal pelvic fin. The anal fin is very long which extends more than 2/3 of the length of the fish confluent with its very small caudal fin. The fish is generally dark on its back and silvery on the sides.

“Foli” fish is abundant in the freshwater areas throughout Bangladesh. The largest specimen examined by the project was only about 280 mm in total length. It is observed to breed during May and June. It is mainly carnivorous and offers parental care. It is good for sports fishing with rod-and-line. Reports have indicated that the largest fish which was 355 mm in length and weighing 315 g was recorded at the Gachar Dahar Beel in the Sylhet District (Rahman, 1989).

For the research project, about 200 pcs of “foli” were collected from different areas of the Mymensingh District, and were stocked at the University Fisheries Complex ponds. When the male and female were observed to have attained maturity, they were caught with net and kept under shower for 12 hours. The female were kept under shower after PG hormone injection. After 6 hours of the 1st dose

Table 2. Production of miscellaneous freshwater fishes in Southeast Asia (2005)

| Countries* | Production from inland fisheries | | Production from aquaculture | |
|-------------|----------------------------------|------------------|-----------------------------|------------------|
| | Quantity (mt) | Value ('000 USD) | Quantity (mt) | Value ('000 USD) |
| Cambodia | 323,500 | na | 6,000 | na |
| Indonesia | 28,105 | 29,139 | na | na |
| Malaysia | 1,575 | 3,523 | 2,543 | 4,438 |
| Myanmar | na | na | 323,778 | 3,737 |
| Thailand | 124,500 | na | 3,197 | 76,256 |
| Vietnam | na | na | 585,100 | 36,400 |
| SEA Total** | 497,500 | 49,305 | 920,659 | 566,356 |

* Refers only to countries where the Asiatic knifefishes are found

** Refers to total production from all Southeast Asian countries

Source: SEAFDEC (2008)



Notopterus notopterus
Source: Chavalit et al, 2005

and 2nd dose given to the female fish, the 1st dose was given to the male fish. The eggs were stripped from the female using pressure method 6 hours after the 2nd dose of hormone injection. The sperms were collected from the male, and the sperms and eggs immediately mixed properly. The fertilized eggs were kept on a tray which is supplied with water shower by small drops. The eggs were hatched within 6 days, however, hatching rate was observed to depend on the temperature. After five days from hatching, the fry were given boiled egg emulsion as feed.

Way Forward and Conclusion

The research study being conducted at the Bangladesh Agricultural University in Mymensingh expects to apply more developing methods and more intensive activities during the coming breeding season of the “foli” fish. As envisaged, the technology would be extended commercially with the technology package to be disseminated to the field farmers, which would include the artificial breeding technique, brood fish management, stocking density, water quality management, and feed management including optimum dosage of the hormones used. It was also envisaged that after two to three years, the cost benefit analysis could be derived from the aquaculture of the “foli” fish.

The Southeast Asian countries could also benefit from the results of the research study especially in countries where the “foli” fish is one of the most economically important freshwater fishes. This could bring socio-economic upliftment of the rural fish farmers as reflected in terms of increased fish production, increased supply of protein to mitigate malnutrition problems, increased income, creation of employment opportunities, and ensuring food security.

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