Bangana dero : A potential indigenous fish species for diversification carp culture in north east India for sustainable aquaculture

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Bangana dero (Hamilton 1822), commonly known as kalabans, or ngaton or khabak (in Manipuri), khital (Tangkhul), or ngatai (Myanamar) is endemic to Asia's inland waters. It is one of the most popular indigenous minor carps in the north eastern states of India. It is distributed throughout the Himalayan foothills, in India, Nepal, China (Zhu 1995) and Sri Lanka (Talwar and Jhingaran 1991). It is also found in Iran (Coad 1995), Afghanistan (Petr 1999) and Bangladesh (Rahman 1989). The species is also found in some of the national parks of Nepal, e.g., Koshi Tappu Wildlife Reserve, Chitwan National Park and Karnali National Park (Shreshtha 1999). The fish is characterised by the presence of a groove along the snout, the snout being often covered by pores; the anterior dorsal convexity changes gradually to a concave profile, giving it an elegant slender appearance. Its flesh is well flavoured and highly esteemed as food. It attains a length of 35-40 cm and can readily be caught with cast-nets. According to CITES (2013) this fish species is categorised as Least Concern.

This fish is bottom feeder and feeds on insect larvae, molluscs, algae, zooplankton and detritus. Sexes can be distinguished during the breeding season. The pectoral fin of male is rough and the female dorsal side of the pectoral is smooth. The genital aperture of the female is reddish and swollen and has soft belly. In the case of male, the genital opening is not prominent however, when applying gentle pressure on the belly it oozes milt. The fish matures at 2+ years and males mature earlier than the females. It is a riverine and seasonal spawner and breeds during the south west monsoon (June-August) in adjacent shallow inundated terrain during floods. The relative fecundity had been recorded to be around 3, 25,000 eggs per kilogram of body weight of female brooder. Adults inhabit torrential hill-streams in shallow waters. They migrate to warmer regions of lakes and streams during winter.

This fish species is one of the most important indigenous minor carps in north east India especially in Manipur. It has a ready demand in the local market fetching triple the prices

Bangana dero harvest.

Packing of Bangana dero seeds.

of Indian major carps. The fish occurs in the waters of the Litan, Iril, Thoubal, Sekmai rivers and its adjoining lakes in Manipur. Shoals of advanced fry and fingerlings of this fish species occur in the months of October and November every year. Over the last two decades the occurrence of fries and fingerlings of this high priced fish have become drastically reduced.

In India, particularly in North Eastern states, aquaculture sector plays a vital role in the socio economic development and is recognised as a powerful tool for income and employment generation. This sector stimulates the growth of a number of subsidiary industries and is a cheap nutritious food. However, the production of fish has not reached up to the expected level due to non-availability of quality seeds of cultivable fish both exotic and indigenous. Recently, notable progress has been achieved in widening the spectrum of aquaculture practices using viable fish species including Indian major carps and many indigenous fishes in different parts of eastern India. Development of technology for seed production and culture of local fishes creates opportunities for the fish farmers to diversify their aquaculture practices.

Induced breeding

Efforts have been made by ICAR Research Complex for NEH Region, Manipur Centre, Imphal to domesticate this high priced indigenous fish since 2009 by induced breeding using different hormones. Success was achieved using Wova-FH, Ovaprim and Ovatide (0.5ml/kg body weight of female and 0.2ml/kg body weight male) and low dose of carp pituitary (2.0mg/kg body weight) and obtained maximum egg laying capacity, fertilisation rate and hatching rate at 2:1 male-female ratio. The fertilised eggs were spherical, translucent and demersal measuring 1.8±0.2 mm in diameter. Unfertilised eggs were paler and opaque. Fertilised eggs were hatched out after 18-24 hours of fertilization at temperatures of 25.2-26.8°C. The freshly hatched larvae measure 4.5 mm long and 1.5 mg in weight. They do not take exogenous food for about 72 hours at 26°C. The yolk sac is fully absorbed on the 4th day and the hatchlings grow to 6.5 to 7.0 mm long. Four days after hatching the spawn were ready to release into well-aerated nursery tanks. The duration of hatching depends on water temperature.

Hatching in hapas

Two enclosures or hapas are used one inside the other (outer hapa). The inner hapa or trays are made of nylon net mesh size 2-2.5mm and the outer hapa has a mesh size of 0.5mm. After hatching, the larvae move out of the inner hapa/hatching trays through its large mesh and are collected at the outer hapa. The empty egg shells are left in the inner hapa which are removed along with the inner hapa after the hatching is completed.

Larval care and nursery rearing

Early larval stages are the most crucial and vulnerable stages in the life cycle of a fish. The freshly hatched larvae measure 2.4-4.2 mm long and 1.5mg in weight. They do not take exogenous food for about 72 hours at 26°C. The yolk sac is fully absorbed on the fourth day as the hatchlings reach to 4.0 -5.0 mm long. At this stage, the fish are referred to as post-larvae and they start feeding on exogenous food. Generally, *Bangana dero* seed is classified into three categories viz, spawn, fry and fingerling. The spawn can be kept in the incubation chamber until the yolk sac is absorbed and then are shifted to separate tanks for nursery rearing.

By the fourth day after hatching, the spawn are released into well-prepared nursery tanks free from aquatic weeds predators for growing the post-larval stage. In a well prepared nursery pond *Bangana dero* carp can be stocked @ 10-15 million/ha. Small ponds of 0.02-0.10 ha with depth of 1.0-1.5 m are preferred for nurseries though areas up to 0.25 ha can be used for *Bangana dero* carp fry production. The socking of spawn in nurseries is done preferably during morning or evening hours by acclimatising them to the new environment. The water depth at the time of stocking should be limited to 40 cm. Later, after four days of stocking, water depth can be increased in a phased manner. Low initial depth is advantageous to carp spawn. After 45 days of rearing fish may grow to 1.5 cm and are ready for rearing ponds. Under a given set of conditions, the growth rate of fry of *Bangana dero* is

Fertilized eggs of Bangana dero.

Bangana dero.

extremely high in the first 10 days, with the fish doubling their weight every second day and becoming about 19 mm long weighing 0.09 g in 10 days, and 37 mm long weighing 1.1 gm in 20 days. With adoption of scientific methods of rearing, the fry attains the desired size of 20-25 mm with survival of 70-75% in a 15 days rearing period. Since the nursery-rearing period is limited to 15-20 days, the same nursery can be utilised for multiple cropping, at least for raising 2-3 crops in case of earthen ponds and 4-5 crops in case of cements cisterns in a season.

Bangana dero fingerlings are produced using different techniques. Only one cycle of production is achieved by the majority of farmers in one season. They grow up to fingerling size in single or in dual stages. If fingerlings are produced in single stage, a stocking density of fish is about 0.8–0.9 million newly hatched spawn/ha. Fingerlings of 5.0cm size are harvested after 60–70 days of rearing. Survival is usually low in this rearing system. Another way of fingerling production is the dual stage system. About 2-5 million fish spawn per hectare are stocked and harvested within 15–20 days. After harvesting, the fry are stocked in fingerling rearing ponds, at the stocking density of 1-2 million/ha. Fingerlings are harvested after 45 days to 2 months. Most of them are 4.0-5.0 cm, but 10–15 percent of fish are harvested later at the size of 6.5-7.0 cm.

Water quality of nursery ponds

Plankton are the preferred natural fish food organisms that are produced by fertilising the culture ponds. The ponds used for seed production are first limed after the removal of unwanted predatory and weed fishes depending on the pH of soil. After liming, the ponds are treated either with organic manure such as cow dung, poultry dropping or inorganic fertilisers or both, one following the other. A mixture of 750 kg, cow dung 200 kg, and single super phosphate 50 kg/ha is effective in production of desired plankton. Half of the above amounts, after being mixed thoroughly by adding water to make a thick paste are spread throughout the nursery 2-3 days prior to stocking. The rest is applied in 2-3 split doses depending on the plankton level of the pond.

Bangana dero farming

Packages of culture practices have been developed at the ICAR Research Complex for NEH Region, Manipur Centre for *Bangana dero* culture in ponds ranging from 0.25-0.75.0 ha in area and 1.0-2.5 m in depth in different regions of the valley area of Manipur, resulting varying rates of production. While small and shallow stagnant ponds have several inherent problems, which adversely affect the growth of fish, the large and deep ponds have their own problems of management. Ponds of 0.25-1.0 ha in size with water depth of 1.5-2.0 m are considered to be best for management. The management practices in *Bangana dero* culture along with other carps involve environmental and biological manipulations, which can be broadly classified as pre-stocking, stocking and post-stocking operations.

Ponds are stocked with *Bangana dero* seed of appropriate size after acclimatising them to the new habitat when it is ready after fertilisation. Both the size and density of fish are important to achieve high yields. Fingerlings of over 100 mm in size are recommended for stocking in grow out culture ponds. As *Bangana dero* is bottom feeder it can feed on decayed vegetation, zooplanktons, worms, unicellular algae and other organisms at the bottom and margins of the pond. Fingerlings (100-110 mm) and combination of two or three

Breeding hapa.

carp species may be stocked at the densities 12,000-15,000 for single stocking and single harvesting and 20,000-25,000 for single stocking and multiple harvesting.

Short duration farming

Short duration fish farming is a process of carp polyculture along with indigenous fish species in suitable combination with other carps reared in ponds with high densities for 6-7 months duration. Fish species such as *Bangana dero* and Osteobrama belangeri along with catla, rohu, mrigal and grass carp can be farmed for a period of 7 months in ponds and harvested.

In this farming practice, good water quality of the ponds was maintained throughout the farming period. About 10,000-12,000 fingerlings of mixed carps comprising *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Ctenopharyngodon idella*, *Bangana dero* and *Osteobrama belangeri* in different ratio were reared. Stocking of mrigal and *Bangana dero* together made a total of 30% of bottom feeder component as both species are bottom feeders. The fishes were stocked in the month of March-April and harvested in the month of October. Fishes were fed with pellet feeds, a mixture of rice bran and oil cake (1:1). Good survival of pengba was observed at 80-85% in the valley. The survival of *Bangana dero* was found to be highest among the culture fishes, 87-90% in different locations. However, different growth rates were observed in different locations. It perhaps as a result of different water management, feed management and husbandry practices. The fish production ranged from 5,000-6,000 kg per ha / 7 months (Basudha et al., 2015).

Conclusion

In view of the limitations of land and water resources, exploding population and stagnancy in fish production from capture fisheries sources, aquaculture has become crucial in the national perspective. Rising global consumption of farmed fish constitutes a great challenge and opportunity for the country and the north eastern region of India as well. A diversity of species, cultured with sustainable methods and leading to high added-value products, can be a driver for growth of the market share of regional aquaculture in local and global markets. The introduction of new species in the aquaculture system has been improving the efficiency of resource use and may be reducing negative environmental impact. Introduction of needs-based modification of production technology and development of indigenous species production for enhancement or restocking is continuing and might be promoted in the future as a means for improving livelihoods for many people that rely on fisheries and aquaculture as part of their livelihoods. It is also evident that the use of indigenous species has reduced the disease risks involved in and have provided more stability to aquaculture production.

Acknowledgement

The support provided Director, ICAR RCNEHR during the work is deeply acknowledged. Authors also acknowledge the financial assistance of the Department of Science and Technology, Government of India.

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