# Leveraging indigenous minor carp for sustainable aquaculture in Northeast India

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Northeast India comprises Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. It covers about 7.9% of India's total land area. Two-thirds of the region consists of hilly terrain, including the mountains of Arunachal Pradesh and Sikkim. The fertile valleys of the Brahmaputra, Barak, and Imphal rivers lie in the lowlands. The region receives heavy rainfall during the southwest monsoon. Summers in the valleys are hot and humid, while the hills and mountains experience long, cold winters.

This diverse geography and climate support rich fisheries resources. The region has torrential hill streams, an extensive river system, and lakes at both high and low altitudes. Reservoirs and floodplain wetlands also play a key role in sustaining fish biodiversity. Northeast India is a global hotspot for freshwater fish diversity. Researchers have recorded between 267 and 422 species in the region.

Aquaculture production in Northeast India is mainly concentrated in the valley regions. Mid- and high-altitude areas contribute only a small share. In 2022–23, the region accounted for just 4.6% of India's inland fisheries production. Minor carp production was about 11,000 tonnes in the same period (HFS 2023, 2023).

The average fish productivity in the region is 1.5 tonnes per hectare per year, which is below the national average of 3 tonnes per hectare per year (Debnath, 2022). More than 97% of the population consumes fish, creating a large gap between supply and demand. The current per capita fish consumption in the region is about 10.9 kg, lower than the national average of 13.9 kg. To meet demand, fish is imported from Andhra Pradesh and other Indian states.

## Fish farming in northeast India

Aquaculture in the region mainly involves carp-based polyculture, with catfish playing a minor role. Several indigenous carp species inhabit the natural water bodies of Northeast India. Although many fish species have potential for aquaculture, fish and seed producers typically focus on 12–15 species of carp, catfish, and prawn.

The most commonly cultured species are Indian major carps (IMC), including rohu, mrigal, and catla, along with three exotic major carps—silver carp, grass carp, and common carp. IMC species are mostly farmed in low-altitude areas, as they struggle to adapt to the cold climate of the hills. Some local minor carp species, such as pabda, pengba, gonius, and bata, are also being introduced into aquaculture due to their local importance and market value.

Standardising breeding and culture techniques for indigenous minor carp could boost fish production, not only in the hilly states but also in the valleys.

## Constraints of aquaculture in northeast India

The development of aquaculture in Northeast India faces several challenges, particularly in the hill regions and parts of the valleys. The difficult terrain, cold climate, poor soil water retention, unpredictable rainfall, and monsoon patterns all pose obstacles. Flood-prone plains, small to medium-sized fish ponds, and a short period suitable for fish culture add to the difficulties.

*Labeo gonius.*

*Osteobrama belangeri.*

Composite fish culture, commonly used in low-altitude areas, is not suitable for the hills due to low water temperatures, which are unfavourable for Indian major carps. Many valley and plain areas, which are ideal for aquaculture, are prone to flooding and have highly permeable soils.

Other major challenges include the lack of quality fish seed and the untimely availability of seed for suitable species. There is also a shortage of locally produced feed ingredients, cost-effective nutritionally balanced artificial feed, live food, and larval feed. The high cost of commercial feed further worsens the situation.

Most farmers in the region have limited resources and rely on small to medium-sized ponds, many of which are seasonal. To sustain aquaculture and meet fish demand, farmers need to adopt species that can adapt to local climatic conditions, have a short marketable culture period, and accept artificial feed.

## Minor carp culture in northeast India

Minor carps are commercially important fish from the Cyprinidae family. They have high potential for aquaculture in the region, particularly in areas with a short culture period. According to the Handbook of Fisheries Statistics, 2023, minor carp production in 2022–23 was about 11,000 tonnes.

These fish perform better than Indian major carps at lower temperatures, making them suitable for hilly areas. They grow well in shallow waters, which is ideal for regions with seasonal ponds and flood-prone areas. Most minor carp species are omnivorous and readily accept artificial feed.

Minor carp are widely consumed in the region due to their taste and texture. They have high nutritional value, with good levels of protein, fatty acids, and minerals. Consumer preference and strong market demand make them an attractive option for aquaculture.

The marketable size of minor carp is 100–300 g, compared to 700–800 g for major carps. This makes them well suited for short-term culture. In carp polyculture systems, minor carp are compatible with major carps and help increase overall production.

## Indigenous minor carp species

Northeast India has a rich diversity of indigenous minor carp species, including *Labeo bata*, *L. gonius*, *L. dyocheilus*, *Cirrhinus reba*, *Osteobrama belangeri*, *Bangana devdevi*, and *B. dero*.

*Labeo bata*, *L. gonius*, and *C. reba* are widely used in aquaculture across the region. They are commonly farmed in both polyculture and composite systems alongside major carp species. *O. belangeri* is commercially farmed only in Manipur due to local preference.

*L. dyocheilus*, *B. devdevi*, and *B. dero* are considered potential candidates for aquaculture. These species are valued for their compatibility with other fish, good growth performance, strong market demand, and role in increasing production and income. Their cultivation could also support conservation efforts.

## Feeding habits of minor carp

Minor carp are primarily herbivorous, feeding on algae, aquatic plants, zooplankton, and diatoms. They readily accept plant-based diets and can utilise plant protein sources. Various protein-rich agro-industry by-products can be used to formulate low-cost, farm-made feed for these species.

The ability of minor carp to consume artificial feed, especially plant-based ingredients, makes them a popular choice for small and medium-scale fish farmers. Their acceptance of plant-based feed helps reduce the culture period and lowers feed costs.

## Minor carp culture

Minor carp are mainly cultured alongside other carp species in polyculture or composite culture systems. They require the same management practices as major carps. They are compatible with major carps in composite fish culture and are well suited for integrated fish farming, such as paddy-cum-fish culture.

Minor carp can also be cultured in open water bodies using pens and cages or in closed systems like biofloc. They are an important species for aquaculture as they can reach market size within six months. Since most of the region is suitable for fish farming for only 6–8 months a year, depending on location, their short culture period is a significant advantage.

Minor carp grow well at lower temperatures in hilly areas, adapt to shallow waters, and are suitable for short-

duration farming in small seasonal ponds. Their rapid growth allows for two harvests per year. They are easily marketable, even at a smaller size, making them an attractive option for fish farmers.

## Seed production

Minor carp in the region breed during the southwest monsoon season. The seed production of *Labeo gonius*, *L. bata*, and *Cirrhinus reba* is well established due to developed hatchery management. These species respond well to synthetic hormones, making induced breeding easier. Their larval culture is similar to that of major carps, facilitating large-scale seed production.

The commercial seed production of *O. belangeri* is concentrated in the Manipur Valley. Successful breeding has also been reported at mid-altitudes (900 metres above sea level), highlighting its potential for aquaculture in mid-hill regions (900–1,200 metres above sea level) (Das & Singh, 2017).

*B. dero* has emerged as a promising species for aquaculture. The successful development of induced breeding techniques has enabled efficient spawn production in Manipur (Basudha et al., 2017). *B. devdevi* holds significant economic importance in Manipur. Researchers have successfully bred this species using synthetic hormone techniques, ensuring a steady seed supply for aquaculture (Bedajit et al., 2020).

*L. dyocheilus* is another potential species for the hilly regions, but its seed production technology is still under study to adapt it to local conditions. Developing induced breeding techniques and standardised protocols is essential to boosting seed production for indigenous fish species. Expanding the culture of local fish will help farmers diversify their aquaculture practices and meet growing market demand.

## Economic viability

Minor carp have a fast growth rate and reach market size within 5–6 months. They are easily sold at 100–300 g, making them ideal for short-duration culture in seasonal and hilly water bodies. Farmers can harvest two crops per year, allowing for quicker returns. Minor carp also have a higher market price compared to major carp.

*B. devdevi* and *B. dero* are in high demand in Manipur, fetching three times the price of Indian major carps (IMC) (Bedajit et al., 2020; Sobita & Basudha, 2020). Their simple culture system relies on supplemental feeds, making them suitable for small and medium-scale fish farmers, who form the majority in the region.

Minor carp readily accept plant-based agricultural by-products, reducing feed costs significantly. This is crucial given the high price of commercial feed. In polyculture systems, minor carp contribute to higher overall production and economic returns. Their market price is 20–30% higher than IMC, making them a valuable addition to aquaculture (Das & Mishra, 2016).

## Conclusion

There is great potential to improve aquaculture productivity in the region by introducing fast-growing fish species suited to local conditions. To meet the rising demand for fish and ensure sustainable growth, it is essential to identify indigenous species that can tolerate lower water temperatures, adapt to shallow waters, and reach market size within 7–8 months.

Indigenous minor carp are promising candidates for aquaculture. They are compatible with composite fish farming and have strong potential for commercial adoption. However, further research is needed to optimise their culture and establish them across different parts of the region.

**References**


Basudha, C. H., Singh, N. G., Devi, N. S., & Sinthoileima, C. H. (2017). Induced breeding and embryonic development of an indigenous fish *Bangana dero* (Hamilton) in captivity using Wova FH. International Journal of Fisheries and Aquatic Studies, 5(1), 428–432.

Bedajit, Y., Irungbam, S., Yumnam, R., Behera, B. K., Chimwar, W., Robindro, T., Salam, M. A., & Saha, R. K. (2020). Optimisation of hormone dosage for breeding of *Bangana devdevi*. Journal of Krishi Vigyan, 9(1), 260–263.

Das, P. C., & Mishra, B. (2016). Multi-species farming of major and minor carps for enhancing fish production in freshwater aquaculture. Indian Journal of Fisheries, 63(2), 55–61.

Das, S. K., & Singh, T. N. (2017). Captive breeding and embryonic development of endangered *Osteobrama belangeri* (Val., 1844) under mid-hill conditions in Northeast India. Indian Journal of Animal Sciences, 87(12), 1546–1550.

Debnath, C. (2022). The prospects and potentials of fisheries in Northeast India: Strengths, weaknesses, opportunities, and threats. Just Agriculture (A Multidisciplinary e-Newsletter), 2(11), 1–23.

HFS 2023. (2023). Handbook on Fisheries Statistics 2023 (16th ed.). Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India.

Sobita, N., & Basudha, C. (2020). Growth performance of an indigenous carp B*angana dero* (Hamilton) fed on formulated and commercial diets. Agricultural Science Digest – A Research Journal, 40(2), 199–202.