Aquaculture opportunities in lowlands of Brahmaputra valley, Assam

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A haul of carps in polyculture system.

The floodplains of the Brahmaputra valley in northeast India are rich in aquatic resources, including rivers, streams, wetlands (beels), ponds and tanks. Studies on the productivity of warm-water fish in lowland water bodies have received much attention in western and central India, but similar research in the northeastern states is lacking. The lowland water bodies of the Brahmaputra valley are important habitats and conservation sites for many native fish species. Developing fish farming technology, seed production and recreational facilities in these areas can improve food security and livelihoods for people living in these fragile but productive lowland regions.

The ICAR-Indian Agricultural Research Institute was established on 26 May 2017 with the laying of the foundation stone by the Honorable Prime Minister Shri Narendra Modi ji in the easternmost Dhemaji district on the north bank of the Brahmaputra valley. The institute serves agricultural research and education across Northeast India and aims to advance higher agricultural education throughout South-east Asia. As the institute has grown, a second centre at Gerua, Hajo in Kamrup (Rural) District was transferred from ICAR-National Rice Research Institute to ICAR-IARI Assam on 31 August 2025. The Gerua Centre covers 12.20 ha across two sites: Gerua and Abhaypur. One of the centre's mandates is to increase and sustain productivity of rice-based farming under rainfed lowland conditions. With this in mind, an assessment was conducted from 22–26 September 2025 to identify opportunities to integrate fish farming with other agricultural activities at the Gerua campus and its surroundings. The following aquaculture-based research and development programmes showed strong potential in the region.

Integrated farming system

Combining rice cultivation with fish farming using quality fish seed, appropriate stocking sizes, culture duration and ratios in trenches and dugouts along rice fields can increase overall productivity per unit area[1]. Growing horticultural crops such as Assam lemon, banana, papaya, betel nut, coconut, dragon fruit, guava and apple bogori on the embankments can further increase production from the integrated unit. Adding suitable duck varieties such as Khaki Campbell and Indian Runner

can boost egg and meat production. Integrating fish farming with pig breeds such as Hampshire and Ghungroo, and poultry breeds such as Kadaknath, Gramapriya, Vanaraja and Giriraja, is a proven option in the northeast. Waste water and muck from the fish ponds can be used as manure for crops on the dykes.

Polyculture

Fish ponds and tanks in the region are mainly carp-based, as in most parts of the country. Farmers are also stocking *Chitala chitala* (chital) and *Piaractus brachypomus* (roopchanda), along with minor carps such as *Labeo calbasu*, *L. gonius*, *L. bata* and *Cirrhinus reba*. Other species such as *Puntius sarana* (seni puthi) are also stocked. Current yields range from 3,500 to 4,500 kg per ha. Low production in these systems is likely due to imbalanced stocking densities, poor-quality seeds from unreliable suppliers, insufficient supplementary feeding and poor water management. Adopting best management practices suited to Assam conditions can increase pond productivity and improve returns for farmers in the region.

Monoculture

Some fish farmers in the region cultivate *Anabas testudineus* (vietnami kawoi). Ponds of 1,000–5,000 m² are used for monoculture. Fertilisers such as urea, single superphosphate and organic manures promote dense plankton growth, visible as green pond water. The fish are reared from April to September, a period of five to six months. Fish seeds are sourced from West Bengal and the nearby district of Nalbari. The species' ability to breathe air and tolerate extreme conditions makes it a strong candidate for aquaculture[2]. The harvested fish are marketed across the Northeast region according to demand.

Fish fingerling production

Another opportunity is short-term nursery rearing, raising day-old fish spawn to fingerling size over two to three months. Spawn can be procured cheaply from a reputable nearby hatchery and reared until fingerlings reach 100 mm, ready for stocking in larger ponds. Water quality, plankton production and fish health management are all important during the pre-stocking and post-stocking process. Fingerlings can be sold to local farmers at a much higher price than the cost of spawn. Selling fish seed is a viable source of income for small-scale farmers. Low-lying areas currently choked with grass and weeds can be converted into fish nurseries to maximise their value.

Ornamental fisheries

Ornamental fish are in high demand across the northeast. The Gerua Centre benefits from its proximity to Guwahati, the capital of Assam. Most inputs for ornamental fish farming - markets, aquarium accessories, fish species, vendors and traders - are readily available in Guwahati. The region's rail and air links are an added advantage for import and export trade. Many commercially valuable exotic and indigenous ornamental species can be reared and bred at the Centre with

Integrated fish with piggery.

A fish pond for polyculture of carps.

Integrated fish cum duck farming.

Monoculture of kawoi (climbing perch).

basic facilities such as glass tanks, small earthen or concrete ponds and FRP tanks. Fish produced at the Centre can be sold locally or traded to distant markets, providing another revenue stream for the Centre. Developing a public aquarium would be a significant step for the institute, generating revenue and promoting public education.

Biofloc technology

Biofloc technology is another promising option. It uses in-situ microorganism production to continuously recycle and reuse nutrients in the culture medium, with minimal or zero water exchange. Air-breathing fish such as *Heteropneustes fossilis* (singhi), *Clarias batrachu*s (magur), *Ompok pabda* (pabda), *Anabas testudineus* (koi) and *Pangasianodon hypophthalmus* (pangasius), as well as non-air-breathing fish such as *Cyprinus carpio* (common carp), *Labeo rohita* (rohu) and *Oreochromis niloticus* (tilapia), are reared in this system. Seeds for these species are available from reputable hatcheries in Guwahati and adjoining districts such as Barpeta, Nalbari and Nagaon. A small, suitable site can generate profitable returns for farmers in the region. This technology suits farmers with small landholdings and new entrepreneurs. Skills training and demonstration programmes run by the Gerua Centre can help fish farmers take up biofloc technology as a viable livelihood.

Recirculating aquaculture systems

Recirculating aquaculture systems (RAS) provide a controlled environment for high-density fish culture, reducing water use and land requirements while offering better biosecurity than traditional open-water aquaculture. Water is recycled and reused after mechanical and biological filtration to remove suspended matter and metabolites. Fish are grown at high density in indoor or outdoor tanks rather than in open ponds or raceways. Units can be installed using equipment from local suppliers in Guwahati. Fish produced in this system sell readily in the region, particularly in Guwahati. A RAS could be planned for the Centre, given the available space. RAS allows fish to be reared in a small area, making it suitable for farmers with marginal land, urban settings and areas with limited water. Some local residents have suggested installing RAS units on rooftops.

Freshwater pearl culture

Freshwater pearl farming in India mainly uses the Indian pond mussel (*Lamellidens marginalis*) and involves a culture period of 15-18 months. The process requires nucleation, implantation and rearing, and demands technical expertise. Pearl culture can be practised in ponds and wetlands with the right care and skills. This system has strong prospects in the Hajo region and can deliver significant economic returns. Pearls can be traded easily from the Hajo or Gerua region thanks to the proximity of Guwahati and its transport links. This practice would be an innovative addition to aquaculture in Assam, making use of underutilised aquatic resources. Careful, coordinated effort by aquaculturists, jewellers, traders and entrepreneurs at the Gerua campus could establish freshwater pearl production in the region.

Monoculture of commercially important fish species.

Underutilised aquatic resources of for fish seed trade.

Unmanaged fish ponds for short term seed rearing.

A unit of biofloc for raising high valed fishes.

Freshwater pearl culture as an innovative avenue.

Recreational fisheries

Fish-based recreational attractions can be developed in the region. Hajo is already a tourist destination that draws visitors regularly from Guwahati. The nearby foothills of Bhutan, Meghalaya and Arunachal Pradesh offer additional opportunities for riverine communities and aquaculture entrepreneurs. This could also support conservation of coldwater and hill stream fish species through catch-and-release angling and fish watching. Recreational fisheries could stimulate growth in related businesses such as homestays, trekking, water sports, bird watching, cycling, rafting and souvenir shops. Fish seed ranching programmes can be carried out in natural water bodies to restock depleted fish populations. Other options include managing underutilised open-water systems in wetlands (beels) through cage and pen culture. These wetlands can also be developed as recreational hubs for travellers and tourists.

Possibilities of recreational options in low lying wetlands.

Wetland fisheries

Wetlands are low-lying areas and an integral part of the Brahmaputra and Barak drainage systems in Assam. The state holds 50% of India's wetlands, locally known as beels. These wetlands provide a substantial fish harvest, and a large part of the state's population depends on them for food and livelihood[3]. The beels are naturally replenished by fish migrating from adjacent rivers through connecting channels. However, the use of intensive fishing gear has led to over-exploitation and declining fish productivity. Plant infestation, heavy siltation, encroachment by human settlement, the introduction of exotic species and illegal

Installed cage culture in wetlands.

Fish seed production in cages for restocking in wetlands.

fishing have further reduced fish catches. Given this situation, culture-based fisheries in these wetlands offer an ideal option for fish production. Cage culture is already practised in the region, where fish seeds are stocked for three to four months and then released into the beels. These water bodies are rich in nutrients and live food organisms, supporting rapid fish growth. Species stocked in cage culture include pangasius, koi, roopchanda[4], carps, magur and singhi. When water levels recede in winter, fish-aggregating devices (katal mara, jeng) are used to harvest fish for market. The beels are usually leased on short-term arrangements by the government to lessees and mohalders.

Conclusion

The Northeast region has great potential for fish-based development, provided the necessary infrastructure is in place. The region's natural environment also offers significant tourism assets. Promoting aquaculture in rural areas requires integrated planning alongside regional economic and social development. No aquaculture plan can succeed unless it is linked to the development of local communities through employment and livelihood opportunities. Developing underutilised wetlands is one important avenue. Aquaculture is a fast-growing industry but still lags behind agriculture and livestock in many aspects of production technology, including improved certified fish seeds, feeds, diversified farming systems, species selectivity, water budgeting, biotechnology and value-added fish products. Further research in these areas can complement traditional practices and improve the competence and productivity of aquaculture, whether the innovations come from farmers, research institutions, companies or governments.

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