

Augmenting fisheries via community-based cage culture: Scope and opportunities in Northeast India

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Fisheries are vital for Northeast India's socio-economic development, with over 95% relying on fish consumption. Despite abundant aquatic resources, local fish production (0.57 MMT/year) falls short of demand. Community-based cage culture (CBCC) emerges as a promising solution, leveraging local connections to water activities. A pilot CBCC initiative with 48 m² cages housing 2000 Cyprinus carpio (Common carp) demonstrated significant potential. Positive outcomes include 920 kg fish production/cage, FCR of 1.6, and a BCR of 2.0 over a period of six months. CBCC has not only the capacity to boost fish supply but also offers localized economic benefits, promising a resilient and prosperous fishery sector in Northeast India.

Keywords: Cage culture, Community-based, Enclosure culture, Hill fisheries, Open water fisheries

FISHERY is an important sector in the economic and livelihood development in India. Its contribution to the Indian economy amounts to ₹2,32,620 crore. In terms of its percentage contribution to India's GDP, it stands at 1.1% and in terms of its percentage contribution to agricultural GDP, it stands at 6.72%. The sector earns around ₹57,586.48 crore through export of fish. An annual growth rate of 10.34% has been recorded in India's fish production, which is currently (2021-22) 16.248 million metric tonnes (MMT). The sector supports the livelihoods of over 2.8 crores people in India. Recognizing the importance of this sector in socio-economic development, the Government of India introduced the *Pradhan Mantri Matsya Sampada Yojana* (PMMSY) on July 5, 2019, with the objective of increasing fish production by an additional 0.7 MMT, elevating fisheries export earnings to ₹1,00,000 crore, doubling the income of fishers and fish farmers, reducing post-harvest losses from 20-25% to about 10%, and creating around 55 lakh gainful employment opportunities

in the fisheries and allied sectors by 2024-25.

In the context of Northeast (NE) India, fisheries play a pivotal role in driving socio-economic development and sustaining livelihoods for over 26.3 lakh people. After rice farming, it stands as the most crucial component of livelihood in this region. With more than 95% of the region's population relying on fish as a source of animal protein, the demand for fish and its derivatives, such as dried fish, fermented fish, and smoked fish, is substantial. Despite the abundance of aquatic resources, local fish production, currently at 0.57 MMT, falls significantly short of meeting the regional demand. To bridge this gap, the region depends on fish imports from other Indian states, such as Andhra Pradesh, Tamil Nadu, and West Bengal, as well as neighbouring countries like Bangladesh. While these imports largely meet the local demand, they raise certain concerns, including the drainage of substantial funds from the region, the issue of formalin and ammonia adulteration in fish leading to health concerns, the risk

of transboundary fish pathogens, and the illegal introduction of exotic or banned fish species in the region. Presently, the fish deficit in NE India amounts to 43,050 metric tonnes. When considering nutritional security, aiming for 11 kg of fish per capita per annum as per ICMR recommendations, only Tripura has achieved self-sufficiency in fish production among the states in the region. Meghalaya faces the most significant fish deficit. Looking back, until 2004-05, NE India's annual fish production was a mere 0.24 MMT. However, focused and integrated efforts have resulted in an impressive 137.5% increase in fish production, reaching the current annual figure of 0.57 MMT. Despite this progress, substantial challenges persist. These include overconsumption of fish beyond nutritional requirements, sustaining production and productivity levels once government support is stopped, reducing production costs, and mitigating the associated carbon footprint.

Fish holds a significant place in the culinary traditions of NE India, acting as a crucial source of animal



Community cage culture in Dumbur reservoir, Tripura

protein for over 43 million people. In recent times, spurred by the COVID-19 pandemic, the demand for fish, particularly fresh fish, has notably increased in the region, driven by a growing awareness of its benefits as a 'health food'. Furthermore, the understanding that fish farming is a highly lucrative livelihood enterprise has firmly taken root in the public consciousness. Substantial opportunities also exist to create secondary livelihood avenues through value additions in the fish supply chain. This surge in the demand for fresh fish, coupled with the potential to expand livelihood opportunities, aligns seamlessly with the broader global trend that emphasizes locally-sourced fish and sustainable aquaculture practices. To effectively address this situation, the current concentration of fish production methods in land-based systems, such as ponds and tanks, needs diversification through innovative approaches like enclosure culture, specifically, cage culture and pen culture. Cage culture, in particular, offers a promising solution, as it provides protection for fish from all sides. By adopting this innovative technique, not only can a stable fish supply be ensured, but also the region's economic growth and food security can be supported.

Community cage culture in Dumbur Reservoir, Tripura

The extensive and diverse aquatic

ecosystems of NE India provide an excellent backdrop for implementing cage culture. By cultivating a variety of fish species, either individually or together within cages, this method can offer a sustainable and localized fish supply. This aligns with local preferences for fresh fish and reduces reliance on imports. Cage culture's capacity to produce fish intensively in controlled environments alleviates the burden on natural fish stocks and ecosystems, promoting long-term sustainability. By embracing cage culture and advocating for responsible practices, NE India can not only address its increasing demand for fish but also empower local communities,

enhance nutritional intake, and drive economic growth. With the abundance of vast open water bodies and the enhancement of these resources through cage culture, NE India possesses the potential to shift from being a 'fish importer' to transforming into a 'fish exporter.' This change could benefit not only India but also its neighboring countries such as Nepal, Bhutan, Myanmar, etc. where the demand for fresh fish is high.

Community-based cage culture (CBCC) represents a highly innovative method involving the stocking, rearing, and management of fish within cages, all under the active participation of the local community. In the context of NE India, where the local population has a deep connection to fish and water-related pursuits, this approach holds immense promise. Embracing CBCC can effectively rejuvenate cage culture, propelling it forward as a promising avenue to cultivate sustainable development within fishery-based livelihoods across the region.

Economic scope and opportunities

- **Diversification of livelihoods:** NE India, with over 87% of farmers categorized as marginal and small, relies predominantly on traditional farming for



Community cage culture in the Umiam lake, Meghalaya

sustenance. CBCC offers the opportunity to create additional income sources, reducing dependence on a single sector and bolstering economic resilience.

- **Employment generation:** The establishment and operation of cage culture systems require a skilled workforce. From cage construction to daily maintenance and market linkage, CBCC can generate employment opportunities across various skill levels, benefiting both skilled and unskilled labour.
- **Enhanced fresh fish production:** Given the escalating demand for fresh fish, CBCC holds the potential to significantly contribute to meeting this demand. Opportunities for 'live fish' marketing emerge. Controlled conditions often lead to improved growth rates and yields in cages compared to land-based farming, potentially escalating fish production in the region.
- **Value addition:** Cage culture enables high-density rearing of valuable species such as Pengba (*Osteobrama belengeri*) in Manipur, Pabda (*Ompok bimaculatus*) in Tripura, and Chital (*Chitala chitala*) in Assam. This promotes value addition in the fisheries sector, translating to increased income and enhanced profitability for aquaculture entrepreneurs.
- **Market access:** Well-managed CBCC systems ensure consistent and high-quality fish supply, catering to local markets effectively. Moreover, surplus production can be channeled to distant markets, further amplifying income opportunities for the region.

Social scope and opportunities

- **Social security:** Poaching and poisoning stand out as the primary challenges in fish culture within NE India. However, these issues can potentially be addressed through community participation and collaboration.

- **Women empowerment:** In numerous communities across Northeast India, women hold a crucial role in fish-related activities. CBCC has the potential to empower women by engaging them in various aspects of the process, such as feeding, maintenance, and marketing. This active involvement can contribute significantly to their economic and social empowerment. It has been observed that aquaculture proves more successful when women are actively engaged.
- **Skill development:** The practice of cage culture requires specialized knowledge in fish husbandry, water quality management, and cage maintenance. Implementing training programs can build local capacity and enhance the skill sets of individuals, improving employability.
- **Rural-urban linkages:** The fish produced through cage culture can bridge the rural-urban divide by supplying urban markets with fresh produce. This linkage can foster economic ties and create opportunities for urban investment in rural aquaculture.
- **Youth engagement:** NE India boasts a substantial youth population, exceeding 20 lakhs, within the age group of 15-35 years. By introducing contemporary cage culture techniques and technologies, the region can involve its youth in entrepreneurial endeavours, thereby lessening the inclination towards migration in pursuit of livelihood opportunities.

Environmental scope and opportunities

- **Resource optimization:** NE India is endowed with abundant water bodies, comprising 16.91% of India's rivers/canals, 0.15% of small reservoirs, 0.69% of medium and large reservoirs, 1.63% of ponds and tanks, 38.16% of beels/oxbow lakes/derelict water, and 55.09% of water bodies other than rivers

and canals. The adoption of CBCC holds the potential to optimize the utilization of these resources, thereby enhancing overall resource efficiency.

- **Pressure reduction on wild stocks:** Overfishing is a concern in the region. By adopting cage culture, pressure on wild fish stocks can be alleviated, contributing to the conservation of aquatic biodiversity.
- **Adaptation to increased flood incidences:** In recent years, NE India has experienced an alarming increase in the frequency and intensity of flood incidents, to the tune of 25%, particularly in Tripura, Mizoram, Manipur, parts of Meghalaya, and Nagaland. These floods are affecting half a million people every year. Often triggered by heavy rainfall and the complex topography of the region, these floods have posed significant challenges to local communities, ecosystems, and infrastructure. In this situation, embracing innovative strategies like CBCC offers a beacon of hope as an adaptive measure.

Challenges and mitigation strategies

- **Environmental sustainability:** Mismanaged cage culture can result in water pollution, habitat degradation, and disease outbreaks. To counter this, enforceable guidelines encompassing cage placement, stocking density, and water quality management are crucial. A well-defined regulatory structure is essential for responsible and sustainable community cage culture. Collaboration among government bodies, local communities, and experts is vital for comprehensive guideline development.
- **Climate vulnerability:** Climate-induced occurrences like flooding pose a threat to cage infrastructure, causing damage and disruption.
- **Disease management:** Disease outbreaks can devastate fish

stocks and livelihoods. Disease risks can be reduced through the implementation of biosecurity measures, robust quarantine procedures, and enhanced disease surveillance.

- **Financial access:** Overcoming the initial investment hurdle is challenging for communities and entrepreneurs. Government subsidies, microfinance initiatives, and developmental agency support play a pivotal role in facilitating financial access for cage culture development.

Experience gained from CBCC

A pilot-scale CBCC was demonstrated in 2021 at the Dumbur Reservoir in Tripura, involving local tribal farmers. The cages, each sized 48 m² (6m x 4m x 4m), were provided by the Department of Fisheries, Government of Tripura. One cage was stocked with Common carp (*Cyprinus carpio*) at a rate of 2000 fish per cage. These fish were fed pellet feed (2-3 mm) at 5% of their body weight during the initial 3 months, followed by 3% of the fish body weight for the subsequent three months. The average size of the fish at the time of stocking was 10 g. After 6 months of rearing, the fish size had grown to 500 g, with a survival rate of 92%. The total fish production from the cage was estimated to be 920 kg, with a Feed Conversion Ratio (FCR) of approximately 1.6. The total operational expenditure



for one cycle of 6 months was estimated to be ₹72,600. This included the costs of fish seeds, feeds, and miscellaneous expenses such as hiring boats, repairing nets, and transporting feeds. The total benefit generated from this venture was estimated to be ₹1,38,000, resulting in a net benefit of ₹65,400 over 6 months. The Benefit-Cost Ratio (BCR) was approximately 2.0. This positive outcome from the intervention indicates significant potential for CBCC in Northeast India. It underscores the importance of proper training, demonstration, and capacity-building programs to ensure the successful implementation of CBCC in the region.

SUMMARY

CBCC stands as a potentially transformative practice in NE India, promising economic growth, social empowerment, and environmental sustainability. Through meticulous planning, active stakeholder participation, and effective regulatory supervision, this approach holds the potential to usher in livelihood diversification, heightened fish production, and enhanced resource management. By capitalizing on the region's aquatic resources and its cultural connection to water-related activities, NE India can seize the advantages offered by CBCC to pave the way for a prosperous and sustainable future.

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