*SATSA Mukhapatra - Annual Technical Issue* ***29*** *: 2025* ISSN 0971-975X

# Sustainable Aquaculture through Catfish Culture in Village Pond : Adding a Means of Livelihood

*Biswajit Goswami* and Samiran Patra*[1]

(Received : January 8, 2024; Revised : January 16, 2025; Accepted : January 19, 2025)

**ABSTRACT**

A pioneering catfish breeding initiative has empowered rural communities by providing a reliable source of income and nutrition. This innovative approach leverages local resources and simple infrastructure to cultivate catfish in village ponds. The project's remarkable success has boosted fish production, enhanced household earnings, and improved food security. By promoting sustainable aquaculture practices, this initiative has the potential to uplift rural livelihoods, alleviate poverty, and drive rural development. The findings offer valuable insights for policymakers, development experts, and rural communities seeking to foster sustainable aquaculture and improve livelihood outcomes.

**Keywords :** Catfish, pond culture, sustainable livelihoods, rural development, aquaculture.

## Introduction

Magur (*Clarias batrachus*), a species of catfish, holds significant importance in Indian aquaculture. As one of the most widely cultivated freshwater fish species in India, Magur contributes substantially to the country's fish production (National Bureau of Fish Genetic Resources, 2018). Its hardiness, fast growth rate, and high market demand make it an attractive species for farmers (Jena *et al.*, 2014). Moreover, Magur is an excellent source of protein and has medicinal properties, further enhancing its value in Indian aquaculture (Sahoo *et al.*, 2017).

Magur, a native Indian catfish species, is of great significance in Indian aquaculture, especially in West Bengal. Thanks to its high market demand, rapid growth rate, and adaptability to various environments, Magur has become a promising species for cultivation in the region (Chakraborty *et al.*, 2018). The favorable climate, abundant water resources, and established aquaculture infrastructure in the state provide an ideal setting for Magur farming (Mandal *et al.*, 2017). Additionally, Magur serves as an excellent source of protein and is known for its medicinal properties, rendering it a valuable species for human consumption and health benefits (Sahoo *et al.*, 2017). With effective management and cultural practices, Magur has the potential to significantly contribute to the growth and advancement of West Bengal's aquaculture industry.

*Subject Matter specialist (Fishery Sc.), Dakshin Dinjapur Krishi Vigyan Kendra, Uttar Banga, Krishi Viswavidyalaya, Majhian, Patiram, D. Dinajpur-733133, WB; [1]Subject Matter Specialist (Fishery Sc.) Murshidabad Krishi Vigyan Kendra, West Bengal University of Animal & amp; Fishery Sicences, Milebasa (Digha), Kalukhali, Bhagwangola-I,

*Clarias batrachus*, widely recognized as a nutritious catfish species, is not only a staple in many diets but is also known for its therapeutic benefits, particularly during illness. This fish is rich in essential nutrients, such as protein, omega-3 fatty acids, vitamins, and minerals (Sahoo *et al.*, 2017). It typically contains about 18-20% protein, 1-2% fat, and 70-80% moisture, making it an excellent source of nutrition for human consumption (Jena *et al.*, 2013).

In addition to its nutritional value, *C. batrachus* has been shown to possess various therapeutic properties, including anti-inflammatory, antimicrobial, and antioxidant activities (Das *et al.*, 2015). Traditional uses of this fish include its potential medicinal benefits, such as reducing fever, alleviating respiratory issues, and promoting wound healing (Sahoo *et al.*, 2017). This dual role as both a nutritious food source and a natural remedy underscores the significance of*Clarias batrachus* in promoting health and well-being. *Clarias batrachus*, commonly known as the Magur or Walking Catfish, boasts a long history of aquaculture in Asia, tracing back to the 19th century (Jena *et al.*, 2013). This species is native to the Indian subcontinent and Southeast Asia and is classified within the family Clariidae and order Siluriformes (Nelson, 2006). Phylogenetic studies indicate that C. batrachus shares a close relationship with other species of the Clarias genus, such as *C. gariepinus* and *C. macrocephalus* (Sullivan *et al.*, 2006).

*Clarias batrachus*, commonly known as the Magur fish, holds considerable promise for promoting rural development and alleviating poverty, especially in regions like West Bengal. Renowned for its air-breathing capabilities and resilience to poor water quality, this species commands a strong market presence, with prices averaging Rs. 150.00 per kg in West Bengal and reaching as high as Rs. 450.00 elsewhere (Sahoo *et al.*, 2017).

The resilience of certain fish species enables them to thrive in underutilized water bodies, creating income opportunities for marginalized communities and fostering economic self-sufficiency (Chakraborty *et al.*, 2018). By utilizing these less accessible aquatic environments, farmers can tap into a new resource that enhances their livelihoods while also contributing to local food security. This approach not only empowers communities economically but also promotes sustainable practices by making productive use of available natural resources. Consequently, the cultivation of hardy species serves as a catalyst for positive change within these communities, leading to improved standards of living and greater economic independence. By leveraging local resources to cultivate Magur, rural development programs can empower individuals and families, particularly among the economically disadvantaged, thereby fostering sustainable livelihoods. This approach not only addresses immediate economic needs but also holds the potential to disrupt cycles of poverty and enhance overall community well-being (Mandal *et al.*, 2017). The aquaculture of Magur fish emerges as a strategic avenue for rural empowerment, presenting a viable solution for enhancing food security and improving the socio-economic conditions of vulnerable populations in West Bengal and beyond.

*Clarias batrachus*, commonly known as Magur fish (in bengali), is typically cultured in ponds alongside carps; however, it is also found in shaded areas and abandoned water bodies. Cultivating air-breathing fish like Magur presents a commercially viable opportunity, particularly for rural youth. Catfish are adept at thriving in challenging environments, including pits, ponds, marshes, and neglected water bodies characterized by low dissolved oxygen levels and high organic content.

In West Bengal, a significant portion of the population lives in poverty. Many of the most disadvantaged individuals find themselves trapped in a cycle of poverty due to a lack of collateral for income-generating activities. Efforts to break this cycle often focus on providing access to resources that enable individuals to earn an income, which in turn allows them to acquire additional resources. Rather than simply offering financial assistance for income generation, a more effective approach is to identify ways for impoverished communities to leverage the resources they currently possess. Most individuals facing economic hardship have the ability to work and can utilize the land beneath their homes and the surrounding area for support, including the abundant aquatic resources available.

In particular, the culture of*Clarias batrachus* thrives in pond-based systems that create optimal conditions for its growth and survival (Chakraborty *et al.*, 2018). This aquaculture approach involves stocking fingerlings in earthen ponds with a typical depth of 1-2 meters over areas ranging from 0.1 to 1.0 hectares (Jena *et al.*, 2013). To enhance productivity, these ponds are often fertilized using organic materials such as cow dung or poultry litter, which stimulate the growth of natural food sources in the water (Das *et al.*, 2015). Additionally, *C. batrachus* are supplemented with nutritional feeds, including commercial pellets or locally sourced ingredients like rice bran or mustard oil cake (Sahoo *et al.*, 2017). These practices not only support fish growth but also provide a pathway for generating income for those in need.

One promising income-generating activity that effectively utilizes local resources is homestead catfish farming. The essential requirements for this venture include fish feed, a small pond, access to water, and catfish fry. Catfish fry can be sourced at reasonable prices , costing approximately Rs. 2.00 per fry and can be procured from Hare Krishna Biswas in Kholsi, Tapan.

After a six-month rearing period, each Magur fry can grow to about 120 grams, with a market value of around Rs. 50.00 per fish. Additionally, thanks to the initiative from the Krishi Vigyan Kendra (KVK), another local fish farmer, Mr. Swapan Bhowmik from Balurghat, has established a Magur hatchery.

**The concept of catfish culture**

The fundamental idea behind the homestead catfish culture program is to provide an accessible and straightforward method for the poorest residents in an area to cultivate fish in small ponds or pits located on their homesteads. *Clarias batrachus*, or Magur fish, is particularly well-suited for this initiative as it not only breathes through gills but also absorbs

atmospheric oxygen via specialized respiratory organs. This adaptability allows the fish to thrive in a variety of water conditions, making it an ideal species for local farming.

Magur fish is highly valued for its taste, medicinal properties, and significant market demand, which underscores its potential as a lucrative farming option. Experience has shown that once individuals are introduced to the homestead catfish farming technique, they readily adapt it to their specific circumstances, optimizing the resources available around their homes.

Following the successful rearing of an initial batch of fish, participants often take the initiative to continue the practice. They may contact local fry traders for future stocks and explore various locally available food sources to enhance the nutrition of their fish. These grassroots initiatives are encouraged within the program and are critical to its long-term success, fostering a sense of ownership and sustainability among the participants. By empowering individuals to leverage their local resources and knowledge, the homestead catfish culture program not only helps alleviate poverty but also promotes community development and food security.

**Materials and methods :**

**Dissemination of Technology :**

To promote homestead catfish culture, a series of training and demonstration programs were organized by KVK for interested farmers, alongside field days aimed at extending the reach of this valuable technology. These training sessions for Magur culture were conducted directly at the homestead level, ensuring participants received practical, hands-on experience.

To select the most needy participants, a thorough review of their situations was conducted based on specific criteria:

1. Land Ownership: Participants had to be landless, defined as those owning less than 0.02 hectares of land.
2. Economic Status: Participants needed to demonstrate a generally poor financial situation.

Those who expressed interest in the program were provided Magur fry at no cost. This distribution was crucial in encouraging farmers to engage in fish culture, as it lowered the entry barriers and fostered enthusiasm for the activity.

To support these farmers, KVK staff made regular visits to their ponds, allowing them to ask questions and share experiences. During the fry stocking process, three key rules for effective catfish culture were communicated:

1. Daily Feeding: The fish need to be fed every day, ideally until they show signs of satiation.
2. Food Variety: Farmers were advised that any food could be used for catfish, except for grass and plastic, with an emphasis on protein-rich options as the most beneficial.
3. Water Management: Farmers were instructed to change the pond water whenever it began to emit a foul odour.

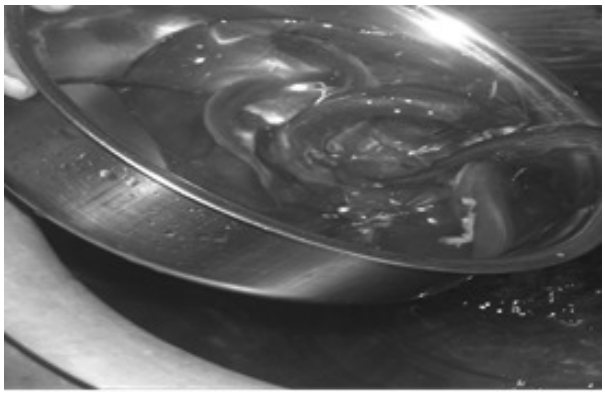
The initiative led to the cultivation of catfish in 15 ponds across three villages in the Tapan block of West Bengal,

facilitated by KVK under the National Agricultural Innovation Project (NAIP) during the 2013-2014 period. A total of 15 farmers participated in this homestead catfish culture program.

Household demographics indicated that the average size of participating households was about five members. A significant majority (84 percent) of male members held income-generating jobs, earning approximately Rs. 100 per day. Conversely, most women (90 percent) remained at home and did not earn an income. Those women who did earn brought home an average of Rs. 50 daily.

The households typically consumed two to three meals a day, primarily made up of rice and vegetables, with pulses (dal)—a good source of protein—appearing in their diet only three times a week. Fish was included in meals twice a week, while meat was consumed every two weeks. Eggs and milk were consumed less frequently, at less than four times per week.

Overall, this program not only provided immediate economic benefits through additional food sources and income but also empowered participants with new skills and knowledge, fostering a sense of independence and community resilience.



Catfish (Fry) to be released

Releasing Catfish (Fry) in the pond

**Grow out culture and Management :**

Grow-out culture of catfish involves the process of rearing fingerlings to marketable size in either earthen ponds or concrete tanks (Das *et al.*, 2015). For the successful culture of Magur, earthen ponds were specifically prepared, and effective management practices were identified as essential for optimal growth and survival rates. Key management practices include maintaining optimal water quality parameters, such as dissolved oxygen, pH, and ammonia levels, to ensure a healthy environment for the fish (Chakraborty *et al.*, 2018).

Stocking density plays a crucial role in the successful culture of Magur catfish in pond-based systems. Research indicates that a stocking density of 50,000 fish per hectare is suitable for this species. Optimal growth rates and minimized mortality have been associated with stocking densities ranging from 2 to 6 individuals per square meter (Das *et al.*, 2020). However, it is important to note that higher stocking

densities—ranging from 8 to 10 individuals per square meter can negatively affect growth rates, increase disease susceptibility, and reduce overall water quality (Chakraborty *et al.*, 2020). A recent study has suggested a stocking density of 4 individuals per square meter as optimal for Magur catfish culture in earthen ponds, resulting in improved growth performance and better management of water quality (Sahoo *et al.*, 2022).

At the project site, pond sizes varied between 0.0133 and 0.0665 hectares, and fingerlings weighing approximately 10 grams demonstrated favorable survival and growth throughout the culture period. Regular monitoring of water quality, along with prompt corrective measures, is essential to prevent disease outbreaks and minimize mortality among the fish population (Sahoo *et al.*, 2017).

Nutrition is another critical component of catfish culture. Providing adequate nutrition through either commercial pellets or locally available feed ingredients, such as rice bran and mustard oil cake, is essential for promoting healthy growth and development (Jena *et al.*, 2013). Fish were fed at a rate of 3-5% of their body weight using homemade feed, which was commonly placed in feeding baskets distributed strategically around the pond. The supplied feed was primarily sourced from the homestead and included a variety of ingredients such as snails (46%), rice (18%), wheat bran (9%), bivalves (5%), and slaughter waste (5%). Additionally, other ingredients such as termites, earthworms, wheat powder, cow dung, fish, bread, and duckweed were utilized to diversify the fish diet.

The average time spent caring for the fish was about one hour per day. Given that Magur catfish are air-breathing, they often rise to the water's surface to intake atmospheric oxygen, which can attract birds and other predators. To mitigate this risk, it is advisable to cover the ponds with nets, providing protection for the fish while they grow to marketable size. This combination of effective management, optimal stocking practices, and protective measures contributes significantly to the overall success of the catfish culture program.

Harvested Catfish

A haul of Catfish

Three households were not able to grow their fish to marketable size (>75g), due to several reasons :

- Not enough time spent on the management of the pond by the responsible person in the household (less than one hour per day).
- Escaping of fish (after flood, or heavy rain).

**Results and Discussion :**

The homestead fish culture program has significantly favored the use of local catfish (*Clarias batrachus*) due to several distinct advantages over the African catfish. The local variety is preferred for its less carnivorous nature and better taste, as well as its environmental friendliness. Concerns have been raised about the potential ecologic impact of the African catfish, particularly the fear that it could lead to the decline of local fish populations, making the local catfish a more sustainable choice for aquaculture practices.

**Supply and Demand**

Currently, the market demand for catfish remains high, and as the homestead culture program gains traction, this demand is anticipated to increase further. The success of the program has encouraged fry producers to actively participate by distributing fry directly to homesteads. This model not only meets the immediate needs of local farmers but also empowers women by facilitating their ability to purchase fry conveniently at home.

**Sustainability**

The sustainability of the homestead fish culture program hinges on the consistent availability of fry. As long as fry for local catfish remains accessible, the program is likely to thrive. The impacts of the initiative are evident; over a six-month period, 20 new households adopted this fish farming method without the influence of the regular program, resulting in a diffusion ratio of 20/15 = 1.3.

The growth rate of the fish in this culture system has proven effective, with the catfish reaching a marketable size of approximately 100 grams within six months. Harvesting typically involves dewatering the ponds completely and manually collecting the fish from their holding environment. This method proved to be efficient, resulting in a production yield of 3 tons from a one-hectare water area.

**Economic Viability**

The economic outcomes from the catfish culture program appear promising. The net income generated from an area of 0.133 hectares was reported to be around Rs. 83,500, yielding a Benefit-Cost (B:C) ratio of 3.87. Such metrics underscore the program's profitability and suggest that it provides a reliable source of income for participating households.

In summary, the preferences for local catfish in the homestead fish culture program are rooted in its ecological and nutritional advantages, while the growing market demand and economic benefits highlight the program's potential for sustainability and community empowerment. The combination of effective fry distribution, successful growth rates, and encouraging economic returns can significantly enhance the resilience and viability of small-scale aquaculture in the region.

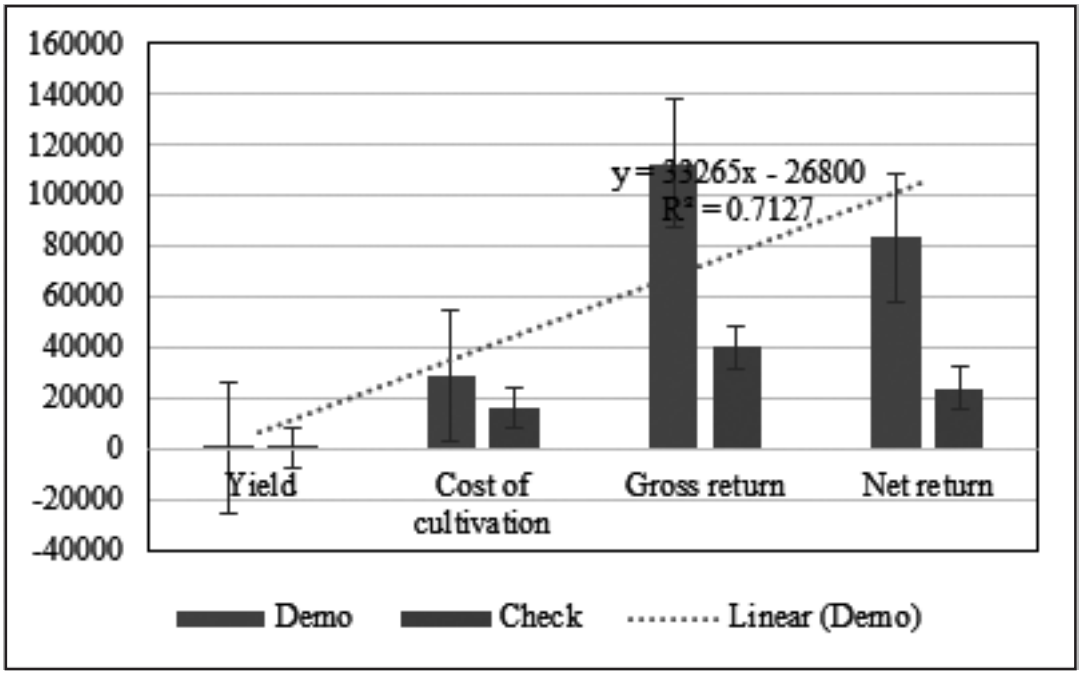



**Figure : Economic Analysis of magur (*Clarias batrachus*) production**

**Possible Outcome :**

The homestead fish culture program has established a strong preference for the use of local catfish (*Clarias batrachus*) over the African catfish, owing to several notable advantages. Local catfish are favored due to their less carnivorous diet, superior taste, and lower environmental impact. Additionally, concerns regarding the ecological consequences of introducing the African catfish particularly the risk of diminishing local fish populations—make the local variety a more sustainable option for aquaculture.

**Supply and Demand**

Market demand for catfish is currently robust and is expected to rise further as the homestead culture program expands. The program's success has led to increased participation from fry producers, who are now distributing fry directly to local homesteads. This direct supply model not only meets the immediate needs of farmers but also empowers women by making it easier for them to purchase fry from their homes.

**Sustainability**

The sustainability of the homestead fish culture program is closely tied to the consistent availability of fry. As long as local catfish fry remain accessible, the success of the program is likely to continue. Over a six-month period, the initiative has seen 20 new households adopt fish farming practices independently, leading to a diffusion ratio of 20/15 = 1.3. This growth highlights the program's ability to spread organically within the community.

In terms of growth rates, local catfish in this culture system have performed well, reaching a marketable weight of around

100 grams within six months. Harvesting is conducted by dewatering the ponds completely, allowing for manual collection of the fish, a method that has proven efficient. This approach led to a commendable production yield of 3 tons per hectare.

**Economic Viability**

The economic prospects of the catfish culture program are promising. In terms of profit, a net income of approximately Rs. 83,500 was reported from an area of just 0.133 hectares, resulting in a Benefit-Cost (B:C) ratio of 3.87. These figures reflect the program's profitability and indicate that it serves as a reliable source of income for participating households.

**Conclusion**

The homestead fish culture program highlights the advantages of cultivating local catfish, making it a compelling choice for aquaculture. Its ecological and nutritional benefits support not only environmental sustainability but also the health of the community. The combination of growing market demand and favorable economic outcomes illustrates the program's potential for long-term viability and community empowerment.The preference for local catfish minimizes ecological risks, such as the potential decline of native fish populations caused by the introduction of the more carnivorous African catfish. Local catfish is celebrated for its quality and taste, serving as an important source of protein and contributing to improved nutrition for participating households. There is a rising market demand for catfish, which is expected to grow further, creating a promising landscape for fish farmers. With reported net incomes of Rs. 83,500 from a small area of 0.133 hectares and a strong Benefit-Cost ratio of 3.87, the economic viability of the program is evident, making it an attractive opportunity for local farmers. By simplifying access to fry sales at home, the program empowers women in the community, enhancing their roles in local aquaculture and improving their financial independence. In conclusion, the homestead fish culture program stands as a robust model for sustainable aquaculture, offering numerous benefits that extend beyond economic gains. It represents a strategic approach to enhancing livelihoods, fostering community development, and promoting environmental stewardship, thus ensuring a resilient future for small-scale aquaculture in the region.

**References**

Chakraborty, B. K., Das, S. K. and Mandal, S. C. 2018. Catfish culture in West Bengal: A review. *Journal of Aquatic Science* **33**(1): 1-12.

Chakraborty, B. K., Das, S. K. and Mandal, S. C. 2020. Effects of stocking density on growth and survival of*Clarias batrachus* in pond culture. *Journal of Aquatic Science*, **35**(1): 1-9.

Das, S. K., Chakraborty, B. K. and Mandal, S. C. 2015. Antimicrobial and antioxidant activities of*Clarias batrachus*. *Journal of Aquatic Science* **30**(1): 1-9.

Das, S. K., Chakraborty, B. K. and Mandal, S. C. 2015. Pond-based culture of*Clarias batrachus*: A review. *Journal of Inland Fisheries Society of India* **47**(1), 1-11.

Das, S. K., Chakraborty, B. K. and Mandal, S. C. 2020. Optimal stocking density for Magur catfish (Clarias batrachus) in pond culture. *Journal of Inland Fisheries Society of India* **52**(1): 1-8.

Jena, J. K., Das, P. C. and Mohapatra, B. C. 2013. Catfish farming in India: Present status and future prospects. *Journal of Aquatic Science* **28**(1): 1-13.

Jena, J. K., Das, P. C., and Mohapatra, B. C., 2013. Nutritional value of*Clarias batrachus*. *Journal of Food Science and Technology* **50**(4): 741-746.

Jena, J. K., Das, P. C. and Mohapatra, B. C. 2014. Catfish farming in India: Present status and future prospects. *Journal of Aquatic Science* **29**(1): 1-13.

Mandal, S. C., Chakraborty, B. K. and Das, S. K. 2017. Aquaculture in West Bengal: Present status and future prospects. *Journal of the Inland Fisheries Society of India* **49**(1): 1-15.

National Bureau of Fish Genetic Resources. 2018. Fish Genetic Resources of India. Lucknow: National Bureau of Fish Genetic Resources.

Nelson, J. S. 2006.(in) *Fishes of the World* (4$^{th}$ed.). John Wiley & Sons.

Sahoo, S. K., Swain, P. and Mohapatra, D. 2017. Nutritional and medicinal importance of catfish (*Clarias batrachus*). *Journal of Food Science and Technology* 54(4): 1010-1018.

Sahoo, S. K., Swain, P. and Mohapatra, D. 2022. Effects of stocking density on growth, survival, and water quality in Magur catfish (*Clarias batrachus*) pond culture. *Aquaculture Research***53**(4): 1241-1251.

Sullivan, J. P., Lundberg, J. G. and Hardman, M. 2006. A phylogenetic analysis of the catfish family Clariidae (Teleostei: Siluriformes). *Molecular Phylogenetics and Evolution* **41**(3): 636-646.