

Incorporation of Pabda (*Ompok bimaculatus*) in Polyculture Systems to Promote Sustainable Aquaculture

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Abstract

The incorporation of *Ompok bimaculatus*, commonly known as pabda or butter catfish, into fish polyculture systems in Northeast India can enhance sustainability in aquaculture. Pabda is a small indigenous catfish with high nutritional and economic value. Its biological characteristics, including tolerance to varying water quality parameters, high reproductive potential and adaptability to polyculture environments, make it suitable for integration with Indian Major Carps and minor indigenous species. The incorporation of pabda into polyculture systems can increase overall productivity, maintain ecological balance, improve biodiversity and provide additional income for rural farmers. Optimal culture practices such as proper stocking density, balanced feeding regimes, water quality management and disease prevention are crucial for maximizing growth and survival. Adoption of pabda in polyculture also addresses socio-economic concerns, including income diversification, employment generation and preservation of culturally important fish species in Northeast India.

Keywords: Pabda, polyculture, sustainable aquaculture, Northeast India, aquaculture, diversification

Introduction

Aquaculture in Northeast India has traditionally focused on carp-based polyculture systems due to their high adaptability, fast growth and established market demand. However, over-reliance on a limited number of species has led to ecological imbalances, declining fish diversity and increasing vulnerability to diseases. The region possesses a rich diversity of indigenous freshwater species that remain underutilized in aquaculture. Among these, *Ompok bimaculatus* (pabda) is a small indigenous catfish highly valued for its taste, nutritional quality and market demand. Pabda inhabits rivers, ponds and lakes, exhibiting tolerance to a range of water quality conditions and compatibility with other fish species. Its biological characteristics, such as high fecundity, rapid growth in favourable conditions and benthic feeding habits, make it particularly suitable for integration into polyculture systems alongside Indian Major Carps and minor indigenous species. Culturing pabda in polyculture systems can enhance overall productivity, improve

biodiversity and contribute to sustainable aquaculture practices while providing additional income opportunities for rural fish farmers. Incorporating indigenous species like pabda also aligns with conservation objectives, helping to maintain native fish populations and ecological balance in freshwater ecosystems.

Biological Characteristics of Pabda

Ompok bimaculatus is a small, elongated catfish species characterized by its silvery body and



distinctive barbels. Typically inhabiting clear and muddy waters of streams, ponds and lakes,

pabda thrives in environments with temperatures ranging from 20°C to 26°C, a pH between 6 and 8 and dissolved oxygen levels of 4 to 5 mg/L. The species exhibits a high reproductive rate, with females laying over 40,000 eggs and can reach a maximum length of approximately 30 cm.

Incorporation of Pabda into Polyculture Systems

Incorporation of pabda into polyculture systems involves co-cultivating it with other species such as Indian Major Carps (IMCs) and indigenous minor carps. Studies have shown that pabda can coexist harmoniously with these species, utilizing the lower trophic levels and contributing to the overall productivity of the system. For instance, research indicates that pabda's incorporation can enhance the biodiversity and ecological balance of aquaculture systems, leading to improved water quality and reduced disease incidence.

Optimal Culture Practices for Pabda



The culture of pabda requires careful management of pond ecology and husbandry practices to achieve high survival and growth. Water quality is one of the most critical factors influencing the success of pabda aquaculture. The species thrives in a temperature range of 20 to 26°C, with a slightly acidic to neutral pH of 6 to 8 and dissolved oxygen levels above 4 milligrams per liter. Regular monitoring of these parameters is essential since fluctuations in temperature or depletion of oxygen can reduce feeding efficiency, increase stress and predispose the fish to disease outbreaks. Proper water exchange, liming and organic or inorganic fertilization may be required to maintain favourable pond conditions depending on seasonal and regional variations.

Stocking density and feeding practices are also important in ensuring good growth and optimum yield. For polyculture systems, a density of 2,000 to 3,000 fingerlings per hectare

has been found suitable for pabda, though adjustments may be made depending on the biomass of companion species such as Indian Major Carps. Pabda is a carnivorous fish that requires protein-rich feed for proper growth and reproduction. Supplementary diets containing 30 to 35 percent protein, often formulated with fish meal, oilseed cakes and locally available feed resources, can be provided in addition to natural food available in the pond. Feeding should be regular and balanced to prevent competition with other species in the system and to reduce feed wastage, which can deteriorate water quality.

Health management forms another crucial aspect of pabda culture. Being a delicate species compared to hardy carps, pabda is more prone to stress-induced diseases. Routine observation of fish behaviour, checking for abnormal swimming, discoloration or lesions, helps in the early detection of disease. Preventive measures such as pond sanitation, use of disease-free seed and periodic health checks are important for maintaining stock health. Common bacterial and fungal infections can be minimized through proper water management and by avoiding overcrowding. Where necessary, herbal or approved chemical treatments may be applied judiciously. Integration of health management practices with good nutrition and water quality control forms the basis of a sustainable and productive pabda culture system.

Socio Economic Implications

Integration of pabda into polyculture systems offers significant socio-economic benefits for rural communities in Northeast India. Pabda is a high value fish with strong consumer preference due to its soft flesh, delicate taste and absence of intramuscular spines. Market surveys have consistently shown that pabda fetches premium prices compared to carps and other small indigenous fishes. By diversifying the species composition in aquaculture systems, farmers can secure an additional source of income, which reduces dependence on a single group of species. This income diversification is particularly important in small scale aquaculture where vulnerability to market fluctuations and disease outbreaks is high.

Employment generation is another important socio-economic benefit. The culture of pabda requires seed production, nursery rearing, grow out farming, feed formulation and marketing activities. Each of these stages provides opportunities for engagement of rural youth and women, thereby contributing to livelihood security. Women in particular play an important role in seed nursing and feeding operations,

which can be conveniently managed at the household level. In this way, pabda culture not only supports economic development but also strengthens social inclusion and gender equity in aquaculture.

The cultural significance of pabda further enhances its acceptance in the region. In several communities of Assam, Manipur, Tripura and other Northeastern states, pabda is considered a traditional delicacy served during festive occasions and family gatherings. The revival of its farming aligns with the preservation of culinary heritage and ensures a continuous supply of this preferred fish that is becoming scarce in natural waters due to overfishing and habitat degradation. In this way, pabda culture contributes simultaneously to food security, cultural identity and rural prosperity.

Challenges and Constraints

Despite the promising scope, several challenges limit the widespread adoption of pabda in polyculture systems. One of the major constraints is the lack of awareness and technical knowledge among farmers. Carp culture has been widely promoted for decades through training and extension services, but pabda remains relatively new in organized aquaculture. Many farmers are unfamiliar with its feeding habits, stocking densities and disease management requirements. As a result, adoption remains low despite high market demand.

Another significant barrier is the shortage of quality seed. Natural populations of pabda have declined rapidly in recent years due to overexploitation, pollution and destruction of breeding grounds. Hatchery production of pabda is still in its infancy and the availability of seed is limited to a few government and research stations. Farmers often face difficulties in obtaining sufficient and reliable seed for stocking, which restricts expansion of pabda culture. In addition, feed requirements of pabda differ from carps and high protein feed is often expensive or unavailable to small farmers.

Infrastructure limitations such as inadequate water supply, poor pond management facilities and limited access to credit and insurance also affect adoption. Disease outbreaks, particularly under conditions of overcrowding and poor water quality, can lead to heavy losses. Market dynamics add another layer of uncertainty, since pabda prices fluctuate based on seasonal supply and demand. Although the fish usually fetches high prices, farmers sometimes face challenges in transportation and marketing due to the perishable nature of fresh fish and lack of cold chain infrastructure. Addressing these

constraints is essential for realizing the full potential of pabda culture in Northeast India.

Strategies for Promoting Pabda Culture

The promotion of pabda in fish polyculture requires a multi-pronged approach involving research, extension, policy support and community participation. Training and capacity building are the most immediate requirements. Regular farmer training programs, field demonstrations and exposure visits should be organized to disseminate knowledge on pond preparation, seed nursing, stocking density, feeding regimes and disease prevention. Local languages and community based participatory methods should be used to ensure effective communication and adoption.

Research and development efforts need to focus on seed production, nutrition and health management. Successful captive breeding of pabda has been achieved in some research institutions, but large scale dissemination of breeding protocols and establishment of hatcheries are required to ensure year round availability of quality seed. Research on cost effective feed formulations using locally available ingredients such as oil cakes, fish byproducts and plant protein sources can help reduce input costs and improve sustainability. Disease diagnostics and preventive health care strategies tailored for pabda are also necessary to minimize losses.

Policy interventions play an equally critical role. Government schemes can provide subsidies for pond renovation, seed procurement and feed purchase to encourage farmers to adopt pabda culture. Financial institutions can be engaged to provide accessible credit facilities and insurance coverage to reduce risks associated with aquaculture. Establishing farmer cooperatives or producer groups will help in collective marketing, bulk procurement of inputs and bargaining for better prices. Public private partnerships can further strengthen seed supply chains and market linkages.

Integration of pabda culture with other innovative systems such as rice fish farming, integrated multitrophic aquaculture and cage culture in floodplain wetlands may also expand opportunities for farmers. These strategies not only promote species diversification but also enhance resource use efficiency, conserve biodiversity and improve ecological resilience. Through a combination of research, extension and policy support, pabda can emerge as a key component of sustainable aquaculture in Northeast India.

Conclusion

Incorporating *Ompok bimaculatus* into fish polyculture systems in Northeast India holds significant promise for sustainable aquaculture development. By leveraging its biological attributes and aligning culture practices with ecological principles, pabda can contribute to

enhanced productivity, biodiversity and socio-economic upliftment in the region. Addressing the existing challenges through targeted interventions will facilitate the widespread adoption of pabda culture, thereby fostering a resilient and sustainable aquaculture sector in Northeast India.