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Nutrition-Sensitive Carp-Mola Polyculture for Improved Livelihoods and Wellbeing: Lessons from India

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Introduction

The integration of the nutrient-rich indigenous small fish, mola (*Amblypharyngodon mola*), with conventional carp farming in a form of nutrition-sensitive aquaculture presents a transformative approach to enhancing food and nutrition security, diversifying income, and promoting sustainable aquaculture, thus supporting livelihoods in rural communities (1). This polyculture system leverages the high nutritional value of mola, which is rich in essential micronutrients such as calcium, iron, vitamin A, vitamin B12, and omega-3 fatty acids, making it a valuable addition to the diets of populations suffering from micronutrient deficiencies. The mola is a surface-dwelling fish, predominantly feeding on phytoplankton. Remarkably prolific, the mola reaches sexual maturity at just 3 months of age. The success of a carp-mola polyculture system depends on improved pond management practices, including pre-stocking, stocking, post-stocking, and harvesting strategies. These practices aim to optimize pond conditions, stocking densities, and feeding regimes to enhance mola yields while maintaining a healthy pond environment.

In response to this need, this paper aims to provide comprehensive insights into carp-mola polyculture in homestead ponds. It offers detailed guidance on farm management practices, production potentials, productivity trends, and economic factors associated with carp-mola polyculture systems. With a particular focus on income diversification, this document presents detailed strategies and solutions for enhancing food security and livelihood sustainability in target communities.

Materials and Methods

The carp-mola polyculture system involves several key steps similar to that of carp culture with a special focus on plankton and nutrient management.

Pre-stocking management: Preparation of ponds is crucial. This includes cleaning, drying, and liming the pond bed, followed by fertilization to ensure a nutrient-rich environment.

Stocking: Mola seeds or brood are introduced into the ponds. The stocking process can involve either wild broods or hatchery-reared mola seeds. The latter has proven more sustainable due to uniform size, reduced infection risk, and higher survival rates.

Post-stocking management: This involves regular monitoring, supplementary feeding, and fertilization to maintain optimal pond conditions. Continuous guidance and training on Better Management Practices (BMPs) ensure sustainable operations.

Harvesting strategies: Both partial and bulk harvesting methods are employed. Partial harvesting ensures continuous production and availability of mola for household consumption, while bulk harvesting caters to market demands.

Results and Discussion

Carp-mola polyculture represents a holistic approach to developing sustainable aquaculture technology. It enhances the average productivity of high-value carp species for commercial purposes while also providing highly nutritious small fish for household consumption. This integrated approach contributes to improving the overall nutritional quality of the total production. However, the productivity of mola within carp-mola polyculture ponds is influenced by a multitude of factors, including the quality of stocked broodfish, the presence of predatory fish, stocking density, the composition of carp species, pond size, fertilization levels, and climatic conditions. It is argued that the introduction of the phytoplankton-grazing mola may diminish food and plankton resources directly impacting Indian Major Carp such as rohu and catla. However, research indicates that the carp-mola polyculture system exhibits superior productivity and income compared to only carp polyculture systems (2-4).

Various reports from carp-mola polyculture systems in Asia have demonstrated diverse levels of mola productivity based on stocking densities. In small-scale settings, an average mola production of 150-300 kg/ha can typically be attained (5). Depending on carp stocking density (2500–16000 numbers/ha) in the carp-mola polyculture system, annual carp production ranges from 0.7 to 3.7 tons per hectare (5). Evidence from Bangladesh indicates that integrating mola alongside commonly farmed carp in household ponds or larger water bodies is technically straightforward. This integration can significantly enhance overall productivity to 3.6 metric tons per hectare per year, boost income from fish sales, and enhance family nutrition (6).

The implementation of carp-mola polyculture has shown significant results in various regions:

Production and productivity: Average fish production in these systems ranges from 1.7 to 1.9 tons per hectare, with mola production reaching up to 155 kg per hectare. This integrated system enhances the overall yield without compromising the production of conventional carps.

Economic impact: Financial support and training provided to Women Self-Help Groups (WSHGs) have resulted in increased incomes. The system not only supports food security but also provides a reliable source of income, particularly empowering women in rural areas.

Nutritional benefits: Mola is rich in micronutrients, which significantly improves household nutrition. The increased availability of nutrient-dense fish contributes to better health outcomes in local communities.

Environmental sustainability: The use of improved management practices and reduced reliance on wild fish for stocking has minimized environmental impacts. The introduction of hatchery-produced seeds ensures sustainability and ecological balance.

Case studies: Success stories from Assam and Odisha illustrate the transformative impact of carp-mola polyculture. In Assam, the Assam Agribusiness and Rural Transformation Project (APART) has promoted economic growth and improved nutrition through innovative polyculture techniques. Similarly, Odisha's policy intervention through WSHGs has led to increased fish production and enhanced food security. Collaborative efforts by organizations like WorldFish and GIZ to develop scalable hatchery techniques for mass seed production of mola are crucial for the sustainability and expansion of this aquaculture system (7).

In conclusion, the carp-mola polyculture system offers a promising solution to the challenges faced by small-scale aquaculture communities in India. By integrating nutrient-rich small fish with conventional carp farming, this system enhances food security, diversifies production, and supports livelihoods. The collaborative efforts of various organizations have established a sustainable and scalable model that can be replicated across different regions.

To fully harness the potential of carp-mola polyculture, a multifaceted approach is recommended. This includes raising awareness and building capacity among farmers, particularly women, to manage ponds and harvest fish effectively. Supportive policy measures, expansion of outreach and extension services, integration of a gender perspective, and provision of business coaching and access to financial services are essential. Additionally, investing in research and innovation, facilitating market access, and implementing robust monitoring and evaluation mechanisms are critical to assess the impact and refine strategies. By implementing these recommendations and building on existing successes, stakeholders can work synergistically to unlock the full potential of carp-mola polyculture. This will lead to improved nutrition, enhanced livelihoods, and the promotion of sustainable aquaculture development across India. The integration of this system with agroecological approaches and decentralized renewable energy sources can further enhance its sustainability and resilience, making it a viable model for rural economic empowerment and food and nutrition security.

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