

Securing the future of the melon barb: Science-based aquaculture for conservation

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The melon barb (*Haludaria fasciata*) is a freshwater cyprinid endemic to the Western Ghats of India.

A species of endemic beauty and ecological significance

The melon barb (*Haludaria fasciata*) is a freshwater cyprinid endemic to the Western Ghats of India and a living emblem of the region's aquatic biodiversity. Native to the hill streams of Kerala and Tamil Nadu, this vibrant fish has a striking lemon-yellow lateral stripe and gentle schooling behaviour. These qualities have made it a favourite of the global ornamental fish market.

In the wild, melon barb thrive in cool, well-oxygenated streams with cobble-stone substrates and riparian vegetation. This vegetation stabilises the microclimate, maintains water clarity, and provides food such as insects and plant detritus. Water temperature in these habitats ranges between 22 and 28° C, with a slightly acidic to neutral pH and dissolved oxygen levels consistently above 5 mg/L.

These habitats are increasingly threatened by deforestation, sand mining, urban encroachment, and agricultural runoff, which cause siltation and chemical pollution. These pressures have caused a measurable decline in many native species, including *H. fasciata*. Conservationists now emphasise ex-situ measures such as captive breeding and brood banking as essential complements to habitat protection.

The ecological significance of the melon barb extends beyond its visual appeal. As an omnivore at mid-trophic level, it contributes to nutrient cycling by grazing on algae, detritus, and micro-crustaceans, and it serves as prey for larger native fishes and aquatic birds. Its short generation time, flexible diet, and readiness to breed under controlled conditions make it both a key species for sustainable ornamental aquaculture and a model organism for freshwater ecological studies. Conserving the melon barb is both an economic and ecological necessity, ensuring the continued functioning of Western Ghats stream ecosystems and providing a sustainable resource for the ornamental fish trade.

Breeding success through careful broodstock management

Captive breeding of *H. fasciata* is a science-based success story that combines ecological stewardship with rural livelihood opportunities. The first step is developing robust broodstock. Farmers condition wild-caught or farm-raised adults separately for two to three weeks on a high-protein, carotenoid-enriched diet of live *Artemia*, *Moina*, and carefully formulated micro-pellets. This diet improves gonadal development, intensifies natural coloration, and synchronises spawning readiness.

Farmers gradually raise the water temperature to around 26 °C while maintaining a neutral pH and continuous aeration. This mimics the natural monsoon cues that stimulate breeding in the wild. Sexual dimorphism, though subtle, helps in selecting brooders: males are slimmer and more intensely coloured, especially around the dorsal and caudal fins, while females have a fuller, soft abdomen when gravid.

Farmers typically use spawning tanks of 60 × 30 × 30 cm, equipped with fine-mesh false bottoms and synthetic spawning mops to protect adhesive eggs from predation. They introduce males first, then add females 24 hours later to trigger courtship behaviours such as circling and fin flaring. Covering the tank to maintain darkness completes the environmental simulation.

Within 8 to 12 hours, females scatter several hundred eggs that sink through the mesh and attach to the substrate, safe from adult fish. Fertilisation rates are high, and eggs hatch within 20–26 hours, depending on water temperature. Farmers must remove brooders immediately after spawning to prevent cannibalism and improve hatch rates.

This farmer-friendly protocol requires modest infrastructure and low running costs. Hatcheries across multiple sites have replicated it successfully, providing a reliable supply of seed stock and reducing dependence on wild-caught specimens.

From yolk-sac to juvenile: Rearing the next generation

Larval rearing is the most delicate phase of melon barb culture and demands close attention to nutrition and water quality. Newly hatched larvae, about 2.3 mm long, stay on the bottom and do not feed for their first three days while absorbing yolk sac reserves rich in essential fatty acids. Within 24–48 hours, pigment cells (melanophores) appear along the optic rim and muscle segments (myotomes), fin rays begin forming, and the gas bladder inflates, enabling vertical movement.

Once free-swimming, farmers feed larvae live *Artemia* nauplii at least three times daily for 12–15 days to promote rapid growth and reduce mortality. After this period, they gradually wean larvae onto *Moina* and high-quality micro-diets until the fish accept fine formulated feeds. Consistent feeding sched-



ules, stable water parameters, and gentle aeration are essential. Ammonia and nitrite must remain near zero, and partial water changes every 48 hours maintain ideal conditions.

Many farmers transfer larvae to outdoor FRP tanks or fine-mesh pond hapas, where natural plankton boosts growth. By the end of the first month, juveniles reach 25–30 mm and develop the vertical banding typical of the genus. With optimal feeding and clean, oxygen-rich water, they reach sexual maturity within four to five months. This rapid life cycle allows multiple breeding cycles per year, ensuring a steady supply of ornamental-grade fish for domestic and export markets. These protocols for larval and juvenile rearing provide a model for small-barb aquaculture and show how careful husbandry can convert a vulnerable wild species into a sustainable farmed resource.

Economics and conservation: complementary goals

Melon barb aquaculture is a rare example where conservation and commerce reinforce each other. A starter hatchery unit with 500 L FRP tanks and a few breeding aquaria can be set up for around ₹22,500. From 30 breeding pairs, farmers can harvest

5,400 to 8,400 juveniles within two months. At a conservative farm-gate price of ₹10 per 2-inch fish, gross returns can easily exceed ₹50,000 per cycle, yielding attractive profit margins even after accounting for feed, electricity, and labour. For rural households and small entrepreneurs, especially in biodiversity-rich but economically constrained regions, this represents a reliable supplementary income.

Beyond economics, captive production relieves harvest pressure on wild stocks, which have been declining due to deforestation, agricultural runoff, and unregulated collection for the aquarium trade. By supplying a consistent flow of healthy, farmed fish to domestic and export markets, hatcheries reduce the incentive to capture fish from native streams. The establishment of ex-situ brood banks and genetic resource centres also safeguards against catastrophic losses in the wild and provides material for restocking programmes where natural populations have been depleted.

When combined with catchment reforestation, riparian buffer creation, and pollution control, these hatchery-based measures can play a decisive role in ensuring the long-term survival of *H. fasciata*. The melon barb's commercial success is a compelling case study of how well-designed aquaculture can simultaneously deliver livelihood security and biodiversity conservation.

A sustainable future for an aquatic jewel

The melon barb shows the promise of an integrated approach to ornamental fish farming that unites scientific innovation with environmental ethics. Indian researchers and progressive farmers have shown that careful broodstock conditioning, precise water quality management, and staged larval nutrition can turn a species once threatened by habitat loss into a resilient and profitable aquaculture candidate.

Scaling up through farmer cooperatives and community hatcheries, backed by government extension services and private-sector marketing, will extend economic benefits to a broader rural base while safeguarding natural populations. Consumer awareness is equally important: every aquarist who chooses a certified farmed melon barb instead of a wild-caught specimen supports a supply chain that values ecological sustainability.

Future priorities include molecular tools for genetic monitoring, refinement of live-feed protocols to further reduce early larval mortality, and long-term ecological studies to track remaining wild populations. Internationally, *H. fasciata* can serve as an ambassador for India's unique freshwater heritage, reminding the world that conservation and commerce can work together when managed wisely. The melon barb's success story can inspire similar efforts for other endemic fishes of the Western Ghats and beyond, ensuring that economic development and biodiversity protection advance together for generations to come.

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