Polyculture of carps and mola in ponds and ponds connected to rice fields

CGIAR RESEARCH PROGRAM ON Aquatic Agricultural Systems

Summary

Throughout Bangladesh, there are more than 4.2 million household ponds. Regardless of their size and seasonality, whether they are isolated or connected to rice fields, each of these ponds has the potential to enhance its production with the addition of carps and mola.

Mola is a micronutrient-rich small fish that is very popular, and grows well along with carps in ponds and rice fields. Carps are one of the most commonly farmed fish by small-scale farmers in Bangladesh. Carps grow to a large size and are profitable when sold at the market.

Two sustainable, low-cost technologies: culture of carps and mola in stand-alone ponds and culture of carps and mola in ponds connected to rice fields, have been developed to increase production and productivity, and the nutritional quality of the fish produced. These technologies can boost household income for millions of Bangladeshis, and help build healthy families through the consumption of micronutrient-rich mola.

Culturing mola and carps in ponds connected per year to rice fields can yield up to 7.4 metric tons fish per hectare, and up to 3.6 metric tons fish per hectare per year in stand-alone ponds.

This brochure provides an overview of these pond polyculture technologies.

Benefits of producing mola

- can be grown alongside carps in ponds and ponds connected to rice fields
- can increase the production, productivity and nutritional quality of fish produced in ponds and ponds connected to rice fields
- only need to be stocked in the pond once as they will continue to breed if a small amount of water is retained in the pond throughout the winter season
- command a high market price
- are popular in the Bangladeshi diet
- should be partially harvested regularly–these harvests can be used for household consumption
- are rich in micronutrients, particularly vitamin A, calcium, iron and zinc.

Culturing mola with carps in ponds

Pond preparation

The success of polyculture begins with correct preparation of the pond. The pond dyke should be repaired if necessary, and predatory fish and aquatic weeds cleared from the water. The pond should be dried, thick mud at the bottom of the pond removed, and lime or dolomite spread on the bottom of the pond at a rate of 1 kg per decimal[1]. Cow dung, urea and Triple Super Phosphate (TSP) should be added 4 to 5 days after liming to encourage growth of natural fish food.

Testing for natural food

Natural food organisms in the pond are essential for good growth of fish. It is important to test for the presence of sufficient natural food before the fish are stocked. Four to five days after fertilization, the pond water becomes green or brownish green in color, indicating that there is abundant natural food in the pond.

After stocking, the pond water should be tested for the presence of natural food at least once per week.

Fish stocking

- Fish should only be added to the pond if there is abundant natural food present.
- Mola brood should be stocked during the first week of *Boyshakh* (April). Mola spawns shortly after stocking and schools of fry are visible after 20 to 25 days. Netting should not be done at this time.
- Mola brood need to be stocked only once in a perennial pond, as they continue to spawn, laying their eggs in the floating and submerged vegetation near the banks of the pond.

Collection and transportation of mola brood

Many small fish, including mola are present in natural water bodies during the monsoon. Mola broods for cultivation can be collected from these natural sources.

Mola should be caught using a net of such mesh size that only large size mola are trapped, and small fish can escape and continue to grow. The mola caught should be kept in a *hapa* (an inverted mosquito net tied to four bamboo poles) and aerated well, by regularly splashing the water by hand on to it.

The mola brood should be transported in the early morning or late evening when it is cool, in a plastic bag, or earthenware or aluminum container.

Mola brood can be stocked in perennial brood ponds to allow them to grow before being stocked in culture ponds, or they can be stocked directly in culture ponds.

Identifying good quality carp fry and mola brood

Healthy carp fry and mola brood are energetic, fast swimming, and swim against the water current. Their bodies are slippery, without spots, and they are brightly colored. Healthy carp fry and mola brood are essential for the success of the pond polyculture.

Stocking of carp fry and mola brood

- Carp fry or mola brood in a bag or container should be floated in the pond for 20 to 25 minutes to ensure the water temperatures inside and outside the bag are similar.
- Open the bag and feel the water temperature in the bag and the pond.
- Add some pond water to the bag so that the temperature of the water in the bag and the water in the pond become similar.
- The bag should then be slowly lowered into the pond water, allowing the fry or brood to swim out.

Fish stocking density

Type of culture	Species	Stocking density per decimal[1]
Stand-alone pond: carp-mola polyculture decimal pond	Mola (*Amblypharyngodon mola*)	80 – 100
	Catla (*Catla catla*)	6
	Mrigal (*Cirrhinus cirrhosus*)	10
	Rohu (*Labeo rohita*)	12
	Silver carp (*Hypophthalmichthys molitrix*)	12

Do not overstock the pond as the fish will remain small, become weak and die, making the pond unprofitable

Feeding the fish

Fish should be given supplementary feed every day to complement the natural food in the pond. The growth rate of fish is directly dependent on the quality of the feed they are given.

From the day after stocking the fish, a mixture of rice bran and mustard oil cake at a ratio of 2:1 should be fed to the fish every day at a rate of 3% body weight of carps.

- Feed application is based on the age and body weight of fish. Fish samples should be caught and weighed each month to calculate the amount of feed needed.
- Feed should be given at the same time and from the same place in the pond each day.
- If the pond water becomes deep green in color, the feed application should be decreased or stopped temporarily to avoid overgrowth of phytoplankton.

Seasonal ponds

If the pond dries out during the winter months, a ditch should be dug in the middle or corner of the pond to hold water and create a refuge for mola and other small fish.

[1] 1 decimal = 40 m^2; 10,000 m^2 = 1 hectare.

Fish harvesting

Partial harvest of mola for household consumption

Mola spawn 2 to 3 times a year, so the fish should be partially harvested frequently and can be cooked in a variety of dishes. Without partial, frequent harvesting, the density of mola will increase, resulting in food scarcity in the pond.

Mola are rich in micronutrients that are essential for good nutrition and health. Micronutrients are particularly important for pregnant and lactating women as well as young children for optimal growth and development.

Harvest of carps

Four to five months after stocking, large carps can be harvested for sale. An equal number of juvenile carps should be added to the pond after partial harvesting to maintain the number of fish in the pond. Overall fish yield can be increased in this way. At the end of the production season, all carps can be harvested.

Selling the fish in the market

To maximize the profit from fish farming, marketing the fish should be carefully planned, considering the demand and price. If the distance to the fish market is great, the fish should be kept on ice during transportation to maintain their quality.

Culturing carps and mola in ponds connected to rice fields

Ponds connected to rice fields provide an expanded productive habitat for mola and carps. It has been shown that fish production from ponds that are connected to rice fields is higher than the production in stand-alone ponds. Farmers can produce 7.4 metric tons per hectare per year, using this polyculture technology.

During the monsoon, rice fields become inundated and fish can move between ponds and rice fields.

Benefits of carps and mola polyculture in ponds connected to rice fields:

- increased rice (10%) and straw (15%) yield
- two crops produced from the same land at the same time, with relatively low costs and labor
- no need for application of insecticides as the fish feed on insects and pests in the rice fields
- fish movement in the rice fields reduces the growth of weeds
- as rice field dry out during the winter months, they provide a healthy habitat for fish when they become flooded during the monsoon
- most ponds connected to rice fields are close to homesteads, which is convenient for women who take care of them and for harvesting fish for home consumption.

Proper preparation of the land is essential for optimal production of rice and fish. The rice field should be ploughed several times and the surface evened to ensure that the water depth is the same throughout the field. A dyke should be constructed around the field to hold the water in and ensure that the fish cannot escape. Vegetables can be grown on the dykes of ponds and rice fields, which can increase household income and consumption.

Rice planting method

Rice should be planted using systematic rows so that fish can move freely and ample sunlight can enter the water, promoting the growth of phytoplankton. A paired line method of rice planting gives high production of rice and fish. The distance between each line of rice should be 6", and the distance between each paired line should be 14".

Fish stocking density

Type of culture	Fish species	Stocking density per decimal pond and rice field
Pond connected to rice field: carp-mola polyculture	Mola	300–400
	Catla	6
	Mrigal	10
	Rohu	12
	Silver carp	12

Stocking of carp fry and mola brood
Carp fry and mola brood should be released in the pond at least 15 days after the rice seedlings are planted in the connecting field. As the production cycle of fish in ponds connected to rice fields is shorter than in stand-alone ponds, large carp fry (20–25 g) should be used.

Rice field management
After planting of rice seedlings, a water depth of about 10 cm should be maintained so that the seedlings can grow well. Thereafter, a minimum of 30 cm water depth should be maintained throughout the fish culture period to ensure that the fish can thrive in the rice field. The rice field must always be kept free from weeds. At the time of rice harvest, the rice field becomes dry and all fish gather in the pond.

Feeding the fish
To obtain high fish production, supplementary feed should be given to carps in the pond. The most effective feed is rice bran and mustard oil cake at a ratio of 2:1 and at a rate of 3% feed per body weight of carps. Mola do not need additional feed.

Fish harvesting
During the culture period, partial harvesting of mola and other small fish, as well as carps can be carried out. At the end of the culture period, 6 to 7 months after stocking, all carps can be harvested at one time from the pond and sold. As for stand-alone and seasonal ponds, some mola and other small fish species should be maintained in a refuge for the next culture season.

Acknowledgements

This document was prepared through financial support of the South Asia Food and Nutrition Security Initiative (SAFANSI). SAFANSI was established as a multi-donor trust fund by a joint undertaking of the World Bank, DfID and AusAID. SAFANSI is supported by both AusAID and UKaid from the Department for International Development; however, the views expressed do not necessarily reflect these departments' official policies.

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This publication should be cited as: Thilsted, S.H., Wahab, M.A. (2014). Polyculture of carps and mola in ponds and ponds connected to rice fields. CGIAR Research Program on Aquatic Agricultural Systems. Penang, Malaysia. Brochure: AAS-2014-06.

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