Carp polyculture in India

1 January 2007 Dr. C. Mohanakumaran Nair Dr. K.R. Salin

Practices, emerging trends

Carp polyculture in India is based on extensive or modified extensive farming techniques. Most farmers in India raise catla (left) and rohu. Photos by Ravi Ramakrishna.

Over 70 percent of India's people live in rural areas, where the main occupation is agriculture, but inland aquaculture makes significant contributions to their livelihoods. About 85 percent of this aquaculture is contributed by carp polyculture.

The Fish Farmers Development Agencies, set up with World Bank assistance in the early 1970s, promoted the adoption of modern aquaculture through polyculture of various Indian major carps or combinations of Indian and exotic carps, and the freshwater prawns (*Macrobrachium rosenbergii* and *M. malcolmsonii)*. The All India Coordinated Research Project on Composite Fish Culture and Fish Seed Production initiated by the Indian Council of Agricultural Research in 1971 transformed the traditional polyculture practice from a production level of less than 1,000 kg/ha/year to as high as 10 metric tons (MT) per hectare per year through fertilization and supplementary feeding.

Over the past two decades, a nearly sevenfold increase in the output from freshwater aquaculture was achieved by the application of appropriate technologies, financial investments, and the enthusiasm shown by private entrepreneurs.

Varied carp species

In India, polyculture has traditionally been based on three indigenous carp species with complementary feeding habits: the surface feeder catla (*Catla catla)*; the column feeder rohu (*Labeo rohita)*; and the bottom feeder mrigal (*Cirrhinus cirrhosus)*. These three species accounted for 26 percent of the country's total fish production and 64 percent of freshwater aquaculture production in 2004-05. Most farmers in India culture catla and rohu for their higher market prices and rapid growth.

Three exotic species – silver carp (*Hypophthalmichthys molitrix)*; grass carp (*Ctenopharyngodon idella)*; and common carp (*Cyprinus carpio)* – were introduced to the polyculture system during the late 1950s, but are less preferred and priced in the Indian market.

Resource use

India has over 2.39 million ha of water bodies suitable for freshwater aquaculture across the country, of which only 800,000 to 900,000 ha have been brought under technical fish culture.

The state of West Bengal produces about 29 percent of the total inland fish production in India, followed by Andhra Pradesh (20 percent), Bihar, and 26 other states and seven union territories that contribute the remaining production. West Bengal had a steady 5 percent annual production growth over the past few years, while Andhra Pradesh had a 10 percent increase except for a marginal decline in 2004-05.

The average area cultivated by farming households is as high as 4.24 ha. Private owners usually operate carp farms, although joint ownership is common, especially in the public irrigation reservoirs, 30 percent of which are used by the Fisheries Department for ranching. In general, the gross per-capita incomes of carp farmers in India are above the national average.

Extensive culture

Modern carp polyculture in India began in the Kolleru Lake basin of Andhra Pradesh, where 2- to 4-m-deep rearing ponds ranging 1-40 ha in area were built during the mid-1980s by digging inundated paddy fields. Carp culture was established on an extensive level at that time, although current carp polyculture is based on extensive or modified extensive farming techniques.

In West Bengal, polyculture is now mostly traditional and extensive, and dominated by small and medium-sized farms, whereas Andhra Pradesh has the most specialized carp polyculture practices in India. Although the available area and productivity from polyculture systems are greater in Andhra Pradesh, official estimates project higher production from West Bengal.

Pond preparation

Aquafarming is often a continuous process in Andhra Pradesh, where ponds are immediately restocked after a crop period of eight to 12 months. Complete pond drying is done once every two years, followed by application of agriculture lime at 500 kg/ha.

Carp polyculture ponds in India are heavily manured using organic products like cow dung or poultry droppings. The former is often mixed with an inorganic fertilizer such as single super phosphate (SSP). Sometimes urea and SSP are mixed with the manure and kept overnight before being applied to ponds. One half is applied initially and the rest in equal monthly doses during the rest of the cycle. Additional monthly doses of inorganic fertilizers are also often applied as needed to sustain pond productivity.

Harvested fish are iced whole and packed in plastic crates with additional ice, plastic sheets, and rice husks for their lengthy shipments to India’s northeastern states.

Stocking schemes

Private hatcheries supply over 60 percent of the carp fingerlings for polyculture. Stocking sizes range 1-5 cm, but average 3 cm. Farms devote at least 10 percent of their area to fingerling rearing, where hatchery-produced fry are grown in large numbers for eight to 10 months to 50-100 grams.

In Andhra Pradesh, about 70 percent of farmers culture catla and rohu fingerlings stocked at 8,000-10,000/ha at a ratio of 1 catla:10 rohu. The fish are grown nine to 12 months because these two species fetch better market prices than mrigal and the exotic carps. Catla reach 1.5-2 kg and rohu 1-1.5 kg in one year with 80-95 percent survival and overall yield of 10-13 mt/ha/year. Sometimes snakehead, (*Channa striata)*, are al-so stocked at 500 fish/ha to control trash fish and insect pests in ponds.

About 20 percent of farmers use three-species stocking, with 5,000 rohu, 500 catla, and 250 mrigal per hectare. In this system, catla grow to 2.5-3.5 kg, rohu 1.5-2.5 kg, and mrigal 1.0-1.5 kg, with an overall yield of 9-11 mt/ha/year. The remaining farmers stock 10,000 rohu and 500 catla, with catla

growing to 1.5-2.0 kg and rohu to 0.8-1.3 kg, with average production of 13-15 mt/ha/year.

In West Bengal and other states, a six-species stocking ratio comprising 30-40 percent surface feeders, silver carp and catla; 30-35 percent column feeders, rohu and grass carp; and 30-40 percent bottom feeders, common carp and mrigal; is also used for more efficient use of the different niches in the pond ecosystem. Some farmers include bottom-feeding freshwater prawns in place of common carp and mrigal.

Feeding

Carp fingerlings are initially fed ground nut/mustard oil cake for up to one month, followed by a mixture of deoiled rice bran and oil cake for the next month, and after that exclusively rice bran. Other feedstuffs include soybeans, cotton seeds, broken rice, pearl millet, and maize. A general composition of supplementary feed used in Andhra Pradesh includes 70 percent rice bran, 10 percent oil cake, 10 percent cotton seed cake, and 10 percent raw rice bran.

The initial feeding rate of 5 percent of body weight is reduced to 1 percent as the culture cycle progresses. Initially, the feed is broadcast on the pond surface or made into dough and placed on wicker trays lowered into the water. In grow-out ponds, rice bran is usually placed in perforated plastic bags suspended in the pond from a central line.

Fish production is largely dependent on the natural productivity boosted by periodic fertilization of the ponds. Very recently, some farmers started using floating extruded feeds with 15-27 percent protein produced by leading manufacturers.

Few diseases

Carp polyculture in India is relatively problem-free, particularly in regards to diseases. The “red disease” in carp, which can result in total mortality in several days if not treated, is the major disease reported. Some parasitic infections are also common in carp ponds during nursery and grow-out periods.

Harvesting and marketing

Ponds are partially harvested by seining six months after stocking, when about 20 percent of the stock – largely catla – is removed. A second partial harvest occurs at nine months, followed by a final harvest with complete pond draining at the end of the year.

Little of India’s freshwater fish production is exported. Of the 66,900 mt of frozen fish exported from India during 2005-06, freshwater fish contributed less than 2 percent. Cultured carp are therefore consumed primarily within the country. In general, the preference for carp is lower among the population in peninsular India than in the northeastern states. This can mean costly transportation from producing to marketing regions.

Fish are iced whole and packed in plastic crates or Styrofoam boxes. The crates are then packed with additional ice, plastic sheets, and rice husks, a by-product of local paddy fields that provides improved insulation and protection from the warm tropical climate. This packing keeps fish fresher during their transport to northeastern states, which can involve distances of more than 2,000 km.

Polyculture with shrimp

In Andhra Pradesh, inland farming of black tiger shrimp, (*Penaeus monodon)*, has been established for several years. Farmers stock 150 to 250, 100- to 200-g catla/ha to condition pond water and utilize the surface water niche, and tiger shrimp seed at 5-10 animals/m^2. The catla grow to 1.5-2.0 kg in four or five months with almost 100 percent survival. Similar stocking of catla at 500 fish/ha is also practiced with freshwater prawns, (*Macrobrachium rosenbergii)*, in Andhra Pradesh and other states.

In the state of Kerala, where paddy-prawn rotational cropping is practiced, grass carp that feed on vegetation and Indian major carp like catla and rohu are stocked in paddy fields at 1,500 fish/ha, while prawns are stocked at two animals per square meter. In Kerala’s small and medium irrigation reservoirs, multispecies stocking of Indian major carp, common carp, and *M. rosenbergii* is common.

Other culture combinations

Many indigenous freshwater fish, including several medium and minor carps, enjoy better markets and prices in India than major carp. The incorporation of these fish with major carp in polyculture should make them more economical than major carp polyculture alone, although the yield characteristics and concepts of competition among these species need to be more fully understood.

As Indian aquafarmers test new species, the polyculture of carp and (*Pangasius hypophthalmus)* catfish is becoming popular in low-salinity shrimp ponds abandoned after the White Spot Syndrome Virus outbreaks in Andhra Pradesh. Rohu and catla grow in salinities up to 8 ppt, while *Pangasius* grow well in 12 ppt and can tolerate up to 23 ppt. However, grow-out under higher salinities can confer a darker coloration to carp, which is not desirable in the market.

About 20,000 ha are now under *Pangasius*-carp polyculture in the West Godavari district, at a stocking density of 10,000 *Pangasius* and 1,250 rohu or catla per hectare. Total production is 10-15 mt/ha, with *Pangasius* weighing 1.5-3.0 kg and carps 1.5-2.0 kg. Polyculture of pacu introduced in India by the aquarium trade with carp, especially rohu, is another emerging aquaculture practice in Andhra Pradesh.

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Authors

- Dr. C. Mohanakumaran Nair

  Dr. C. Mohanakumaran Nair

  Department of Aquaculture
  College of Fisheries
  Kerala Agricultural University
  Panangad, Kochi 682 506
  Kerala, India

  [109,111,99,46,108,105,97,109,116,111,104,64,109,99,114,105,97,110]

- Dr. K.R. Salin

  Dr. K.R. Salin

  KVK Regional Agricultural Research Station
  Kerala Agricultural University
  Kottayam, Kerala, India

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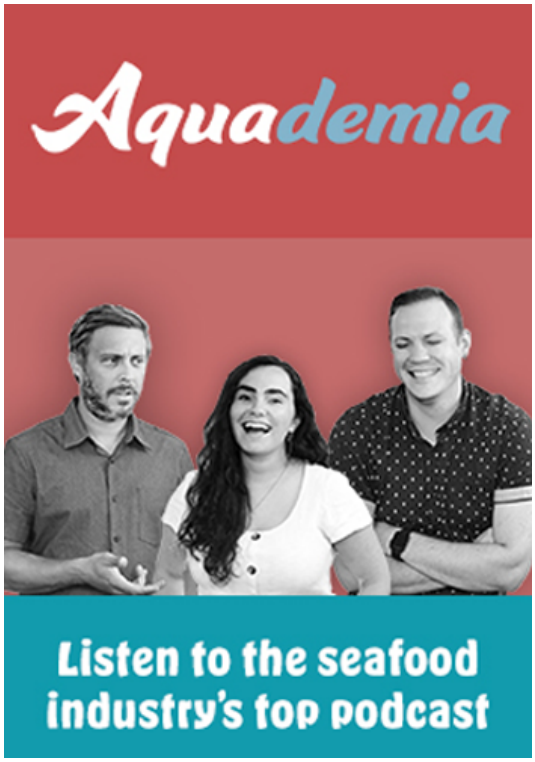

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