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Moyna model of major carp farming in Purba Medinipur District, West Bengal, India

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Major carp farming in West Bengal and Andhra Pradesh

Major carp culture accounts for 80-85% of total inland fish production. West Bengal is the second largest producer of table-sized fish in India, next to Andhra Pradesh; with production amounting to 1.773 million tonnes in 2018-2019. West Bengal leads in hatchery-oriented fish seed production, which amounted to 22,691 million fry in the same year. In Andhra Pradesh, Krishna, West Godavari and Nellore districts are primary carp culture areas and the predominant centre is in and around Kolleru Lake. Grow-out ponds are often 0.4-4 ha in area but may extend up to 40 ha¹. 'Bigger is better' for grow-out ponds, with an average of about 8.1 ha, and the optimum range considered to be around 10-20 ha². The Kolleru system is the dominant production model for Indian major carp culture in India, termed 'yearling-based culture' which has proved highly profitable for Andhra Pradesh farmers. Large, stunted yearlings/stunted carps of 50-150 g are stocked in grow-out systems.

In West Bengal, progressive fish farmers mostly practice commercial carp farming in leased ponds. They prefer to produce sub-adult fishes that are harvested and transported live to market. In 254 treated domestic wastewater-fed fish culture ponds i.e., the East Kolkata Wetlands covering 3,944 ha, fish are harvested in 3-4 months to avoid bioaccumulation risk. The majority of Andhra Pradesh farmers harvest major

carps at table size, whereas in West Bengal, major carps are mostly harvested as advanced fingerlings and juvenile fish because of high demand.

Purba Medinipur is the largest (in quantity) table-size major carp producing district out of 23 in West Bengal and uses large-scale production systems as followed in Moyna Community Development Block. In Moyna, suitable fish farming plots are taken on lease by fish farmers and the area of a single water body is comparable to conventional fish ponds with typical sizes in the ranges 6-8 ha, 20-21 ha or even 48-56 ha, although they may be less deep than a typical pond. State-of-the-art of carp farming at Moyna is the same as in Andhra Pradesh, aiming to produce large sized major carps from big, shallow water bodies in a modified extensive system.

Moyna fish production system as model

Moyna town is 90 km from Kolkata city via road. This block was declared as a fishery hub in West Bengal by the State Government and the 'Moyna Model' accepted as an example for freshwater fish culture throughout West Bengal. Moyna is a great example of the freshwater fish culture revolution in West Bengal and a new horizon for culture of the major carps. Moyna fish farmers have adapted the procedures of Andhra farmers incorporating their own blend of experience,



Larger Indian major carp fingerlings (80-100 g).

skill and technology. Its reputation has spread to different parts of West Bengal and neighbouring states. The unique kind of pisciculture in vast tracts of water bodies is practiced in 55-60 villages out of 81 in 11 Gram Panchayats in Moyna and some neighbouring blocks. Many commercial carp culturists at Moyna produce major carps of 1.2-2 kg in seven to eight months.

As considerable success has been achieved, the Hon'ble Chief Minister, West Bengal, dignified state-of-art of carp farming at Moyna as an official Fishery Model. The State Fisheries Department adopted it as a flagship model and pilot project in September 2017 to boost production of farmed table size major carps in other districts of West Bengal and reduce imports. About 150,000 tonnes of table fish are brought to West Bengal annually from Andhra Pradesh, Madhya Pradesh and Odisha, mostly major carps with 80,000 tonnes supplied from Andhra Pradesh (Srikakulam, East Godavari). Every day not less than 15-20 trucks loaded with approximately 100 tonnes of major carps are sent to Kolkata market from Andhra Pradesh and other places³. Emphasis is now being given to achieving self-sufficiency, increasing local production and meeting consumer demand for table size carp within West Bengal; hopefully farmers here will be able to meet demand following this model. Fish farmer beneficiaries in West Bengal will receive technical assistance and input support aiming for a production target of 8,000-10,000 kg/

ha/year. With reference to the Moyna Model, there is good scope for cultivating large carps; 150 g fingerlings will weigh about or more than 1.5 kg after 6 months. This practice will contribute to rural socio-economic upliftment and nutritional and livelihood security.

Rainwater stagnation in fields

Moyna is bordered by the Kansai/Kansabati rivers in the north and east, the Chandiya River in the west, the Keleghai River in the south and the Baksi canal in the north. Out of 26 community development blocks in Purba Medinipur, Moyna first gets inundated during incessant rain and flood. As a basin, water accumulates here during rain in the surrounding blocks. River water flows into Moyna from the end of May and remains until January⁴. Villages highly-affected by water stagnation (between 0.9-1.0 m depth) are Mathurichak, Harakhulibhandarchak, Balbhadrachak, Kalagechia, Panchpukuria, Gourangachak, Mathurapur, Baitalchak, Kripanandapur, Dakshin Ankha, Uttar Ankha, Lалуageria, Dakshin Moyna, Chrandaschak and a few others. Extended low-lying fields unsuitable for Aman and Boro paddy cultivation have proven to also be conducive environments for carp farming. Jute, paddy and betel leaf are traditionally grown at Moyna, but the increasing commercial importance and popularity of farmed major carps, a more profitable venture,



Carp farming water body at Bhagabanpur Block.

have exceeded others. Flood water from Khirai River enters paddy plots every year but increasing annual losses in paddy due to floods have led to leasing out of the majority of lands to commercial fish farmers.

Beginning of fish farming at Moyna

Once farming of paddy varieties such as raktapani kalas, sadapani kalas, gadahuta, aamol, kalamocha, banshkaati, bhuto were well-known in Moyna, and propagation of naturally-grown fish such as *Clarias batrachus*, *Mystus* sp., *Channa* sp, *Anabas testudineus*, *Tilapia* sp was done simultaneously with paddy farming, with fish harvested at the onset of winter. Paddy was produced 2-3 times a year. However, in 1995 commercial major carp farming started in conjunction with deepwater paddy in standing water fields during mid-June to December. In agricultural fields taken on lease for carp farming, fishes under culture didn't harm growing paddy and fields were dewatered during their harvest. Both paddy and fish farmers benefitted. Over time, due to the fast growth rate and success of organised paddy-cum-fish farming with fingerling stocking and feeding, the practice has also flourished outside Purba Medinipur.

Individual plots are in production at villages including Gopalchak (505 ha), Dakshin Changrachak (50.5 ha), Janakichak (8 ha), Mathurichak (65.5 ha), Charandaschak

(40.4 ha) and Baitalchak (60.7 ha), traditionally used for rice culture by some 1,100 farmers. Simultaneous kharif paddy and major carp farming is conducted after flooding by the monsoon rain, beginning in June/July⁵. From 2002 onwards, paddy plots in Annapurna Village started to be leased out solely for carp farming to highest bidders for 3-5 years. Many farmers paid 3,000-4,000 INR as a yearly lease for every 64 m² land, started this vocation, dug out earth in paddy fields to increase depth and hold more fish. It spread to almost all villages in Moyna; presently about 200 fish farms exist covering about 7,000 ha. Vast fish farming plots are densely located at villages Gojina, Ramchak, Bakcha, Tilkhoja, Paramanandapur, Noichonpur and others. Around 2005 and earlier, the flood-affected people of Moyna sought shelter in other districts. Since the recent past, the majority of flood-affected villagers have found a new source of livelihood via fish culture in such areas, i.e., large lowlands with continuing rainwater stagnation. Owing to high profitability in carp culture, most paddy fields in Moyna have turned to 'fish ghery' (a vernacular term for big freshwater bodies). It started on large scale in 2011-12. Paddy-cum-fish farming continued at Janakichak until 2008.

At Moyna, embankments are strengthened on all sides of ghery to prevent the entry of flood water within. After two successive crops, black bottom mud is removed to avoid dissolved oxygen depletion in the next one and ploughed to oxidise material that will cause harmful gases. Freshwater

is channelled into gherys from river/canals via sluice gates up to depths suitable for fish farming. After liming, 50-150 g carp fingerlings are stocked @ 15,000-30,000/ha. Harvest begins once fishes reach 500 g and above on 100-120th day of stocking (Courtesy: FEO, Moyna Block). Banks and the slope of some gherys are covered with large plastic sheets all around extending into the water column to prevent erosion.

Case studies at Moyna

State-level awardee progressive farmer Sri Jhantucharan Middy, Village Bakibhandar Chak possesses two farming plots of 81 ha and 69 ha respectively at Bakibhandar Chak and Ramtarak in adjacent Sahid Matangini Block. Earlier, paddy was cultivated here but it was spoilt by medium to heavy rainfall in most years and was not profitable even during good production. Landowners now earn from people like Sri Middy who ventured into pisciculture in 2001-2002 making Rs 1,000,000/- annually as income after subtracting the amount invested. He determined to elevate himself to the standards of Andhra farmers in table fish production and proceeded ahead⁶.

His Indian major carp fingerlings are stocked twice a year and reach 500-600 g in four months with proper feed and medicines (at times of need). Such fishes are in good

demand. He explained that the profit margin will reduce if the fish are raised to 900-1000 g. Fish growth is retarded during winter months in West Bengal unlike Andhra Pradesh, where it is consistent throughout year with higher winter temperature (warmer winter), favouring growth. Many fish farmers in Moyna produce carp yearlings (90-100 g) and earn a good profit by selling to grow-out farmers, who in turn are benefited as yearlings have an almost 100% survivability, exhibiting fast growth in large water bodies once stocked. Sri Chandan Bera at Paramanandapur has two fish farming water bodies of 26.7 ha and 29.9 ha respectively, taken on lease and makes a profit of Rs 3,800,000/- from the first plot alone in a year⁶. In October 2016, author had an on-site conversation with three fish farmers namely Sri Debtoosh Moni at Purushottampur, Sri Dipankar Barman at Putputir Math and Sri Dibakar Mal at Charandaschak villages⁷; growth of their fish as obtained is mentioned in Table 1.

Groundwater exploitation for fish farming - an issue

At Moyna, many fish farming water bodies/ghery(s) have been established near rivers and wide canals to intake fresh-water when in need and maintain depth during post-winter, pre-summer and summer months. But a lack of adequate

Harvested carps from D. Barman's ghery under oxygenation, before transportation.





Medium-sized carp culture pond.



Stunted IMC fingerlings (yearlings 150-200 g).



Pelleted floating major carp feed (3mm diameter).



Tin-built boat for aquaculture works on bank of a gheri.



An extended fish farming water body at Moyna.



Sri D. Barman, Sri D. Moni and author at Moyna.



Fish farmers from Jharkhand on bank of large gheri at Moyna.

Table 1: Growth of Indian major carps in water bodies of D. Barman, D. Moni and D. Mal, Moyna Block.

Farmer	Village	Water area	Size and time of stocking	Size and time of harvest	Fish feed used	Crops / year
Dipankar Barman	Puthputia	6.87 ha	<i>Labeo rohita</i> and <i>Cirrhinus mrigala</i> 100-150 g each <i>Catla catla</i> 200-250 g March	<i>C. mrigala</i> and <i>L. rohita</i> 600-650 g <i>C. catla</i> 1.5 kg End of July	Commercial pellets Farm-made formulated feed	2
Debtosh Moni	Purusottampur	5.27 ha	<i>C. mrigala</i> 50 g <i>L. rohita</i> 60 g <i>C. catla</i> 100-120 g June	<i>L. rohita</i> 450-500 g <i>C. catla</i> 1.2-1.5 kg <i>C. mrigala</i> 400 g November	Farm made formulated feed	2
Dibakar Mal	Manuakhali	56.6 ha	<i>C. mrigala</i> <i>L. rohita</i> <i>C. catla</i> 125-140 g each	<i>C. mrigala</i> , <i>L. rohita</i> and <i>C. catla</i> 500-600 g each; 60th-75th day of stocking	Farm-made Commercial floating pellets	4

water supply is felt. Gherys have been newly formed in villages Radhaballavchak, Kanchichak, Mathurichak, Jagirchak, etc in Gokulnagar Gram Panchayat of Moyna, quite far away from rivers and canals. Here, submersible pumps are set up and groundwater extraction is indispensable to sustain carp farming. Groundwater intake into gherys is practiced in villages Mathurapur, Donachak, Sudampur, Uttar Chengrachak, Dakshin Chengrachak and others and loaded

in trucks during live major carp transportation from Moyna. Questions have been raised against incessant groundwater extraction and ongoing carp culture activity in certain villages. Fish farmers possessing gherys located far from the river face water shortages and year-round carp farming is prevented.

Water replacement during live table fish transportation.



If fish farming done all year round, instead of for 7-8 months and water requirement met, 60-70 tonnes of table fish will be produced annually from gherys in Moyna. Use of submersible pumps for drawing groundwater for pisciculture will be prohibited. To supply water into these vast fish farming plots regularly throughout the year, the West Bengal Government is examining ways to bring freshwater in, particularly from the lower 87 km stretch of the Rupnarayan River (about 10 km east from Moyna) through connecting canals/pipelines at Moyna when required.

Other issues and way forward for sustainability

Economic analysis of fish culture for carp farmers Sri Moni, Sri Barman and Sri Mal in monetary terms and estimating the strengths, weaknesses and deficits in detail have led to some measures, suggested to make the activity more effective⁸. Farmers should get more production and income in terms of money invested for inputs (production cost); production is high but not at par to investment. Many are producing carps @ 3,500-6,500kg/ha/year, which must be improved. Farmers must increase planktonic food production in water bodies in addition to the use of commercial pelleted fish feed. Stocking of Indian major carp fry together with larger fingerlings, heavy stocking (that will retard fish growth), application of raw poultry droppings, left over chicken viscera and animal skin

by-products in fish farming water bodies, use of anti-parasite agents in water and antibiotics with carp feed - such activities must be completely debarred. After determining the real valuation of all inputs used by Moyna pisciculturists, fish farmers will be benefitted if a project for 1 ha water area is formulated considering expenditure. A special loan strategy can be introduced with some facilities (also financial support from Government).

Fish markets at Moyna

Annapurna fish market at Moyna is one of the biggest in West Bengal, where the auction of fishes is conducted at 9.00 pm, midnight and 3.00 am every night. About 50 tonnes of fish is bought and sold here each day in a season, which commences after the Durga Puja festival⁹. Fish are transported via wholesalers. About 36,000 tonnes of table size carps is supplied from Moyna every year to different districts of West Bengal, to Bihar, Jharkhand and Chhattisgarh (Courtesy: FEO, Moyna Block), to fish markets at Patipukur, Howrah, Chinsurah, Srirampur (in Hooghly) and other places. Auction and wholesale fish markets grew up steadily at Moyna owing to the increase in farmed carp production; fish merchants are involved in trade from 4.00 pm to 4.00 am. There are 18 fish auction shops in Annapurna market, 70-75 in Moyna Block including Balaipanda fish market and 8 in Moyna market⁴. About 20,000 people are directly or indirectly involved with carp farming activities in gherys in Moyna Block.



Moyna Ramkrishnayan Association - helping Moyna pisciculture to prosper.

Epilogue

The individual area of quite a few gherys at Moyna exceed 81 ha or more. With a production target of 12,000kg/ha/year, the Government of West Bengal in the end of 2017 decided to provide input and technological support to fish farmer beneficiaries in different districts excluding Purba Medinipur where the Moyna model of carp farming be replicated. Scientific organic-input oriented fish farming has begun at Moyna and is flourishing (Courtesy: Official of Moyna Fishery Association). Rajendrapur wholesale market at Naihati, North 24 Parganas (one of the biggest in India for many kinds of fish seeds), Ramsagar in Bankura (widely known for carp hatcheries and quality spawn supply) and now Moyna - as if Vedic 'Matsya Yagya/Yajna' is performed with popularity in these places, which occupied a distinct place on the fisheries map of West Bengal.

With trust, fish auctioneers at Moyna lent lump sum amounts of money to fish farmers as a source of funds, on condition that after 4-5 months, these farmers have to bring the entire harvest to the disposal of the auctioneer, and must supply at a low rate. In order to get lease of a field-turned-waterbody, the farmer as renter takes out a loan from the local fish wholesaler/auctioneer to cover the cost of lease and required inputs. The author observed gherys 0.9-1.2 m deep, newly constructed within 30-45 days on the side of railway tracks between Mecheda and Panskura stations in Purba Medinipur. Another 4,500 ha of large water bodies in addition to 7000 ha have been encompassed in 'big' carp production systems in neighbouring blocks namely Sabang, Panskura, Pingla, Tamluk, Bhagabanpur and Nandakumar in Purba Medinipur and Paschim Medinipur districts, each being 3.2-8.1 ha. The new term 'jheel byabsa' (commercial carp culture in big water bodies) has emerged. In addition to carps, *Penaeus monodon* and *Litopenaeus vannamei* farming is practiced in villages south of Moyna. About 1,000 fish farmers at Moyna, mostly women, have formed a farmer-producer company. Women started *A. testudineus* and *Heteropneustes fossilis* farming in shallow earthen or concrete wells and backyard ponds; culture of *Pangasianodon hypophthalmus* is done in semi-derelict ponds (Courtesy: Sri Sasanka Maity, Secretary, Moyna Ramkrishnayan Association).

Thirty-three fish farmers at Moyna have organized themselves into the Moyna Vivekananda Fishermen Co-operative Society Ltd at Janakichak village; active since its registration in September 2003 (Courtesy: Dr Swapan Kr. Barman, Asst. Professor, P. K. College, PM). It took a lease of the 33.1 ha ghery in Janakichak for fish culture⁴. Indian major carps of 1,500-2,000 g can be produced in six months if *C. catla* (250 g), *L. rohita* (150-200 g) and *C. mrigala* (100-150 g) are stocked at 150-200 : 400 : 200 in every 0.13 ha water body (Courtesy: Janab C. Muzammal Hoque, ADF, South 24 Pgs). After overcoming the COVID-19 pandemic induced lockdown and crisis period since 3rd week of March 2020 in West Bengal, transportation of fresh table size major carps (90-100 fish-loaded trucks/day or 60-70 tonnes fish/day) has resumed from the end of July from Moyna, Mahishadal, Sutahata, Haldia Blocks of Purba Medinipur to Howrah, Asansol, Siliguri and other markets in West Bengal and in Bihar, Odisha, Jharkhand. Before lockdown, about 300 tonnes of freshwater fish on average were transported daily from Purba Medinipur to different places within and outside West Bengal. With restoration of expected income to normalcy, fish farmers in Purba Medinipur are able to buy fish feed in bulk and

repay bank loan. In West Bengal, since the very recent past, table sized carps produced in West Bengal itself have been considered superior by consumers over imported ice-laden fish. Andhra-produced *L. rohita* and *C. catla*, 1-3 kg, are now sold in West Bengal @ 120-130 INR and 140-180 INR / kg respectively but fresh ones produced in West Bengal are sold @ Rs 150-180 INR and 200-220 INR / kg (*C. catla* 2-4 kg) respectively.

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