

Entrepreneurship development through brackish water ornamental fish farming in Indian Sundarbans

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Crescent perch, *Terapon jarbua*.

The Indian Sundarbans are crucial in supporting fisheries and providing livelihoods for local communities in West Bengal, India. These mangrove forests are surrounded by a network of rivers and estuaries and are home to many euryhaline fish. Situated in the transition region between the riverine zone and the Bay of Bengal, brackish water fish species are dominant and found in different saline zones. The Sundarbans also provide excellent breeding and nursery areas for many fish species. Fishing and aquaculture are major sources of income and food security for the people living in and around the region.

Many fish seed collectors capture juvenile stages of various euryhaline ornamental fish - including spotted scat (*Scatophagus argus*), green puffer fish (*Dichotomys fluvialis*), four-banded tiger fish (*Datnioides polota*), crescent perch (*Terapon jarbua*), brackish water eels (*Anguilla* spp.),

and knight goby (*Stigmatogobius sadanundio*) - for livelihood generation. These juveniles are either reared in nursery ponds for a short duration or directly sold to ornamental fish traders in Kolkata. As the ornamental fish trade expands year by year, the number of people involved in ornamental fish rearing increases simultaneously.

Globally, ornamental fish culture is a multi-million-dollar industry with many enthusiasts. Due to this emerging hobby, many fish farmers have adapted to ornamental fish culture for livelihood. The earning potential of this sector has been poorly understood until now. This activity has the potential to create substantial employment opportunities in rural areas, due to simple technological interventions. Farmers can generate additional income with minimal risk within a short time. Due to their euryhaline nature, brackish water fishes can thrive in marine as well as freshwater environments.



A local seed collector in Sundarbans.

In West Bengal, seed of these brackish water fish naturally enter traditional bheries situated at coastal regions and grow with other cultured food fish species. Bheries are harvested annually during the winter season and food fish are sold in the market. Many traders associated with the ornamental fish trade collect live ornamental fish from bheri owners and transport them to pet markets at Kolkata and Howrah in West Bengal. After realising the demand and opportunity, a few small-scale farmers recently started raising and selling brackish water aquarium fish on a commercial scale in South 24 Parganas, West Bengal. The culture of these fishes has upgraded their economic profile, as the ornamental fishes have wide domestic and export markets.

Interventions at Kakdwip Block, Indian Sundarbans by ICAR- Central Institute of Brackishwater Aquaculture

Kakdwip is a small block in the South 24 Parganas district in West Bengal, India, located in the south-eastern part of the Indian Sundarbans. It is prone to cyclones and coastal flooding due to its proximity to the Hooghly River and the Bay of Bengal. Traditional capture fisheries and brackish water aquaculture are the main livelihoods for people at Kakdwip block.

ICAR-Central Institute of Brackishwater Aquaculture has a regional centre that is strategically located in the Indian Sundarbans. Kakdwip Research Centre (KRC) of ICAR-CIBA at Kakdwip is known as a harbinger of scientific brackish water aquaculture in eastern India. Farmers have been trained for scientific brackish water aquaculture since 1987. Brackish water ornamental fish species such as pearlspot (*Eetroplus suratensis*) and orange chromide (*Eetroplus maculatus*) were introduced and disseminated to many fish farmers by the centre for livelihood generation of small-scale farmers.

Three experienced brackish water ornamental fish farmers from Kakdwip Block - Mr Tapan Maity, Mr Arabinda Haldar, and Mr Mahendra Dului - are among many farmers who have successfully run this venture for the past 5-10 years after being trained by the centre. These farmers produce larval stages of ornamental fishes in hatcheries and scientifically culture them in their earthen ponds. These entrepreneurs from rural Indian Sundarbans are gaining employment as well as setting trends for the younger generation to take up ornamental fish production and culture for sustainable livelihood generation.

Success story of Mr Tapan Maity

JoyKrishna Hatchery, which is located in South 24 Parganas in West Bengal, has been operated by Mr Tapan Maity (father) and Mr Himadri Maity (son) since 2010. Mr Tapan Maity was trained by KRC of ICAR-CIBA, Kakdwip and since then he has been managing his farm and hatchery with scientific guidance from the institute.

Brackish water ornamental fishes having commercial value - such as spotted scat, green puffer, pearlspot, orange chromide, eels, and crescent perch - are produced at his farm. His farm sprawls over 5.7 hectares and is divided into eight ponds for fish culture and seven ponds for nursery rearing of hatchery-produced larvae and fry stages. He collects juveniles of brackish water ornamental fishes from nearby tidal water sources and grows them for selling to the ornamental fish trade. He has also constructed a backyard hatchery for seed production and larval rearing.

His farm receives tidal water from the Muri Ganga River around the year. The water depth in the pond is between 1.0 and 1.5 metres and water salinity ranges between 3 and 15 ppt. Mr Tapan Maity produces the fry and fingerlings of pearlspot and orange chromide using broodstock maintained on his farm. These broodstocks were provided by KRC of ICAR-CIBA, Kakdwip along with training on broodstock management, pairing of fishes, incubation of eggs in hatchery, and larval and fry rearing in tank systems. Now each month, he usually sells 1,000-3,000 pearlspot and orange chromide fingerlings to traders.



First author with Mr. Tapan Maity's family (centre) at his farm.



Orange chromide (*Etroplus maculatus*).

He purchases juveniles of ornamental fishes such as spotted scat, green puffer, eel, and crescent perch from seed collectors in Sundarbans. These juveniles are further reared in nursery ponds for 2-3 months until they attain marketable size (5-9.5 cm). He rears each fish species in separate ponds due to their different feeding habits and growth rate. He prepares the nursery pond a month before stocking using mustard oil cake, yeast, wheat flour, cow dung, and other materials. He ensures that a good amount of zooplankton is available throughout the nursery-rearing period. Feeding with farm-made feed is also practised, a technique he learnt during his training at KRC of ICAR-CIBA, Kakdwip.

Pond fencing and bird net fencing are strictly followed to avoid the loss of fish due to flooding during cyclones and bird predation. The bird net fencing is made from a high-quality monofilament net with a mesh size of 1 cm. Fingerlings are harvested from the pond and acclimatised for 2-3 days in the concrete tank before transportation.

Father and son usually sell fish to traders at the Kolkata and Howrah pet markets. Occasionally, his son sells some fish in other states like Chennai, Kerala, and Ahmedabad upon demand through social media marketing. Acclimatised ornamental fish are carefully packed in polythene bags filled

with water and oxygen to ensure safe transportation. The fish are then transported via road or rail to markets in Howrah, which serves as a major commercial and transportation hub.

Success story of Mr Mahendra Dului

Mr Mahendra Dului, aged 62 years, and his son Mr Shyamal Dului reside in Lakkhi Narayanpur, South 24 Parganas, West Bengal. He was introduced to brackish water ornamental fish rearing during a training programme conducted at KRC of ICAR-CIBA, Kakdwip in 2010. He owns a hatchery and four backyard culture ponds. Mr Dului has constructed 32 cement tanks, each designed to accommodate a diverse range of fish species. These tanks have varying capacities, ranging from 1,500 to 2,500 litres, allowing for the optimal growth and health of the fish.

He produces juveniles of pearlspot and orange chromide in this hatchery using the brooders procured from the institute in the past. Apart from this, Mr Dului also cultivates several other species of ornamental fish that hold significant commercial value in the market. Among these are the spotted scat, known for its unique colour and adaptability; the green puffer, distinguished by its unusual body shape; crescent perch; and four-band tigerfish, which are in high demand in the ornamental fish market.



Mr Mahendra Dului and son, Shyamal.



Backyard hatchery at Mr Mahendra Dului's farm



Fertilised eggs of pearlspot.

Mr Mahendra Dului uses commercial floating feeds and farm-made feeds for nursery rearing for a profitable and sustainable business. For instance, he uses a combination of mustard oil cake, rice mill dust, and soybean dust fermented with yeast to optimise nutrition and reduce costs. He maintains the water quality parameters in the optimum range and tests his pond water monthly with the help of the KRC laboratory. The careful management of the farm illustrates Mr Dului's commitment to quality brackish water ornamental farming.

His son helps him run the hatchery and manage the farm. Mr Shyamal manages the transportation and sale of farmed ornamental fishes to ornamental traders at Kolkata and Howrah every week or fortnight. In the future, they aim to start seed production of many brackish water ornamental fish species at their hatchery facility for profitability and sustainability.



Four banded tiger fish (Datnoides polota).

Success story of Mr Aurobindo Haldar

Mr Aurobindo Haldar, a 62 year-old entrepreneur, used to run a small shop until 2008. However, he incurred losses and became debt-ridden. During this time, he attended a day workshop at KRC of ICAR-CIBA at Kakdwip where he learnt about brackish water fish farming and its profitability for small-scale farmers. Mr Aurobindo Haldar owned 1.4 hectares adjacent to a brackish water canal at Ganeshpur, South 24 Parganas. The farm is conveniently located just 3.5 kilometres from Kakdwip.



Indian mottled eel (Anguilla spp.)

Earlier he used to lease his three ponds to other farmers but after attending the workshop he decided to engage himself in fish farming and the ornamental fish trade. The pond has water depths from 1.0 to 1.5 metres throughout the year with the salinity profile fluctuating between 5 and 15 ppt, which is perfectly suited for brackish water fish species. He also procured brooders of pearlspot and orange chromide from the institute and released them on his farm. Within a year, he started harvesting juveniles which he transported himself to the Howrah pet market. He is primarily involved with the juvenile production of pearlspot, which he also sells to fish farmers for grow-out culture.

After three years of ornamental fish production, he could rid himself of debt and now he is fully occupied with fish farming and ornamental fish production. He also designed a small backyard hatchery at his home consisting of 16 cement tanks with capacities ranging from 1,000 to 2,000 litres. At this facility, Mr Haldar rears juveniles of brackish water

ornamental fish species - including spotted scat, green puffer, knight goby, crescent perch, and brackish water eels - which he collects from creek water as well as from seed collectors. These fish become marketable size after 90-100 days of rearing. In the future, he wishes to expand his farm and hatchery facility for large-scale production.

Way forward

The brackish water ornamental fish sector in India is witnessing steady growth, particularly in coastal states like West Bengal, Tamil Nadu, Kerala, and Maharashtra. These states are also major export hubs in India for ornamental fishes. Traditional farmers in these states are now using scientific methods and community-driven practices to improve production and meet market demands.



Mr Aurobindo Halder with pearlspot fingerlings.



Spotted scat (Scatophagus argus).



Knight goby (Stigmatogobius sadanundio).

In India, particularly in West Bengal, brackish water fish species such as spotted scat, green pufferfish, and pearlspot are already finding strong domestic market demand. However, challenges such as fluctuating salinity, limited access to high-quality seeds, and natural calamities remain. Addressing these issues through targeted interventions - including advanced hatchery techniques, improved market connectivity, farmer training programmes, and awareness - can significantly enhance productivity and profitability of farmers in this region. The sector also needs to focus on exploring export opportunities among neighbouring countries to promote indigenous species and to cater to the international ornamental trade.

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