Prospects of ornamental fish culture in seasonal water bodies of upper Assam

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Selling potential ornamental fish as food fish in upper Assam.

Ornamental fish keeping is an age old hobby. Ornamental fish are considered to be “living jewels” and are kept as pets in aquariums owing to their huge aesthetic value. Globally, fish keeping is the second most popular hobby in the world, next only to photography. It is a multibillion industry with a value of more than 10 billion dollars annually. Global export of ornamental fish is currently lead by Singapore followed by countries such as Japan, the Czech Republic, Thailand, Malaysia and Indonesia. USA is the leader in import of ornamental fishes.

India’s share of the international ornamental fish trade is marginal (<1%) but has been able to show consistent growth over the years[2,5]. Of the total fishes traded by India, approximately 85% are native ornamental fishes sourced from the Western Ghats and North East India, which are two major biodiversity hotspots region of the world, with Assam standing out as the major contributor.

Assam enjoys a favourable tropical climate and diverse landscape with huge resource potential. Despite having such vast resources, both in terms of natural water resources as well as rich fish diversity, the state lags far behind with respect to ornamental fish trade. A host of factors is undervaluing this potential venture of economic growth. Capture of wild, native ornamental fishes form the available resources has resulted in depletion of wild stocks. Anthropogenic problems such as habitat degradation, population explosion, overexploitation, pollution and destructive methods of fishing are also adding pressure on existing resources to meet the ever increasing demands of the region.

In this regard, the aquaculture of native fishes in seasonal water bodies can definitely play a crucial role to minimise the existing threats lingering upon the endemic and rare varieties of ornamental fish species. Seasonal water bodies are those aquatic resources that fill up on the onset of monsoon such as ephemeral streams, ponds, wetlands, roadside canals, paddy fields and ditches. While many of them dry up during the

A typical roadside pond which harbours many native ornamental fishes.

winter, some do not and expand once the monsoon season starts. Since the native fishes are well adapted to such water bodies, they can be tapped successfully to venture into the lucrative ornamental fish trade. This will not only minimise the existing threats to water bodies as well as fishes but will open up new sources of income through entrepreneurship development in aquaculture and allied sectors. Farming in these types of water bodies requires minimal effort and investment, which can be an added advantage.

Water resources of upper Assam

The upper Assam region, comprising the Dibrugarh, Tinsukia, Sivasagar, Jorhat, Golaghat, Majuli, Charaideo, Dhemaji and Lakhimpur districts, boasts a huge array of diverse water resources. The mighty Brahmaputra River and its tributaries are the principal water resources in the region. Data compiled by Department of Fisheries, Government of Assam (2014-15) reveals that the districts of upper Assam jointly occupy 13.37% ponds and tanks, 31.83% of beels, 18.02% of swamp and derelict water bodies, 32.90% reservoirs and 61.05% of forest fisheries of the total water resources of Assam. The monsoon rains start in April and peak in July, filling most of the water bodies in the region. According to the data from Indian Meteorological Department, the average rainfall received by the upper Assam districts is 332 mm in Dibrugarh, 329 mm in Tinsukia, 270 mm in Jorhat, 265 mm in Sivasagar, 217 mm in Golaghat, 413 mm in Lakhimpur and 327 mm in Dhemaji for the last five years (2012-2016) during the monsoon season and tends to remain more or less uniform at the same time period. Although high precipitation causes severe floods in most part of upper Assam, at the same time it opens up lots of opportunities in the fisheries sector. Inundation of lands and water bodies during flood leads to dispersal of native fishes, effectively stocking ephemeral water bodies as the flood water recedes. Also, the onset of monsoon creates a variety of micro habitats; ultimately leading to a rich repository of fish species[2]. The seasonal water bodies become a natural habitat for fishes, providing them with breeding and feeding grounds. The adaptation of native fishes to these water bodies makes their culture feasible and provides a rationale for the development of ornamental fisheries[7] and generates avenues for ornamental fish trade.

Ornamental fish resources of Assam

Divergent views regarding the total number of ornamental fishes has been recorded in Assam[2]. Srivastava et al. (2001) recorded 115 species of ornamental fishes from Assam. Working on the *beels* of upper Assam, Das and Biswas, (2005) reported 70 species of fishes with ornamental potential demanding commercial value in domestic and international market. Mahapatra et al. (2007) and Dhar and Ghosh (2015) enlisted 187 ornamental fishes from Assam out of total 250 potential ornamental fishes found in North East India. The major native ornamental fishes with good commercial value

from the region include *Channa bleheri, C. aurantimaculata, C. stewartii, Leiodon cutcutia, Glossogobius giuris, Botia dario, Macrognathus pancalus, M. aral, Acanthocobitis botia, Danio rerio, Devario devario, Chaca chaca, Esomus danricus, Pethia gelius, Badis assamensis, B. badis, Trichogaster lalia, Xenentodon cancila* etc. to name a few. Of the total ornamental fishes reported, many of them are endemic to the region. The endemism of fishes leads to greater threats or vulnerability and hence requires immediate conservation strategies. Therefore, in this regard aquaculture in seasonal water bodies can play a very pivotal role in formulating conservation strategies for the threatened species along with prospects of generation of revenue.

Fish harvesting in a paddy field.

Prospects of ornamental fish culture in different water bodies

Almost the entire range of native fishes available in the state are dispersed during the monsoon season. The availability of this huge array of aquatic resources opens opportunities for entrepreneurship development in the fishery sector. Different water bodies can be selected according to the habitat and ecology of the prospective culture species. Culture of air breathing fishes such as *Channa gachua, C. aurantimaculata, C. bleheri, C stewartii, C. gachua, Anabas testudineus, Trichogaster fasciata, Heteropneustes fossilis, Clarias magur* and other such as *Nandus nandus*, *Trichogaster lalia, Badis badis* can be carried out in water bodies normally infested with weeds such as 'beels' (wetlands), ditches, roadside canals and swamps etc. as they can easily sustain in such water bodies. In this context, high value fishes such as *Clarias magur, Heteropneustes fossilis, Channa auranti-maculata, Anabas testudineus* can be preferred over other fishes as they command high market value amounting to Rs. 300-Rs. 400/kg in domestic market as food fishes along with their ornamental value. Similarly, the fishes that require relatively open access areas such as *Xenentodon cancila, Glossogobius giuris, Esomus danricus, Rasbora daniconius, Danio rerio, Macrognathus pancalus, Acanthocobitis botia, Mystus spp. Puntius spp.,* and *Chanda nama* can be cultured in open ponds, canals and paddy fields. It is important to note that most of the native food fishes, especially major and minor carps, are compatible with native ornamental fishes which can be cultured together to increase production further. Along with culture of the fishes, local traditional knowledge can be

A pond constructed in rice field environment.

Traditional duck cum fish farming in pond in upper Assam.

applied successfully in rearing, feeding, capture and management purposes of the aquatic resources. Such sustainable culture practice will not only decrease the existing pressure on the natural water bodies but will also pave the way for conservation strategies for both water bodies and native fish germplasm.

Scope for integrated fish farming

The advantages and success of integrated fish farming has been acknowledged globally. Since the region has abundant natural resources, it is often seen that different farm animals exist in rural households in the region thereby providing a huge potential of integrated farming of ornamental fishes in combination with other domestic animals. As the majority of households in Assam have access to ducks, pigs and other livestock, they can be integrated with ornamental fish culture which will boost rural economy as well as farm production. However, presently aquaculture in Assam is mainly focussed on major carp culture[7] and the paradigm should be shifted to include culture of small fishes to develop ornamental fish culture and trade in the region.

Entrepreneurship development through paddy cum fish culture

With more than 200,000 hectares of paddy fields in Assam, the development of paddy cum rice culture systems is a potential driving factor for economic growth in rural areas. High precipitation during the monsoon season in paddy fields creates ambient environment for propagation of native fishes which can be tapped for economic growth in ornamental fisheries. Currently, the indigenous farming system of capturing fishes in rice fields prevails in rural areas in upper Assam. Roadside canals, *nallahs*, ditches, wetlands, water-logged paddy fields and other seasonal water bodies are very common in the region. Such water bodies can be tapped successfully for culture of small colourful fishes instead of depending on nature for stocking and dispersal of fishes. Fishes adapted to environment of ponds and roadside canals can be utilised for revenue generation. It can be beneficial in comparison to other types of culture system as multiple resources can be cultivated together such as rice cum fish cum duck culture in the same niche. Practising culture techniques such as cage culture and pen culture in the wetlands and paddy fields can be an added advantage for further increase in fish production.

Empowerment of women

Women have been engaged in the fishery sector since time immemorial. It is a well-established fact that women are engaged consistently in different fishery related activities such as sorting, grading, processing, transporting along with marketing of fishes. Engagement of women can be a major boost to the lucrative ornamental fish industry, further supplementing total household income. There is also potential to earn income through preparation of feed, or through integrating ornamental fish culture into existing farming practices. In this regard, transfer of technologies for a wide range of aquaculture techniques from scientific laboratories to agriculture will be greatly helpful in entrepreneurship development and women's empowerment. Establishment of self-help groups and cooperative societies will open up new dimensions that will attract funding support from various government schemes. Successful implementation will enable women to increase household income and purchasing power, increase their status in the society, reduce poverty and better utilise available resources.

Funding agencies

A lot of emphasis has been given to culture of native ornamental fishes of northeast India. A host of national bodies such as NFDB, CIFA, MPEDA, NABARD and also state governments have been consistently providing funding support for the development of ornamental fish culture in the region. They can be approached for grants to set up tanks, breeding unit, marketing chain as well as other expenses. They also train fishermen about different aspect of aquaculture. CIFA in particular have been successful in demonstrating and providing training in culture technologies, integrated fish farming and ornamental fish breeding in the northereastern region of India. Hence, collaboration with these institutes and organisations will augment well for the fish farmers in the region.

Existing constraints

Due to many constraints, the ornamental fish trade in the region has remained very much nascent and untapped. Since more than 95% of the people in the region consume fishes, most native ornamental fishes are primarily utilised as food owing to high price of major carps that are imported from other states of India. Lack of awareness regarding ornamental fishes and their trade is another bottleneck. Consequently, existing fish hobbyists tend to prefer exotic fish varieties to readily available native ornamental fish varieties. Even though the region is endowed with diverse water resources, only capture fisheries persist with no inclination towards culture practices of ornamental fishes. The immediate implication is that most of the water bodies remain unattended and unproductive. Also, almost the entire shipment of ornamental fishes from the region is conducted by traders collecting directly

A seasonal roadside canal which can be utilised for culture of native ornamental fishes.

from the natural water bodies resulting in the depletion of the natural stocks and creating conservation threats as well. Protocols for captive rearing and supplementary feeding with pigment-rich food for locally available ornamental fish species is still a far cry from reality. All these factors together have had a negative impact on the growth of ornamental trade in the region.

Way forward to develop ornamental fisheries

Imparting sound knowledge regarding ornamental fish trade would be the first step towards successful ventures into this lucrative business. Every strata of the society in rural areas need to be educated and provided with technical guidance for sustainable utilisation of water bodies and fish germplasm that is essential for the conservation of the available resources in the region. Strict implementation of existing fisheries and forest acts applicable to fish catch and trade, use of fishing gears and other equipment, prevention of habitat destruction and destructive methods of fishing of native fishes would be immensely helpful in regulating unlawful practices. Furthermore, available breeding and culture techniques, fish management measures, identification and diagnosis of fish diseases and integrated farming techniques needs to be transferred to the fisher communities to encourage them to take part in culture of native ornamental fishes. State Government and other national bodies associated with aquaculture also need to step up their extension services for inclusive growth of ornamental fish trade in the region.

An example of unattended and polluted roadside ditch commonly seen which can be utilised for native ornamental fish culture.

Conclusion

Seasonal water bodies are a potential source of income generation in rural areas. Favourable climatic conditions and availability of huge array of aquatic bodies and fish fauna provides a bright scope for development of culture fisheries in the region. Still being in the nascent stage, culture of ornamental fishes in the seasonal water bodies has the potential to open up opportunities for local people to participate in the ever increasing global ornamental fish trade. A host of other culture practices can be done side by side along with ornamental fish culture. Successful implementation will open doors for income generation; increase returns on available resources; reduce poverty through entrepreneurship development, empower women and potentially contribute to the conservation of native fishes as well.

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