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Raising the bar in Malaysia

100% replacement of *Artemia*

All-female crustacean culture

Ingredients vs nutrients and performance

Progress with marine fish in India

Focus on vaccine for fish health

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Perspectives on mariculture in India

By Sekar Megarajan, Ritesh Ranjan, Biji Xavier, Muktha Menon, Loveson L Edward, Narasimhulu Sadhu and Shubhadeep Ghosh

A slow start but a big leap in the near future with progress in hatchery seed production of several species and feed development.

The aquaculture sector in India has a long history and has witnessed an increase in production for the last two decades with an annual growth rate of 6-7%. This means that India is the second largest producer of farmed fish in the world after China. At present, freshwater aquaculture contributes to a major proportion of the aquaculture production from India (FAO, 2014).

In India, brackish water aquaculture is a traditional practise in natural coastal low land areas such as pokkali fields (salt resistant deepwater paddy fields along the Kerala coast), bheries (man made impoundments in coastal wetlands of West Bengal state), khar lands (tidal lands in Karnataka state) and khazan lands (saline flood plains along tidal estuaries in Goa) with varying production capacities and depending on tidal influences and natural supply of seeds (Kutty, 1999). After several trials, under different R&D programs, scientific coastal farming was initiated in the early 1990s with the active involvement of different stakeholders. Since then, shrimp farming has grown tremendously and at present, dominates coastal aquaculture. However, the frequent problems in shrimp culture raises the question on the sustainability of coastal aquaculture as it is solely dependent on a single group i.e. shrimp. Therefore, species diversification with high value marine finfish is now being considered to develop a sustainable and eco-friendly coastal aquaculture industry in India.

Status of mariculture in India

India has vast potential areas for mariculture with 8,129 km of coastline, 2.2 million km^2 of the exclusive economic zone (EEZ) with 0.5 million km^2 of continental shelf, 1.2 million ha of brackishwater areas and 20 million ha for sea farming (Modayil et al., 2008). In spite of having huge mariculture resources, the country is still at the initial stage in marine finfish production with only 1.43% contribution to the global farmed marine finfish production (FAO, 2016). Marine finfish culture in India has not taken up in a big way due to several problems associated with its farming.

However, this may soon change with recent developments. The breeding and culture technology of some species, namely the Asian seabass (*Lates calcarifer*), cobia (*Rachycentron canadum*), silver pompano (*Trachinotus blotchii*) and orange spotted grouper (*Epinephelus coioides*) have been developed and successfully demonstrated in Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Gujarat and West Bengal. Farming in sea cages and cages located in earthen ponds use both hatchery produced and wild caught seeds.

Open sea cages

Cages in brackish water creeks

Culture system and species

In 2007, the Central Marine Fisheries Research Institute (CMFRI), under the Indian Council of Agricultural Research (ICAR) initiated open sea cage culture for marine finfish. After several modifications of the mooring system and frame structure, an appropriate low cost cage design suitable for Indian conditions was developed. Thereafter, experimental culture of seabass, mangrove red snapper, pearl spot, milk fish, cobia, silver pompano and different species of mullet were carried out in floating sea cages off several states (Kerala, Tamil Nadu, Karnataka, Andhra Pradesh and Odisha) with varying degree of success.

Nevertheless, the progress in cage culture has convinced several government organisations, entrepreneurs and farmers to venture into cage farming using hatchery produced and naturally available seed stock of high value marine finfish. In addition to cage culture, the culture of marine finfish in earthen ponds is also gaining importance among farmers as the pond design and pond preparation are similar to shrimp culture ponds. Some shrimp ponds have been converted for finfish culture as shrimp farming was facing frequent disease outbreaks, high production costs, and low prices in international markets.

ICAR-CMFRI and ICAR-CIBA (Central Institute of Brackishwater Aquaculture) have developed and standardised hatchery production of the Asian seabass, cobia, silver pompano, pearl spot (*Etroplus suratensis*) and orange spotted grouper. The Rajiv Gandhi Centre for Aquaculture (RGCA) has developed commercial hatchery seed production for Asian seabass, cobia and silver pompano. In addition, Asian seabass, milk fish, mullets, pearl spot and mangrove red snapper juveniles are collected from the wild for grow-out culture. Research showed that these species are suitable for cage culture and the Asian seabass, orange spotted grouper, silver pompano, milk fish and mullet are suitable for culture in ponds.

Silver pompano harvest from brackish water cages

Asian seabass culture in brackish water cages

Challenges and prospects for finfish mariculture

Finfish culture was initiated in 1940 at Narakkal, Kerala. Initially, the culture began with milkfish (*Chanos chanos*) and grey mullets (*Mugil cephalus*) and they had registered an encouraging production of 1,000 kg/ha/yr (Regunathan & Kitto, 2007). However, since then the progress was not as expected and there are several underlying reasons for the poor growth of mariculture in India.

Hatchery production

The major bottleneck for the development of a finfish mariculture industry is the availability of hatchery produced seeds. Hatchery seed production technology for several tropical marine finfishes are well developed in several Asian countries but only at an initial stage in India. Marine fish culture using hatchery produced seeds is popular in Taiwan, China, Thailand, Philippines, Indonesia and Malaysia. However, the efficient transfer of these hatchery technologies to India is a major challenge. Unlike shrimp post larvae and fresh water fish fry production, marine fish fry production is comparatively difficult, because of the lengthy larval cycle and low survival rates. These factors prevented farmers from venturing into marine fish fry production. Therefore, more effort on training and demonstrations on marine fish fry production is required to impart confidence among farmers to undertake such activities.

To this end, several R&D organisations frequently conduct training programs for aqua entrepreneurs and farmers. With successful technology transfer, the setting up of hatcheries by private entrepreneurs may be realised in the near future. The use of wild seeds for fish culture is another option. Recently, CMFRI took the initiative to prepare the seed calendar for marine finfishes making available information on species availability, location and seasonality under the All India Network Project (AINP) on mariculture. Certainly, it gives a correct picture on the available seed resources in India and may help the grow-out sector.

Feed

Feed is another constraint for marine finfish culture. In most farms, low value fish and trash fish are used as feed (Yamamoto, 2006). Nowadays, the availability of trash fish is scarce. Therefore, imported and locally produced artificial feeds are used as an alternative to trash fish. However, the use of artificial feeds is constrained by cost, availability, performance and other issues. Recently, feed company, Growel Feeds Pvt Ltd, introduced sinking and floating feeds for the cobia, silver pompano, and seabass. Initial trials using these feeds in several locations were encouraging. Thereafter, the feed is being commercially used by different stakeholders. In a similar way, many Indian feed companies may come up with different feeds for marine finfish, similar to that in the shrimp industry.

Markets

In general, there are large communities within a 50 km vicinity from the coast and these communities consume marine fish, usually low cost fish such as anchovy, sardines, barracuda and trevally. Initially, they were the target market for farmed marine fish. However, it was certainly difficult for the marine fish farmers to produce fish matching prices of these lower cost fish from capture fisheries. This price constraint prevented farmers venturing into marine finfish farming. However, in recent years, there are changes. Fish consumption in India has increased significantly due to lifestyle changes and higher cost of meat (Salim, 2014). In addition, the perception of fish as a healthy food with high omega 3 fatty acids with cholesterol lowering properties promotes marine fish consumption. This positive preference on fish consumption among the domestic consumers has given hope to farmers to venture into marine fish farming.

The lack of demonstrations for large scale farming systems such as sea cage farming and pond culture of finfish is another constraint in this sector. However, after the development of sea cages by CMFRI, several government organisations have taken the initiative to train and demonstrate sea cage farming to various stakeholders. In addition, culture of finfish in ponds were also demonstrated by CMFRI, CIBA and RGCA. These demonstrations reached the different stakeholders across the country.

An Asian seabass culture pond

Asian seabass sampled from culture ponds

Conclusion

A huge gap exists between the contribution of freshwater and marine finfish aquaculture to the national aquaculture industry in India. There is scope for mariculture development in India via the efficient use of technologies, resources and species available in the country. Understanding the importance of mariculture in food security and income generation, the government of India has taken several initiatives to provide a greater boost to mariculture development through several welfare schemes and research programs and it is envisaged to bring a big leap in Indian mariculture in the near future.

References are available on request

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