Global status of Giant prawn, *Macrobrachium rosenbergii* farming with special reference to India and measures for enhancing production

Bindu R. Pillai* and D. Panda

ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha, India

Corresponding author : B.R. Pillai; pillaibrcifa@gmail.com

ABSTRACT

Macrobrachium rosenbergii widely known as Giant Prawn (GP) is one of the most important freshwater prawn species widely cultured in several tropical and sub-tropical countries around the world. The global production of GP in 2021 was 3,13,756 t with a value of over $ 2.45 billion. China is the top producer with a production of 1,71,263 t accounting for 54.4% of the global production. Bangladesh, Thailand, Myanmar, and India are the other major producers of GP. India used to be the second largest producer of GP in 2005, however, since then the production showed a declining trend till 2012 with production declining from 42,800 t in 2005 to 3,333 t in 2012. The major reasons for the declining production were slow growth rate, outbreak of diseases and low survival during grow-out, which led to poor production and declining profit for the farmers. However, since 2013 there has been a gradual increase in production till 2020, and in 2021 the production showed a 2.5-fold increase from 2020 production. Considering the huge natural resources available for GP farming in the country and the high value it fetches, demand in domestic and export markets, and its potential to enhance the income of farmers, there is an urgent need to further expand GP farming in India. The present paper provides a brief status update on global GP farming with special reference to India and suggests measures for enhancing the aquaculture production of GP in India.

Keywords: Freshwater prawn, Global status, Macrobrachium, Scampi

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INTRODUCTION

Giant freshwater prawn also called giant prawn (*Macrobrachium rosenbergii*), is an important freshwater prawn species widely cultured in several South and Southeast Asian countries around the world. Its fast growth rate, compatibility with fish such as carp, high market price, and demand make it a sought-after species for culture. In addition to freshwater, it is also cultured in low saline brackish water areas and is a suitable species for paddy-cum-fish culture. The price of giant prawns increases with size and as the size shows a negative relation with stocking density it is cultured at relatively lower stocking densities and hence does not adversely affect the natural water bodies.

Global Production Status of Giant Prawn

The FAO started reporting the global production data of giant prawn from the year 1970 when it reported a production of 10 t. The production rapidly grew to over 1000 t by 1978 (1,309 t) and by 1985 the production crossed 10,000 t. In 1990 the reported production was 30,842 t. Suddenly in 1996 the production jumped to 61,964 t due to the huge production from China. In 1999 the production crossed 100,000 t and continued to increase till 2007 when the GP production crossed 2,00,000 t. Subsequently, till 2015 the production remained more or less static with minor variations. However, in 2016 the production showed a significant increase and the trend continued till 2021 when the production crossed 3,00,000 t (3,13,756 t). The global production of GP from 2010 to 2021 is provided in Figure 1. The value of farmed GP in 2021 was over US$ 2.45 billion (FAO, 2023). In 2021, thirty-one countries reported aquaculture production of GP, however, only eight countries produced more than 1,000 t (FAO, 2023).

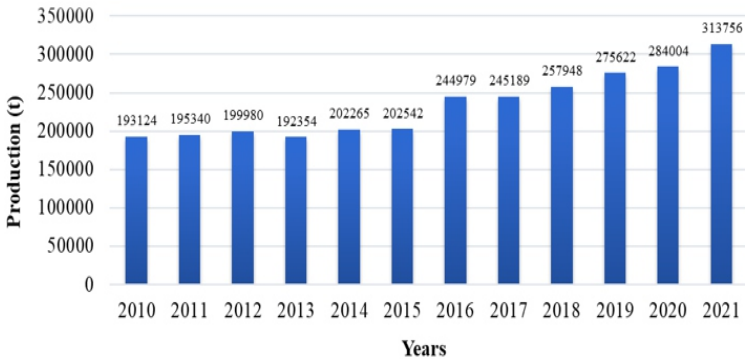

Figure 1: Global production of giant prawn from 2010 to 2021 (FAO, 2023)

GP is a native species in the South and Southeast Asian countries where it has been cultured for long. GP has also been introduced to several countries including China, USA, Brazil, and to several European counties. However, only in China it became an important cultured species. China is the top global producer of GP in 2021, followed by Bangladesh, Thailand, Myanmar and India in that order (Figure 2). The other major producer is Taiwan with a production of 5,358 t. In 2021, Vietnam slipped to 7th position from 4th position in 2019 (20,129 t) with a production of only 2,740 t. Indonesia is the 8th largest producer with

a production of 1,321 t in 2021. Asia continues to dominate and contribute more than 99% of the production. Outside Asia, only Brazil shows some production in 2021. The rapid rise of Pacific white shrimp (*Litopenaeus vannamei*) farming in Asia has caused a decline in GP farming in some major producers like India and Thailand mainly due to the huge production potential of the former species. However, the frequent disease outbreaks in vannamei farming and its lowering market price have caused a renewed focus on GP which is expected to continue.

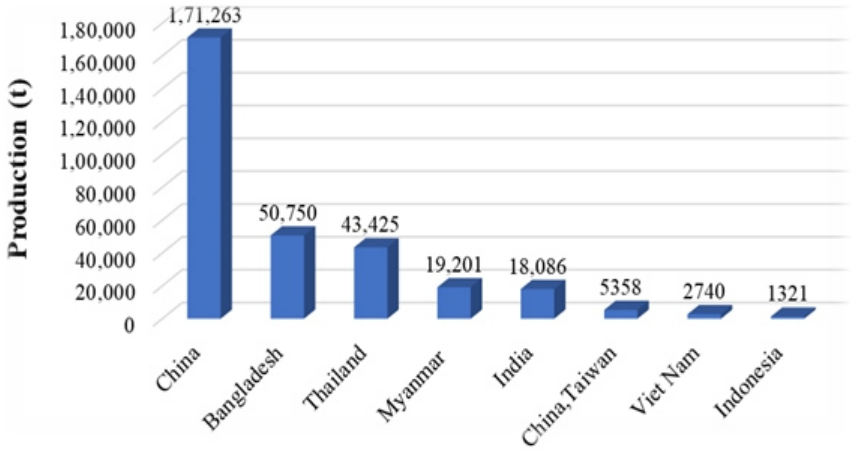

Figure 2: Giant prawn production in major producing countries in 2021 (FAO, 2023)

China

From 1996 until 2021, China was the leading producer of GP, accounting for more than 50% of the global production. The GP production from China in 2021 was 1,71,263 t (FAO, 2023), accounting for nearly 55% of global production. From 1996 to 2001, there was a rapid increase in production in China. Production somewhat declined in 2002 and 2003 as a result of outbreaks of white tail disease (WTD) (Yang et al., 2012). After 2003, prawn production gradually recovered as a result of the development of specific pathogen-free (SPF) seed stock, and the production was more or less stable and ranged from 1,00,000 to 1,20,000 t from 2006 to 2016. From 2017 until 2021, there has been a steady increase in production, from 1,37,000 to 1,71,000 t. In China in the early 1990's, GP farming was practiced in earthen ponds and the yields ranged between 1,500 to 3,000 kg/ha/year with much higher profitability than that of traditional fish farming (Ming, 2014). From 1976 to 2002, Guangdong Province was China's main producing region, however, since 2003, GP production in Jiangsu Province has exceeded that of Guangdong Province (Ming, 2014). Due to very low water temperature in winter, GP farming occurs from mid-May to early October, therefore, a single crop is only obtained annually in the Yangtze River Delta

region. However, local farmers have adopted a greenhouse system, covering ponds with plastic and using a boiler to raise the water temperature. This allows farmers to stock prawn seed into nursery ponds two months ahead compared to the traditional, open culture method. This farming practice has made it possible to extend the culture period and achieve remarkable expansion in the Yangtze River Delta region (Ming and Fujiang, 2016). Average production is reported to be 5,250 kg/ha, although production of 7,500 kg/ha has also been achieved (Ming, 2014). In addition to monoculture, some other culture methods like rice-prawn culture, polyculture with fish, polyculture with Pacific white shrimp (*L. vannamei*), and polyculture with mitten crabs (*Eriocheir sinensis*) are also in practice, however, these culture systems are not common (Ming, 2014). Currently, genetically improved and faster-growing breeds are available for culture. However, the intensification of culture has also brought several diseases like Decapod iridescent virus 1 (DIV1), iron prawn syndrome (IPS), causing large-scale mortalities in GP farms. Research is ongoing to develop disease-resistant SPF strains of GP.

Bangladesh

GP has been traditionally cultured in Bangladesh since 1970s and currently it is the second-largest producer of GP with a production of 50,750 t in 2021. Bangladesh started reporting GP production data to FAO in 1995. From 1995 to 2000, the production showed a steady increase from 1,596 t to 5,504 t. In the next 10 years, the production showed a six-fold increase to 30,636 t. From 2010 to 2020 the production showed a steady increase to 51,096t. However, in 2021 there was a slight decrease in production (50,750 t) compared to 2020. Bangladesh is often considered as one of the most suitable countries in the world for GP farming due to its abundant freshwater resources and agro-climatic conditions (Ahmed et al., 2008). GP farming is mostly concentrated in southwest Bangladesh, mainly Khulna, Bagerhat and Satkhira districts (Kibria, et al., 2022). Kibria et al. (2022) evaluated the status of GP farming in the Dinajpur district of Bangladesh and found that the majority of the farmers cultured GP in ponds (94.64%), while a small percentage of farmers cultured it in rice fields (5.36%). The majority of the farmers were either small or marginal. Pond areas of over half of the surveyed farmers (51.78%) were less than 0.50 acres and that of a few (14.29%) were larger than 1.0 acre. All the farmers in the surveyed area adopted polyculture systems, however, most of them did not follow any scientific combination of the species. Fish species cultured with GP included rohu (*Labeo rohita*), catla (*Gibelion catla*), mrigal (*Cirrhinus mrigala*), silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*), common carp (*Cyprinus carpio*), sarputi (*Puntius sarana*), bighead carp (*Hypophthalmichthys nobilis*), tilapia (*Tilapia mossambicus*) (Kibria et al., 2022). The main constraints to its culture include the lack of availability of quality seeds and the rising prices of various inputs, including feed.

Thailand

Thailand is currently the third largest producer with a production of 43,435 t in 2021. Thailand reported a production of one tonne of GP in 1976 (FAO, 2023) and the production increased to 100 t in 1978, and 10,000 t in 1987. However, after 1987 there was a decline in GP production and there was no definite trend till 2001. From 2001 to 2004 the production showed a rapid increase from 13,310 t to 32,584 t. In subsequent years the production declined slightly and remained more or less static till 2011. However, from 2011 to 2016 there was a steady decline in production from 21, 079 t to 14,950 t. From 2016 onwards production showed an increasing trend till 2021. Thailand used to be the top GP producer till 1996. The tropical climate, plentiful water resources, and multiple networks of manmade canals and natural waterways support high levels of year-round production (Schwantes et al., 2007). GP is cultured throughout Thailand, but farms are mostly concentrated in the central river valley of the Chao Phraya, which flows through Bangkok to the Gulf of Thailand. Monoculture is widely practiced, varied management strategies involved stocking nursery ponds with post-larvae or stocking directly into grow-out ponds, and harvesting with the batch or combined method. The most prevalent strategy, was to stock post-larval prawns in nursing ponds at high densities and after 60 to 75 days, prawns were transferred to grow-out ponds, with the first harvest after five months (Schwantes et al., 2007). GP culture in Thailand is intensive, with high stocking densities (20 nos/m^2), most farms are less than 5 ha in size. The majority of the farmers use commercial feed and the farmers' average feed-conversion ratio was 2:1. Aeration is also used throughout the cycle using paddle wheels, and water was exchanged or topped up every 12 days, on average, to maintain water quality. Diesel generators are the most common source of power for electrical aerators and pumps. Yearly production ranges 500 to 6,500 kg/ha/year, averaging 2,500 kg/ha/year. The conventional practice has led to disease outbreaks and deteriorated pond bottoms that result in frequent detection of antibiotic residue. This led to the development of an improved culture technology of the mono-sex culture. It involves manual sexing of the prawns at three months and restocking only the male prawns into new ponds at low density. The technique gives a higher yield and reduces the incidence of disease and thus the need for prophylactics (Na-Nakorn and Jintasataporn, 2012). Farm gate and market prices for GP are similar throughout Thailand, and prices increase with prawn size. The majority of prawns are sold for local consumption. The constraints to GP culture business in Thailand include low yield and a limited export market (Na-Nakorn and Jintasataporn, 2012). There are ongoing selective breeding programs on GP aimed to improve growth and disease resistance by private as well as government institutions.

Myanmar

Myanmar has emerged as the 4th largest producer of GP with a production of 19,201t in 2021. Myanmar reported production of 100 t to FAO in 2002, the production showed a steady increase and in 2012 it reached 4,355t (FAO, 2023). However, there was a sharp decline in production to 872 t and 800 t in the next two years. In the subsequent years till 2018 the production did not show any definite trend, but from 2018 until 2021, the

production showed an increasing trend. Myanmar is endowed with a rich resource of freshwater and brackish-water fisheries due to its extensive large river systems running north to south and a huge network of river and tributary systems in the Ayeyarwaddy Delta (FAO, 2023). Prawns form an important part of seafood exports, though most of the produce is domestically consumed and only a small percentage of the total output is exported. Most farmers use a polyculture system that includes freshwater prawns and other freshwater fish to reduce production costs. Only a few farmers use the monoculture system for semi-intensive and intensive production even though productivity is better than the polyculture system. There is a lack of technical expertise in properly maintaining a monoculture system. Demand for freshwater prawn seed continues to increase. As a result of the increase in demand for the largest-size prawns from foreign markets, the monoculture of GP under intensive management is now underway in some of the larger farms. Rice-prawn culture is also practiced in some parts of Myanmar.

India

As per the FAO statistics, India is the 5th largest GP producer globally with a production of 18,086 t. GP farming is traditionally practiced in most of the coastal states in India. Figure 3 shows the production of GP in India from 2005 to 2021 (FAO, 2023). According to data provided by the Marine Products Export Development Authority (MPEDA), the GP production in 2021-22 was 21,317 t, a 2.5-fold increase from the 2020-21 production of 8,303 t. The production data of major GP-producing states and areas under culture from 2015-16 to 2021-22 is provided in Table 1. In 2021-22, Andhra Pradesh (AP) emerged as the top GP-producing state in India followed by West Bengal, Maharashtra, Gujarat, and Odisha. AP used to be the major producer, contributing more than 80% of the production untill 2010. GP farming rose to prominence in AP during the late nineties, when shrimp farmers who were incurring losses due to white spot disease were searching for an alternate species. During 1999-2000, the GP cultivation area in the state was 6,510 ha, and the productivity was below 700 kg/ha. By 2002-03, the farming area increased to 21,580 ha and the production rose to 27,020 t, taking the productivity to 1,250 kg/ha. GP farming was mainly concentrated in the coastal districts of AP i.e. east and west Godavari, Krishna, Guntur, Prakasam and Nellore. Nellore, the southernmost coastal district of AP produced the bulk of production until 2005. Around 40 hatcheries in the state were engaged in freshwater prawn seed production and around 20 feed mills with a cumulative production capacity of 60,000 t a year had taken up GP feed supply in the state in early 2000. However, the production started to decline from 2006 onwards. The lack of availability of quality seeds for stocking was a major problem faced by farmers. They had to depend on seeds of unknown quality, which led to slow growth and poor survival thereby decreasing production and ultimately reducing the profit margin of farmers. An increase in the cost of farming (cost of feed, labour and energy) and static nature of farm gate price led to reduction in profit from farming and forced farmers to shift to other fish species such as carps, pangasius, and shrimp (*L. vannamei*) or to agriculture.

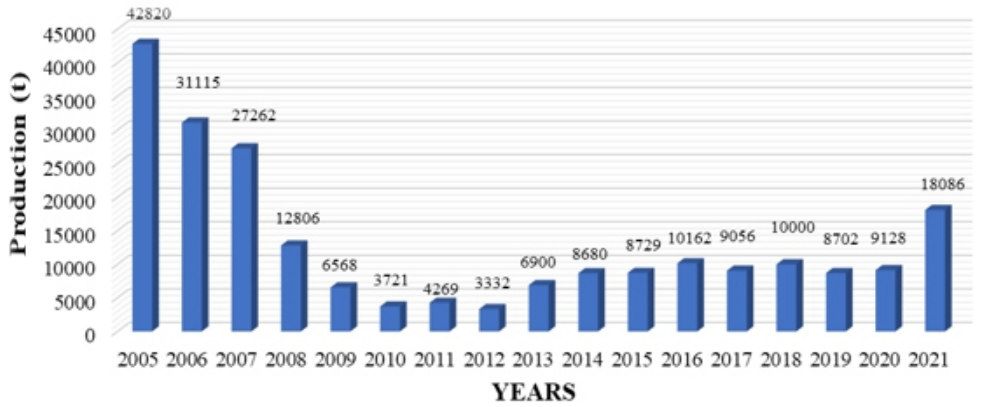

Figure 3: Aquaculture production of GP in India from 2005 to 2021 (FAO, 2023)

Table 1: State-wise production and area under culture of *M. rosenbergii* from 2015-16 to 2021-22

State		2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
West Bengal	AUC	6305	4628	#	#	#	7745	7745
	EP	3780	2421	5024	2784	3307	3373	3037
Odisha	AUC	1787	921	#	#	#	1675	1637
	EP	1504	769	1619	1118	1235	1074	976
Andhra Pradesh	AUC	25	17	#	#	#	427	1772
	EP	1207	14	167	329	1580	335	13,399
Tamil Nadu	AUC	239	540	#	#	#	76	220
	EP	86	144	90	111	38	41	70
Kerala	AUC	4294	45	-	0	#	2	0
	EP	263	29	-	0	1.08	0.22	0
Karnataka	AUC	0	-	-	0	#	0	0
	EP	0	-	-	0	20	0	0
Maharashtra	AUC	54	-	-	#	#	179650	1,79,650
	EP	2002	-	-	1350	1469	1497.87	2415
Gujarat	AUC		-	-	#	#	#	0
	EP	1310	-	-	1530	1890	1982	1420
Total	AUC	12704	6151	#	#	#	9924	11,379
	EP	**10152**	**3377**	**9983**	**7222**	**9540**	**8303**	**21,317**

AUC-Area under culture; EP – Estimated production (MPEDA, Kochi)

In West Bengal (WB) the GP production is practiced mainly in two districts viz., East Medinipur and North 24 Parganas. Tentulia in Bilbally area of North 24 Parganas is the major hub of GP farming in WB. Bilbally is a low-lying area of more than 20,000 ha fed by River Sonai. In this area nearly 600 ha is under GP culture. Polyculture of GP and IMC is practiced in this area. Nearly 5000 small farmers are involved in GP farming here Culture is based on wild seed as the farmers are not happy with the quality of hatchery

seed. The farmers stock 20,000 to 30,000 post larvae (10 mm size) per acre. Seed are collected from nearby rivers during April and culture continues up to March next year. As there is no GP feed available in the market the farmers use *L. vannamei* feed at Rs.100/kg. Harvest starts from October onwards and continues till March. In October the harvest size is 40 to 50g and by December it is 80g. There is a dedicated market for GP in Tentulia where every day from October till March GP are sold by local farmers by auctioning. The rate they receive for 30g size GP is Rs.400/kg and for 80 to 100g they receive Rs. 500/kg. Farmers report a net revenue ranging from Rs.2.0 to 4.0 lakhs/acre. They get a production of 900 to 1000kg/per acre. Larger fish seed (yearlings of 150-200g) are stocked at a very low density of 500 nos./acre. Farmers experience some diseases like black gill, rostral deformity and antennae cut. Overall the farmers are keen to continue the GP farming.

In Odisha, carp-GP polyculture is widely practiced. GP farming is popular in the coastal districts of Balasore, Jagatsinghpur, Bhadrak and Puri. The majority of the farmers are small and marginal farmers. They stock GP along with the carp to get an additional income from carp farming. Many of the farmer's stock wild collected seed and only a few stock hatchery produced seed. Panda et al. (2022) reported a mean GP production of 217.79±28.18 kg/ha from carp-GP polyculture in Odisha.

In Maharashtra and Gujarat, it comes from village ponds as well as reservoir stocking. GP production is also going on in states like Telangana, Madhya Pradesh and Chhattisgarh but it is not reflected in the MPEDA data. The state of Telangana has a fully funded state scheme of reservoir stocking of GP. The data available from the department of fisheries about the details of the water bodies stocked with prawn juveniles, numbers of stocked juveniles and the freshwater prawn production is provided in Table 2, which shows a significant amount of production from this state. The freshwater prawn production in Telangana includes both *M. rosenbergii* and *M. malcolmsonii.*

Table 2: Details of freshwater prawn production in Telangana

Year	Nos. of open water bodies stocked	Nos. of juveniles stocked (million)	Freshwater Prawn production (t)
2017-18	11	10.8	7,782
2018-19	24	31.9	9,998
2019-20	90	41.5	10,453
2020-21	57	17.1	11,734
2021-22 (E)	273	77.3	12,304

Status of GP Seed Production in India

The GP production scenario has shown signs of revival in the last three years. Till very recently nearly all of the 70-odd hatcheries engaged in GP seed production have either closed down or diverted to vannamei seed production. Now, there are around 20 GP hatcheries in the country producing and supplying seed to the farmers. Out of this, only around 10 are large commercial hatcheries and the remaining are small backyard hatcheries. Table 3 gives the details of GP hatcheries in India. As could be seen from the table though there is an installed capacity of about 689 million GP seed in the 20 hatcheries, the production was only about 157 million (23%) due to the low demand from farmers.

Table 3: Status of giant prawn hatcheries in India

State	No. of GP hatcheries	Installed Capacit (in million)	Seed output in 2020 (in million)
Andhra Pradesh	10	490	70
Tamil Nadu	2	140	75
Odisha	7	60	8
Tripura	3	5	0.5
West Bengal	-	-	NA
Rajasthan	1	10	4
Total	**23**	**705**	**157.5**

GP seed production in brackish water ponds

In addition to the GP seed production in hatcheries, a relatively new innovative and low-cost technique of seed production of freshwater prawn in small brackish water ponds is going on in certain coastal areas of West Bengal and Odisha for the last few years. This is practiced mostly in East Medinipur district in West Bengal and Balasore district in Odisha. Sundaray and Bhattacharya (2017) provided a detailed account of this novel seed production technique in WB. In brief, initially farmers stock berried prawns in small brackish water ponds (0.04 ha to 0.20 ha). Prior to stocking, the ponds are dewatered, disinfected with bleaching powder @30ppm and filled with 10-15 ppt salinity water up to a depth of 80-100 cm. After 3 days, water is heavily aerated using pump or paddle wheel aerator for dechlorination. Organic fertilization (mostly soaked mustard oil cake @ 50-70 kg/ ha) is applied to achieve plankton production. Berried females weighing 50-100 g bearing grey eggs are stocked @ 50-100 kg/ ha. Pond water is aerated 1-2 hours for 4-5 times a day using pump fitted with fine mesh net at the suction head or paddle wheel aerator especially at night. The eggs generally hatch out within 2-3 days after stocking of berried female. Pond water is fertilized with mustard oil cake at the rate of 20-30 kg/ ha/ day. Larvae generally metamorphose to post larvae in 18-24 days. After 20 days of stocking berried female, pond water is daily examined using scoop net for the presence of post larvae. When most of the larvae metamorphose into post larvae, bundles of date palm leaves are tied under water with longitudinally driven ropes over the pond surface. Post larvae resting on the submerged date palm leaves are harvested using scoop nets at night and kept in hapas. Post larvae are acclimatized to freshwater by decreasing salinity at the rate of 1 ppt/ hour in cement tanks fitted with aeration systems. Post larvae are sold or transferred to nursery rearing ponds after acclimatization. It takes 3-4 days to harvest all the post larvae from the pond. The pond is then dewatered and prepared for the next cycle. Production of post larvae in this system varies between 1 to 5 lakh/ ha depending on the quality of berried females and experience of the farmer. Operational of cost for each cycle in 1 hectare ranges from Rs. 40,000 to 80,000 and net profit ranges from Rs. 20,000 to 1,00,000 depending on the survival of post larvae. Though the survival is very low (<5%)

farmers get good profit due to the low investment. This is seasonal operation and practiced during February to June when the salinity is high in the brackish water canals. The seed obtained through this method are larger in size compared to the hatchery seed and are healthy as they are produced in the pond itself. There is good demand of this seed in both the states.

Scope of GP farming in India

India has vast natural resources in the form of 2.03 million ha of reservoirs, 2.38 million ha of ponds and tanks, 0.798 million ha of *bheels* and oxbow lakes that can be used for GP culture. In addition, some of the 1.44 million ha of available brackish water area in the country can also be made available for GP culture. Already, nearly 0.9 million hectares are under fish culture in the country. With little concerted effort, GP can be easily incorporated into this system, as prawns are compatible with major carps thus helping the farmer to generate additional income. GP is an indigenous species in India and is widely distributed in all the major river systems on both coasts of India. The availability of standard breeding and culture techniques will help in expanding the culture operations. As most of the GP farms are away from the coastline they do not contribute to coastal pollution and are relatively safe from environmental issues. Attractive market prices and demand in both export and domestic markets are other positive points for taking up GP culture. Apart from earning export revenue, GP culture also provides rural employment opportunities and augments the socio-economic development in remote villages.

Measures for enhancing GP production in India

Pillai and Panda (2024) gave a detailed account of the measures for enhancing GP production in India. In brief, it includes the development of a fast-growing strain of GP through selective breeding, the promotion of carp-GP polyculture, the development of dedicated nurseries for producing juvenile GP, the establishment of dedicated broodbanks of GP, promotion of cluster approach, large-scale awareness programs among fish farmers on the potential of GP farming creation of marketing channels, use of ICT to link farmers with hatcheries and buyers.

ICAR-Central Institute of Freshwater Aquaculture (ICAR-CIFA), Bhubaneswar, Odisha has developed a fast-growing strain of GP through selective breeding in collaboration with WorldFish (Pillai et.al., 2011, Pillai et al., 2020). The fast-growing strain of GP was registered as CIFA-GI Scampi®. The grow-out performance of the new generations of selectively bred GP was evaluated in farmers' ponds in Odisha, AP, West Bengal, and Telangana which revealed its superior performance (Pillai et al., 2022; Panda et al., 2023; Hoque et al., 2023). ICAR-CIFA has selected five GP hatcheries from AP and signed MOUs with them for the multiplication of CIFA-GI Scampi® for its nationwide dissemination to the

GP farmers. ICAR-CIFA will supply brood seed of CIFA-GI Scampi® to these multiplier hatcheries and they in turn raise the broodstock of CIFA-GI Scampi® and use them for the commercial production seed for supplying to farmers. The multiplier hatcheries will be able to disseminate the CIFA-GI Scampi® to farmers across India and help enhance GP production in the country.

Promotion of the polyculture of GP with Indian major carp has the potentialto enhace GP production as India has a huge area under carp culture. GP can be easily incorporated into the carp culture system as the bottom feeder by replacing the bottom feeding mrigal and common carp. The recommended stocking rate of GP in polyculture ponds is 10,000-15000 juveniles and that of carp is 6000-8000 yearlings (catla and rohu) which can give a GP production of 500-600 kg and fish production of 6 to 8 tonnes/ha/year. Many small-scale farmers in Odisha and West Bengal who were selected for on-farm demonstrations of CIFA-GI Scampi® could achieve GP production of 700 to1200 kg/ha/8 months (Pillai et al., 2022; Panda et al., 2023; Hoque et al., 2023).

Promoting the development of dedicated nurseries for supplying juvenile GP (>2g) has the potential to help growers as well as farmers in enhancing their income as juvenile GP can be sold to farmers at much higher prices than PL and stocking of GP juveniles enhances survival and yield from carp-GP polyculture. State government department of fisheries can demarcate a few ponds in their farm for the production of juvenile prawn to supply to farmers.

Another way to enhance GP production is the establishment of a dedicated brood bank for GP especially that of high-quality faster-growing strains like CIFA-GI Scampi® near a commercial hatchery to ensure the supply of good quality brooders to the hatchery which helps them to produce good quality seed. However, a tie-up with one or two existing hatcheries before the establishment of the brood bank is essential for the successful operation of the brood bank. ICAR-CIFA established the first brood bank for GP in Nellore in a five-ha water spread area in collaboration with the College of Fisheries, Muthukur, Nellore in 2012. However, the closure of many GP hatcheries in the vicinity of the brood bank affected its functioning as there were no takers for the broodstock raised by the brood bank.

The promotion of a cluster approach similar to the one adopted for shrimp farming will help the small and marginal farmers in increasing profit from farming as more than 90% of freshwater prawn farmers belong to small or marginal categories with operational holdings of less than two hectares per individual. MPEDA demonstrated that cluster farming had resulted in substantial benefits to shrimp farmers in AP (MPEDA, 2001). The same cluster approach would be beneficial to GP farmers as well. The cluster enables participating farmers to organize the schedule of farm operations like quality seed procurement, simultaneous stocking, water exchange, and harvesting regimes

contributing to a substantial reduction in the cost of production. The unity gives them bargaining power to deal with the local government departments to get subsidies or other assistance. State government fisheries departments can play a major role in forming clusters for GP farming. Clusters should be linked with a GP hatchery for the assured supply of quality seed and also with a feed supplier. Marketing channels also need to be developed to prevent low prices due to higher production.

CONCLUSION

To put GP back into its well-deserved prominent position in the aquaculture sector in India, concerted efforts from all stakeholders are essential, starting with policymakers, research organizations, developmental agencies, hatchery operators, and GP farmers. In the last few years since the formation of a new Ministry of Fisheries in the Central Government, a lot of importance has been given to GP farming in India. New government schemes like Pradhan Mantri Matsya Sampada Yogana (PMMSY), the flagship scheme for the development of the fisheries sector in the country has attractive provisions for the farmers. At present scampi farming is mostly practiced in coastal states and one or two inland states. The majority of the carp farmers in potential inland states like UP, Bihar, Jharkhand, Chhattisgarh, Telangana, and Assam are not aware of the potential of the inclusion of GP in enhancing farm income. Therefore, more stress needs to be given to creation of awareness among farmers on the advantages of GP farming. The creation of mass-scale awareness among farmers regarding the potential of GP farming in enhancing production and farm income will attract more and more farmers to GP farming. Further, efforts need to be taken towards linking farmers with hatchery operators as well as markets. The fisheries departments at the state level can help in this. With the coordinated efforts of all the stakeholders involved in the sector, it is hoped that soon GP production will enhance significantly and India will regain its position in GP farming globally.

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