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DIVERSITY OF COMMERCIALLY IMPORTANT FRESHWATER PRAWNS AND THEIR AQUACULTURE POTENTIAL IN INDIA

A. K. Pandey, A. S. Upadhyay* and W. S. Lakra

National Bureau of Fish Genetic Resources, Canal Ring Road, Lucknow - 226 002, India.
*National Fisheries Development Board, Maitri Vihar, Ameerpet, Hyderabad - 500 038, India.
e-mail : akpandey_cifa@yahoo.co.in

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ABSTRACT:- Of the 200 taxa of freshwater prawns, *Macrobrachium rosenbergii* is the most preferred species due to its suitability for aquaculture on account of fast growth rate, omnivorous feeding habit, hardy nature, compatibility for polyculture, resistance to certain diseases, unique appearance and high price in domestic as well as in international markets. In natural system, it attains a size of 30-35 cm with 400-450 g weight thus being the largest prawn available for culture. It grows well in almost all freshwater and low-saline water bodies such as lakes, rivers, swamps, irrigation ditches, canals, ponds and small dams. While cultured in earthen ponds, the marketing size of 70-80 g is obtained over a period of 8-10 months under the tropical climate. Polyculture with compatible species of carps facilitate better utilization of pond resources and also control excessive growth of algae and zooplankton. The grass carp, silver carp, catla, rohu, milkfish and green chromids can be used for polyculture with scampi, however, the bottom feeders like mrigal, common carp and tilapia are not advisable as they compete for food and space.

Key words: *Macrobrachium rosenbergii*, polyculture, organic aquaculture.

INTRODUCTION

Because of its universal appeal, unique taste and low fat content, prawns are fast becoming a popular food item among the young and olds, especially in Japan, United Kingdom, United States, Hong Kong, Singapore and several other countries (New and Valenti, 2000). In all these places, the demand for prawns is increasing day-by-day and the supply can hardly be met (Kutty, 2001, 2005). Japan and United States have the biggest frozen prawn market and these two places alone account for about eighty percent of the total world prawn consumption (Kutty, 2005; Nair *et al*, 2007). Prawn catch in the sea and other traditional natural resources has been stagnating for the last several years and at certain places even fast declining due to many factors which deeply affected it. As such, any further increase to meet the widening supply and demand gap can be achieved only through aquaculture (New, 2003, 2005). Therefore, a world aquaculture race for prawn culture has been initiated (Upadhyay *et al*, 2006; Nair *et al*, 2007). During the past five years, prawn culture has developed at a very fast pace in several countries and over 3,00,000 mt of *Macrobrachium* were raised through aquaculture in 2001. It has now become a worldwide industry with annual expansion rate of over 29% during 1992-2001 and global expansion rate of around 48% during 1999-2001. Between 1999-2003, the annual increase in farmed *Macrobrachium rosenbergii* production in India was about 80% with production touching 30,450 mt in 2002-2003 (Kutty, 2005). As such, India is the second largest contributor of freshwater prawn to the world markets (Balamurgan *et al*, 2004). The basic method of prawn culture is almost similar in every country, the only difference being the variety of prawn each country tends to produce.

Currently, prawn culture technology has advanced so fast that it is now considered a relatively new, progressive and high profitable industry. Because of its high unit value and ever-increasing demand in the world market, prawn farming is found to be one of the most profitable enterprises of the day with a net return of more than Rs.1.5 lakh/ha/year. In India, culture of freshwater prawn is prevalent in about 34,630 ha area with cumulative production to the tune of 30,450 mt (Sakthivel, 2003; Balamurgan *et al*, 2004). During the year 1997-98, approximately 66,000 tones of frozen prawns were exported from our country fetching foreign exchange worth Rs. 3,112 crores. Aquaculture production of prawn contributes to 42% by quantity and 68% by value to the total prawn exports worth US$ 579 million from India. However, the quantity of scampy exported from this country was 10,380 tones worth Rs. 447 crores during 2002-2003 (Sakthivel, 2003; Nair *et al*, 2007).

Prawns belong to the freshwater egg-bearing Family Palaemonidae of which *Macrobrachium* is popularly cultured Genus or the marine, non-egg-bearing Family Penaeidae. The United Nations Food and Agricultural Organizations (FAO) adopted the convention of referring all palaemonids as prawns and all penaeids as shrimps (Apud *et al*, 1985). However, there is no clear-cut distinction between the terms shrimp and prawn and they are being used interchangeably with emphasis on one or the other in different parts of the world. Among the shrimps, *Penaeus monodon* (tiger prawn), *Penaeus indicus* (white prawn) and *Penaeus merguiensis* (banana prawn) *etc* are a few commercially important species. They require sea water or brackishwater for their growth. Among the prawns, *Macrobrachium rosenbergii* (the giant long-legged river prawn), *M. malcomsonii*, *M. choprai (M. gangeticum)*, *M. villosimanus*, *M. josephi*, *M. idella*, *M. rude*, *M. equidens*, *M. lanchesteri*, *M. idae*, *M. scabriculum*, *M. mirabili*, *M. latimanus* and *M. lamarrei* are commercially important species (Kanaujia, 2003; Nair *et al*, 2007). Of them, the first three species are suitable for aquaculture in India. They require freshwater (sweet water) or low-saline water for their growth (Rao and Tripathi, 1993; Kanaujia, 2003).

Species of the freshwater prawn genus *Macrobrachium* are distributed throughout the tropical and subtropical zones of the world. They are found in most inland water areas including lakes, rivers, swamps, irrigation ditches, canals and ponds as well as in estuarine areas. Most species require brackishwater in the initial stages of their life-cycle and therefore, they are found in water that is directly or indirectly connected with the sea. However, some complete their life-cycle in inland saline and freshwater lakes (Rao and Tripathi, 1993; Kanaujia, 2003).

Macrobrachium rosenbergii is a crustacean with exoskeleton or shell. The body of prawn is divided into head, abdomen and tail. There are five pairs of walking legs. The first pair is used for putting feed into the mouth. The second pair is much larger than the others and ends in pronounced claws. It is used for self-defense and catching food. The rostrum develops at the tip of the head. Dorsal and ventral teeth numbers are 12-15 and 8-14, respectively. There are five pairs of swimming legs at the abdomen with one pair at each abdominal segment, except the last one. The tail part is composed of two uropods and one telson. The head of mature female and its second walking legs are much smaller than the adult male. The genital pores are at the base of third walking legs, the pleura of abdomen are longer and the abdomen itself is broader. The pleura form a brood chamber in which the eggs are carried between laying and hatching. A ripe or ovigerous female can easily be detected because the ovaries can be seen as large orange coloured masses occupying a large portion of the dorsal and lateral parts of cephalothorax. Like other crustaceans, all freshwater prawns have to regularly cast their exoskeleton or shell in order to grow. This process is referred to as moulting and is accompanied by a sudden increase in size and weight. The number of moults and duration of intermoult are not fixed and depend on the environment, particularly temperature and availability of food. *Macrobrachium* spp. have a smooth round dorsal surface to the abdomen while penaeids have a simple or complex ridge at the dorsal apex of the abdomen. Moreover, the second pleuron of the abdomen (or tail) of *Macrobrachium* overlaps both the first and third pleura. In penaeids, the second pleuron overlaps the third pleuron only and is itself overlapped by the first (D'Abramo and Brunson, 1996).

M. rosenbergii is indigenous to South and Southeast Asia, Northern Oceania and in the Western Pacific islands. As this species is the most favoured for commercial farming, it has been introduced to more countries covering almost every continent. *M. rosenbergii* is now farmed in considerable quantity in many countries including Hawaii, Honduras, Mauritius, Taiwan and Thailand and the farms are now being established in many other countries including India, Costa Rica, Indonesia, Israel, Malaysia, Mexico, the Philippines, Zimbabwe *etc* (D'Abramo and Brunson, 1996).

Of the total global production of 8,06,260 tones of cultured crustaceans during the year 1991, marine prawns contributed 90.5% while contribution of freshwater prawns was only 4.1% (New, 1994). The percentage sharing of freshwater prawns in the total 6,23,709 tones production of prawns in Asia during 1991 was only 5% compared to 95% that of marine prawns. Global production of formed *M. rosenbergii* was estimated to be 33,297 tones in the year 1991 and 1,19,000 tones during 2000 (FAO, 2002; Kutty, 2003). Over 93% of them are produced in Asia, 52% of Asian freshwater prawn production was from Taiwan while Thailand and Vietnam contributed 24% and 23%, respectively. The other Asian countries where freshwater prawn culture is being practised includes India, Japan, Myanmar, Brunei Darussalem, Combodia, China, Indonesia, Iran, Nepal, Pakistan, Bangladesh, the Philippines and Saudi Arabia (Phuong *et al*, 2003; Tayamen, 2003; Yoonpundh *et al*, 2003; Hossain, 2003). Though FAO has given the production level of over 1,28,000 mt of *M. rosenbergii* for China during 2001 but they claim to have achieved the total production of culture freshwater prawns (*Macrobrachium* spp.) over 3,00,000 mt during this period (Weimin, 2003).

Outside Asia, the two South American countries Ecuador and Brazil were the next major contributors in the global production of freshwater prawns during 1991. In Brazil, there are more than 600 grow-out culture farms and with productivity varying from 1,000-4,500 kg/ha/year, total production of 400 mt was realized (Valenti, 2003). Colombia, Guyane, Peru, Surinam and Venezuela are few other South American countries where freshwater prawn farming is being practised (New and Valenti, 2000).

Among the North America and Caribbean countries, contributions of Mexico, Hawaii and Commonwealth of Puerto Rico in the global production of freshwater prawns during 1991 has been important. The Dominican Republic, Jamaica, Guadeloupe and Martinique in the Caribbean are significant producers of the freshwater prawns. Costa Rica, El Salvador, Guatemala, Honduras, Panama and Lucia are few other countries were freshwater prawn farming is gaining importance (Nambudiri, 2003). Compared to other parts of the world, relatively insignificant quantities of freshwater prawns are cultured in South Africa. Mauritius and Zimbabwe are the major producers in South Africa, other countries being La Renunion and Malawi. Production of *M. rosenbergii* in the Pacific region is very small. Apart from French Islands, only Fiji, Guam and Solomon Islands have reported the production of freshwater prawns (New and Valenti, 2000). In India, only 1,49,591 ha has so far been brought under prawn farming yielding about 80,000 tones of prawn annually with maximum share of *P. monodon*. The quantity of freshwater prawns produced during 1991 was around 10,000 tones. There is enthusiastic interest amongst farmers and entrepreneurs for freshwater prawn aquaculture in India, especially from Andhra Pradesh which contributes to 88.6% of total freshwater prawn production during 2002-2003 and more and more new farms are being developed day-by-day for the purpose (Kutty, 2003). However, at present, quantity–wise it has little contribution in total export of fishes and fishery products from our country.

Freshwater Prawn Aquaculture in India

Development of aquaculture in India is centred around prawn culture due to its high unit value realization and ever-expanding export demand. Scientific culture of marine prawn started in India during eighties and by mid-nineties, more than one lakh ha area was brought under culture. However, the rapid growth of the marine prawn farming industry halted suddenly in 1994-95 along the East coast and in 1995-96 along the West coast. The collapse of the industry was attributed mainly to environmental and health problems resulting in the outbreak of the diseases (Sakthivel, 2001). Subsequently, marine prawn farming industry suffered yet another setback due to judgment given by Honourable Supreme Court of India during 1996 banning setting up of prawn culture ponds within coastal regulation zone (CRZ). Consequently, a great interest has been developed in India for freshwater prawn aquaculture and during the past seven-eight years several new farms have been developed. More and more prawn farmers of the country are turning to freshwater prawn aquaculture to overcome the setback in marine prawn farming (Sakthivel, 2003).

India has vast potential for commercial farming of both marine as well as freshwater prawns and possesses one of the richest resources for freshwater prawn aquaculture in the world. On account of its ideal climatic conditions, it can be regarded as the "sleeping giant" for freshwater prawn farming in Asia. While around 1.2 million ha of coastal area located in and around backwaters, estuaries and other brackishwater bodies provide potential sites for marine prawn farming, a vast portion of another several million ha area in and around the close vicinity of 2.25 million ha of ponds and tanks, 1.30 million ha of beels, jheels and derelict waters, 2.09 million ha lakes and reservoirs and also 0.12 million km of canals and channels as well as a portion of about 2.30 million ha of paddy fields can scientifically be developed for commercial exploitation of freshwater prawn through aquaculture or culture-based capture. Of the 1.9 million ha available freshwater ponds, if 0.3 million ha is used for prawn culture, the production of scampy can be raised to 1,50,000 tones worth Rs. 3,000 crores (Sakthivel, 2003).

Of the 200 taxa of freshwater prawns, *M. rosenbergii*, commonly called "scampi" is the most preferred species due to its suitability for aquaculture on account of fast growth rate, omnivorous feeding habit, hardy nature, compatibility for polyculture, resistance to certain diseases, unique appearance and high price in domestic as well as in international markets. In natural system, it attains a size of 30-35 cm with 400-450 g weight thus being the largest prawn available for culture. It grows well in almost all freshwater and low-saline water bodies such as lakes, rivers, swamps, irrigation ditches, canals, ponds and small dams. However, while cultured in earthen ponds, the marketing size of 70-80 g is obtained over a culture period of 8 to 10 months under the tropical climate. Polyculture with compatible species of carps will facilitate better utilization of pond resources and also control excessive growth of algae and zooplankton. The grass carp, silver carp, catla, rohu, milkfish (*Chanos chanos*) and green chromid (*Etroplus suratensis*) can be used for polyculture with scampi. However, the bottom feeders like mrigal, common carp and tilapia are not advisable for polyculture with scampi as they are competitors for food and space (Jose, 2003; Radheyshyam, 2009).

Scientific commercial farming of scampi has just started in our country. Since the net return from such farming is much more than normal fish farming, several new farms are being developed for monoculture of scampi or mixed culture with other fish species, especially in the states of Andhra Pradesh, West Bengal, Kerala, Orissa, Maharashtra, Punjab, Haryana and Gujarat (Upadhyay, 1995; Vasudevappa, 2001; Sakthivel, 2003; Singh, 2003). Apart from development of new farms, several existing fish farms are now being used for monoculture or mixed culture of *M. rosenbergii*. Most of the farms in West Bengal, Orissa and Gujarat use seed collected from the wild whereas those in Andhra Pradesh, Tamil Nadu, Kerala and Maharashtra mainly use hatchery produced seed for culture. However, a major constraint in the development of this aquaculture in our country has been the scarcity of seed. Hatchery technology for production of *M. rosenbergii* seed has been developed and about 71 hatcheries have been set up in India with a production capacity of more than 13 million seeds to overcome this problem (Bojan, 2003). Even though site conditions and environmental factors being ideal for prawn aquaculture in the states like Uttar Pradesh, Bihar and Madhya Pradesh, its importance is yet to be demonstrated and popularized in these areas (Janaki Ram and Pandey, 2003; Bojan and Viswakumar, 2003; Sultan, 2003). Keeping in mind the vast potential for freshwater prawn culture in our country, even 10% of its utilization on scientific lines can earn daily bread for millions of people besides bringing billion dollars to the nation.

Like other forms of aquaculture, prawn farming is limited by environmental constraints. *M. rosenbergii* is amenable to extensive, modified–extensive as well as semi-intensive culture. However, it can not be reared as intensively as marine prawns. Considering the vast potential areas available in our country for culture and with a view to ensure long sustaining yield, better economics and eco-friendly practice, it is advisable to adopt to extensive or modified–extensive farming system. The over-intensification in marine prawn culture has already proved to be disastrous and invited a lot of criticisms in several corners including Taiwan, Thailand, China, India and other countries. However, farming of *M. rosenbergii* is more environmentally sustainable because of its lower grow-out intensity. Moreover, in contrast to marine prawn culture, it does not require seawater except in hatcheries or coastal sites. Even hatcheries can be operated inland by diluting transported seawater, brine or artificial sea salt. The hatchery period is twice as long as that for marine shrimps (New, 1994; Kanaujia, 2006).

Culture of Freshwater Giant Prawn

Culture operation of *M. rosenbergii* in artificial ponds can be divided into following five steps: (i) pond preparation, (ii) transportation of seed to the farming sites, acclimatization and stocking, (iii) culture techniques, (iv) water quality and feed management, and (v) harvesting.

Pond preparation: Pond preparation includes drying, liming, ploughing of bed, application of mahua oil-cake or other fish killers to eradicate predators from the pond, application of lime and manure (raw cow dung *etc*) and fertilizers (urea and single-super-phosphate or NPK). Ponds should be dried up till they crack. Thereafter, ponds are limed and tilled. Application of lime adjusts soil and water pH, sterilizes pond bottom, maintains optimum alkalinity, helps decompose organic matter and kills predators or other undesirable aquatic organisms living at pond bottom. This improves pond condition and increases production. Various types of compounds can be used for liming during pond preparation. However, the application rate varies with soil pH.

Then water should be filled into the pond to an average depth of nearly 40 cm and subsequently fish killers such as tea seed cake powder @ 150-200 kg/ha be added into it to kill predators and other aquatic organisms. The pond should be further enriched with organic manures such as dried chicken manure @150-22 kg/ha or raw cow dung @ 500-1,000 kg/ha and fertilizers such as urea and single super phosphate @ 50-70 kg/ha. The pond should be left for 4-5 days to provide time for the growth of natural food in it. When colour of the pond water turns green or brown, more water is filled in until the desired depth of 1.25 meter is attained. Now the pond is ready for stocking.

Transportation of seed to sites and stocking: Two weeks old post-larvae (PL) of *M. rosenbergii* produced in a hatchery or collected from natural resources such as river *etc* are transported to the farming site in oxygenated polythene bags packed in insulated boxes made of card boards and thermocol. Prawn seeds can be transported for 18-20 hours at a packing density of 250 PL/litre. Before releasing the prawn seeds into the pond, they are properly acclimatized for a period of 1-2 hours by keeping the polythene bags (with seeds) open and then kept in the pond water adjacent to bundhs slowly sprinkling water into them. The acclimatization should be normally done in the morning so that the water temperature fluctuation is minimized. Sample cortons should be counted for stock estimation. The seeds are then released into the ponds at the desired stocking density. The post-larvae (PL) obtained from hatchery could be stocked into the culture ponds directly after acclimatization. However, it is advisable to rear them in small nursery tanks for a period of one month before transferring them into the culture ponds. This ensures predictable percentage of survival and shortens the grow-out phase. An initial density of 50,000 number of one–month old prawn PL/ ha, 70 g size is easily achievable in a growing period of 8 months. Some of the farms in Thailand and Hawaii stocking of as much as 2,00,000 seeds/ha is in practice followed with cull-harvesting resulting in higher production but the size at harvest is reduced.

Culture techniques: The two types of culture techniques being adopted for prawn culture are: (i) continuous culture with cull–harvesting and (ii) batch culture and batch–harvesting or drain–harvesting. Continuous culture with cull–harvesting or repeated culling of larger prawns is widely adopted in Thailand and Hawaii. It consists of stocking the ponds, usually once a year or sometimes 4-6 times a year at high stocking densities and after about 5-7 months, culling of marketable-sized prawns at regular intervals. The ponds are not drained out but the larger ponds are fished out by seining. Following this system, a production up to 276 kg/ ha/month has been reported in Hawaii which works out to be 3,312 kg/ha/year. The yield varies from 2,500-5,000 kg/ha/year (New and Singholka, 1985; Upadhyay, 1995; Nair and Salin, 2003). The other techniques consist of batch culture and batch–harvesting or drain–harvesting. It involves stocking the ponds at the optimum level for maximum rate of growth and harvesting the whole crop, possibly by draining the ponds.

In Thailand, most farmers adopt a combination of these two techniques. About 5 months after the post-larvae stocked, cull–harvesting commences to be repeated once every month until the eight month when the pond is drained completely and the prawns harvested. The pond is again prepared and restocked when water supply is available again. An estimated production of 3,800-4,700 kg/ha/year has been reported with this culture practice under semi-intensive prawn farming. In an experimental tank, a production rate of 3,300 kg/ha/year has already been achieved in India. Under agro-climatic conditions of Uttar Pradesh, an average production of freshwater giant prawn 800-1,000 kg/ha/6 months under monoculture operation has been realized.

Water quality and feed management: The main purpose of water exchange from the aquaculture pond is to maintain the water quality. It also stimulates moulting of the prawn resulting in acceleration of growth and production. Depending upon various physico-chemical parameters of the pond water such as dissolved oxygen content, transparency, algae density *etc*, stocking density and stage of culture, the amount of water to be exchanged from any aquaculture pond will vary considerably. For a prawn culture pond with initial stocking density of 5-7/ m^2, the average daily water exchange requirement may be taken as 10% of the total water volume of the ponds. The pumping capacity should be sufficient enough to meet this requirement. For a higher stocking density of 12-15/ m^2, the average daily water exchange may be 25-30% of the total pond water volume. Usually water exchange starts after one month of initial stocking. In the beginning, it may be 5% only and reaches to maximum towards harvest. If the dissolved oxygen content of the pond water body is lower than 3 ppm in the morning or water transparency is less than 30 cm, percentage of water exchange requirements from the ponds will be more than usual. pH of the pond water is maintained to be around 8. During culture period, 200-300 kg lime/ha may be applied every week from second week onwards for getting better result. It is advisable to use agricultural lime (calcium-magnesium carbonate) during the culture period. For a pond having higher stocking density of prawns, use of paddle wheel aerators become essential to check depletion of dissolved oxygen level in the pond. The water quality parameters like temperature, pH and dissolved oxygen levels should be monitored continuously.

Diet of *M. rosenbergii* consists of aquatic insects and larvae, small molluscs, fish and offals of other animals, algae, grains including rice seeds and fruits. They accept compounded feeds, chopped butchery wastes, tapioca, oil-cakes *etc* and occasionally may turn cannibalistic too. They relish live organisms and therefore manuring the ponds to increase benthic fauna is advantageous. For a prawn farm with targeted production of 1-1.5 tones/ha/ year, mostly farm prepared feed is used. However, a scientific prawn farm with comparatively high targeted production of 2 tones/ha/year and above, application of pelletized feed containing high protein percentage is essential (Raju, 2003). Food is usually spread around the periphery of the pond or presented in predetermined areas a few metres apart. The intention is to observe how much feed has been consumed. The feed ratio will have to be increased or decreased according to the extent of consumption by the prawns. They may be fed once a day at 4-5 p m, five days out of 7, with palletized feed 1 mm in diameter in nursery ponds and 4 mm in diameters in grow-out ponds. The daily ration is calculated from the estimated total weight of prawn then a theoretical daily feeding rate is controlled by the observation of remains from the dike or underwater feed trays. The observation of prawns and measurement of growth can be done through periodic seining (every second week) of samples including few hundred prawns from two different locations of the pond. The days when any moulting occur, no feed is given. The theoretical daily feeding rate may be assumed to be 10% of body weight of prawns at initial stage. This may be gradually reduced to nearly 2% towards harvest. Usually during the initial two weeks of stocking, supplementary or pelletized feed is not given as prawns can eat natural food. Feed conversion ratio (FCR) of a good pelletized feed is usually 2:1 to 1.5:1 (New, 1994; New and Valenti, 2000; Mohanta, 2000; Mitra *et al*, 2005).

Harvesting: In cull–harvesting usually bottom seining is done and the first harvest takes place 5-7 months after initial stocking. In batch–harvesting, usually the pond is drained. Prawns are caught by multiple seining followed by hand picking. The final draining of pond is made through a net that retains the prawns. In all cases, harvesting operations should take place in the early morning hours when it is cooler. Head on prawns are transported to the processing plant after proper icing. Depending upon existing infrastructure facilities, location of the sites, distance from the water source, topography and various other parameters as well as type of technology adopted for culture, the development as well as operating cost of one scampy farm may vary. The commercial scientific farming of scampi has become popular in several parts of world. Much of the potential for prawn culture has not yet been realized. This form of aquaculture is particularly appropriate for small-scale units, though to exploit export markets, produced groups or marketing organizations will be essential. Substantial expansion of freshwater prawn farming is expected, especially in the Asian farm production by the year 2020 (New, 1994; Bojan and Viswakumar, 2003; Sakthivel, 2003).

Organic Scampy Farming in India

Organic farming systems rely on the ecologically-based practices including culture and biological pest management completely excluding the use of synthetic chemicals in crop production and prohibit the applications of antibiotics as well as hormones in livestock production. The preference of consumers demanding for organic products is reflected in the increase in organic commodities found in the market places, especially in United States and European Union (EU). Thus, enhanced demand for such food products may lead to the increased profitability for all concerned (Bergleiter *et al*, 2009). Organic aquaculture is a new concept for this country (Purushan, 2008; Kumar and Pandey, 2010). It is a holistic production management system which may play a pivotal role in development of aquaculture as well as fish and shellfish diversity conservation. Our traditional (extensive) and semi-intensive prawn farming practices continued to sustain the aquatic environment as well as livelihood of fish farmers. Keeping the huge potential of selling aquaculture products in markets of European Union and USA, the Marine Products Export Development Authority (MPEDA) (Ministry of Commerce, Government of India), Cochin has initiated the Indian Organic Aquaculture Project (IOAP) on organic black tiger and scampi farming in Kerala and Andhra Pradesh in January 2007 in technical and consultancy collaboration with Swiss Import Promotion Programme ((SIPPO). M/S Rosen Fishery Hatchery, Trichur has produced 11.50 lakh organic scampy seeds and supplied the same to Kerala (3.4 lakh) and Andhra Pradesh (8.1 lakh) for organic freshwater giant prawn aquaculture. Harvest of the first organic scampy was done on 01.11.2008 in 20 ha spread over four farms in Kuttanad of Alappuzha district of Kerala. Buyers were from Germany, exporters, officials from SIPPO and Naturland Association (Germany). The organic prawns were sold @ 350-500/kg. With this, India has also embarked on the path of organic aquaculture which will be expanding with the active support of MPEDA. The industrialized and developed countries of the West where affluence, education and consumer awareness are quite high remain as the main destinations of organic prawn products.

Aquaculture of Minor Prawns Species

Though *M. rosenbergii* is the fastest growing natantian but the success of small-sized *M. nipponense* for aquaculture in China has opened the avenues for the entry of other minor species for aquaculture production as well as diversification (Kutty, 2003). In African countries, trials are being conducted to introduce *M. carciuns, M. amazonicum, M. acanthurus* and *M. vollenhovenii* in freshwater aquaculture. It is interesting to note that *M. malcolmsonii* accounts for more than 10% of artisanal aquaculture and an yield of 327-805 kg/ha/year under monoculture with wild seed and 880-1,130 kg/ha/year with hatchery-produced seed has been achieved (Kanaujia *et al*, 1997). Polyculture of this species with fish is commonly practised in Orissa due to natural availability of seed from rivers. In this system, compatible carp species such as *Catla catla* (surface feeder), *Labeo rohita* (column feeder) and grass carp, *Cteopharyngodon idella* (plant eater) and silver carp, *Hypophthalmichthys molitrix* (phytoplankton feeder) are cultured while bottom feeder carps like *Cirrhinus mrigala* and *Cyprinus carpio* are not used (Kanaujia *et al*, 1997; Radheyshyam, 2009). Under prawn polyculture operations, 170-327 kg/ha/year prawn and 2,084 kg/ha/ year fish has been recorded (Kanaujia, 2006). The recent development in seed production, hatchery management, larval rearing and domestication of *M. malcolmsonii* and *M. gangeticum* (*M. birmanicum chprari*) will go a long way in diversification of freshwater prawn culture in India (Kutty, 2005; Kanaujia, 2006; Radheyshyam, 2009).

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