

# Impacts of mono-sex *Macrobrachium* culture on the future of seed availability in India

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India has about 2.36 million hectares of ponds and tanks of which hill states cover 0.4 million ha. Out of the 1.9 million hectares remaining at least 300,000 could be utilized for monoculture and polyculture of freshwater prawn<sup>1</sup>.

*Macrobrachium* culture is gaining momentum since it is less likely to have a detrimental impact because these prawns cannot be reared at densities as high as the marine shrimp. Indeed while its productivity is generally lower, management is less labour intensive and the potential pollution of water sources is minimal. Among the 200 species reported under the genus *Macrobrachium*, *M. rosenbergii* is by far the most commercially important species, with its life cycle closed over three decades ago in Malaysia<sup>4</sup>. Other species such as *M. malcolmsonii*, *M. nipponense*, *M. carcinus*, *M. amazonicum*, *M. vollenhovenii* and *M. acanthurus* are under trial as new candidate species and have the potential to enter the commercial aquaculture<sup>6</sup>. Almost all the river systems and even some of the independently flowing small streams of peninsular India are richly endowed with giant freshwater prawn<sup>7</sup>.

In India freshwater prawn farming has been practiced by adopting traditional methods, where the young ones collected from the wild are reared in semi intensive farms<sup>8</sup>. The first artificial seed production technique was attempted during the year 1963-65 at the Central Inland Fisheries Research Institute, Barrackpore; afterwards systematic research on freshwater prawn culture began in the pond culture division of the Central Inland Fisheries Research Institute at Cuttack<sup>9</sup>. The successful rearing of larval stages of *M. rosenbergii* was achieved in 1975 at prawn breeding centre, Kakinada<sup>10</sup>.

Freshwater prawn culture has attracted more attention in the recent years due to its export potential and increasing demand as luxury protein. India is the second largest contributor of freshwater prawn to the world market with production of 30,450 MT in 2002-2003 (Table 1). The farmed area utilized for scampi production increased from 12,022 ha to 34,630 ha marking a four-fold spurt and a three-fold increase in cultivation<sup>11</sup>. The main constraint in the culture potential is currently a lack of quality seeds. At present 56 freshwater prawn hatcheries

are in operation with a production capacity of nearly 1.3 billion seeds.

The present commercial requirement for quality seeds cannot be fully met by collection from the wild, which has resulted in over exploitation of wild brooders, which sell for Rs 100/ each (US\$ 2). Due to the shortage of brooder availability in the wild, hatcheries have resorted to procuring brooders from commercial farms. Such pond-reared brooders have advantages such as year round availability for seed production coupled with the possibility of genetic improvement. However there are some demerits like inbreeding depression, insufficient feeding and increased density in grow out ponds that affect the brooder quality. Moreover the pond-reared populations are characterized by lower reproductive performance and precocious maturation even at a 7-10g weight, which yield poor quality eggs when compared to that of wild brooders<sup>12</sup>. The main reason may be that these animals cannot grow large enough and cannot compete for resources in their environment and hence tend to mature precociously.

The natural stocks have the superior quality over pond populations. In the

**Table1. Showing State-wise details of farmed freshwater prawn (Scampi) production in India in 2002-2003 (Source: MPEDA, 2003).**

States	Area (ha)	% total area	Production (Tonnes)	% total production	Production/ha (kg)
West Bengal	4,100	11.8	2,140	7.0	521
Orissa	2,995	8.6	410	1.4	137
Andhrapradesh	21,580	62.3	27,020	88.6	1,252
Tamilnadu	180	0.5	130	0.4	722
Kerala	830	2.5	200	0.7	241
Karnataka	165	0.5	180	0.6	1,090
Goa	0	0	0	0	0
Maharashtra	4,420	12.7	290	1.0	204
Gujarat	360	1.1	80	0.3	22
Total	34,630	100.0	30,450	100.0	879

wild the females attain first maturity at  $30 \pm 10$ g; eggs produced by these females are of good quality with a higher larval survival<sup>13</sup>. More importantly the brooders collected from wild populations have more chances to cross with individuals of different parentage with the unique advantage of natural selection. The feeding habitat and spatial distribution are more favorable for the quality brooders from wild population. The major problem is over exploitation of wild brooders, which is a limiting factor to meet the ever-increasing needs of the aquaculture industry<sup>13</sup>.

### Monosex culture (all male)

Differential growth and dominance of larger individuals characterize *Macrobrachium* populations. Males grow faster than the females aggravating the differential growth pattern within and between sexes. Monosex culture of this species aims to avoid sex based size hierarchy<sup>14</sup>. Further, when reared with the males the precocious maturation of the females that enter into reproductive phase stunts somatic growth, which ultimately affects the total yield of the population and production cost since the females by virtue of their smaller size are not marketed. This has paved the way for the monosex culture of all male populations. All male culture is the new trend adopted in commercial farming of freshwater prawn, in order to ensure maximum yield and unit weight/prawn. Extensive research has been initiated to determine the factors, organs, hormones and gene sequence for regulatory mechanisms of sex differentiation<sup>15</sup>. In India, some farmers claim to have acquired expertise in the culture field to segregate males and females by various morphological characters. The PL 10 are collected from hatchery and stocked at nursery for a period of two months, after which experienced farmers can segregate males and females with an accuracy of around 95%. At this time an average female weigh  $6.5 \pm 1.5$ g. Any females that finds its way into the farm are picked out and sold to the hatchery at the cost of Rs.15/individual. Through constant observation and training over a period, these local fishermen claim that they can segregate males and

females even at 5g size. This has led to the wide spread practice of all male culture.

Currently the hatchery operators neither maintain specific broodstock nor maintain the brooders over a long time. They collect brooders (the 5% females that get mixed during segregation in all male culture) as and when they need them from local commercial farms. The brooders collected from these populations will be of poor quality, characterized by poor fecundity, larval survival and growth. Due to dearth of wild females the hatcheries have to depend on farms for brooder supply, despite the fact that in the long run larval quality and survival ranges from 25 to 35%, where as local hatcheries report that larvae obtained from wild stock have around 70% survival.

The recently held "International symposium on Freshwater prawns 2003" at Cochin, Kerala, India, strongly emphasized the vital need to augment quality seed production to improve and sustain freshwater prawn culture in the coming years. For instance the freshwater prawn production potential of India is 150,000 tonnes worth Rs 3000 crores @ Rs.200/kg (US\$ 65 million) among the nine coastal states of India except Goa where freshwater prawn culture is yet to take off. Andhra Pradesh contributes the lion share of 88.6% in all India production of freshwater prawns (Table 1). In this state the current production is about 27,020 tonnes, is expected to increase three fold to reach 75,000 tonnes accounting to 50% of the total Indian production within the next 5 years. To achieve this target India needs to produce 12,000 million seeds with a survival rate of 50% to get 6,000 million seeds per annum<sup>16</sup>. In order to fulfill the seed demand the country requires 200 hatcheries located in different areas. With a viable-quality average of 30,000 eggs/ female for seed production around 2,000 broodstock are required per hatchery per year. Hence, for year round seed production the 200 hatcheries would need 400,000 brooders to supply six billion seeds.

Such a huge requirement of brooders may adversely affect the already over exploited wild stock. The situation will worsen since the emerging all male culture also can not

satisfy the need for brooders. The only solution for this impasse is for hatcheries to begin maintaining their own broodstock.

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