

SHRIMP SEED PRODUCTION IN MALAYSIA

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ABSTRACT

The giant freshwater prawn, *Macrobrachium rosenbergii*, and the marine shrimp, *Penaeus monodon*, are now becoming the most important cultured species in Malaysia. The progress in the aquaculture of these species has led to the development of hatcheries in various parts of the country. To date, a total of 50 hatcheries are now in operation.

Fry production technology varies between hatcheries. For *M. rosenbergii*, clear-water, closed system, and green-water larviculture techniques are common. For *P. monodon*, the two-tank and one-tank larviculture systems are used. A range of problems such as lack of skilled hatchery personnel, larval diseases, and lack of financial support hampers hatchery operations. In order to ensure the continued operation of the hatcheries, the Department of Fisheries (Malaysia) is providing the necessary support services and technical assistance.

Shrimp culture (*Penaeus monodon*, *P. merguensis*, and *Metapenaeus* spp.) was first practiced in Malaysia in the 1930s whereas, the culture of the giant freshwater prawn (*Macrobrachium rosenbergii*) began only in the 1960s.

The artificial propagation of the giant freshwater prawn was first achieved experimentally in the early sixties. This was followed by success in rearing several species of marine penaeid shrimps, with the giant tiger shrimp (*P. monodon*) being successfully propagated at Glugor, Penang for the first time in July 1969.

A research hatchery was first established at the Fisheries Research Institute in Glugor, Penang in 1975, essentially for the mass propagation of the giant freshwater prawn. Later, the station went into hatchery-scale propagation of marine shrimps, particularly the giant tiger shrimp. With the establishment of National Prawn Fry Production and Research Centre (NAPFRE) at Kampung Pulau Sayak, Kedah in February 1987, the Department of Fisheries (Malaysia) has now expanded and concentrated all its research and training programs in one center, especially fry production technology and broodstock maturation.

Shrimp culture is now the fastest growing sector of the aquaculture industry in Malaysia. There has been considerable private/corporate sector involvement in the development and intensification of shrimp culture on a commercial basis with investments totalling millions of ringgit. This resulted in the development of marine shrimp hatcheries all over the country. Most of these hatcheries have small production capacities and serve the requirements of small grow-out farms while some large hatcheries cater to larger farms and the lucrative fry export market.

Status

Presently, there are 50 crustacean hatcheries, five of which are freshwater prawn and the rest are marine shrimp hatcheries. Out of this number, two are government-owned, one in Perak producing mainly freshwater prawn seed while the other (NAPFRE, Kedah) produced both freshwater and marine shrimp seeds. The annual production capacity for freshwater prawn hatchery is between 2-12 million juveniles and for the marine shrimp hatchery, 5-25 million postlarvae.

In 1990, the country's marine shrimp hatcheries produced an estimated 1 billion fry. The giant tiger shrimp is by far the main species cultured, although the banana shrimp (*P. merguensis*) is also produced to a small extent. The production in the freshwater prawn hatcheries was estimated at 20 million juveniles and the bulk of it, i.e., 16 million, came from the government hatcheries.

The total area of freshwater ponds in Malaysia is about 4,900 ha while 1,550 ha are under marine shrimp culture. It is expected that by the year 2,000 about 21,000 ha of brackishwater ponds and 15,000 ha of freshwater ponds could be developed. Based on these figures, the fry requirement for penaeid shrimp culture will be about 2.1 billion and 51 million for freshwater prawn culture.

Hatchery technology

Hatchery design. The hatchery design commonly used varies considerably depending on the system adopted. Some low-budget projects use a simple shed with just a roof to cover the larval rearing tanks. Most hatcheries, however, are well enclosed to maintain optimum temperature conditions. The use of transparent roof sheets is common to ensure adequate light penetration and to raise the ambient temperature close to the optimum 30°C. Sun-shade screens are normally used to control light intensity and, hence, water temperature. On the other hand, there are some hatcheries that keep the larviculture tanks totally covered and sheltered from light (Taiwanese system).

Hatchery tanks are built of fiberglass, plastic, or concrete; fiberglass are often lined with epoxy polyester paint. The tanks vary in shapes (round, conical, square, and rectangular) and sizes (1-2 to 10-50 t).

The tanks are usually placed on the same level. However, some of the newly constructed marine shrimp hatcheries have adopted a design where the algal tanks are placed slightly higher so that algae-rich water could flow by

gravity into the larval rearing tanks and subsequently to the nursery tanks which are, again, placed at a lower level.

Water treatment. The seawater treatment normally follows sedimentation-filtration-storage process before being used in the hatchery. Sedimentation is done for silt precipitation. Filtration is by passive sand filters or pressurized sand filters. Cotton-bag filters or cartridge filters are also used by some hatcheries. Storage facility for water is optional as some hatcheries use the water immediately after filtration. In some hatcheries, water is treated by UV-light irradiation or by chlorination.

Broodstock supply. Most hatcheries are totally dependent on the supply of gravid females caught from the wild which are found in abundance. Only 1 hatchery (NAPFRE) is known to supplement its spawner needs by induced spawning of mature female tiger shrimp using the unilateral eyestalk ablation technique.

The broodstock supply of freshwater prawn is either caught from estuarine areas or obtained from the ponds. Some hatcheries have ponds to raise juveniles to broodstock.

Larval rearing systems

Marine shrimp (*P. monodon* and *P. merguensis*). The larviculture systems can be classified as same tank system or different tank system. These systems are briefly described below:

Same tank system

In this system, there is no change of tanks throughout postlarval production activities. Spawning, egg hatching, larval rearing, and nursery maintenance (until PL 5 to 35) are all carried out in the same tank. The tank sizes vary among hatcheries. Gravid females either caught from the wild or eye-stalk ablated are stocked at a rate of 1-1.5 individuals per ton of water. After spawning, the females are removed. The eggs in the tanks are allowed to hatch and larval rearing commences. Prior to this, the tank water is fertilized with agriculture fertilizers to encourage growth of mixed diatoms which are important larval feeds. Some hatcheries culture diatoms (*Chaetoceros* sp., *Skeletonema* sp.) in separate outdoor tanks. Diatom cell densities range from 25,000 to 80,000 cells/ml. Artificial larval pellets are also used. *Artemia salina*, either newly hatched or hatched and frozen, is given from late protozoa 3 to PL 5 stages. After PL 5, a range of larval diets is used until PL 15 to PL 35. Water change for larval rearing may commence during late protozoa 3 stage and onwards. The amount of water change is 30-70% during mysis to early postlarval stages. After PL 5, water change may be restricted to 30-50% on alternate days and siphoning of uneaten feed and organic debris is carried out simultaneously.

Harvesting is done by draining the tanks and finally trapping the postlarvae into filter screen boxes or fine-mesh bags (500-1000 μ) submerged in collecting basins. Most hatcheries claim an average survival of 50%.

Separate tank system

Spawning, hatching, larval rearing (PL 1 to 5), and nursery rearing are

done in separate tanks of different volumes. Hatchery owners claim better control and programming of hatchery management in this system. For spawning, 0.3-1 t cylindrical tanks with conical or flat bottoms are used. The eggs are allowed to hatch in the same tank after the waste left by spawning is removed by changing the water. A few hatcheries even collect and wash the eggs before hatching them in another tank. After hatching, nauplii population is estimated, and transferred to larval rearing tanks. Feeding of larvae commences at protozoa 1 or at late nauplius (N6) stage. As in the previous system, algal (*Chaetoceros*, *Skeletonema*, *Isochrysis*) and artificial larval diets are fed. Algal cell densities vary from 25,000 to 50,000 cells/ml. Algal culture is done separately. *Anemia* nauplii are given as feed at late protozoa 3, mysis stages, and up to postlarvae 1. Water is changed every other day or as required (e.g., daily or after every few days) with simultaneous siphoning of tank wastes at the bottom. PL 2-5 are transferred to nursery tanks (20-50 t) by draining the tanks and trapping the postlarvae in nets. Nursery rearing is up to PL 15-35; thereafter, postlarvae are harvested for distribution to farms.

Freshwater prawn (*M. rosenbergii*). There are several larval culture systems: closed, clear-water, and green-water. Government hatcheries use all three while private hatcheries use the clear water or green water system. These are briefly described below:

Close system

This is usually practiced at small-scale level though it involves a high density (100 larvae/1). This technique uses 2-t cylindrical tanks with conical bottoms. The larval rearing tanks are connected to a highly efficient biological filter system which can remove water pollutants (ammonia, organic wastes) and recirculate water continuously. Larval rearing uses different salinities: 4 ppt on the 1st day, 8 ppt on the 2nd day, and 12 ppt on the 3rd day until the 22nd or 23rd day; thereafter, salinity is reduced to 8-10 ppt to facilitate metamorphosis into postlarvae. Newly hatched *Artemia* nauplii are fed at a rate of 6-50 nauplii per larvae daily. Formulated larval pellets (particle size, 200-400 μ) are fed daily in the morning at a rate of 50-250 mg/1,000 larvae on the 11th day (PL 6-7) and onwards. Daily monitoring of larval activity (feeding, metamorphosis), water quality, diseases, and condition of biological filter is carried out. Water change is done only to adjust salinity levels for the different stages of larvae. Duration of larval culture is 30-35 days. The system can give an average postlarval metamorphosis and survival of 58%.

Clear water system

The stocking density of larvae is 20-100 larvae/1. Rectangular or circular cement, concrete, or fiberglass tanks (2-20 t) are used. Larviculture uses clear brackishwater with initial salinity of 6 ppt which is raised by 2 ppt daily until 12 ppt is reached. Water change (50-80%) is done on alternate days or once in three days. Larval feeds used are *Artemia* nauplii, egg custard, and formulated pellets. Daily monitoring of larval culture involves observation for general activity of larvae and metamorphosis. Duration of culture is usually 30-35 days with larval survival estimated at 50-70%.

Static green water system

This system is carried out by using the green algae, *Chlorella virginica*, culture at a density of 2×10^5 - 1×10^6 cells/ml. Larvae are stocked in this green water culture at 10-50 larvae/1. Some hatcheries even claim a stocking rate of 100 larvae/1. Larval feeding and daily monitoring are generally similar to the clear water system. If the green algae culture collapses in the rearing tank, augmentation of green water from separate *Chlorella* culture tanks is necessary. Duration of culture is 30-35 days. Survival at postlarvae is 19-64%.

Problems of hatcheries

The common problems faced by hatcheries are as follows:

Water quality. Major constraints in the operation of the hatcheries are related to water quality. A number of hatcheries reports variation of salinity (below 25 ppt) levels and turbid water conditions during the monsoon months. Some hatcheries have also complained of runoffs from estates, farm wastes, and heavy metal pollution.

Diseases. Disease is another major problem. Most hatcheries lack the necessary experience in tackling disease problems.

Diseases such as ciliate, fungal, and bacterial infections are commonly encountered as a result of poor management practices, poor hygienic conditions, poor water quality, high stocking densities, and inadequate and unsuitable feeds.

Disease outbreaks cannot be completely eliminated but several measures can be taken to reduce its occurrence. The optimal environmental, nutritional, and culture conditions must be maintained at all times. The use of Treflan, a fungicide, and antibiotics such as Furazolidone and Oxytetracycline in prophylactic doses has helped minimize losses. Usually, a badly infected culture is discarded to prevent the spread of the disease and production of weak postlarvae.

Another common practice is complete dry-out of the hatchery or a break-cycle between several production cycles. This has been found to be very effective in minimizing the occurrence and severity of disease outbreaks.

Plankton culture. Plankton collapse has been faced in some hatcheries. The frequent collapse of algal cultures is due to unfavorable outdoor conditions, mainly climatic and water quality factors.

Broodstock. The inconsistent and seasonal supply of good quality spawners caught from the wild is a problem faced by many hatcheries. High prices (M\$180-200) are also common.

Artificial feed. The quality of some imported artificial larval feeds is sometimes questionable. Feeds are also generally expensive.

Nursery operations. The lack of nursery facilities in most shrimp farms results in expensive hatchery space and valuable time is spent in growing the postlarvae to PL 15, PL 20, or PL 25 as most farmers require these ages for stocking their ponds.

Manpower. Generally, the newly started hatcheries face the problem of lack of experienced personnel to manage the hatchery while others complain of

high staff turnover due to more attractive offers from other establishments.

Power and freshwater supply. Hatcheries in remote areas still lack electricity and water supply. In addition, operation of power generating units increases cost and causes maintenance problems. Collection of rain water is insufficient, and well water is sometimes high in iron.

Finance. Some hatcheries lack sufficient operating capital due to cash flow problems.

Marketing. The hatcheries also face an inconsistent and unstable market. This results in fluctuation of the price of postlarvae. Exporters are faced with erratic demand, lack of cargo space when needed, and poor coordination of export schedules.

The progress of the shrimp hatcheries in Malaysia has shown that the local hatchery technology is satisfactory. The freshwater prawn and shrimp grow-out industries are becoming more active because of the success of these hatcheries in producing good quality fry and their ability to meet the demand.

Some problems, however, still need to be resolved. These include the various support services provided by the Malaysian Government, particularly the Department of Fisheries, Malaysia. However, the establishment of NAPFRE, which also provides training and extension services, is a testimony to the Government's commitment to develop the shrimp industry.

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REFERENCES

- Annual Fisheries Statistics. 1990. Department of Fisheries, Ministry of Agriculture, Kuala Lumpur, Malaysia.
- Chan, H.H. 1988. The status of marine shrimp/prawn seed production in Malaysia. *In*: Marine prawn farming in Malaysia - present problems, future prospects. Tarlochan Singh and Ang Kok Jee (eds.). Malaysian Fisheries Society Occasional Publication No. 1.
- Ong, K.S., P.C. Liong, and H. Hambal. 1988. Prawn shrimp culture technology in Malaysia. Paper presented at the Seminar on Aquaculture Investment Opportunities in Sabah, Kota Kinabalu, 10-13 Aug. 1988.
- Palanisamy, V. 1988. Progress and problems of freshwater prawn/marine shrimp culture with particular reference to small-scale hatcheries in Malaysia. Paper presented at the Expert Consultation On Small-Scale Prawn /Shrimp Hatcheries, Bangkok, Thailand.
- Yaakob, Ahmad. 1988. Pemiakan benih udang galah, teknik intensif - sistem tertutup. Proceedings of 'Seminar Penyelidikan', 28-29 June 1988. Institut Penyelidikan Perikanan, Jabatan Perikanan, Glugor, Pulau Pinang, Malaysia.