

SEED PRODUCTION OF MARINE FISH IN MALAYSIA

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Aquaculture especially brackishwater fish culture in Malaysia has a very high potential for development. It is also a very important source of protein. The three major species cultured in cages are sea bass, grouper, and snapper. They are very popular, especially sea bass which is a highly esteemed delicacy.

Sea bass culture started in the mid-1970. The fry was obtained from the wild or imported from Thailand or Singapore. This industry developed slowly because of inadequate supply of seed. During this period also, the culturist had very little experience in managing the cages.

As an answer to the problems of the industry, the Fisheries Research Institute (FRI) of the Department of Fisheries, Ministry of Agriculture, Glugor, Penang, established a unit responsible for research on hatchery propagation, larval feed development, and cage culture of sea bass. The Brackishwater Unit of FRI situated in Gelang Patah, Johor is responsible for research and development of sea bass grow-out in coastal ponds. The Marine Finfish Production and Research Centre (MFPRC) situated in Tanjung Demong, Terengganu was set up in 1982 for marine fish fry mass production. The Extension Branch of the Department of Fisheries in Kuala Lumpur is responsible for all extension services, including promotion of sea bass aquaculture as well as other species. The Extension Branch also operates the MFPRC and organizes training on coastal aquaculture at the Brackishwater Aquaculture Centre in Johor.

The Fisheries Development Authority of Malaysia (LKIM), a government statutory body formed in 1971 with the objectives of upgrading the socioeconomic status of fishermen and developing the fisheries industry, is also involved in marine fish culture, especially in setting up commercial culture projects involving local fishermen.

In addition to government bodies, some universities in Malaysia also carry out activities related to marine fish culture, especially disease studies.

Status

Sea bass, grouper, and snapper are among the most important marine fishes cultured in Malaysia. The production of sea bass seed has been very successful while the other two are still experimental although some breakthroughs have been achieved in 1990.

Larval propagation of sea bass (based on wild broodstock) was first developed by FRI in Penang in 1982. And the first spawning of sea bass broodstock raised in captivity was achieved in July 1985.

The earlier success in sea bass propagation in Thailand has stimulated research in Malaysia. In July 1982, with the expansion of research hatchery facilities at Glugor, the first hatchery production of sea bass fry in Malaysia was achieved based on broodstock caught from water off Penang. Fry raised from this successful breeding venture are now reared to maturity in cages in Terengganu. Since July 1985, after matured fish were transferred to spawning tanks, several spawnings were obtained and millions of hatchlings and fry has been produced.

So far, three private commercial hatcheries were set up, two in Kedah and one in Johor. These hatcheries obtain their hatchlings from the MFPRC.

The LKIM also has one hatchery which supplies sea bass seed to its cage culture projects throughout the country.

Production method at MFPRC

Spawning. Spawners are usually caught from the wild or raised in cages. For the latter, fingerlings are collected from the wild or selected from a rearing run, nursed, and cultured until they mature. These rearing cages are about 30 km from the MFPRC.

The fingerlings (5-10 cm) are initially stocked in *hapa* nets at 500 pieces per *hapa* (2.5 x 2 x 1.2 m). After one month, the fry reach the size of 12-15 cm. They are then selected and stocked into another nursery cage (3 x 3 x 3 m) at 400 fish per cage for another 60-90 days. At this time, mortality rate is approximately 10%. Again, the fingerlings are transferred to a production cage (3 x 3 x 3 m) for culture to 0.8-1.0 kg size, for about a year. Selection are again made from 50% of these stock. Two years later, another 50% are selected.

The broodstock are ready to spawn at the end of their third year when their body weight reaches 3.5 kg. For male spawners, maturing age is 2-4 years and for females 3-4 years. At maturity, the fish are fed 5-10% of their body weight on alternate days.

A 150-t tank (10-m dia., 2-m deep) is used for spawning. The inside layer is painted with dark-green epoxy paint to increase the tank's resistance to water and for easier cleaning. About 30-40 spawners are selected from cages and transferred to 150-t tanks in the hatchery. The mature fish are paired 1:1 male to female. This is done visually. The males are usually smaller with a slender shape and narrow body depth. The females are bigger with soft round belly and red-pink papilla that extends to the urogenital aperture.

The salinity of water in spawning tanks ranges 28-32 ppt. The water is changed daily, approximately 80% of the total volume is drained out and clean seawater is replaced.

The spawners are fed sardine or other small fishes once a day in the morning at 2% of their body weight. The excess food which settles down at the bottom of the tank is removed by siphoning.

Prevention of diseases is done by incorporating tetracycline in the feed at

20 mg/kg body weight. Bacterial infection normally occurs as secondary infection due to scratches on the body. Formalin is commonly used at 30 ppm for the treatment of external parasites.

Live food culture

Chlorella culture

In the culture of *Chlorella*, cooled boiled seawater and sterile 2-l flasks are used. Nutrients are provided by the following stock solutions (1-l each are prepared):

Potassium nitrate, KNO ₃	100 g
Sodium biphosphate, NaHPO ₄ .12H ₂ O	10 g
Sodium EDTA complex	3 g

One ml of each stock solution is added to 1 l microalgae culture.

In mass culture, the seawater is sterilized overnight with 5 g hypochlorite/m³ of water and strongly aerated. Sodium thiosulphate (9g/m³ of water) is used to neutralize residual chlorine. The following commercial grade chemicals are added to 1 m³ of culture water as nutrients:

Ammonium sulphate	100 g
Calcium superphosphate	10 g
Urea	10 g

Rotifer culture (*Brachionus plicatilis*)

In the culture of *Brachionus*, a modified partial-harvest system is used. Two methods of culture are done at the MFPRC:

1. *Brachionus* culture using *Chlorella* - Initially, one-third of the culture tank is filled with microalgae and then inoculated with *Brachionus* at 20-30 ind/ml. After two or three days, the microalgae is consumed and the *Brachionus* population multiplied. Additional microalgae is pumped to the tank. When the microalgae is again consumed and *Brachionus* has multiplied, a portion of the culture water is siphoned through a 60- μ mesh size screen to collect *Brachionus* for feeding to larvae. The culture is continuously maintained by pumping new microalgae to the tank. The procedure is repeated until the tank accumulates wastes at the bottom. Culture is stopped and the tank is washed and disinfected with hypochlorite.

2. *Brachionus* culture using yeast enriched with fish oil, egg yolk, and vitamins - Yeast is enriched with a solution described below before being fed to *Brachionus*:

Fish oil	500 ml
Egg yolk	3/4 pcs
Mixed vitamin	20 g

The ingredients are dissolved in freshwater to fill up 3 l. One liter of

solution is used per 1 kg yeast.

One-third of the culture tank is filled with fresh seawater and *Brachionus* is inoculated at 20-30 ind/ml. Yeast is fed daily (at 0.5-1.0 g yeast per 1 million *Brachionus*). After 2 or 3 days when the population of *Brachionus* has multiplied, seawater is added to full tank capacity. When *Brachionus* population is more than 100 ind/ml, a certain portion of the culture water is siphoned through a 60- μ mesh size screen to collect *Brachionus* for feeding. The procedure is repeated until the tank bottom accumulates waste. Culture is then stopped and the tank is washed and disinfected with hypochlorite.

Larviculture

Egg collection

At Tanjung Demong Hatchery, the spawner is allowed to spawn naturally. Spawning occurs between 1900-2300 H continuously for 4-7 days around the 1st and 3rd quarter phases of the lunar cycle. Eggs are pelagic and can be collected by a seine net (mesh size, 400 μ ; length, 10 m; depth, 3 m) and are then stocked in larval rearing tanks.

Incubation and hatching

Rectangular cement tanks with capacities of 10-20 t are used for incubation, hatching, and rearing. The eggs are washed with fresh seawater and stocked at 30,000-50,000/t with moderate aeration. Hatching usually occurs at about noon, 12-19 h after fertilization of eggs. Aeration in the tank is suspended for 30 min. to enable unhatched eggs and other detritus to settle on the tank bottom. These are then siphoned out.

Water exchange

The water is changed every day starting on the second day after hatching. The rate of water replacement in the rearing tank depends on the feeding of each larval stage. For instance, only 10-20% of the rearing water is drained out in the period of rotifer feeding to prevent loss of rotifers. During *Artemia* feeding, 50% of water is changed while almost complete change is made when trash fish is fed.

Feeding

The rotifer *Brachionus* is fed to 2-day old larvae until the 15th day at 5-20 ind/ml. *Artemia* nauplii are given from the 10th day until larvae reach 2.0 cm (TL). Larvae, however, are first weaned for five days by feeding small amounts of *Artemia* with *Brachionus*. Problems do not usually occur during adaptation as the large larvae tend to prey on much larger food particles.

Minced trash fish are initially given with *Artemia* nauplii when larvae reach 1.5 cm (TL). Usually, the larvae take one week to adapt to this new type of food. When the larvae totally accept the minced fish as food, feeding with *Artemia* nauplii is stopped.

Grading

Sea bass do not grow uniformly. A few show very fast growth rate and exhibit highly cannibalistic behavior, preying on small larvae. Hence, grading is necessary to reduce cannibalism. The first grading is usually done on day 14 or 15, and the subsequent gradings every 5 days.

Stocking density

The stocking density varies depending on stage or size of larvae. The stocking densities practiced at MFPRC are shown below:

<i>Age</i>	<i>No. of larvae/t</i>
1-14	30,000 - 50,000
15-25	5,000 - 10,000
26-35	3,000 - 5,000
36-45	2,000 - 3,000

Problems

Hatcheries of marine fishes are new to Malaysia, and a lot of problems have to be solved. These include (1) availability of broodstock; (2) egg quality; (3) availability of larval food of appropriate size; (4) availability of artificial diet for fish larvae; and (5) availability of highly-skilled technicians.

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