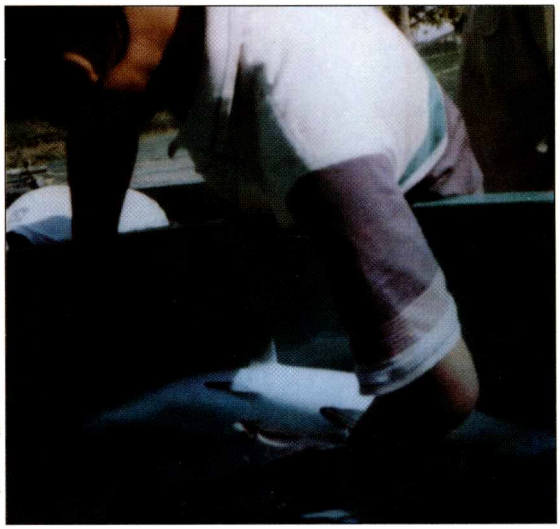
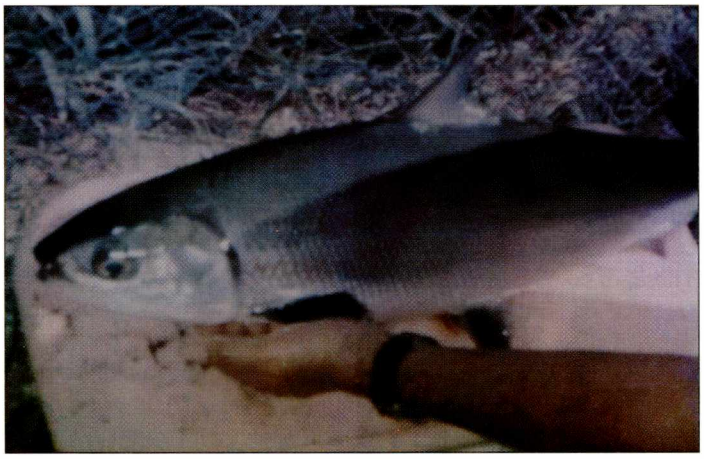
The technology for milkfish hatchery in Indonesia

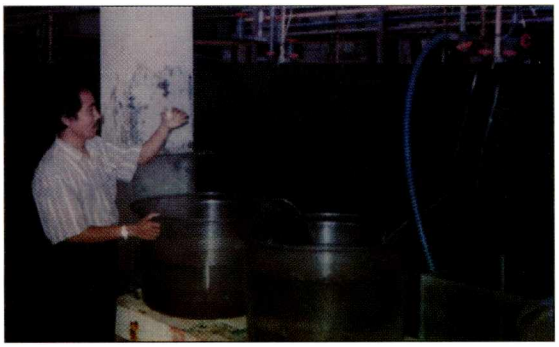
Rahmad Sofyan Patadjai
Department of Fisheries
Faculty of Agriculture
Halouleo University
Kendari, Indonesia



Determination of gonadal maturation ▶



Measuring the weight of broodstock ◀



Egg incubation in the glass tank ▶

Milkfish is one of the most popularly cultured species of fishes in the domestic and international market. It is consumed either fresh or processed. The culture of milkfish, which is the oldest fish cultured in Indonesia, started in Java around the 14th century. Recently, almost all provinces in Indonesia have gone into the trade.

Indonesia has around 4.5 million hectares of mangrove areas. Only 270,000 hectares have been used for pond culture. About 10% of this is used for intensive shrimp culture and polyculture of shrimp with milkfish and other species. Therefore, the demand for fry which is estimated at 4.35 billion a year is not met. Available fry produced is only 1.5 billion a year. Based on the total area of fishponds (*tambak*), if the stocking density is about 10,000 fry per hectare, the estimated total fry needed is about 2.5 billion for every culture cycle.

NOTE This article is the result of the author's volunteer research work at Loka, a research institute for coastal fisheries in Gondol, Bali, Indonesia

The gap between demand and supply of milkfish fry has to be met in order to avoid a decrease in production of milkfish and supply of fry (from the wild). Fry production through the hatchery method is one of the best solutions to the problem.

To answer the demand for milkfish fry in Indonesia, a series of studies on artificial fry propagation has been conducted since 1988 at Loka, Gondol, Bali. Since 1993, fry production of milkfish through artificial propagation has been known and practiced in big and small scale hatcheries. Apart from Gondol and Negara in Bali, some milkfish hatchery now operate in Situbondo, Tanjung Kodok (in East Java), and recently in South Sulawesi.

The milkfish hatchery system

Production of milkfish fry has been practiced in Indonesia both in big scale and small scale hatchery (or backyard hatchery) technology. Small scale hatchery production is popular because of the minimal risks, low operational costs and good income. Small scale hatcheries can help ward off poverty because it helps increase the income of fishers. On the other hand, big hatcheries

are operated with the aim to produce good quality and low priced fry in large quantities in time with the culture cycle.

A big-scale hatchery or complete hatchery is a unit which produces eggs and fry of milkfish. Small scale hatchery only produces fry and are operated in a cluster of houses near the seashore. Big-scale hatcheries support the fry production of small-scale hatcheries with the excess eggs they produce. In one run of spawning, a big-scale hatchery can produce about 300,000 to 1,000,000 eggs.

Milkfish fry production from big- and small-scale hatchery has supported the development of milkfish culture and the tuna fishing industry in Indonesia. Milkfish fingerlings are among the best bait used in tuna fishing. In Benoa Bali, at least 50 rean (1 rean is equal to 5,000 fingerlings and equivalent to 100 M Rupiahs) are needed daily by fishing boats as tuna bait.

Site selection for milkfish hatchery

Site selection, considering both the technical and non-technical aspects, is a necessary requirement for hatchery operation. A major technical criteria in selecting a site for a milkfish hatchery is as follows:

- The area should be flood and pollution-free, and should be near the water source
- Adequate good quality sea and freshwater should be available the whole year round
- The area should be near the broodstock source

The non-technical criteria includes accessibility to transportation (for the transport of broodstock and fry); supply facilities like feeds, fertilizer, chemicals, etc; and labor support.

Operation of milkfish hatchery

Activities in big scale hatchery of milkfish production are as follows (see also chart next page):

Broodstock rearing. Broodstock may be reared in ponds or cages. The author has conducted some studies in the preparation of milkfish broodstock to be used in the hatchery. The broodstock is reared in cages using different quantity and quality of feeds to accelerate both body weight and gonad development. Broodstock should be more than five years old, with a body weight of more than 4 kg, and with a body length between 58 to 60 cm. This criteria should be used to ensure quality production of milkfish fry in the hatchery.

Hormone implantation. Successful spawning of milkfish broodstock is done in the rearing tank with the use of LHRHa (luteinizing hormone-releasing hormone analogue) and MT (17α methyl testosterone) applied by implantation to the broodstock to accelerate gonad maturation. Hormone application is conducted every month between 6 to 12 times based on the gonad maturation level until the broodstock has spawned naturally. Pellets are used for hormone application. The doses are presented in Table 1.

Pellet hormone implantation is done by injection on the dorsal part of the broodstock. It is only applied to broodstock that has a body weight between 4 to 7 kg, with a body length between 60 to 70 cm and is estimated to be 4 to 7 years old. This is because the gonad of 4- to 7-year old broodstock is already well-developed, since the aim of hormone application is to accelerate gonadal maturation.

Table 1. **Doses of hormone pellet implantation in milkfish broodstock**

	Doses
First month	200 μg LHRHa
Second month	200 μg LHRHa
Third month	250 μg 17α-MT
Fourth month	200 μg LHRHa
Fifth month	200 μg LHRHa
Sixth month	250 μg 17α-MT

Broodstock maintenance. Care of milkfish broodstock that has been implanted with hormone should be carefully conducted. This is important so that gonadal development can be observed. Milkfish broodstock are reared in 100 ton capacity tanks (with a depth of 2 meters and a diameter of 8 meters) with a density of 25 broodstock in one tank. Broodstock tanks should be circular in order to facilitate natural spawning.

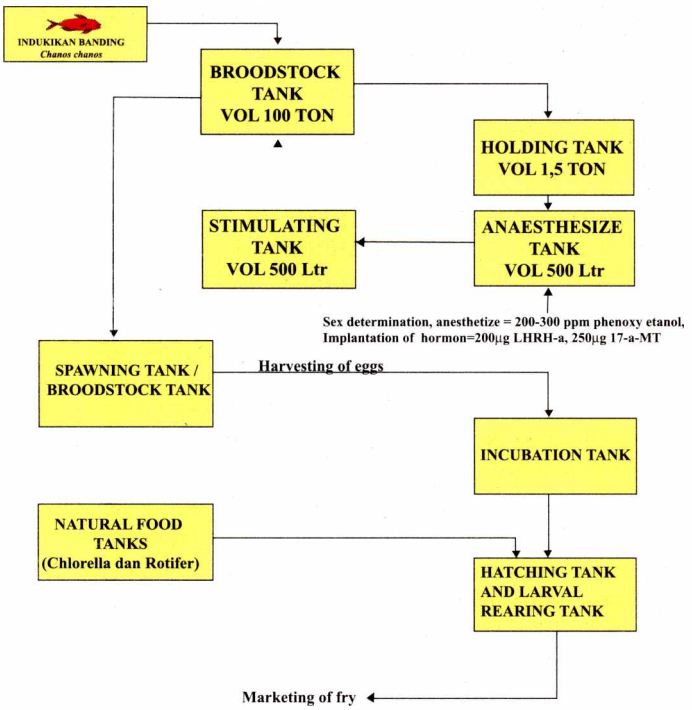
Sex determination is an important factor in broodstock maintenance even if it is difficult to do. It should be carefully conducted to prevent the broodstock from easily getting stressed. Broodstock from the rearing tank is transferred to the stimulating tank (with a capacity of 1 to 1.5 m^3). Water in the stimulating tank should be continuously aerated. Prior to sex determination, broodstock is anesthesized using phenoxyl ethanol with a dose of 200 – 300 ppm. When the broodstock begins to look sluggish, a cannula (0.9 mm diameter) is carefully inserted in its sex organ. The tip of the canula is pushed in, then carefully pulled out. If the liquid in the canula takes a round shape, the broodstock is female. If it remains as a thick liquid, the broodstock is male.

After sex determination, the broodstock is directly transferred to another stimulating tank and is moved to and fro until it recovers from the anesthesia. The male and female broodstock are then transferred to the rearing tank with a ratio of 1 male to 1 female (1:1).

Water quality is another important factor in broodstock rearing. Salinity of 34 ppt is required. This is also an important requirement in the spawning and harvest of eggs. Fertilized eggs have a buoyancy while unfertilized eggs are those that sink to the bottom of the tank. To maintain water quality in the broodstock tank, a flow through system is applied with 100 to 150% exchange rate per day. During broodstock rearing, supplemental feed is given at 5% of BW, twice daily – one in the morning and one in the afternoon.

Egg production and harvest. The use of hormones can accelerate spawning, affect the fecundity and egg quality of milkfish. Studies using this method have shown that rearing of 20 male and 40 female broodstock produced 45 million eggs, while rearing 35

☞ NEXT PAGE



Schematic diagram of the milkfish hatchery

male and 55 female broodstock produced 50 million eggs in 1991 and about 60 million eggs in 1992. Broodstock with 4-6 kg body weight produced 300,000 – 600,000 eggs in one spawning. Spawning is done on a staggered basis so the broodstock could spawn 8 to 15 times a year. Production of eggs follows the natural spawning peaks during the months of September to December, and decreases from January to March. It drastically decreases during June to August.

Mature broodstock usually spawn between 23:30 to 01:00 or around midnight. Collection of eggs is conducted at 07:00 am.

Harvested eggs are placed in glass containers from which fertilized and unfertilized eggs are selected. Fertilized eggs are characterized by a clear transparency while unfertilized eggs are whitish. After the separation and sampling of fertilized eggs, preincubation is conducted for three hours. Then the eggs are transferred to 500-liter fiberglass tanks for incubation until they hatch. Strong aeration should be applied during incubation to improve hatching rate. Water temperature should be between 26-29.5°C. Fertilized eggs that incubate at 34 ppt and temperature of 31.5°C hatch after 20.5 – 22 hours.

The study which was conducted by the author in 1995 and 1996 in Loka, Gondol, Bali showed that hatching rate was 60-70%.

Larval rearing. Newly-hatched larvae are then transferred to 10-ton larval tanks. These usually have a body length of 4-5 mm with a relatively big yolk-sac. About 3/4 of the larvae's body length, the yolk-sac is found along the head to the anus of the milkfish larvae.

Aeration should be maintained carefully. It should not be too strong.

Larvae should be fed with *Chlorella* sp. at a density of 2-3 x 10^5 cells per ml. Rotifer (*Brachionus plicatilis*) is given starting the second day with a density of 10-15 individual per ml up to day 6. At day 7, density of rotifer is increased to 20-25 individuals per ml. Starting day 9 and day 10, water in the larval tank is changed at 10% daily. It is then increased based on the age of the larvae. When the larvae are 21 days old, water exchange is 100% per day. At day 10-12, nauplii *Artemia* can also be given, increasing this to not more than 10 individual per ml at the 21st day. To maintain water quality, tank bottom is cleaned daily and water temperature is maintained at 27-31°C, salinity at 30 ppt, pH at 7-7, dissolved oxygen at 5-7 ppm and water level in the larval tank at 125 cm.

Harvest of fry is conducted after 21 – 25 days by reducing the water level in the tank and transferring the fry to the containers. They are then ready to be sold.

REFERENCES

Anonymous.1991. Pembenihan Ikan Bandeng Skala Kecil/Rumah Tangga. Pusat Penelitian dan Pengembangan Perikanan, Badan Penelitian dan Pengembangan Pertanian Deptan, Jakarta

Kuo CM. 1984. Natural spawning of captive milkfish in Taiwan. Taiwan

Lacanilao FL, Marte CL.1980. Sexual maturation of milkfish in floating cages. SEAFDEC Asian Aqualuture 3:4-6

Patadjai RS. 1996. Studi Tentang Pembenihan Bandeng di Loka Peneltian Perikanan Pantai, Gondol Bali dan Kemungkinan Pengembangannya di Sulawesi Tenggara. Lembaga Penelitian Universitas Haluoleo. Kendari

Patadjai RS. 1998. Pengaruh Pemberian Pakan Buatan Terhadap Pertumbuhan dan Tingkat Perkembangan Gonad Ikan Bandeng (*Chanos chanos* Forskl). Majalah Ilmiah Agriplus No. 22 : p 104-112

Patadjai RS. 2000. Teknik Budidaya Calon Induk Bandeng (*Chanos chanos* Forskal) Untuk Merangsang Pertumbuhan dan Kematangan Gonad dengan Sistem Manajemen Pemberian Pakan. Majalah Ilmiah Agriplus No. 27 : p 100-109

Prijono A. 1987. Petunjuk pembuatan pellet hormon Luteinizing Hormon-Releasing Hormon, Cholesterol Pellet dan Silastic Hormon 17_ Methyltestosteron untuk implantasi induk bandeng (*Chanos chanos* Forsskal). Report on the training program on induced maturation and spawning of milkfish by hormone implantation. Oceanic Institute (OI) of Hawaii. Makapuu Point, Waimanalo, Hawaii

Prijono A. 1993. Peran Ikan Bandeng *Chanos chanos* Forskal Dalam Menunjang Pembenihan Skala Rumah tangga. Makalah Simposium Perikanan Indonesia I, Jakarta 25-27 Agustus 1993.

Puslitbang Perikanan. 1993. Pedoman Teknis Perbenihan Ikan Bandeng. Balitbang Pertanian Deptan. Jakarta