

7.12 Freshwater fish seed resources in Indonesia

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ABSTRACT

The status of freshwater fish seed resources in Indonesia is described in this paper. The most commonly cultured species are common carp (*Cyprinus carpio*), tilapia (*Oreochromis niloticus*), catfish (*Clarias* sp., *Pangasius* sp.) and gouramy (*Osphronemus gouramy*). The main freshwater producing regions are Java (23 percent) and Sumatra (67 percent) of the total production at 482 683 tonnes in 2003. Freshwater cultured fish seed are mostly supplied from hatcheries and only some species are supplied from the wild. There are about 20 species of freshwater fish that have been successfully bred in captivity. Despite the progress, development of the freshwater seed sector is very slow compared to marine fish and shrimp hatchery business. This may be market-related as freshwater fish are particularly intended for the local market and only a small percentage (i.e. tilapia and catfish) is aimed for the export market. Other reasons include the decreasing quality of seed, inbreeding issues which caused slow growth and exporter requirements (e.g. fish size, number of fish, off-flavour, etc.). Another obstacle to the development of the freshwater aquaculture sector is the non-availability of credit for small-scale farmers. Nevertheless, the fish seed requirement to realize the targeted freshwater aquaculture production of the top five freshwater species (common carp, tilapia, walking catfish, gouramy and Siamese catfish) shows the great opportunity and prospect for the freshwater fish seed industry.

INTRODUCTION

Freshwater aquaculture in Indonesia started with the stocking of common carp in backyard ponds in West Java and subsequently expanded to other parts of Java, Sumatra and Sulawesi islands in the early twentieth century. However, it was only in the late 1970s when a remarkable increase in production from freshwater aquaculture was observed as a result of the introduction of new farming technologies, which contributed to the availability of hatchery-produced seed and the development of compound feeds.

During the period from 1999 to 2003, total aquaculture production increased from 882 989 tonnes in 1999 to 1.22 million tonnes in 2003 with an incremental growth of 8.5 percent/yr. In the same period, total freshwater aquaculture production increased from 304 579 to 482 683 tonnes. In 2003, freshwater fish aquaculture production

contributed 39.43 percent to the total aquaculture production. Production increased due to technology innovation, expansion of aquaculture areas and availability of suitable quality and quantity of fish seed.

The most commonly cultured species are common carp (*Cyprinus carpio*), tilapia (*Oreochromis niloticus*), catfish (*Clarias* sp., *Pangasius* sp.) and gouramy (*Osporonemus gouramy*). Common carp is the most dominant species, with production comprising about 46 percent of the total freshwater aquaculture output. Production of common carp in ponds, cages and paddy fields doubled from 139 370 tonnes in 1999 to 220 330 tonnes in 2003. The rapid growth of common carp was the result of floating cage in the reservoirs. The second important species, Nile tilapia, which was first introduced in Indonesia in 1969, is becoming an important species as the aquaculture export commodity, with its production doubling from 31 424 tonnes in 1999 into 71 789 tonnes in 2003 comprising one third of the total aquaculture production. The next dominant species are catfishes. There are some species of catfishes such as *Clarias batrachus*, *C. garipienus*, *Pangasius suchi*, *P. jambal*, with production of 70 826 tonnes comprising 32 percent of the total aquaculture output. Another species is gouramy, with a production of 22 722 tonnes.

The main freshwater producing regions are Java (23 percent) and Sumatra (67 percent) of the total production at 482 683 tonnes in 2003. Common carp, Nile tilapia, catfishes and gouramy are common species cultured in Java. People in Sumatra are not familiar with gouramy; Kalimantan and Sulawesi are not familiar with *Clarias* sp. and gouramy.

Freshwater aquaculture is carried out in fish ponds or fish cages and pens in lake and reservoirs as well as in paddy fields using monoculture or polyculture and integrated with animal husbandry or crop farming.

The culture of ornamental fish has also been expanding, triggered by the huge export demand and strong government support. This industry, comprised of a wide range of producers from small backyard operators to large-scale commercial producers, earn over US\$20 million from the export of 30-40 million fish annually. With the outbreak of koi herpes virus (KHV) disease affecting carp farming, many common carp hatchery, nursery, and grow out farmers/operator have shifted to the production of ornamental fish species for the export market.

SEED SUPPLY

Freshwater cultured fish seed are mostly supplied from hatcheries and only some species are supplied from the wild. There are about 20 species of freshwater fish that have been successfully breeding in captive area. These include common carp, Nile tilapia, catfish, gouramy, giant freshwater prawn, grass carp, Java barb (*Puntius gonionotus*), Nile carp (*Osteochillus hasselti*), freshwater pompret (*Colosoma* sp.), catfish (*Macrones* sp.), Sultan fish (*Leptobarbus hoeveni*), silver carp, bullfrog (*Rana catesbiana*), *Cherax* sp. and some ornamental fish such as guppy, koi, botia, arowana, angelfish and goldfish. Seed dependent on wild source include marble goby (*Oxyeleotris marmoratus*), featherback (*Notopterus chitala*), snakehead, climbing perch (*Anabas testudeneus*) and soft shell turtle (*Trionyx* sp.).

SEED PRODUCTION FACILITIES AND TECHNOLOGY

Government

In the field of freshwater aquaculture, there are four Technical Implementing Units (TIU) under the responsibility of the Directorate General of Aquaculture (DGA) and there are 398 hatchery units owned by local governments (provincial and district levels).

Technical implementing units (TIU)

TIU has the main task of developing and implementing hatchery technology, aquaculture technology, environment and fish health management. The applied

technology developed by TIU are disseminated to provincial freshwater hatcheries and district freshwater hatcheries located in their areas of responsibility. Freshwater TIUs also function as broodstock centers for freshwater fish. The present status of freshwater aquaculture TIUs are presented in Table 7.12.1.

Provincial freshwater fish hatcheries

There are 30 freshwater fish hatchery units under the management of the provincial government. Each provincial government has at least one freshwater fish hatchery unit. Seed production ranged from 1 to 5 million fry/yr depending on facilities, human resources and management. Table 7.12.2 shows the names and capacities of provincial freshwater fish hatcheries.

TABLE 7.12.1

The present status of aquaculture technical implementing units (TIU) in Indonesia

No.	Name of TIU	Commodities	Region
1	Freshwater Aquaculture Development Center, Sukabumi	Nile tilapia, giant freshwater prawn, gouramy, common carp, catfish, ornamental fish	Java, Bali, Nusa Tenggara, Sulawesi, Papua
2	Freshwater Aquaculture Development Center, Jambi	Siamese catfish, Jambal catfish, Malaysian carp, Baung catfish, klemak, botia	Sumatra and Kalimantan
3	Regional Freshwater Aquaculture Development Center, Mandiangin	Walking catfish, Baung catfish, sand goby, Nile tilapia, catfish	Kalimantan, Java, Bali, West Nusa Tenggara, East Nusa Tenggara
4	Regional Freshwater Aquaculture Development Center, Tatelu	Nile tilapia, common carp and gouramy	Sulawesi, Maluku, Papua

TABLE 7.12.2

Production capacities of provincial freshwater fish hatcheries in Indonesia

No	Province	Name of the hatchery	Production capacity (fingerlings)
1	Nangroe Aceh Darussalam	Toweran	1 680 000
2	Sumatera Utara	Kerasaan	960 000
3	Sumatera Barat	Sicincin	888 000
4	Riau	Sei Tibun	216 500
5	Jambi	Kerinci	3 480 000
6	Bengkulu	Marga Sakti	1 485 588
7	Sumatera Selatan	Air Satan	4 200 000
8	Bangka Belitung	Pemali	138 455
9	Lampung	Purbolinggo	3 000 000
10	Dki Jakarta	Ciganjur	5 400 000
11	Banten	Curug Barang	1 200 000
12	Jawa Barat	Wanayasa	2 520 000
13	Jawa Tengah	Janti	4 500 000
14	Di. Yogyakarta	Cangkringan	4 548 000
15	Jawa Timur	Umbulan	3 600 000
16	Bali	Sangeh	2 880 000
17	Nusa Tenggara Barat	Aikmel	3 600 000
18	Nusa Tenggara Timur	Noekele	789 000
19	Kalimantan Barat	Anjungan	2 508 000
20	Kalimantan Tengah	Talohen	107 660
21	Kalimantan Selatan	Karang Intan	3 000 000
22	Kalimantan Timur	Sabulu	5 400 000
23	Sulawesi Utara	Tateli	4 800 000
24	Gorontalo	Paguyaman	269 000
25	Sulawesi Tengah	Kalawara	1 200 000
26	Sulawesi Tenggara	Punggaluku	2 760 000
27	Sulawesi Selatan	Lajoa	2 400 000
28	Maluku	Waiheru	1 440 000
29	Maluku Utara	Jailolo	-
30	Papua	Masni	4 560 000
	Total		70 524 000

District freshwater fish hatcheries

There are 416 freshwater fish hatchery units under the responsibility of the district government. Production ranged between 500 000 to 1 million seed/yr. Table 7.12.3 shows information on district freshwater fish hatcheries in Indonesia.

Private sector

Freshwater fish hatcheries owned by the private sector are mostly dominated by small-scale fish farmers and there are only few hatcheries owned by commercial private companies.

Small-scale fish hatcheries

There are about 26 365 small-scale hatcheries owned by an individual or a farmer group. Most of the individual farmer hatchery operators are small-scale, use traditional technology transferred from generation to generation. Species most commonly used are common carp, tilapia, giant gouramy and Java barb. Production ranged between 30 000 to 3 million seed/yr mainly depending on facilities and financial resources.

Farmer groups with about 25-60 members have more complete hatchery facilities and to some extent apply new technology. They produce more than one species and production is higher at about 16- 45 million seed/yr.

Commercial hatcheries

So far, there are six hatcheries operating at commercial level. Production varies depending upon available facilities which may consist of a laboratory, larval rearing

TABLE 7.12.3
Production capacities at the district freshwater fish hatcheries in Indonesia

No	Province	Number	Production capacity (fingerlings)
1	Nangroe Aceh Darussalam	8	5 040 000
2	Sumatera Utara	31	27 048 000
3	Sumatera Barat	14	10 296 000
4	Riau	4	6 156 000
5	Jambi	8	4 884 000
6	Bengkulu	15	7 872 000
7	Sumatera Selatan	13	17 916 000
8	Bangka Belitung	-	138 455
9	Lampung	10	10 068 000
10	Dki Jakarta	3	11 040 000
11	Banten	4	1 920 000
12	Jawa Barat	24	6 720 000
13	Jawa Tengah	61	50 736 000
14	Di. Yogyakarta	17	18 384 000
15	Jawa Timur	38	39 732 000
16	Bali	20	11 316 000
17	Nusa Tenggara Barat	12	13 656 000
18	Nusa Tenggara Timur	35	11 916 000
19	Kalimantan Barat	8	4 380 000
20	Kalimantan Tengah	-	107 660
21	Kalimantan Selatan	2	5 700 000
22	Kalimantan Timur	5	2 400 000
23	Sulawesi Utara	7	6 120 000
24	Gorontalo	-	269 000
25	Sulawesi Tengah	11	18 260 000
26	Sulawesi Tenggara	7	16 368 000
27	Sulawesi Selatan	29	37 608 000
28	Maluku	-	60 519
29	Maluku Utara	-	0
30	Papua	30	16 152 000
	Total	416	361 688 000

TABLE 7.12.4
List of commercial private hatcheries

No	Name	Location	Species	Seed production/year
1	PT. Surya Dharma Hatchery	Sleman, Yogyakarta	giant freshwater Prawn	50 000 000
2	PT. Aquafarm Nusantara	Klaten, Cental Java	Nile tilapia	4 500 000
3	PT. Toba Tilapia	Deli Serdang, North Sumatra	Nile tilapia	8 000 000
4	PT. Nalendra Sinta Mina Usaha	Subang, West Java	Nile tilapia	12 000 000
5	PT. Central Panganpertiwi	Subang, West Java	common carp catfish Nile tilapia	18 693 394 60 000 000 6 822 366
6	PT. Central Panganpertiwi	Situbondo, East Java	Nile Tilapia catfish	12 000 000 7 000 000

tanks, breeding tanks and other physical infrastructure. Some of them have Seed Production Certificate from the DGA indicating that the seed they produce are of good quality. Table 7.12.4 shows information on commercial freshwater fish hatcheries in Indonesia.

SEED MANAGEMENT

Broodstock management

Small-scale fish hatcheries usually have limited number of broodstock. Regeneration of broodstock is seldom and depends on available budget. Obviously, over-aged broodstock are commonly used. Seed quality is oftentimes neglected and they are caught in a system where middlemen purchase seed paid on an installment basis or delayed payment. Commercial hatcheries, on the other hand, have good procedures for maintaining their broodstock. Regeneration of the broodstock is carried out through improved technology and by following “genetic rules” in the production of good quality breeder based on a national standard developed by the DGA and the National Standard Agency (NSA). Although they do not have research facilities and research staff, they keep in touch with national experts from universities or government research agencies. Feeds are provided daily, either indirectly using fertilizer or commercial pellet. Application of organic fertilization, mainly chicken manure using a rate between 500 g/m² up to 1 000 g/m² and inorganic fertilizers such as urea and TSP at a rate of 150-200 kg/ha are the normal practice. Commercial pellets are applied at a dosage of 2-5 percent body weight daily. Broodstock ponds are usually divided for male and female and to some extent for species separation. Small-scale hatcheries normally mix different species in one pond; males and females are separated. In contrast, commercial operations use only one species. Water is kept flowing gravitationally into broodstock ponds. Table 7.12.5 shows an example of standard procedures to produce Majalayan

TABLE 7.12.5
Standard procedure in the Majalayan common carp broodstock at stagnant water and running water ponds

Process	Larval rearing I (stagnant water pond)	Larval rearing II-IV (stagnant water pond)	Grow-out I (stagnant water pond)	Grow-out II (running water pond)	Grow-out III (running water pond)
Product (g/fish)	1-2	5-10	200	1 000	2 000
Selected number (percentage best selected)	100	50	50	30	25
Stocking density (fish/m ²) (kg/m ²)	50 -	10 -	2 -	- 5	- 5
Time period (weeks)	2	10	12	16-20	40

common carp broodstock using stagnant water pond and running water pond, a common practice at freshwater hatcheries.

Larval management

Most farmer hatcheries implement the natural spawning method using earthen pond or concrete tank. There are four stages commonly practiced by farmers to produce larvae up to fingerling size: (1) Larval rearing I to produce 20-day old larvae, (2) Larval rearing II to produce 40-day old larvae, (3) Larval rearing III to produce 70-day old fingerlings and (4) Larval rearing IV to produce 90-day old fingerlings. All larvae and fingerlings can be produced in earthen ponds, bricked ponds, or paddy fields. In some areas, they can be produced in cage nets. During larval rearing, water depth of pond is maintained at 50-70 cm depending on the size of fish. Water is kept flowing during larval rearing at 0.4 to 0.7 l/sec in a larval rearing area of 500 m². Turbidity is maintained at a reading of 25 cm. Larval rearing in paddy field is slightly different in the sense that water depth at the flat area is maintained up to 20 cm. Table 7.12.5 shows the standard procedure for common carp larval rearing while Table 7.12.6 shows the standard procedure for larval rearing in paddy field.

Feed management

Fish hatcheries feed their young larvae usually with crushed boiled eggs which are spread out evenly in the larval jar or hapas. During larval rearing, no feeds are provided except as part of organic fertilization. In some commercial hatcheries which produce male tilapia, crumbled feeds containing methyl testosterone used to feed first stage of larva are given. After the larvae digestion system is completed, larvae are then fed indirectly with live feeds such as phytoplankton, zooplankton (*Daphnia* sp., *Moina* sp.) through application of fertilizer. For economic species such as Borneo catfish and ornamental fish, *Artemia* nauplii or high formulated diet feeds are added. Under normal conditions, feeding with commercial pellet containing 24-30 percent protein is given twice a day. However, in areas having difficulties in finding commercial pellets, rice bran has become alternative feeds for young fish.

SEED QUALITY

It is difficult to get good quality seed, even from commercial hatcheries. This is due to available broodstock of the fish. The situation was exacerbated due to the outbreak of KHV which seriously affected the industry of common carp in the provinces of West Java and East Java. With regards to tilapia, the problem is getting good quality broodstock. Although some strains were imported from neighboring countries such as the Philippines, Malaysia, Singapore, Thailand and Japan, currently the produced seed

TABLE 7.12.6
Standard procedure for the production of fingerling size of Majalayan common carp at each stage of larval to fingerling rearing

No.	Standard	20-day old	40-day old	70-day old	90-days old
1	Organic fertilizer (g/m ²)	500	200	200	150
2	Agricultural Lime (g/m ²)	50	50	50	50
3	Seed				
	Size to stock (cm)	0.6-0.7	1-3	3-5	5-8
	Stocking density (fish/m ²)	100	50	25	20
4	Feed				
	Dosage (% of biomass)	20	10	5	4
	Feeding frequency (times/day)	2	3	3	3
5	Harvest				
	Rearing period (days)	15	20	30	20
	Survival Rate (%)	60	70	80	80
	Production size (cm)	1-3	3-5	5-8	8-12

have already been mixed. Efforts to get good quality seed and broodstock has been implemented through the Tilapia Broodstock Center established since 2003 where the National Freshwater Aquaculture Center was appointed as center coordinator. The NSA sets up the seed quality criteria, broodstock quality criteria and production procedures. Many stakeholders are involved in determining the criteria for seed and broodstock quality and decisions are taken as a consensus through a combination of

TABLE 7.12.7

Standard procedure for the production for fingerling size of Majalayan common carp in paddy field

No	Standard	40-day old	70-day old	90-day old
1.	Culture method	In between rice crop	Integrated with rice	Integrated with rice
2.	Seed			
	Size to stock (cm)	1-3	3-5	5-8
	Stocking density (fish/m ²)	3-5	2-3	1-2
3.	Feed			
	Dosage (% Biomass)	10	5	3
	Feeding frequency (times/day)	2	2	2
4.	Harvest			
	Rearing period (days)	20	30	20
	Survival rate (%)	50	70	70
	Production size (cm)	3-5	5-8	8-12

practical experience, scientific basis and economic considerations. Currently, there are eight freshwater fish species for which such criteria has been set by the NSA. These include common carp (*Sinyonya* and *Majalaya*), Nile tilapia, Siamese catfish, walking catfish, gouramy, giant freshwater prawn and bullfrog.

Tables 7.12.8 and 7.12.9 show some examples of criteria, published in 1999, for common carp seed and broodstock.

TABLE 7.12.8

Quantitative criteria for seed of common carp, Majalayan strain

Criteria	Larvae (0-4 days old)	Kebul (5-20 days old)	Putihan (21-40 days old)	Belo (41-70 days old)	Sangkal (71-90 days old)
Maximum age (days)	4	20	40	70	90
Minimum total length (cm)	0.6	1	3	5	8
Minimum weight (g)	-	0.2	3	6	10
Minimum uniformity in size (%)	80	80	80	80	80
Minimum uniformity in color (%)	95	95	95	95	95

TABLE 7.12.9

Quantitative criteria for reproductive character of the Majalayan carp

Criteria	Male	Female
Age at early maturation stage (months)	8	18
Standard length (cm)	22	35
Weight at early maturation stage (g/fish)	500	2 500
Fecundity (eggs/kg)	-	85 000 – 125 000
Egg diameter (mm)	-	-
Dry egg	0.9-1.1	-

Note: Qualitatively criteria for the Majalayan broodstock is indicated by the ratio of standard length to body height 2.30:1.00, ratio of standard length to head length 3.57:1.00; total number of scale on lateral line: 26-33; dorsal spine: D.3.15-17; pectoral spine: P.1.12-17; ventral spine: V.1.6-8, anal spine: A.3.4-6 and caudal spine C.12-16

SEED MARKETING

Traditional fish seed marketing uses direct purchasing. This practice dominates in the rural area or through several layers of middlemen (e.g. private traders, collectors or market agents). Local collectors play an important role in marketing from production site to market. There are two kinds of collectors: (a) village-based collectors have usually lived in the villages since childhood and work as local agents and (ii) regional collectors are those who collect seed from the village-based collectors. These collectors usually provide loans, small-scale credit or at times advance their own money to ensure that farmers sell the seed to them.

In Java, live fish markets are available which facilitates the sales of farmer-produced seed. Sukabumi, Majalengka, Tasikmalaya districts in West Java, Magelang District in Central Java and Lamongan in East Java are the places for selling live fish through the live fish market. Live fish markets not only function as venue for marketing activities, they also, to some extent, serve as a venue for monitoring seed quality as well as price level.

SEED INDUSTRY

The freshwater fish seed industry in Indonesia is dominated by small-scale farmer-operated hatcheries whose contribution to the seed supply is about 80 percent of the national seed demand.

Generally, the seed business follows the fish seed culture size categorization, i.e. 1-3 cm; 3-5 cm; 5-8 cm and 8-12 cm. However, hatcheries sometimes sell different stages of fish, e.g. eggs for gouramy, 3-4 day old larvae for common carp and Nile tilapia and nauplii and post-larvae for the giant freshwater prawn.

A major limiting factor in the seed industry is the lack of high quality broodstock caused by in-breeding process.

SUPPORT SERVICES

Technology

The Research Institute for Freshwater Fish (RIFF) located in Sukamandi, West Java and Palembang, South Sumatra undertakes research and technology development on freshwater aquaculture. The technology developed by research institutes are transferred to the TIUs of the DGA and state hatcheries or directly disseminated to fish farmers.

TIUs and state hatcheries have the roles to develop applied technologies which are ready to be applied by the fish farmer.

Recently, institutional cooperation on technology development has been carried out between the Freshwater Aquaculture Development Center (FADC) in Sukabumi and the Fish Culture Research Institute (or HAKI) of Hungary on genetic improvement of common carp. Researchers from FADC Sukabumi had been invited to visit HAKI to learn techniques for producing good quality seed of common carp. This collaboration was supported by FAO.

Meanwhile, FADC Jambi is continuing collaborative work with the Japanese International Cooperation Agency (JICA) on extension programs for fish farmers from Jambi and Riau provinces.

Training and extension

Training is one activity for transferring technology through support from government or in collaboration with regional or international organizations such as JICA or the Network of Aquaculture Centres in Asia-Pacific (NACA). Training varies depending on the target group and whether the program is a Training for Trainers (TOT) and/or a training for farmers. TOT is usually for government officers or extension workers with the responsibility to distribute information to the farmers. The policy on extension was previously mandated to the central government. In line with Legislation No. 22/1999 revised into Legislation Law No. 32/2004, responsibilities for extension

services to farmers and fishers has been given to local government, particularly the district government. The central government is still involved in extension work through government research institutes, the TIU and fisheries service offices which are mandated to disseminate the technologies that they have developed.

Financial

So far, there is no special credit scheme for aquaculture/hatchery business provided by banks, although financial schemes are provided to coastal aquaculture business by many state banks (e.g. Bank Mandiri, Bank Bukopin). Nevertheless, financial support is limited to a small amount. To support the need for a working capital by small-scale farmers, the DGA established an empowerment program for fish farmers where a revolving fund program has been established for use by farmers. This program is for demonstration purposes only and available only in certain areas of the country.

Networking

Networking among fish farmers either at individual or intra-group level is very weak. Transfer of information and knowledge between and among farmers is very limited. Annual meeting of stakeholders of freshwater hatcheries is organized by the DGA.

SEED CERTIFICATION

Since 1998, a certification system was established focused on management of hatcheries. However, certification for good quality seed has not been implemented yet. The DGA issues a "Certificate for Hatchery" after an assessment by an assessor, representing the DGA and the TIU, acting as an Independent Body for Quality System Certification, has been completed. Assessment is conducted concerning some aspects of management, production process, social, environment, food safety and traceability.

LEGAL AND POLICY FRAMEWORKS

The Ministry of Marine Affairs and Fisheries (MMAF), the responsible authority for the development of the aquaculture sector in Indonesia, has issued a number of specific rules and regulations to be used as legal and policy frameworks for seed development. These include the following:

Ministerial Decree of Agriculture Ministry No. 26/Kpts/OT.210/1/98 on Guidance of Indonesian Fish Seeding Development. This decree covers regulations concerning the supply and distribution of fish seed for local demand which should conform with 7 parameters (i.e. type, size, amount, price, quality, time and place) and other aspects related to sustainability of seed production business, rural-based culture industry, standardization and certification of the hatchery unit, control of the exploitation and sustainability of fish resources especially of germplasm, observation on and supervision of hatchery and seed production activities.

Ministerial Decree of Agriculture Ministry No. 214/KPTS/UM/V/1973 on Export Prohibition of Some Fish Species from Indonesian Territory. This decree is related to the supervision and maintenance of sustainability of fisheries resources, in line with preventing the negative effect of fishery development by giving priority to the demands for domestic seed and prohibition of the exportation of certain species from the Indonesian territory.

Ministerial Decree of Agriculture Ministry No. 700/KPTS/IK.120/11/1989 on Exportation of Penaeid Shrimp from Indonesian Territory. Live penaeid shrimp can be exported from the Indonesian territory except broodstock and pre-broodstock sizes, since shrimp hatcheries still depended on wild broodstock as implementation of the broodstock production technology has not yet been successful.

Ministerial Decree of Agriculture Ministry No. 810/KPTS/IK.210/7/1999 on Examination, Assessment and Releasing of Fish Type and Variety. This regulation is

issued to guarantee the availability of fish/shrimp seed in high quantity and good quality which are required for establishing superior varieties. To determine the characteristics of these varieties, assessment and examination are carried out by an Expert Team as required by law.

Ministerial Decree of Marine Affairs and Fisheries Ministry No. 07/2004. Ministerial Decree of Agriculture Ministry No. 1041.1/Kpts/IK.120/1999 on Providing and Distribution of Fish Seed. Under this decree, supervision concerning the production and distribution of fish seed and/or broodstock obtained from nature, hatcheries, or imported from abroad and through genetic improvement should be done in order to guarantee the availability of fish seed both in quantity and quality.

Ministerial Decree of Agriculture Ministry No. 1042.1/Kpts/IK.210/10/1999 on Certification of Hatchery Unit and Monitoring of Fish Seed. This decree regulates the procedures involved to certify good quality seed. The process requires assessing the capability of hatchery units with respect to facility, human resources and production system, as well as procedures in place to comply with the certification requirements (e.g. technical standards for breeding to guarantee quality seed production).

ECONOMICS

Freshwater fish production makes a very important contribution (59 percent) to protein diet from aquaculture, since most of the freshwater fish production are targeted for local consumption. Only Nile tilapia has been exported in fillet form.

To support freshwater fish production, there are at least 26 365 fish farmer households directly involved in freshwater fish seed industry.

STAKEHOLDERS

The different stakeholder groups involved in Indonesian freshwater fish seed production sector are listed and briefly described below.

Producers/farmers. Fish seed producers in Indonesia consist of farmers involved in freshwater fish hatchery operations consisting of about 26 365 households. They breed the broodstock supplied by government and private companies or those which came from the wild to produce fish seed.

Local institutions. There are 33 provincial fisheries service offices and 414 district fisheries service offices. The main task of these institutions are to build a strong extension system for fish farmers. The provincial and district government hatcheries have the main task of producing broodstock and disseminating the seeding technology.

Small hatcheries. Small hatcheries who supply most of local freshwater seed demand consist of fish farmer-operated hatcheries on an individual as well as group business basis. The main objective of the business is to produce seed.

Large hatcheries. Large hatcheries owned by private companies usually have their own breeding program for maintaining their broodstock and seed quality.

Associations. Two associations relevant to Indonesia's freshwater fish seed sector are: (i) Indonesia Seed Society (ISS) and (ii) Indonesia Aquaculture Society (IAS). The ISS is an independent organization oriented to agricultural development (including aquaculture), especially seeding and germination and that which promote the implementation of good agribusiness practices and environment-friendly concepts. ISS provides a place for networking and cooperation in order to strengthen the national seeding system. In partnership with the government responsible for developing the fisheries sector, ISS will make serious efforts towards attaining competitiveness and production of high quality seed and enhancing the distribution system. The IAS is a professional organization oriented towards aquaculture development and the promotion of the

implementation of good aquaculture practices and environment-friendly concepts. The IAS has wide membership from the aquaculture business, research, government, university and academic sectors.

Government institutions. The main national institution who is responsible for Indonesia's freshwater fish seed is the Directorate of Seed Development under DGA. The TIUs, under the DGA, were established to support the implementation of technical duties in the field as well as to serve broodstock centers.

Researchers. Researchers mostly work at research institutes and at universities and other academic institutions. Research institutes in the field of freshwater aquaculture are presented in Table 7.12.10.

Universities and other academic institutions which have fisheries faculty/department are listed in Table 7.12.11.

Donors. There is no specific international agency directly supporting the development of the freshwater fish seed industry. The Southeast Asian Fisheries Development Center (SEAFDEC) has been involved in the development of the giant freshwater prawn, particularly in seed development. SEAFDEC has been working, since the last three years, with FADC Sukabumi to strengthen research collaboration on *Macrobrachium* seedling. Another international organization interested in freshwater seedling technology was JICA, through a project which ended in mid-2005. During project implementation, JICA gave more attention to development of common carp, marble goby, pangasius and tilapia. JICA is continuing the project for another 3 years with FADC Jambi with specific focus on extension.

Other relevant information. Development of the freshwater seed sector is very slow compared to other hatchery business, e.g. marine fish and shrimp. This may be market-related as freshwater fish are particularly intended for the local market and only a small percentage (i.e. tilapia and catfish) is aimed for the export market. Other reasons include the decreasing quality of seed, inbreeding issues which caused slow growth and exporter requirements (e.g. fish size, number of fish, off-flavour, etc.).

Another obstacle to the development of the freshwater aquaculture sector is the non-availability of credit for small-scale farmers. Banks are reluctant to provide loan to small-scale farmers since they require collateral (e.g. land certification) from farmers. Only middle- and large-scale farmers have those documents.

TABLE 7.12.10

Research institutes in the field of freshwater aquaculture

No.	Name	Location
1	Research Institute on Freshwater Aquaculture Sukamandi	Jl. Raya 2, Sukamandi, Subang.
2	Research Institute on Freshwater Aquaculture Palembang	Jl. Beringin 308, Mariana PO. Box 1125, Palembang
3	Research Installation on Freshwater Aquaculture Bogor	Jl. Raya Sempur, Bogor
4	Research Installation on Freshwater Aquaculture Pasar Minggu	Jl. Ragunan PO. Box 20, Ps. Minggu, Jakarta Selatan
5	Research Installation on Freshwater Aquaculture Jatiluhur	Jl. Jatiluhur PO. Box 01 Purwakarta
6	Research Installation on Freshwater Aquaculture Depok	Jl. Perikanan PO. Box 16 Depok
7	Dempond Research Installation Cibalagung	Jl. Banteng Suroso No. 26, Cibalagung, Bogor
9	Dempond Research Installation Cijeruk	Desa Cipulus, Cijeruk, Bogor

TABLE 7.12.11

Universities and other academic institutions with fisheries faculty/department

No.	University	Location
1	Abulyatama University-Faculty of Fisheries	Jl. Biang Bintang Km. 8.5 Banda Aceh - Nanggroe Aceh Darussalam
2	HKBP Nommensen University, Department of Fisheries	Jl. Dr. Soetomo No. 4A Medan 20234 - SUMUT
3	Dharmawangsa University, Faculty of Fisheries	Jl. Yos Sudarso No. 224 Medan - SUMUT
4	Riau University - Faculty of Fisheries	Jl. Bangkinan Km. 12.5 Pekanbaru - RIAU
5	Islam Riau University, Department of Fisheries	Jl. Prof. Muh. Yamin No. 69 Pekanbaru Jl. Kaharuddin Nasution No. 113 Perhentian Maryopan Pekanbaru 28284 - RIAU
6	Bung Hatta University, Faculty of Fisheries	Jl. Sumatera Ulak Karang, Padang 25133 - SUMBAR
7	Muhammadiyah University, Departement of Fisheries - Faculty of Fisheries	Jl. Jend. A. Yani No.13 Ulu Darat, Palembang
8	Batang Hari University, Department of Fisheries	Jl. Letkol. Slamet Riyadi - JAMBI
9	Prof. Dr. Hazairin University,Departement of Fisheries	Jl. Jend. A. Yani No. 01 Bengkulu
10	Fisheries High School (STP) Jakarta	Jl. AUP, Pasar Minggu PO.BOX 7239/7326 JKPSm 12520
11	Satya Negara Indonesia University - Faculty of Fisheries	Jl. Makmur/Arteri, Kebayoran Lama Utara. JKT 12440
12	Bogor Institute (IPB) Faculty of Fisheries	Jl. Rasamala No. 01 Darmaga, Bogor 16680 - JABAR
13	University of Djuanda, Department of Fisheries	Jl. Tol Ciawi, Bogor - JABAR
14	Padjajaran University, Department of Fisheries	Jl. Raya Jatinangor Km. 21 Bandung 45363 - JABAR
15	Gadjah Mada University, Department of Fisheries	Sekip Unit I Yogyakarta 55821
16	Siliwangi University, Department of Fisheries	Kotas Pos 65 Tasikmalaya - JABAR
17	Yogyakarta Fisheries Academy	Jl. Kenari No.65 Muja-muju - Yogyakarta
18	Diponegoro University, Faculty of Fisheries	Jl. Hayam Wuruk No. 4A Semarang - JATENG
19	Fisheries Academy Karya Husada	Jl. Kyai Saleh No.3 Semarang - JATENG
20	Fisheries Academy Kalinyamat	Jl. HMS. No. 1 krian Jepara - JATENG
21	Panca Sakti University, Faculty of Fisheries	Jl Pancasila No. 02 Tegal - JATENG
22	Pekalongan University, Faculty of Fisheries	Jl. Garuda No. 49A Pekalongan Jl. Majapahit No. 16 Pekalongan - JATENG
23	Fisheries Academy PGRI Tuban	Jl. Manunggal No. 61 Tuban - JATIM
24	Fisheries Academy Qomaruddin	Jl. Raya Bungah Gresik - JATIM
25	Muhammadiyah University, Faculty of Fisheries	Jl. KH. Kholil No. 73 Gresik - JATIM
26	Hang Tuah University, Faculty of Fisheries	Jl. Arif Rahman Hakim No. 150 Sukolilo Surabaya 60111 - JATIM
27	Dr. Soetomo University- Department of Fisheries	Jl. Semolowaru Surabaya - JATIM
28	Al Falah University, Faculty of Fisheries	Jl. Taman Mayangkara Surabaya - JATIM
29	Jenggala University, Department of Fisheries	Jl. Sasakandang Sidoarjo 61200 - JATIM
30	Sidoarjo Fisheries Academy	Jl. Raya Sedati Km. 8 Sidoarjo 61200 - JATIM
31	University of Brawijaya, Faculty of Fisheries	Jl. MT. Haryono No. 161 Malang 65100 - JATIM
32	Muhammadiyah University, Department of Fisheries	Jl. Tlogomas Km. 08 Malang 65144 - JATIM
33	High School of Fisheries Science (STIP)	Jl. Cengger Ayam I No. 05 Malang 65100 - JATIM
34	University of 17 August 1945, Departement of Fisheries	Jl. Adi Sucipto No. 26 Banyuwangi 68450 - JATIM
35	Airlangga University, Department of Fisheries	Jl. Airlangga No. 4-5 Surabaya - JATIM
36	University of Marwadewa, Department of Fisheries	Jl. Terompong No. 36 Tanjung Bungak - Denpasar
37	45 Mataram University, Faculty of Fisheries	Jl. A. A. Gede Ngurah Cakranegara, Mataram - NTB
38	University of Nusa Cendana, Department of Fisheries	Jl. Jenderal Soeharto No. 72 Kupang - NTT
39	Veteran University of Ahmad Yani, Department of Fisheries	Jl. A. Yani Km. 32 Loktabat, Banjar Baru 70712 - KALSEL
40	University of Muhammadiyah, Faculty of Fisheries	Jl. KH. Ahmad Dahlan, Walikota Baru Kupang - NTT
41	University of Lambung Mangkurat, Faculty of Fisheries	Jl. A. Yani Km. 36 Banjar Baru 70714 - KALSEL
42	University of Muhammadiyah, Department of Fisheries	Jl. A. Yani No. 111 Pontianak - KALBAR
43	University of Palangkaraya, Faculty of Fisheries	Jl. Yos Sudarso, Tanjung Nyaho Palangkaraya 73114
44	Mulawarman University, Faculty of Fisheries	Jl. Pasir Balengkong PO. BOX 40 Samarinda - KALTIM
45	University of Muslim Indonesia, Faculty of Fisheries	Jl. Urip Sumiharjo Km. 5 Makassar - SULSEL
46	University of Hasanuddin, Faculty of Fisheries	Jl. Perintis Kemerdekaan Km. 10 Makassar - SULSEL
47	45 University of Makassar, Department of Fisheries	Jl. Urip Sumiharjo Km. 4 Makassar - SULSEL
48	Cokroaminoto University, Faculty of Fisheries	Jl. Perintis Kemerdekaan Km. 11 Makassar - SULSEL
49	Politani Negri Pangkep	Mandalle - SULSEL
50	University of Al-Khairaat Palu, Faculty of Fisheries	Jl. Sis Al Jufri No. 44 Kamonji Palu - SULTENG
51	University of Dayanu Ikhsanudin, Faculty of Fisheries	Jl. Yos Sudarso, Bau Bau Buton - SULTRA
52	University of Haluoleo, Department of Fisheries - Faculty of Fisheries	Jl. Malaka, Kampus Baru UNHALU Aduonohu Kendari - SULTRA
53	Sam Ratulangi University, Faculty of Fisheries	Kampus UNSRAT Bahu, Manado 95115 - SULUT
54	University of Pattimura, Faculty of Fisheries	Jl. MR. CHR. SUPLANIT, Poka. Ambon 97100 - MALUKU
55	Khairun University, Faculty of Fisheries	Jl. Bandara Babullah, Akehuda Ternate 97700 - MALUKU UTARA
56	University of Borneo, Faculty of Fisheries	Jl. Jenderal Soedirman No. 85 Kampung Baru Tarakan - KALTIM

FUTURE PROSPECTS AND RECOMMENDATIONS

Exportation of freshwater fish mainly Nile tilapia for 2009 is targeted at 36 000 tonnes (estimated value of US\$144 million) while other species are targeted for local consumption. The target production for 2009 of the main species of freshwater fish and the required supply of seed are presented in Table 7.12.12.

The fish seed requirement to realize the targeted freshwater aquaculture production shows the great opportunity and prospect for the freshwater fish seed industry.

TABLE 7.12.12

Targeted production of the main species of freshwater fish and the required supply of seed for 2009

No.	Species	Production (tonnes)	Seed (million)
1	Common carp	446 000	1 742.5
2	Nile tilapia	195 000	760.5
3	Walking catfish	175 000	622.2
4	Gouramy	45 000	150.0
5	Siamese catfish	36 500	121.7
	Total	717 500	3 396.9

