



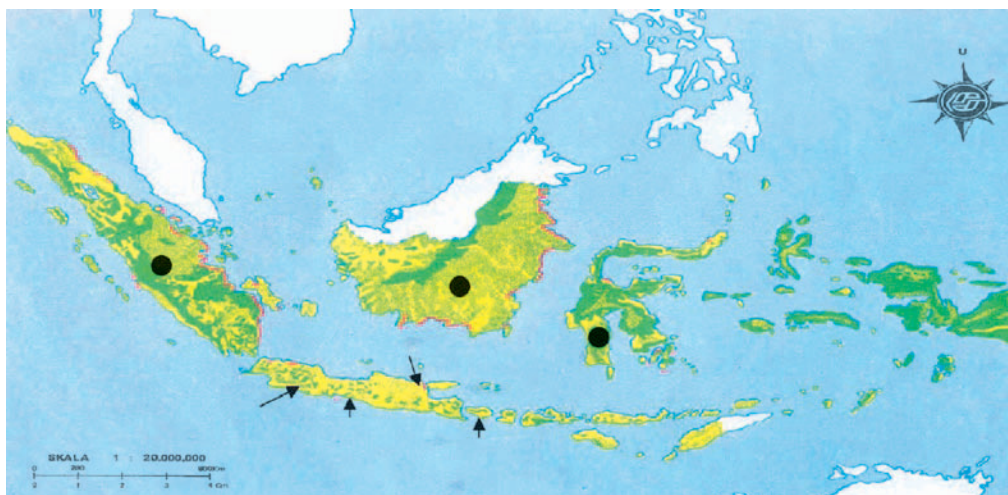
GIANT FRESHWATER PRAWN CULTURE IN INDONESIA



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INTRODUCTION

Indonesia is one of the countries that have high levels of biological diversity in terms of freshwater fishes, the country's rich biological resources, characterized by a high level of endemism. About 30 endemic species of freshwater fishes are found in Sumatera, 149 species in Kalimantan, 12 species in Java, and 52 species in Sulawesi (Anonym, 1994; Kottelat et al., 1993). The country's total freshwater area is 55 million ha consisting of lakes, dams, swamps and other water bodies. The potential area for freshwater pond fish culture is estimated at 233,124 ha with a production of 334,085 mt/year (DGF, Indonesia, 2001), of which about 5140 mt comprises the giant freshwater prawn.



Distribution of the giant freshwater prawn in Indonesia

Recently, the giant freshwater prawn has been considered an important commodity that is successfully cultured in Indonesia. Freshwater prawn culture has been developed in several areas of West Java, i.e., in Ciamis (Tambaksari, Pamarican and Kalipucang) and Tasikmalaya. Commercial hatcheries are mostly found in Jogjakarta area with the Government operating one hatchery while the private sector operates at least seven hatcheries. In East Java, freshwater prawn culture is conducted in brackish water ponds. The development of the freshwater prawn culture has also spread to Bali Island, e.g., in Gianyar, Klungkung, Buleleng and Tabanan.

Freshwater prawn population in Indonesia is unique and its geographical distribution is in almost all islands. Indonesia is recognized as the center of origin from freshwater prawn because of about 19 species still existing until now (Holthuis, 1980). However, the potential genetic resource is not yet fully utilized in freshwater prawn culture. Further, despite the advanced development of freshwater prawn culture in Indonesia, some problems have been found, e.g., declining growth rate, diseases and the edible portion getting smaller. In recent years, the Government of Indonesia stressed its focus on the increased production of the freshwater prawn. One of the ways being promoted to achieve increased production is through a genetic improvement program. Thus, in 2001, a certain race of



freshwater prawn has been released and developed for culture by the country's fish farmers. This strain is the GI Macro or the Genetically Improved *Macrobrachium rosenbergii*.

PRESENT STATUS OF FRESHWATER PRAWN CULTURE IN INDONESIA

The potential area for giant freshwater prawn culture consists of freshwater ponds, paddy-ponds and brackishwater ponds. About 10,000 ha of the potential areas are found in Bali, 2500 ha in West Java, 2200 ha in Central Java, and 21,000 ha in East Java.

Since 1990 there has been an indication of a decreasing production of giant freshwater prawn caught from the natural waters. This phenomenon happens in some areas in West Java and Sumatera. This situation led to the promotion of freshwater prawn culture from Jogjakarta (Central Java) and in Lamongan (East Java). In Bali Island, freshwater prawn culture is well developed since 1997 because of its increasing demand. The estimated consumption of freshwater prawn is about 700 kg/day at the price of US\$ 4.00 to US\$10.00/kg (before the Bali blast).

Freshwater prawn is cultured in Indonesia using the traditional and semi intensive systems in mono- or polyculture with common carp, tilapia, milkfish and Puntius. The ponds used are relatively small about 200 m²/pond. Recently, freshwater prawn culture involves rearing the fry (PL 25-40) for two months, followed by the selection of uniform sized prawn and then rearing the prawn separately by size at a stocking density of 10 fry/m². Production using this scheme is about 300 kg/year (polyculture) and 600 kg/year (from monoculture) with an average size of 30 g/pc.

In order to meet the demand for freshwater prawn fry, hatcheries have been developed in Jogjakarta, West Java and in Bali. The fry needed by farmers in Gianyar-Bali estimated at about 24 million/year, is partly supplied from hatcheries in Jogjakarta and East Java. The price of fry is US\$0.60-0.70/pc for PL 25-40. The production capacity of hatcheries in Bali is about 7 million fry/year, about 300,000 fry/year in West Java, and 11 million fry/year in Jogjakarta.

Freshwater prawn culture in Indonesia is doing very well utilizing the shrimp ponds that have not been used because of the shrimp culture devastation due to the shrimp virus problems. Efforts to recover the tiger shrimp production have not gone far, thus, freshwater prawn culture has become an alternative industry especially in shrimp ponds that are no longer used. For this purpose, a strain of freshwater prawn with high tolerance for salinity is being developed. Further, standardization of seed quality produced from hatcheries is required to guarantee good quality seeds that are distributed to farmers. The country's criteria of good quality seed include fast growing, high tolerance for salinity, and bigger edible portion.

IMPROVEMENT OF THE FRESHWATER PRAWN PROGRAM

It is recognized that the quality of the county's freshwater prawn is genetically deteriorating. As experienced recently, it has been difficult to produce female prawn at a size of 50 g/pc (export size) because the survival rate is very low. Moreover, to produce male prawn until the size of 50 g/pc, the survival rate is only less than 40% in 9-11 months of culture. Since 1996, the Research Institute for Freshwater Aquaculture (RIFA formerly RIFF) has implemented a number of programs with the main objective of improving the growth rate and increasing the edible portion of the prawn. The improvement program includes the following activities:



Breeding Program

Selective breeding program has been conducted to improve the freshwater prawn from synthetic population gathered from numerous breeders collected from the natural waters of Tanjung Air (Bekasi), Kalipucang (Ciamis) and Musi (Palembang). Subpopulation from Tanjung Air was collected in February 1995 with an average body weight of 70 g/pc. Individual selection is applied to this subpopulation to improve the edible portion trait.

The subpopulation from Kalipucang was collected in June 1996 with an average weight of 72 g/pc. Index selection was used in this population to improve the growth rate and edible portion traits. After two steps selection, the synthetic population was constructed from these two subpopulations and added to the subpopulation from Musi (average body weight of 75 g/pc collected in May 1997). Family selection was applied to the synthetic population on the traits of growth rate and edible portion (24 families). The result obtained after the fourth generation of freshwater prawn is shown in Table 1.

Table 1. Results after the fourth generation of freshwater prawn developed at RIFA

No.	Character	Value
1	Heritability of edible portion (h^2_{ep})	0.56 (<i>SE: 0.07</i>)
2	Heritability of body weight (h^2_{bw})	0.84 (<i>0.02</i>)
3	Inbreeding rate (F)	0.0091
4	Total length of male (cm)	21.53 (5.45)
	Total length of female (cm)	15.02 (3.19)
5	Percentage of carapace (male)	30.45 (5.86)
	Percentage of carapace (female)	32.68 (8.05)
6	Hatching rate (%)	65.27-80.0
7	Survival rate (% per 4 months)	46.3-53.1

This year, RIFA obtained the second generation of GI Macro that has salinity tolerance of up to 15 ppt but this strain is still under observation. The GI Macro developed at RIFA are shown in Figures 1 and 2.

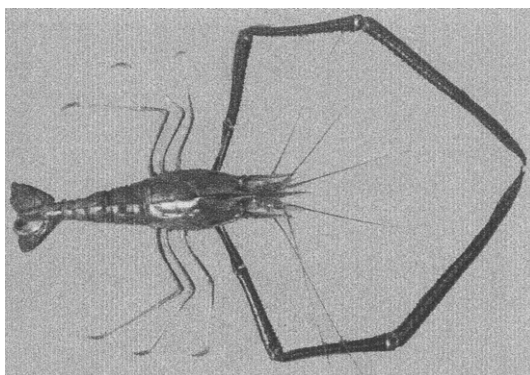


Figure 1. Grandparent stock of freshwater prawn, GI Macro; total length: 38.0 cm and body weight: 480 g

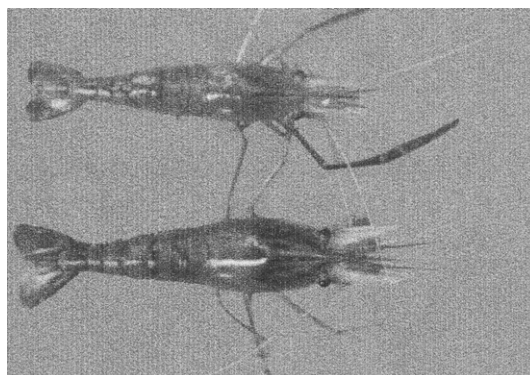


Figure 2. Improved prawn (below) and control-farmer strain (above) after 5 months rearing period



Other Research Activities on the Freshwater Prawn

1. Application of molecular marker

The application of DNA markers has been tested to characterize a number of natural stocks of freshwater prawn collected since 2002. The genetic variability of freshwater prawn collected from Musi, Barito and GI Macro races were examined using polymorphism of the mitochondria DNA (MtDNA) markers. Six composite haplotypes were detected following digestion of CO-1 sequences with four endonucleases: Rsa I, Hae III, MhoI and MspI. The average haplotype diversity was 0.603. Significant genetic difference was observed among freshwater prawn populations. The biggest proportion of the major composite haplotype was in the GI Macro, which came from Citatum and Citanduy. While freshwater prawn of Musi has contributed to the composite haplotype of GI Macro with frequency of 25%, Barito races have good prospects as genetic resource for breeding programs. An example of the restriction patterns is shown in Figure 3.

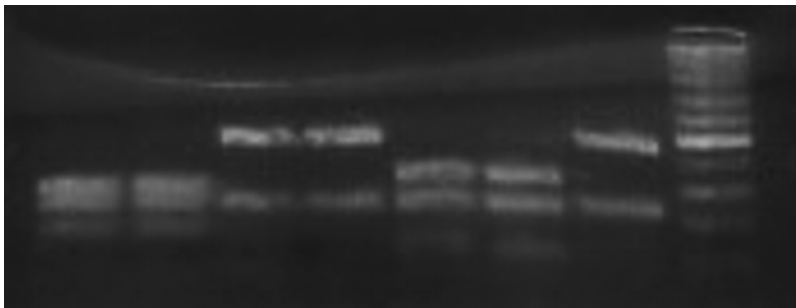


Figure 3. Mitochondria CO-1 region of freshwater prawn digested by Hae III endonuclease (the arrow indicated 500 bp in length)

2. Application of hormone for sex reversal

Male freshwater prawns are bigger in size than the female ones. An alternative to produce all male freshwater prawn in mass scale is done by obtaining female stock that are genetically male or homogamete female. When the homogamete female mates the normal male, the result is a 100% male phenotype. This research is still ongoing with initial results expected to come out before the end of 2003.

3. Culture technology: closed re-circulation system for larval rearing and nursery

The larval rearing system used is re-circulation with biofilter, ozone addition and UV radiation. This system is intended to supply good quality of water for larval rearing and nursery. The PL 25-40 produced using this system, are now being cultured in ponds.

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