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REPORT OF THE ROUND TABLE DISCUSSION ON THE DEVELOPMENT OF GENETICALLY IMPROVED STRAIN OF MACROBRACHIUM

**Freshwater Aquaculture Development Center
Sukabumi, West Java, Indonesia
16-19 November 2003**

INTRODUCTION

As a follow-up of the outcome of the ASEAN-SEAFDEC Conference on Sustainable Fisheries in the Third Millennium: Fish for the People in Bangkok, Thailand in November 2001, SEAFDEC implements the ASEAN-SEAFDEC Special Five-year Program on the Contribution of Sustainable Fisheries to Food Security in the ASEAN Region. The Aquaculture Component of this Special Five-Year Program is the Integrated Regional Aquaculture Program (IRAP) with AQD as the Lead Department.

IRAP has two components, SDII-1: Aquaculture for Rural Development; and SDII-2: Supply of Good Quality Seeds. Vietnam has been identified as the ASEAN Lead Country for SDII-1, while Indonesia is the ASEAN Lead Country for SDII-2. The ASEAN-SEAFDEC member countries are the participating and beneficiary countries of the Program.

IRAP aims to: (1) assure a supply of quality seed stocks of various aquatic commodities; (2) promote environment-friendly aquaculture; and (3) assure that the development of aquaculture will benefit the rural populace through consultation, demonstration and dissemination of specific aquaculture technologies. IRAP also intends to launch an information dissemination campaign to make the people of the region aware of the tremendous potential that aquaculture can offer to produce low-cost protein and generate livelihood opportunities for the rural poor.

SDII-1 (Aquaculture for Rural Development) is expected to come up with appropriate responsible aquaculture technologies that will help alleviate poverty and ensure food security for peoples in the rural areas of the ASEAN region. Specifically, SDII-1 aims to: (1) verify aquaculture technologies for appropriate species in various ecosystems; and (2) disseminate the aquaculture technologies to small-scale fish farmers.

SDII-2 (Supply of Good Quality Seeds) is expected to come up with appropriate and responsible seed production technologies in support of the aquaculture and stock enhancement programs in the ASEAN region, and eventually contribute to food security and sustainable development of the fisheries sector in the region. The specific objectives of SDII-2 are to: (1) verify and demonstrate appropriate seed production technologies of target species; (2) verify on-farm broodstock management techniques; and (3) disseminate seed production technology to fish farmers.

Under IRAP technologies developed by some institutions in the region especially on hatchery rearing may be refined for adoption by certain countries. Since a common problem in aquaculture is feeds and feeding management, some studies on environment-friendly and low-cost feed formulations are also conducted. Testing of low-cost feeds based on formulations already developed by AQD is done in conjunction with the activities on pilot demonstration and verification.



Moreover, during the IRAP Seminar-Workshop held in Bangkok, Thailand in September 2002, three countries proposed to conduct genetic improvement of *M. rosenbergii*. Thus, it was decided that the resources and expertise from these countries would be pooled to develop a collaborative research on the genetic improvement and seed production of *M. rosenbergii*.

Such common species with the required technology, identified by three countries as part of their activities for pilot demonstration and verification under the project on Supply of Good Quality Seeds of the IRAP, would be the subject of a collaborative research. Based on the required technology identified, the collaborative research on the Genetic Improvement and Seed Production of *Macrobrachium rosenbergii* would be conducted as part of IRAP with Indonesia, Philippines and Thailand as the participating countries.

In order to optimize resources, the collaborative research work would be conducted on *M. rosenbergii* with closely related activities in these countries. For the planning of the detailed activities of the collaborative research as well as for the delineation of the role and coverage of each participating country, the round table discussion was convened at the Freshwater Aquaculture Development Center of the Balai Budidaya Air Tawar (BBAT) in Sukabumi, West Java, Indonesia from 17 to 19 November 2003.

OBJECTIVES

The objectives of the Round Table Discussion were:

1. To adopt common criteria for “good quality *Macrobrachium* seed”;
2. To standardize methodology and approach in developing a genetically improved strain of *Macrobrachium* among the participating countries;
3. To formulate definite work plan for the remaining two years or so of the project; and
4. To agree on mechanics for the sharing of results and genetic materials in *Macrobrachium*.

AGENDA

The agenda adopted for the Round Table Discussion were:

1. Election of Chairperson of the Round Table Discussion
2. Criteria for Good Quality *Macrobrachium*
3. Work Plan (including specific activities for each participating country)
4. Time Table and Persons Involved
5. Adoption of Recommendations and Output of the Discussion
6. Other Matters

ROUND TABLE DISCUSSION PARTICIPANTS

The Round Table Discussion was participated in by representatives from the three collaborating countries: Indonesia, the Philippines, and Thailand. Observers from the Directorate General of Aquaculture based in Jakarta, Indonesia as well as technical staff of the BBAT-Sukabumi also attended the Round Table Discussion. The representative from Indonesia, *Dr. Ketut Sugama*, was elected Chairperson of the Round Table Discussion.



COUNTRY PAPERS

Country representatives from Indonesia, the Philippines and Thailand presented country papers that contained the following information:

- Brief status of industry: quantity and value of production, area devoted to *Macrobrachium*, typical stocking density, yields and average body weight (ABW) at harvest, comparison with past results if any even if anecdotal, future plan and prospects,
- *Macrobrachium* seed quality in commercial hatcheries
- Present country definition of good quality seed
- Strains or Families of *Macrobrachium* that have been identified in the country
- Status of existing R & D effort on seed quality improvement.



Venue of the November 2003 Round Table Discussion on Genetically Improved Strain of *Macrobrachium*: Freshwater Aquaculture Development Center, BBAT, Sukabumi, West Java, Indonesia





MACROBRACHIUM AQUACULTURE IN PARTICIPATING COUNTRIES



Indonesia

The giant freshwater prawn (*Macrobrachium rosenbergii*) is cultured in Indonesia mainly in the island of Bali as well as in East and West Java, where more than 50,000 ha is used for its culture. The culture system is traditional and semi-intensive either mono- or polyculture with common carp, tilapia, milkfish and *Puntius*. Prawn production using the monoculture system averaged at 600 kg/ha/year and 300/ha/year for the polyculture. The giant freshwater prawn is cultured in freshwater ponds or paddy-cum-ponds, except in East Java where the prawn is cultured in brackishwater ponds.



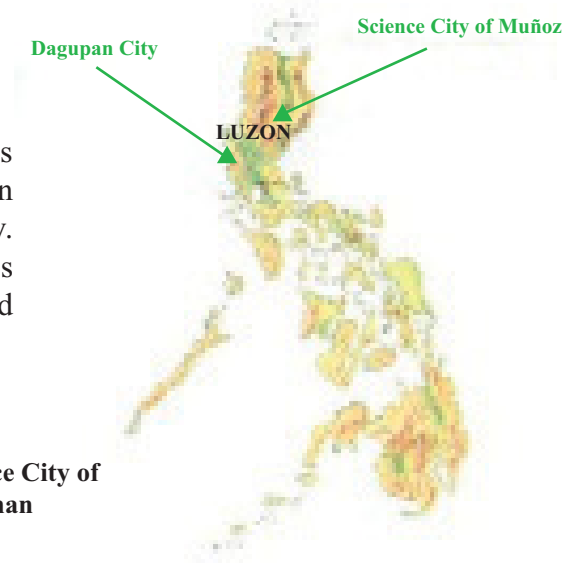
Freshwater prawn pond in Sukabumi, Indonesia (left) visited by Round Table Discussion Participants (right)

The Directorate General of Aquaculture through its facilities at the Research Institute for Freshwater Aquaculture has been conducting studies to improve the quality of the freshwater prawn, which was observed to be genetically deteriorating. A selective prawn breeding program has been implemented in order to improve production. This activity led to the development of an improved strain identified as the GI Macro or Genetically-Improved *Macrobrachium*. The culture of this improved prawn strain is now being adopted by some fish farmers in selected areas of the country.

However, there is still a need to further improve the production of the freshwater prawn and to develop a strain with high tolerance for salinity. The latter is aimed at culturing prawn in shrimp ponds that have not been used since the devastation of the country's shrimp culture industry due to shrimp disease problems. The culture of freshwater prawn is identified as Indonesia's alternative to the shrimp culture industry.

Philippines

Culture of the giant freshwater prawn in the Philippines actually started in the early 1900s when it was then considered an important industry of the country. However, its culture was not sustained until the 80s when it was revived but again eventually abandoned due to certain product diversification.



Map of the Philippines (right) showing the Science City of Muñoz, Nueva Ecija and Dagupan City, Pangasinan



In early 2000, the Bureau of Fisheries and Aquatic Resources (BFAR) through its National Freshwater Fisheries Technology Center (NFFTC) in Muñoz, Nueva Ecija and the National Integrated Fisheries Technology Development Center (NIFTDC) in Dagupan City embarked on a semi-commercial production of the giant freshwater prawn, *Macrobrachium rosenbergii*.

The NFFTC and NIFTDC are conducting research studies that would lead to the production of quality prawn seeds for distribution to fish farmers in the country. These two centers are now commercializing a sustainable freshwater prawn aquaculture throughout the Philippines.

At present, the freshwater prawn culture industry in the Philippines is still in its development stage. In order to hasten the adoption of the culture technology by the fish farmers, it is important that production of the prawn on commercial scale be verified. Efforts are now being done by BFAR to convince the fish farmers to adopt the species as an aquaculture commodity with economic importance.

Thailand

The giant freshwater prawn is one of the most important economic aquaculture species in Thailand. Its culture is well-developed with production steadily increasing during the past five years at about 10,000 mt/year. Through the Department of Fisheries (DOF), rearing systems have been developed producing good quality seeds for the farmers. This means that the seeds being distributed have high survival rate and are fast growing.

However, a number of problems have beset the giant freshwater prawn culture industry in Thailand. These include: slow growth, lack of appropriate broodstock management, and the occurrence of some diseases.

Thailand is also establishing good production procedures for the prawn from the farm to the table. It is now developing the Code of Conduct similar to that developed for the marine shrimp aquaculture. Thailand has also embarked on a number of R&D activities aimed at improving the quality of the prawn. These activities include selective breeding programs and the development of biotechnological approaches to genetic improvement.

RECOMMENDATIONS

In the ensuing discussions, the participants in the Round Table Discussion agreed on the specific activities that would be implemented in the participating countries for the improvement of the giant freshwater prawn. Specifically, the following recommendations were agreed upon:

Selective Breeding

- Each country will develop its own appropriate selective breeding protocols, without duplicating but instead complementing each other.
- Thailand shall continue within family selection but would also develop mass selection procedures for farmers.
- Indonesia to continue family selection combined with hybridization
- Philippines to design a within family selection with rotational mating at the BFAR-NFFTC in the Science City of Muñoz, while a modified mass selection with collimation and rotational mating will be developed at the BFAR-NIFTDC in Dagupan City. Selective breeding protocols would be designed after the completion of the population genetic studies.



Population Genetics

- Philippines should start the characterization of local strains of *Macrobrachium* using molecular genetic techniques and morphological and morphometric measurements, in view of the very significant findings of other researchers (Mather, personal communication; Sudsok, personal communications) that the subspecies *Macrobrachium rosenbergii* is found only in the Philippines with possible affiliation with Australia.
- The Philippine *Macrobrachium rosenbergii* is different from that of Thailand, Indonesia and Borneo. Thus, it is urgent to study the genetic structure of this very important resources.

Transfer of Macrobrachium Stock

- Due to the fact that the Philippine stock of *Macrobrachium* is genetically different from that of the rest of Southeast Asia, there is a need to adopt much greater precaution in the transfer of *Macrobrachium rosenbergii* from Thailand and the rest of Southeast Asia to the Philippines in order to avoid genetic introgression of the Philippine strain of *Macrobrachium*.
- The same precaution should also be observed in the transfer of *Macrobrachium* stock from the Philippines to the rest of Southeast Asia.

Strain Evaluation in Different Environments

- Adopt similar protocol as the GIFT tilapia but with caution because *Macrobrachium* is a crustacean and is very different from tilapia.

Estimates of Heritabilities

- There is an urgent need to design a proper experiment to estimate heritabilities of traits under selection.

Control

- It is important to develop a proper control line in order to really measure the genetic gains after selection.

Criteria for Quality Seeds

- As a short-term output while genetic improvement is ongoing, it is essential to establish criteria for good quality seeds in order to guide farmers when purchasing seeds. In this regard, the short paper by Dr. Melchor Tayamen shall serve as a guide.

Deadline for Detailed Proposal

- Deadline for the submission of detailed proposals by participating countries is on 15 December 2003.

Venue of Next Round Table Discussion

- The proposed venue for the next Round Table Discussion is the Philippines tentatively before or after ISTA VI, which will be held in the Philippines in September 2004.



FIELD TRIP

In order to be able to obtain a first hand information on the status of the giant freshwater prawn aquaculture in Indonesia, field trips were conducted for the Round Table Discussion participants to the Pelabuhan Ratu Macrobrachium Hatchery of the Directorate General of Aquaculture in West Java, the *M. rosenbergii* ponds also in West Java, and the Fresh Fish Market in Sukabumi.



The Government Macrobrachium Hatchery (above) in Pelabuhan Ratu, West Java, Indonesia



Freshwater prawn-fish polyculture pond (left) and prawn monoculture pond (right) in Indonesia



Freshwater fish trading (above) at the Fresh Fish Market in Sukabumi, West Java, Indonesia



WORK PLAN

The work plan of the collaborative research on the genetic improvement of *M. rosenbergii* for each participating country to undertake as contained in the proposals submitted by the country representatives and agreed upon during the Round Table Discussion, is summarized as follows:

Indonesia: Production of high quality seeds and broodstock

- Broodstock collection
- Characterization using molecular starter
- Development of a sustainable tagging system
- Development of breeding and larval rearing
- Development of nursery for post-larvae and grow-out for juveniles
- Development of selection techniques and conduct of multiple location testing

The activities in Indonesia will be conducted in Sukabumi and Sukamandi, West Java, Indonesia.

Philippines: Genetic characterization, domestication and genetic improvement

- Determining the genetic diversity of wild and farmed stocks
- Developing a sound broodstock management and selective breeding methods
- Production of quality *M. rosenbergii* seedstock for rural aquaculture

The activities in the Philippines will be conducted at BFAR-NFFTC, BFAR-NIFTDC and at SEAFDEC Aquaculture Department's Binangonan Freshwater Station.

Thailand: Selective breeding program for genetic improvement

- Evaluation of the economic traits performance and genetic variation of the various crosses of *M. rosenbergii*
- Improvement of the economic traits of the best cross
- Conduct of PCR conditional optimization and primer testing of microsatellite markers
- Application of polymorphism system of the molecular markers

The activities in Thailand will be conducted at the Aquatic Animal Genetics Research and Development Institute in Pathum Thani.

The abovementioned work plan is derived from the summary proposals submitted by the representatives from each participating country, which are also included in the later part of this Report.