

use functions to include *ulang* seed production; (4) promotion and/or dispersal of *ulang* postlarvae throughout the country; (5) establishment of pilot techno-demo farms in collaboration with private cooperators, local government units and the academe; (6) awareness creation on the part of the fisherfolk and/or entrepreneurs on the potentials of *ulang* culture; (7) development of a code of conduct for sustainable *ulang* production; (8) refinement of the rice-prawn technology and promotion of the technology throughout the country; and (9) intensive nationwide information dissemination campaign on the economics of *ulang* aquaculture. With inputs coming from the IRAP collaborative research, the Philippines is assured of the sustainability of prawn aquaculture in the country.

Hatchery and Pond Culture of *Macrobrachium rosenbergii* in Northern Mindanao

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The history and status of hatchery and grow-out culture of *Macrobrachium rosenbergii* is not based on a study nor a survey. Rather, it was derived mainly from his on-the-job experience and information gathered during visits of culture sites or shared by other workers in the culture of freshwater prawn in Northern Mindanao. Thus, the background information may not be as complete as it should be.

The history of *M. rosenbergii* hatchery operations in Northern Mindanao can be traced from minor or side activities in different locations by several institutions. Earlier attempts to produce postlarvae of *M. rosenbergii* in hatcheries by MSU faculty/researchers were conducted in the school laboratory hatchery of the College of Fisheries in MSU Marawi City and in the commercial hatchery facilities for *sugpo*, *Penaeus monodon*, at MSU Naawan.

At the MSU Marawi College of Fisheries, a faculty member led his group to initiate hatchery production of *M. rosenbergii* fry in the 1970s. The breeders were collected live from Kapay near Marawi City. Kapay is more than a thousand feet above sea level, and 30 m away from the oceanic waters of Iligan Bay. The larvae that were hatched were reared in freshwater and died after a week or so. A second and last batch of breeders collected from the same site hatched their eggs and the larvae were reared in brackishwater medium. The larvae survived a few days more than the first, yet they did not attain postlarval stage when mass mortality occurred.

In Naawan, a series of trials on the larval rearing of freshwater prawn in the late 1970s and early 1980s was part of a project that mainly included a study on the biology and ecology of the species in two prawn grounds in the municipalities of Tambulig and Siay, Zamboanga del Sur. The natural habitat of *M. rosenbergii* in Tambulig is located in the innermost portion of Panguil Bay in Northwestern Mindanao. On the other hand, the prawn habitat in Siay is in Sebuguey River that empties into Illana Bay facing the Celebes Sea.

Live berried females from the two study sites mentioned were transported to Naawan and held in wooden tanks until the eggs were hatched. The larvae were reared in brackish and green water medium and fed *Brachionus*, *Artemia*, and strained fish flesh throughout the rearing period. Unfortunately, not a single larval rearing trial was successful.

Hatchery trials to culture freshwater prawn postlarvae were also conducted by a faculty member in 1994 at the Multispecies Hatchery of the Dipolog School of Fisheries in Zamboanga del Norte. A few postlarvae were produced in about a year, but the school administration decided to discontinue this activity.

Present Status of Hatchery and Pond Culture

In March 2004, eggs of some *M. rosenbergii* breeders from the Misamis Occidental Aquamarine



Park (MOAP) in Sinacaban, Misamis Occidental were hatched at the Naawan Sugpo Hatchery. We were informed by the MOAP personnel that the breeders were actually transported as postlarvae from the BFAR-National Freshwater Fisheries Technology Center, Nueva Ecija (BFAR-NFFTC) and grown to mature stage in the earthen ponds of MOAP.

The newly hatched larvae from MOAP breeders were successfully reared to metamorphose (40,000+ pcs of postlarvae) in brackishwater medium containing *Tetraselmis*. The larvae were fed *Artemia* nauplii and strained fish flesh in the early stages until postlarvae. The larvae at the late zoeal stages and postlarvae were also given marine polychaete, *Pereneries* sp. and local earthworm. Many of the first batch of hatchery-produced prawn fry from MSU Naawan were stocked in MOAP pond (17,000 pc) and in a privately owned pond in Valencia, Bukidnon pond (16, 0000 pc). The remaining prawn fry were held in a glass aquarium for observation at MSU Naawan.

The production of prawn fry at MSU Naawan Hatchery is continuing. At present there are four batches of larvae at different stages. As of 12 September 2004, the oldest batch is 5 days old from metamorphosis (PL5) and the youngest batch is 3 days old zoea.

There are at present, four hatchery facilities in Northern Mindanao that have continuing hatchery activities; two are established along the shoreline of Iligan Bay, the others are located in landlocked provinces (Table 1). These prawn hatcheries are producing prawn seedlings but production data are not available except for MSU Naawan and BFAR Kisolon (Table 2).

The initial breeders used in the hatchery production of *M. rosenbergii* postlarvae in BFAR Kisolon, MOAP, and MSU Naawan were postlarvae from domesticated stock at BFAR-National Freshwater Fisheries Technology Center in Nueva Ecija and grown to sexually mature stage in Northern Mindanao ponds. But an additional one hundred egg-bearing breeders were provided free of charge for MSU Naawan by *Dr. Melchor Tayamen*, the Chief of BFAR-NFFTC. These breeders were transported directly from BFAR-NFFTC on 24 July 2004.

Last 16 July 2004 three berried females from the wild prawn population in Panguil Bay were transported to MSU Naawan. Two of our current batches of larvae that are expected to metamorphose to postlarvae before the end of September were hatched from eggs of these Panguil Bay breeders. Aside from the Panguil Bay, other sources of wild stock breeders could be the Illana Bay, Mandulog River in Iligan City, Kapay in Marawi City, Macajalar Bay and Cagayan River in Cagayan de Oro City, Odiongan River in Gingoog City, and Tagoloan River in Tagoloan, Misamis Oriental.

There are many sources of prawn breeders from the wild for the other three existing hatcheries in Northern Mindanao. The MOAP hatchery in Sinacaban can tap the wild stock of giant prawns from the western side of Mindanao such as those reported in Plaridel, Misamis Occidental; and the Katipunan River in Dipolog, Zamboanga del Norte. For BFAR Kisolon Hatchery, the possible sources are the Pulangi River, Rio Grande de Mindanao and the major river tributaries of Davao Gulf such as the Tagum-Libuganon, Davao, Tuganay, Padada-Guihing, and Lasang Rivers. In the CARAGA region where the LGU Freshwater Prawn Hatchery of Prosperidad is located, the known sites of giant prawn habitats and sources of breeders are the rivers in Surigao del Norte, Surigao del Sur, along the bank of upper Agusan River in sitio of Maguinda, and the river mouth of Agusan River near Sitio Magallanes in Butuan Bay.

The culture of *M. rosenbergii* to marketable size is in the early stages of development and the culture system is confined only to small-size earthen ponds (200 m² - 500 m²).

Historically, the first and only attempt to culture the giant prawn in ponds in 1980s in Northern Mindanao, was conducted by MSU Naawan using the freshwater tilapia fishpond of Buruun National

School of Fisheries in Iligan City. The few hundred seed stocks obtained from the Tambulig wild population were 7-10 cm long prawn juveniles. Fed chicken pellets, the prawns attained marketable size (30-60 g) in five months and some females were egg-bearing upon harvest.

The postlarvae from BFAR-NFFTC that were distributed for stocking in BFAR Kisolon, Bukidnon and MOAP, Sinacaban ponds were fed fish pellets. Accordingly, berried females were observed beginning on the 6th month from stocking. The prawn fry from MSU Naawan and stocked in MOAP fishpond were also fed fish pellets. In Valencia, Bukidnon, the MSU prawn fry (more than one month old) stocked in Mr. Benauro's fishpond on 6 May 2004 were fed a variety of feeds that included spoiled *balut pinoy*, rotten fish from commercial fish dealers, and farmed earth worm, African night crawlers. Last September, 41 pcs of berried females and 26 pc of mature males were collected from Mr. Benauro's pond and transported to MSU Naawan. Four of the berried females have already hatched their eggs and the larvae are being reared in 200 L glass aquaria.

Potentials for Development

The demand for prawn fry has steadily increased after its first production at MSU Naawan. The 3,000 pc of prawn postlarvae available at present are scheduled for stocking in landlocked areas of Northern Mindanao; 1,000 pc is booked for a private fishpond owner in Quezon, Bukidnon; the 2,000 pc for the DENR X livelihood program in Baongon, Cagayan de Oro City. The remaining standing orders for prawn postlarvae for September to October 2004 are as follows:

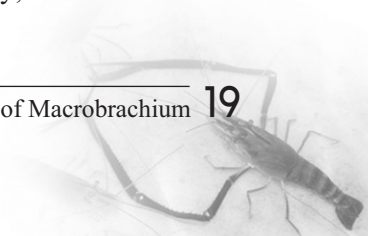
- Municipal LGUs of Bukidnon 50,000 pc for demonstration earthen ponds
- Mr. Benauro, Bukidnon 20,000 pc for backyard earthen ponds
- Mr. Ang, Iligan City 5,000 pc for intensive culture in a concrete pond
- Mr. Castillo, Cotabato 20,000 pc commercial earthen ponds

The potential for expansion of hatchery production of prawn fry in Northern Mindanao is too early to determine. But judging from the current plight of tiger shrimp culture industry and the number of fish and shrimp hatchery owners who inquire about the prospects of freshwater prawn culture, the potential could be greater than expected.

For MSU Naawan, the potential in the capacity for several folds increase in fry production will be bolstered with the transfer of management of the modern facility of the Southern Philippines Development Authority (SPDA) Hatchery to MSU Naawan. The SPDA hatchery is established inside the MSU Naawan Campus through a Memorandum of Agreement (MOA). Under this MOA the SPDA Office will turnover the facilities to MSU Naawan in October 2005.

The culture of giant prawn to marketable size in fishponds is a new aquaculture development in Northern Mindanao. It was probably partly popularized recently by the '*Palay-Ulangan*' Program of the Philippine Government. This program was targeting the vast tracts of rice fields in Northern Mindanao as new sites for raising freshwater prawns. But to date, other freshwater resources such as numerous springs, natural and manmade dams, finfish ponds that are readily convertible to prawn ponds, etc., are being eyed for prawn aquaculture. MSU Naawan has also considered the following as potential sites for expanding prawn culture activities in Northern Mindanao:

1. Privately owned idle lands close to water sources in Bukidnon, Misamis Occidental, Zamboanga, Agusan and Surigao;
2. The fishpond facilities of Iligan City National School of Fisheries in Buruun, Iligan City;
3. The springs in Linamon, Lanao del Norte through the LGU;
4. Abandoned concrete pools inside the compound of an industrial plant in Iligan City; and



5. Underutilized areas inside a privately-owned Piggery in Iligan City

Suggestions for Future R&D Activities

Many potential investors who visited MSU Naawan and expressed interest to venture into freshwater prawn culture have inquired if MSU Naawan can do something to reduce the head-body ratio of the freshwater prawn, to reduce the enormous size of the male claws, to produce all male prawn fry, and to delay the spawning of young female prawns. Their contention is that an improvement along these characteristics would make the freshwater prawn more attractive as an aquaculture species for Northern Mindanao. This inquiry is clearly suggestive of researches that are within the realm of aqua-biotechnology.

Table 1. *List of Existing Macrobrachium Hatcheries Located in Northern Mindanao*

Name of Hatchery	Agency	Location	Distance from Nearest Seawater Source
MSU Naawan Multispecies Hatchery Complex	Mindanao State University at Naawan	Naawan, Misamis Oriental	Few meters
Kisolon BFAR Freshwater Fish Hatchery	BFAR X	Kisolon Freshwater Fish Hatchery and Training Center, Bukidnon	About 60 km
Misamis Occidental Aquamarine Park(MOAP) Hatchery	Misamis Occidental Provincial Government	MOAP, Sinacaban, Misamis Occidental	Few meters
LGU Prosperidad Hatchery	Agusan del Sur Provincial Government	Prosperidad, Agusan del Sur	About 80 km

Table 2. *Some Data on the Operation of Macrobrachium Hatcheries in Northern Mindanao*

Name of Hatchery	Start of Operation	Source (s) of Breeders*	PL Production from start to present
MSU Naawan Hatchery	February 2004	MOAP Fishpond in Misamis Occidental; BFAR-National Fisheries Technology Center, Nueva Ecija; Private Fishpond in Valencia, Bukidnon; Panguil Bay	About 70,000
Kisolon BFAR Hatchery	2003	BFAR-National Fisheries Technology Center, Nueva Ecija	A few thousand postlarvae
MOAP Hatchery	2003	BFAR-National Fisheries Technology Center, Nueva Ecija (Through BFAR X)	No data
LGU Prosperidad Hatchery	2003	Agusan River	No data

Table 3: *Some Data on the Culture of Macrobrachium in Northern Mindanao Fishponds*

Pond Owner	Location of fishpond	Seedling Source/ Date of Stocking	Status
BFAR X	Kisolon Freshwater Fish Hatchery and Training Center, Bukidnon	BFAR-National Fisheries Technology Center, Nueva Ecija/ Later part of 2003	The stock has grown to sexually mature adult and is the source of breeders for hatchery operation in Bukidnon BFAR Training Center
Misamis Occidental Aquamarine Park(MOAP)	Inside the Park	BFAR-National Fisheries Technology Center, Nueva Ecija and MSU Naawan Hatchery/ Later part of 2003	The stock has grown to sexually mature adult and is the source of breeders for hatchery operation in Bukidnon BFAR Training Center
	San Fernando, Bukidnon	BFAR-National Fisheries Technology Center, Nueva Ecija/ Later part of 2003	No data
Mr. Benauro	Valencia, Bukidnon	BFAR-National Fisheries Technology Center, Nueva Ecija and MSU Naawan Hatchery/ Later part of 2003	The stock has grown to sexually mature adult and is the source of breeders for hatchery operation in Bukidnon BFAR Training Center
Mrs. Ruby Macabaya	Quezon, Bukidnon	MSU Naawan Hatchery/ September13, 2004	On-going
DENR X	Baongon, Cagayan de Oro City	MSU Naawan Hatchery/ September13, 2004	On-going



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