

3. AQUACULTURE

Seed production of berri rouge, *Oreochromis* sp. of both the Malaysian and the St. Petersburg varieties and the giant freshwater prawn, *Macrobrachium rosenbergii* was pursued. A culture trial on acclimatised marine shrimp juveniles to fresh water was carried out at La Ferme Fish Farm. Rearing of marine shrimp juveniles in brackish water was done with a view to observe their growth rate. The sexual and asexual modes of reproduction of the two species of the sea cucumbers, *Holothuria atra* and *Bohadschia marmorata* were carried out. Fingerlings of berri rouge and juveniles of *Macrobrachium rosenbergii* were distributed to fish farmers. Breeding and seed production of fresh water ornamental fish, namely; the sailfin molly, *Poecilia latipinna* and goldfish, *Carassius auratus* was initiated.

3.1 Plankton culture

3.1.1 Phytoplankton

The production of an adequate quantity of good quality live feed was maintained to meet the requirements for larval rearing of the giant tiger prawn, the sea cucumber and the freshwater prawn. Pure cultures of four phytoplankton species namely *Nannochloropsis* sp., *Tetraselmis* sp., *Chaetoceros calcitrans* and *Isochrysis galbana* were maintained in the phytoplankton room. The *Isochrysis galbana* was cultured for feeding sea cucumber larvae. Mass production of *Nannochloropsis* sp. was undertaken throughout the year to provide quality food for the culture of rotifers while the *Chaetoceros calcitrans* was produced for feeding the penaeid shrimp larvae. During the peak production of *Nannochloropsis* sp., a maximum of 90m³ of phytoplankton rich water was attained with an average cell density of 1.5 x 10⁶ micro algae/ml.

3.1.2 Zooplankton

The rotifer, *Brachionus rotundiformis*, was produced using the batch culture technique. In winter, an optimum temperature range of 28 to 30°C was maintained in the rotifer culture tanks by making use of water heaters. Baker's yeast was added to the rotifer tanks at the rate of 0.3 to 0.5g/million rotifers as a supplement whenever it was not possible to provide high cell densities of micro algae.

3.2 Camaron culture

3.2.1 Broodstock

A broodstock of 505 camaron spawners was obtained from La Ferme Fish Farm, Riche en Eau Sugar Estate and Medine Sugar Estate for the production cycle. The females were conditioned and maintained in circular polycarbonate tanks in the dark at an ambient water temperature of 28°C. The berried females were fed once daily on chopped frozen mussels.

3.2.2 Seed production

The camaron seed production cycle was undertaken from January to July and from October to December when the average water temperature was 27°C and 28°C respectively. Twenty one rearing cycles were carried out and a total of 1300 000 larvae were obtained and stocked in fibreglass and polycarbonate tanks of 0.5 to 3m³ capacity in clear brackish water at a salinity of 12 ppt. The camaron larvae were fed daily on brine shrimp nauplii, minced and sieved frozen bonito fish and egg cake. The larval stage index was closely monitored. Post-larvae of stage-12 were obtained after a culture period ranging between 25 and 55 days. The salinity of the culture medium was gradually brought down to zero. A total of 145 000 camaron juveniles was produced.

3.2.3 Sale of camaron

A total of 143 130 camaron juveniles was sold as a priority to twenty small farmers at the rate of Rs 1.25/unit. Proceeds of sales amounted to Rs 178 912.50. A total of 78 kg of harvestable size camaron was sold for Rs 25 350.00.

3.3 Berri rouge culture

3.3.1 Broodstock

A broodstock consisting of 700 breeders of the Saint Petersburg variety and 300 breeders of the Malaysian strain was maintained in separate ponds and fed twice daily on dry pellets at 1% body weight. Signs of discoloration were observed in adults of the Malaysian strain and had to be culled, harvested and sold.

3.3.2 Seed production

All male fry were produced by visual selection. Reproduction of the berri rouge of both the Malaysian and the Saint Petersburg varieties occurred in the ponds from January to April. The number and type of berri rouge fingerlings produced for the past five years are presented in table 3.1.

Table 3.1: Number and types of berri rouge fingerlings produced

Year	Malaysian strain			St. Petersburg strain kept at LFFF	Total
	Sex reversed	Visually sexed	Acclimatised to seawater		
2002	16 735	14 750	nil	-	31 485
2003	43 154	27 318	6 414	8 586	85 472
2004	8 000	20 977	nil	9 780	38 757
2005	6 154	17 683	75	10 000	33 912
2006	nil	12 200	nil	12 000	24 200

Berri rouge fingerlings produced were distributed free of charge to small and medium scale farmers.

3.4 Lease of La Ferme Fish Farm

Due to high operating costs Government decided to stop operating La Ferme Fish Farm in July and had it leased to a private firm. The staff of the farm was transferred to AFRC. A total of 600.5 kg of berri rouge and 388.5 kg of camaron amounting to Rs 144 220.50 was harvested and sold. A total of 150 berri rouge was brought to AFRC to constitute a broodstock.

3.5 Sea cucumbers

3.5.1 Seed production

3.5.1.1 Sexual reproduction

Twelve specimens of *Bohadschia marmorata* and sixteen specimens of *Holothuria atra* were induced to spawn by thermal stimulation with a temperature difference of ± 4 at 25°C. In both cases, the males released the milt which induced the females to spawn. The *H. atra* spawned in February and March and *B. marmorata* spawned in March and April. The *H. atra* produced 1 450 000 eggs which hatched out into 1 200 000 *auricularia* larvae. After 18 days of rearing 705 600 *doiliolaria* larvae were obtained representing a survival of 48.7%. *B. marmorata*, released a total number of 2 630 000 eggs which hatched into 1 620 000 *auricularia* larvae. After 19 days of rearing, 864 000 *doliolaria* larvae were obtained representing a survival of 32.9%. The larval rearing was carried out in 0.5 m³ fibre glass tanks at

a water temperature ranging from 27 to 29° C. The salinity ranged between 34 to 36 ppt and pH ranged between 8.2 and 8.5. The larvae were fed on microalgae, *Chaetoceros calcitrans* at a density of 20 000 to 25 000 cell/ml. In both the cases, mass mortality of larvae occurred in the late *doliolaria* stage. The results are presented in table 3.2.

Table 3.2: Results of larval rearing of sea cucumber

Species	No. used	No. of eggs	No. of auricularia	No. of late doliolaria	Survival (%)
<i>H. atra</i>	16	1 450 000	1 200 000	705 600	48.7
<i>B. marmorata</i>	12	2 630 000	1 620 000	864 000	32.9

3.5.1.2 Asexual reproduction

Asexual reproduction was carried out on 30 specimens of *B. marmorata* and 12 specimens of *H. atra*. Out of the 60 cut pieces of *B. marmorata*, 54 pieces regenerated fully representing a survival of 90%, whereas for *H. atra*, 22 pieces regenerated fully representing a survival of 91.6%. The cut pieces of sea cucumbers were maintained in 0.5 m³ polycarbonate tanks provided with a sandy substrate of 15 cm thickness. They were fed on seaweed paste and the water exchange was done at a rate of 70% on alternate days. The average increase in weight per day was 0.48g and 0.5g for *B. marmorata* and *H. atra* respectively. The growth and survival of the sea cucumbers are represented in table 3.3.

Table 3.3: Growth and survival of *B. marmorata* and *H. atra* after asexual reproduction

Species	No. used	No regenerated	Initial average weight (g)	Final average weight (g)*	Average growth rate per day (g)	Survival (%)
<i>B. marmorata</i>	30	54	20.0	180.8	0.48	89.7
<i>H. atra</i>	12	22	66.7	234.2	0.50	91.7

*after 335 days

3.6 Marine shrimp, *Penaeus monodon*

3.6.1 Broodstock

Four *Penaeus monodon* females with a body weight ranging from 114.0 to 195.4g and 12 males from 65.0 to 85.5g were collected from Bambous Virieux barachois and were subjected to unilateral eyestalk

ablation. The broodstock was maintained in 2m³ conical fiberglass tanks provided with a sandy substrate and with aeration. The broodstock was fed three times daily on chopped frozen mussels, squid, beef liver and oligochaete worms at 12 to 15% biomass. The water was exchanged at 70% daily.

3.6.2 Seed production

Spawning occurred after 28 days and a total of 116 000 nauplii were obtained. Larval rearing was carried out in tanks of 2.0 to 2.7 m³ capacity. The larvae were fed on diatoms, *Chaetoceros calcitrans*. From PL-1 to PL-20, the post larvae were fed on freshly hatched brine shrimp nauplii at 0.25 individual/ml and artificial feed. A total of 71 000 PL-20 was obtained representing a survival of 61.2%. The post larvae were gradually acclimatised to freshwater for a period of 5 days; the survival was 96%. The shrimp juveniles acclimatized to freshwater were cultured in brackish water at 15 ppt.

3.6.3 Culture of *P. monodon* juveniles in brackish water

Three ponds of 250 m³ each were stocked with juveniles of marine shrimp *P. monodon* for culture in brackish water. A total of 3 750 shrimp juveniles of average body weight 0.9g was stocked in each pond. A sea water control pond of the same volume was stocked with 3 750 shrimp juveniles of average weight 0.4g. The shrimps were fed on camaron pellets twice daily, initially at 10% body weight and were gradually decreased to 2.5%. The water was exchanged daily at the rate of 10-15%. The water temperature varied between 21 and 28 °C. After a culture period of 180 days the mean weight of shrimps cultured in brackish water and sea water was 9.31g and 10.27g respectively. The growth of shrimps in sea water and brackish water was almost similar. The result of the experiment is presented in table 3.4.

Table 3.4: Culture of marine shrimps, *P. monodon*, in brackish water and seawater

No. of days cultured	Average weight/g			
	Seawater (Pond 1)	Brackish water (Pond 1)	Brackish water (Pond 2)	Brackish water (Pond 3)
1	0.40	0.60	1.27	0.83
30	1.21	2.39	4.13	3.12
60	2.42	3.82	5.83	5.68
90	3.35	4.29	6.61	6.11
120	5.42	4.34	6.63	6.38
150	8.37	6.80	7.98	7.87
180	10.27	8.74	9.42	9.77

3.6.4 Breeding and seed production of freshwater ornamental fishes

Breeding and seed production of freshwater ornamental fish namely the sailfin molly, *Poecilia latipinna*, and the goldfish, *Carassius auratus* were attempted.

A broodstock of five pairs of sailfin molly was maintained in a 100-litre glass aquarium. The fishes were fed on artificial feed twice daily and the water was exchanged at 75% monthly. The sailfin mollies regularly released young ones.

A broodstock of eight goldfish was maintained in FRP tanks and was provided with artificial duck weeds and hydrilla plants. The fish were fed with chopped mussel meat and artificial pellets, twice daily. Spawning was induced through thermal shock of 3°C at 26°C. The artificial duck weeds and hydrilla plants on which the eggs were attached were transferred to another tank for hatching. The fry was fed on *Artemia nauplii*, rotifers and artificial feed.

3.7 Barachois

Technical meetings and site visits were held jointly with surveyors and planners of the Ministry of Housing and Lands. The outputs of these working sessions were used for the preparation of the report “2006 Report No1. on Management of Barachois”. The report reviewed the status of Government owned barachois and their attributes highlighted possible uses of barachois in general and focused on those government barachois with potential for integrated development which were available for lease.

3.8 Aquaculture extension service

The extension service provided technical advice to 310 persons. Site visits were undertaken to assist the potential fish farmers on pond construction and aquaculture practices. Ten new camaron, *Macrobrachium rosenbergii*, farmers started their operation in 2006.

3.9 Introduction of new species

The barramundi, *Lates calcarifer*, was introduced from Singapore by a private promoter in October 2006. A total of 40 000 fry/fingerlings was imported in two successive consignments by the promoter for culture in freshwater.

3.10 Aquaculture Master Plan

An aquaculture master plan for aquaculture development was under preparation. The consultancy for the preparation of the plan was awarded to “Ichtyo-Development-Eau-Environnement” (IDEE). The consultant effected a site visit from 18 July to 31st August 2006 to meet with all stakeholders including this ministry, the Board of Investment, the Ministry Housing and Lands, the Ministry of Finance and Economic Development, the State Law Office, the Ministry of Environment and National Development Unit, the National Coast Guard, the Ministry of Tourism, Leisure and External Communication, the Prime Minister’s Office (Home Affairs), the Civil Aviation Department, Fishermen Associations and the private seafood operators. A draft plan was submitted in December 2006 to the Board of Investment (BOI).

3.11 Aquaculture production

Aquaculture production of red drum, silver sea bream and rabbit fish for the local market amounted to 447 tonnes. A total of 14.6 tonnes of chilled red drum were exported to Dubai, South Africa, Switzerland and the USA. Two tonnes of marine fish and 1.5 tonnes of mud crab together with 80 000 units of oysters were harvested from different barachois. The production of freshwater fish was 17 tonnes. The production details are shown in table 3.5.

Table 3.5: Aquaculture production (tonnes)

Species	Production (t)
Berri rouge	17.0
Ed-Freshwater prawn	2.5
Marine fish (barachois)	2.0
Mangrove crab (barachois)	1.5
Red drum (floating cages)	416.0
Gold lined sea bream (floating cages)	28.0
Rabbit fish (floating cages)	3.0
Total	470.0

