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MASS PRODUCTION OF JUVENILES OF FRESHWATER PRAWN *MACROBRACHIUM ROSENBERGII* IN FRENCH POLYNESIA : PREDEVELOPMENT PHASE RESULTS

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ABSTRACT

Since 1973, a new method for mass production of *Macrobrachium rosenbergii* post-larvae has been set up in French Polynesia in CNEXO-COP centre in collaboration with Territorial Fisheries Service.

The larvae are reared in clear water daily renewed, without phytoplankton and at high density (100 to 120 larvae per liter in conical bottom tanks of 0.8 and 2 m^3). 90 post-larvae per litre are obtained within six weeks on a diet of *Artemia* nauplii and inert particles. Since 1976, a pilot hatchery is working and ten pilot scale productions gave 4.6 million juveniles demonstrating the reliability of this method. The technology is described and the production costs discussed.

INTRODUCTION

SINCE 1973, the CNEXO-COP aquaculture team, in collaboration with the Fisheries Service of French Polynesia is setting up an original technology for mass production of *Macrobrachium rosenbergii* post-larvae ; after an experimental phase (1973-1976) for exploring the basic parameters of the technology and going through the problems, and a pilot phase (1976-1979) for evaluating the costs, we are now moving to a production scale hatchery, which will provide the local farmers with post-larvae (15 millions post-larvae per year).

As far as possible all the parameters are controlled (temperature, salinity, water quality, food quantity and quality, sanitation, light). The experimental phase showed that these controls are better performed at high density (100 larvae/litre) and in clear water.

PRODUCTION TECHNOLOGY

Since hatchery technology is described in details elsewhere (AQUACOP 1977 a, b), only a brief summary is given here.

For broodstock, about 3,000 female and 1,500 male prawns, generally larger than 30 g in weight, are maintained in three 1,000 m^2 earthern ponds ; a fourth pond is used to grow out the juveniles till reproduction size. As long as water temperature remains above 23°C, this broodstock provide in a week a minimum of one hundred gravid females with dark grey (nearly ready to hatch) eggs. The females

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seined from the ponds are placed in 2 m^3 circular tanks at 4 ppt salinity and within five days release more than 1,000,000 larvae.

After hatching, the larvae are reared in cylindrical tanks with conical bottom and central aeration. The hatchery includes experimental tanks of 0.8 m^3 and production units of 2 m^3. Larvae are stocked in the tanks at initial density of 100 larvae/litre and production is nowadays routinely greater than 90 post-larvae/litre in 42 days.

TABLE 1. *Inert food composition (% of dry weight)*

Squid flesh	.	20
Shrimp flesh	.	10
Hen eggs	.	20
Herring roe	.	20
Vitamin mix	..	2
Mineral mix	.	1
Cod liver oil	..	15
Alginate	..	12

Salinity of the culture water is increased from 4 ppt at hatching to 12 ppt and temperature is maintained at 29-31°C. The mixture of fresh and seawater first chlorinated and filtered is used to completely exchange each rearing tank once a day at 1600 hours.

The larvae are given two types of food : inert particles (compositions and amount given in Tables 1 and 2) and newly hatched *Artemia* nauplii. The inert food is given from 0800 to 1400 hours in two to four meals from stage zoea 6 and the *Artemia* nauplii after the daily water exchange from late stage zoea 2. The amount of food given is adjusted according to consumption, which may vary widely around the standard given in Table 2.

Post-larvae are harvested from each tank at the 32nd and 40th days. They are transferred to 2 m^3 cylinder tanks where the salinity is dropped to zero within 24 to 48 hours. After acclimation to freshwater the prawns are sent to grow-out ponds ; their average weight is 8-15 mg at this time.

To avoid bacterial contamination and resulting mass mortalities, the hatchery is washed out and allowed to dry for three days between production runs. Antibiotics (chloramphenicol, penicilline-streptomycine, terramycine, 1 to 20 g/m^3) are used if bacterial diseases appear during larval culture, and preventively at appearance of first post-larvae.

The hatchery labour force consists of a technical manager and two to four assistants. Two workers can manage eight to ten tanks per day and the amount of labour required is virtually the same for both 0.8 and 2 m^3 tanks. However, for continuous daily management of eight production tanks, a squad of four would be recommended because of the normal five day work week and occasional absenteeism. About one third of the labour is for feeding, one third for observations and countings and one third for water changing.

TABLE 2. *Standard amount of daily feeding rate, according to the stage, for a thousand larvae*

		1	2	3	4	5	6	7	8	9	10	P.L.
Artemia nauplii (number in thousands)	..	0	5	15	20	25	35	45		45		35
Inert food (mg dry weight)	..	0	0	0	0	0	.08	.12		.15		.12

Production Results and Costs

Total survival has increased from an average 45% for the first pilot assays to an average of 92% for the last two (Table 3) in the standard conditions.

Cost : For estimating the budget of the future production hatchery, using solar energy for heating, computations were made according to a projected production of 15 millions/year (7 productions of 2.1 each) and in accordance with the last results obtained. The investment for such a hatchery is estimated at $ 292,000 (Table 4). All the figures are from proforma invoices on a mid 1979 basis. Amortization is computed linearly for 20 years for housing, 5 years for mechanical fittings, plastic tanks, freezer, mixer-liquefier, micro scope, measurement fittings.

The projected yearly budget ($ 139,000 or $ 9.27/1,000 post-larvae) is computed in accordance with the two last assays on Table 5. Social insurances, holiday bonuses and management costs are all included in the labour costs. Energy costs are computed by multiplying the power of every electrical fitting by the number of hours each one worked and adding on 10% for electrical loses in the circuit.

TABLE 3. *Results of the pilot scale assays*

Number of assay	1	2	3	4	5	6	7	8	9	10
Raising duration (days)	60	54	66	46	40	40	41	40	44	40
Average temperature (°C)	27	28	26	29.5	30	30	29.5	30.5	30	30.5
Raising volume (m^3) ..	8x.8	5x.8 3x2	4x.8 1x2	7x.8 4x2	4x.8 4x2	4x2	2x2	5x2	5x2	2x2
Initial number of larvae (thousands) .	835	1187	448	1774	1135	841	385	1070	1065	434
Number of larvae at 1st post-larvae occurrence (thousands) ..		987	192	883	1000	841	385	763	1065	434
Number of post-larvae produced (thousands)	390	520	37	550	600	610	205	288	1006	396
Survival (%) ..	47	44	8	31	53	72	53	27	94	91
Number of post-larvae produced per litre ..	61	52	7	40	54	76	51	29	101	99

Discussion

The technology developed in Tahiti differs mainly from others developed in Hawai (Fujimura, 1967-73) and Taïwan (Nai-Hsien

TABLE 4. *Projected initial investment for an hatchery of 15 millions post-larvae yearly capacity (in US $ mid 1979 estimation)*

		Initial cost	Amortization Annuities
Broodstock ponds (4 × 1,000 m^2)	..	70,000	3,500
Hatchery building (300 m^2)	..	66,000	3,300
Solar heating system	..	60,000	6,000
General store and service building (100m^2)	..	10,000	500
Spawning and post-larvae storage tanks (10 × 5 m^3)	..	8,000	1,600
Raising tanks (+ accessories) (12 × 2 m^3)	..	20,000	4,000
Treatment reservoirs (2 × 30 m^3)	..	10,000	2,000
Water pumps and pipes	.	22,000	4,400
Air suppressor and pipes	..	4,000	800
Laboratory apparatus		10,000	2,000
Food storage and preparation	.	6,000	2,000
Miscellaneous		5,000	1,700
		292,000	31,200

TABLE 5. *Projected yearly hatchery budget for production of 15 million Post-larvae per year (US $ mid 1979 prices)*

Salaries	1 biologist	..	30,000
	2 technicians	..	22,000
	3 workers	..	21,000
Food	Alginate diet (2 000 kg wet)	..	5,000
	Artemia cysts (200 kg)	..	10,000
Antibiotics (10 kg)		..	1,000
Energy (55,000 KWh)		..	11,000
Broodstock maintenance salary		..	7,000
food		..	800
Investment annuities (as In Table 4)		..	31,200
			139,000

US $ 9.27/1 000 Post-larvae.

Chao and I-Chiu Liao,1977), by a higher density and no phytoplankton in the water, this technology allows a close control of the rearing procedures and conducts in standard conditions, to obtain constant results. In case of bacterial attacks or epiphytes or epizooty, more effective treatments can be done due to the small volume of the rearing tanks.

In the projected yearly budget, the cost of labour is the major expenditure in the operation (58 % of the total) and the skill and efficiency of those employed the major reasons for its success.

Water treatment through biological filters which gives good results on experimental scale could be used in the future on the production scale. The daily water changing will be suppressed and the heating greatly reduced ; a three men team (one biologist and two technicians) then will run a 12 tanks hatchery all year round ; the cost will be lowered approximatively to $ 7.5/1,000 post-larvae.

Many prices in French Polynesia are higher than in other tropical places, especially salaries ; almost everything must be imported and long distance shipping and high import taxes increase all prices of goods by an average of 66%. It can be assumed that in other country, the production cost could be greatly reduced.

Conclusion

The technology set up by the CNEXO-COP aquaculture team (Aquacop), in co-operation with the French Polynesia Fisheries Service, is now on a production scale. The projected production cost ($ 9.27/1,000 post-larvae) seems low enough to go on to commercial scale. The reliability of the technology is high due to the control of all the parameters and the skillness of the technicians.

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