DEVELOPMENT OF CAPTIVE BROODSTOCK OF MARINE PRAWNS

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INTRODUCTION

With the rapid development of shrimp culture in India, there is enormous demand for shrimp seeds. As the availability of seeds from wild resource is limited, alternate source to meet the increasing demand is hatchery production which provides quality seeds of desirable species in large quantities. For successful management of a hatchery, maintenance broodstock and induced maturation in captivity are important.

SPECIES

The tiger shrimp *Penaeus monodon*, Indian white shrimp *P. indicus* and green tiger shrimp *P. semisulcatus* are the three important cultivable species in India. Technology has been perfected for seed production as well as for commercial culture of these three species.

SIZE

For selection of broodstock, size of the shrimp is a very important aspect. In nature, the size at first maturity of male and female *P. monodon* is 37 mm cl and 47 mm cl respectively. The male and female of *P. indicus* mature at 27 mm cl and 30 mm cl respectively; and the male and female of *P. semisulcatus* at 18 mm cl and 23 mm cl respectively. All these species attain maturity at the age of 6 months. Preferable size is always above the maturity size to obtain good reproductive performance. Large size broodstock gives better result than the smaller size.

SOURCE

There are two sources for collection of shrimp broodstock. One is from the wild (sea) and the other is from ponds. Large size females are easily available from the sea, mature females migrate to deeper waters (20-30 m depth) for spawning and these locations are good source for capture of broodstock. Shrimp trawl nets are used to capture from these grounds.

In ponds, broodstock is developed by growing juveniles upto adult size for a period of six to eight months in low densities. The ideal stocking density is 20/m^2 during nursery phase (upto 2 g size), 3/m^2 upto 20 g size and 0.5/m^2 upto 60 g and above. Shrimps are fed with compound pellet diet (3-5% of biomass) as well as natural diet like clam meat, squid meat and fish fillets (10% of the biomass) during growout period. Broodstock development in pond is more expensive than collecting from the sea.

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TRANSPORTATION

Broodstock either from sea or from pond is transported to the hatchery using plasti tanks containing sea water. The seawater is aerated by using battery operate aerators.If the transportation involves long distance, broodstock is transported insulated trucks with oxygenated seawater. After reaching the hatchery, broodsto is acclimatised for 4-5 days and then treated with 25 ppm formalin for 15-20 minut before introducing into maturation system.

MATURATION SYSTEM

The following maturation system has been developed at the Regional Centre of CMFR Mandapam for securing repetitive spawning in *P. monodon, P. indicus* and *semisulcatus*. Sand bed filter of 5-10 cm height is arranged on a perforated fal bottom erected at about 125 cm height over the bottom of the polycraft pool (12' x size). Four PVC tubes of 1 m length each (50 mm diameter) are fixed vertically in t peripheral region of sand bed at equal distance. Water recirculation is maintained the rate of 300% by lifting the filtered water from below the sand bed through the PVC pipes with the help of aeration. The pool is covered with lid or black cloth reduce light intensity. Water exchange rate is 100% per day. pH is maintained at 8 - 8.2 by addition of sodium carbonate. About 20 - 40 females and equal number males are introduced into 10 t capacity system. After 10 days, females are subject to unilateral eyestalk ablation. Polychaetes or intertidal oligochaetes, clam meat a squid are provided as feed daily at 3% and 10% of total biomass respectively. Polych etes or intertidal earth worm are given in the morning hours, clam meat is fed in t afternoon and squid is given in the evening hours. Faecal matter and unfed mater are siphoned out in the morning hours daily.

Water Quality

Water quality is an important factor for successful induced maturation in captiv Water parameters should be monitored daily in the maturation system and ma tained at optimum levels. Salinity, temperature, pH, dissolved oxygen, total amm nia and nitrite are the important parameters to be monitored daily.

Ideal water salinity range is 29-34 ppt. If the salinity of the source from where wa is drawn drops due to floods and fresh water influx, salinity is maintained at op mum levels by adding salt. But this practice will not give effective result if the am ent water salinity falls below 26 ppt.

The desirable water temperature range is 27-30°C, and it is corrected by using mersion water heater.

Water pH is a limiting factor for securing induced maturation. Desirable pH ra is 8.0 - 8.2. This ideal range is maintained either by addition of sodium carbonat the rate of 25 g/ton per day or by providing 100% water exchange per day in maturation system.

Optimum dissolved oxygen level is between 4.0 and 5.5 ml/1. The range is maintained by stocking broodstock at optimum density and by providing adequate aeration.

High levels of total ammonia and nitrite in the maturation system are toxic as well as limiting factors for induced maturation. Penaeid shrimps are very sensitive to these parameters and do not mature at high levels. The total ammonia and nitrite contents in water should not exceed 0.07 and 0.02 ppm respectively. These parameters are regulated by maintaining hygienic conditions in the system like removing faecal matter and unfed material daily and by adequate water exchange.

Besides the above mentioned parameters, light intensity is another limiting factor of induced maturation. Optimum light intensity range during day time is 150-3600 lux. Light intensity at desirable level is maintained by covering the maturation system or by housing the system in a closed building.

Eyestalk ablation

After acclimatising for 10-15 days in the maturation system, females are subjected to unilateral eyestalk ablation to induce ovarian maturation. There is no need to ablate males as they easily mature in the system. X-organ sinus gland complex in eyestalk produces gonad inhibiting hormone (GIH) which inhibits the vitellogenesis. In contrast to this, neuerosecretory centre in the brain and thoracic ganglia produce gonad stimulating hormone which promotes vitellogenesis. X-organ produces high titre value of GIH during the quiescent phase of ovary and this reduce vitellogenesis either directly or by acting through neurosecretory centres which produce GSH. When physiological and environmental factors are conducive for reproduction, the titre value of the GIH secreted by X-organ sinus gland is reduced and then the process of vitellogenesis is accelerated under the influence of GSH. By removing the eyestalk, the titre of GIH is reduced and the GSH accelerates the ovarian maturation. Eyestalk [illegible]on is done during intermoult period of female. There are three methods of [illegible]lk ablation, electrocauterisation, cutting eyestalk near the base with a pair of scissors, and incision of eye-ball and squeezing out the contents. Among these methods, electrocauterisation is advisable because loss of blood is avoided as the cut gets sealed immediately.

Artificial Insemination

Generally when females and males are stocked at 1:1 ratio in the maturation system, natural mating takes place between moulted female and non-moulted male. In case of failure of natural mating that leads to unfertilized eggs, which in turn increases the broodstock maintenance cost, artificial insemination can be done. To minimize the handling stress, artificial insemination is done 8-10 hours after moulting of female. Spermatophore is extracted from the male by giving electric shock of 9 volts A.C. current at the base of the fifth walking leg (pereopod). Immediately after securing spermatophore from male, the same is inserted into thelycum of female by widening the gap between two lateral plates with the help of forceps and needle. After inserting

the spermatophore, the female is kept under observation in a separate container 3-4 hours to confirm the acceptance of the spermatophore. Then the female transferred to the maturation system. A female that is inserted with sin spermatophore and subjected to unilateral eyestalk ablation spawns 2-4 times/mo cycle and gives viable eggs every time. Average hatching rate is above 50%. Artifi insemination is done for a single female continuously for 3 times and 10-12 spaw can be obtained during three moult cycles period.

Spawning

After 8-20 days of eyestalk ablation, females mature and spawn and are transfer to spawning tanks in the evening hours every day by using dip net. One spawne kept in one cylindroconical spawning tank of 500 l capacity. Sea water that is tered through 5 µ micron mesh is used in the spawning tank and mild aeratio provided. Spawning tank is covered with net to prevent the female from jumping of the tank. Disodium salt of EDTA is added to the water at the rate of 0.1 g/10 No lights are used in the hatchery during night time to avoid disturbance. Spawn takes place between 2000 hrs and 0200 hrs.

Counting of eggs

In the morning hours of the following day, the spawner is removed from the spa ing tank. Spawning is recorded by observing the gonad and the female is transfe back to the maturation system for re-maturation. For estimating the number of produced, the eggs are dispered in the water by thorough mixing and three 10 samples are taken with a 100 ml beaker. The total number of eggs in each samp counted and the average number in 100 ml is calculated. The total number of released by spawner is calculated by the following formula:

Total number of eggs = 10 x average number of eggs in sample x volume of wat spawning tanks (500 1)

Counting of nauplii

After 12-14 hours of spawning, the number of nauplii are estimated by followin method adopted for estimation of eggs. Hatching rate is computed in percentage the estimated number of eggs and nauplii. Healthy nauplii are separated in the eve hours for further larval rearing. Aeration in the spawning tank is stopped a beam of light is directed on the water surface. Healthy larvae are attracted by and congregate. Weak larvae and unhatched eggs are siphoned out from the bot Healthy nauplii are collected with buckets or directly allowed to flow into the l rearing tank through a flexible pvc hose that connects to the opening valve at bo of the spawning tank.

INFRASTRUCTURE FACILITY

To produce 100 million nauplii of cultivable shrimps annually, the following infrastructure facility is required.

A. SHEDS (AC sheets roof)

1.	Maturation shed	150m²
2.	Blower/generator/pump house	50m²
3.	Laboratory/store	50m²

B. TANKS (Cement)

1.	Water storage/treatment tanks	40 t cap. 2 No.
2.	Overhead tank	40 t cap. 1 No.
3.	Broodstock holding tank	20 t cap. 2 Nos
4.	Maturation tank	10 t cap. 4 No.

C. FIBREGLASS TANKS - FRP

[redacted]	Spawning tanks - 500 l cap. (cylindro-conical)	10 Nos.

D. ESSENTIAL EQUIPMENT

1.	Generator - 30 KVA	1 No.
2.	Air blowers 10 hp capacity	2 Nos
3.	5 HP pump	2 Nos
4.	2 HP pump	1 No.
5.	Deep Freezer 500 l capacity	1 No.
6.	Refrigerator 300 l capacity	1 No.
7.	Microscope	1 No.
8.	Thermometer 0.50°C range	1 No.
9.	pH meter	1 No.
10.	Salinity refractometer 0-100 ppt	1 No.
11.	Balance 500 g capacity	1 No.
12.	Electrocavolt apparatus	1 No.
13.	Heating elements 1 KV with thermostat	4 Nos
14.	Egg collectors	10 Nos.

15. Underwater torch	1 No.
16. Cartridge filter 8-10 μ	1 No.
17. Filter bags 5 μ	10 Nos.
18. Filter bags 1 μ	10 No.

COST AND RETURNS

	Rupees in Lakhs
A. Fixed Costs	
LAND & SHEDS	3.00
Cement and Fibreglass tanks	2.60
Other Equipments	4.52
Water & Electrical Systems	1.00
Consultancy charge	1.40
Total	12.52
B. Operational Cost	
Broodstock	6.00
Feed	3.50
Wages	2.80
Electricity	1.30
Chemicals	0.50
Miscellaneous	0.50
Total	**14.60**
Income	
Sale price of 100 million nauplii at the rate of Rs.25/1000 No.	25.
D. Gross Profit (C - B)	**10.**
E. Net Profit	7.
(after deducting 20% interest on total cost and 20% depreciation on equipment	