

OBSERVATIONS ON COMPLETE AND PARTIAL SPAWNING AND RELATED SEED PRODUCTION IN *PENAEUS SEMISULCATUS*

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ABSTRACT

Complete and partial spawnings in *Penaeus semisulcatus* are reported. Among the 106 specimens ranging in size from 131 to 210 mm in total length utilized for spawning, higher percentage of full spawning was observed in prawns belonging to the size group 131-150 mm. Among the partial spawnings highest percentage was recorded in 151 - 170 mm size group. In the larval rearing experiments, the average survival rate of larvae, between those observed in the fully spawned and partially spawned groups, was better in the former group. While there was no significant difference in the larval survival rate obtained between the fully and partially spawned prawns in the size of 131 - 170 mm, considerable difference was observed in higher size groups of 191 - 210 mm. Besides the causes such as stress, crowding, adverse environmental conditions, disturbance during spawning process, overripe and not fully matured conditions of the ovaries, are suspected to be the other reasons for bring forth partial spawning. The result of spawning performance and larval survival shows that *P. semisulcatus* measuring 151 - 170 mm are more suitable for spawning and seed production than the larger size groups.

INTRODUCTION

IT is a common experience in penaeid prawn hatcheries that all the spawners, whether from wild source or developed under captive conditions or through induced maturation of gonads, do not breed completely releasing all the mature ova from the ovaries. Approximately 50% of the spawners either spawn partially or do not spawn. This failure in the spawning performance has been assigned to various causes such as stress due to transport, handling, overcrowding, use of prawns that are not fully mature enough to breed, uncongenial environmental factors and disturbance during the spawning process. Although information on different aspects of maturation, reproduction and seed production of wild, captive, eye-stalk ablated and non-ablated penaeid prawns are now fairly well documented (AQUACOP, 1975; Primavera, 1984; Kungvankji, 1984) there is not much comparative information on the

spawning performance and related seed production from the complete and partial spawnings. This paper presents some observations made on this aspect on *Penaeus semisulcatus* during the course of a project on sea ranching of the prawn being carried out at Mandapam Camp.

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MATERIAL AND METHODS

A small, open-on-all-side building (5 × 5.5 m) with semi-transparent roofing, was constructed about 200 metres away from the Gulf of Mannar side in the complex of the Regional Centre of Central Marine Fisheries Research Institute at Mandapam Camp, to house the spawning and larval rearing facilities. These facilities included three 0.2 t capacity

cylindro-conical fibre glass spawning tanks, four larval rearing tanks made up of fibre glass, two of which are cylindro-conical capable of holding 2,000 litres of water and the other two oval in shape having a capacity to hold 1,500 litres, five 0.5 t rectangular tanks inner surface of which either in light blue or white, for culturing phytoplankton, and an air compressor run by 0.5 HP Motor. A circular polythene lined pool of 10 t capacity was used to store sea water pumped as and when required from the adjacent Gulf of Mannar.

Mature *Penaeus semisulcatus* for breeding in the hatchery were collected from the trawl nets operated in the Gulf of Mannar (during October to March) or in Palk Bay (during April to September) by mechanised vessels (9 metre length) engaged in the commercial fishing in this area. These were transported to the hatchery (5 km distance) in plastic bins of 70 l capacity with frequent change of water. In the hatchery, the prawns were kept temporarily in tanks containing fresh aerated sea water. Later, in the evening, the prawns in the late maturing stage were selected and used for spawning. The techniques employed for spawning, larval rearing, culture of mixed phytoplankton to feed the larvae and management of larval rearing system were essentially similar to that developed by the Institute and documented in detail by Silas *et al.* (1985) for the hatchery production of seed of *Penaeus indicus*. As the sea water pumped from the Gulf of Mannar is relatively clean, clear and devoid of large scale suspended matter, unfiltered sea water, but stored atleast for about 6 hours was used for spawning and larval rearing. All the experiments were conducted in ambient temperature and salinity which ranged from 25.0°C to 34.5°C and from 31.0‰ to 34.0‰ respectively.

RESULTS

Spawning: During April 1987 to March 1989, 106 specimens ranging in size from 131 mm to

210 mm in total length and having ripe ovaries were utilised for spawning. Of these 54 specimens liberated all the mature eggs as observed from the external examination of the ovary through exoskeleton after the completion of the spawning process. The remaining specimens spawned only partially as determined by the retention of colouration of the ovary visible through the exoskeleton. Although these prawns were kept for spawning for a couple of days more, further spawning did not occur and reabsorption of the ovary was observed.

The spawning performance of fully spawned and partially spawned specimens according to the size is given in Table 1.

TABLE 1. Spawning performance of *Penaeus semisulcatus*

No. of prawns spawned in the size range (mm)	Fully spawned	Partially spawned
	(54) Percentage	(52) Percentage
131 - 150 (group I)	20.7 (22)	15.1 (16)
151 - 170 (group II)	17.9 (19)	24.5 (26)
171 - 190 (group III)	10.4 (11)	07.7 (08)
191 - 210 (group IV)	1.9 (2)	1.9 (2)
Average number of nauplii produced/specimen		
Group I	98,783 ± 52,659	72,833 ± 40,877
Group II	1,68,088 ± 64,398	1,50,895 ± 75,868
Group III	2,02,249 ± 1,07,338	1,61,283 ± 70,580
Group IV	2,52,000 ± 1,69,970	1,40,425 ± 62,472
Average survival rate (%) from nauplius to PL ₁		
Group I	30.4	17.3
Group II	26.1	23.9
Group III	24.6	7.5
Group IV	7.5	24.2

The figure in paranthesis indicates the number.

Among the fully spawned specimens, 20.7% constituted in the size range of 131 - 150 mm, and this percentage decreased gradually in the higher size ranges. Among the partially spawned specimens, highest percentage

was seen in the prawns ranging in size from 151 to 170 mm. This indicates that relatively better spawning performance was obtained with the prawns measuring between 131 - 150 mm.

The average number of viable nauplii obtained for female in respect of fully and partially spawned specimens in different size groups, as expected was always greater in the former category. However relatively greater difference between that produced by fully spawned and partially spawned specimen was seen in the size range, 190 - 210 mm.

Seed production: In the larval rearing experiments conducted during the period, the overall survival rate from nauplius to PL₁ stage in different experiments fluctuated from 0.3% to 96.2%. The average survival rate, when compared between the fully spawned and partially spawned groups, indicated generally a better survival rate in the former group. The highest percentage of survival among the fully spawned group was registered by those produced in the size group 131 - 150 mm; in contrast it was observed in 191 - 210 mm size group among the partially spawned prawns. It is also interesting to note that while there was not much difference in the survival rate of larvae obtained between the fully and partially spawned prawns in the size group 151 - 170 mm, considerable difference was encountered in the other groups, particularly in the higher size group of 191 - 210 mm. The lower survival rate recorded in some of the rearing experiments was found to be due to oxygen depletion caused by *Trichodesmium* bloom in the water used for larval rearing. During the summer months of May to July, the occurrence of *Trichodesmium* blooms in the inshore waters of Gulf of Mannar is a common feature in this area. This entering into the rearing system through the pumped sea water, multiply rapidly and cause oxygen depletion. The other factor causing larval

mortality in the hatchery was due to *Leginidium* infection which was generally encountered in April, May, August and sometime in October. Nauplius VI and Protozoa I stage were found to be more susceptible for *Leginidium* infection.

DISCUSSION

Several causes such as stress and over ripe ovaries affected by haemocytes (Beard *et al.* 1977), unfavourable environmental conditions of low temperature and white light (Kelemec and Smith, 1984), disturbance during the spawning process and microsporidian infection of the ovary were mentioned to bring about partial spawning, non-spawning and reabsorption of ovaries. As all the spawning experiments carried out at present were in identical conditions, the stress of the environmental factors might be considered as exerting the same influence on the spawning performance when partial and full spawnings were obtained. Under this assumption, the selection of spawners with the right stage ovary would greatly contribute for the successful spawning. Although utmost care was taken to select the spawner with advanced stage ovary, biased selection might have contributed to the partial spawnings recorded in the present investigation as the spawners were selected on the macroscopic examination of the ovarian maturation through the exoskeleton. Nevertheless, Thomas (1975) studying the maturation and fecundity of *P. semisulcatus* from the same area has observed no correlation between the number of eggs and the length or weight of the prawn, and the weight of the ovary. Could it be possible that this observation and the greater percentage of partial spawning seen in the large size groups in the present study indicates asynchronous maturation of ova or spawning in the larger spawners? Further Thomas (1978) and Soni (1986) have reported microsporidian parasite affecting the gonad of wild population of *P. semisulcatus* of this area. *Sulcovaria mannarenis* described by Soni

(1986) is found to be site specific infecting only the ovary of *P. semisulcatus*. It is quite possible that the ovaries of prawns infected by the microsporidians might not spawn fully. Further detailed histological studies on the ovarian maturation process are required to understand this phenomenon.

The results of the experiments relating to spawning performance and subsequent survival rate of larvae in the rearing experiments show that *P. semisulcatus* measuring between 151 - 170 mm are more suitable for spawning and seed production than the larger specimens.

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