7. SUMMARY

The aquaculture in India is mainly concern with shrimp culture. But shrimp culture industry in recent time is suffering from viral and pollution problems. So the farmers are looking forward to a suitable alternative species for culture with high profit. In this juncture, best alternative species are undoubtly crabs, because they have high potential for aquaculture. The focus of the present day aquaculture was increasingly shifted towards the development of hatchery technology and crab farming to meet the human protein demand. The crab *C. feriata* is a commercially important species but is not being cultured commercially. It is a good potential aquaculture species because of its meat quality, taste and size. However in recent years it is noticed that the catch of the crucifix crab is decreasing and for future development and conservation of the species, aquaculture is a right choice to increase the production. Studies on the mass seed production technology were under experimentation for mud crabs with low survival rates, but such studies are scanty in the sea crabs in general and *C.feriata* in particular especially in Indian perspective. Hence the present study was aimed to investigate the reproductive biology and mass seed production of *C.feriata.* The results obtained are summarized as below;

Reproductive System

Information about the reproductive biology of a crab species is important for the successful seed production in captivity. Hence the present study was aimed to investigate the male and female reproductive system of *C.feriata.* The male reproductive system of *C.feriata* composed of a pair of testes, a pair of vas differentia and a pair of ejaculatory ducts. The testes are connected with the vas deferens through a short small duct called vas efferens. The vas differentia has been divided into three distinct regions, based on the morphological and functional criteria: Anterior (AVD), Median (MVD) and Posterior (PVD) vas deferens. The developmental stages of male gonads include immature, maturing and matured. The gonadosomatic index of the male crab was increased from immature crabs (0.48) to matured crabs (0.79). The female reproductive system composed of a pair of ovaries, a pair of seminal receptacles (or) spermatheca and a pair of oviducts. The ovaries of *C.feriata* are categorized into five stages according to the size, colour and external morphology of the ovaries. They are immature, early maturing, late maturing, ripe and spent. The GSI in females were increased from immature crabs (1.95) to ripened crabs (3.97). Based on the change in colour, increase in the size and change in the shape of the berry eggs, three different stages (I, II & III) of egg development was observed. The fecundity of the female was

found to be from 2, 83,963 to 9, 67,293 eggs in the animals had the carapace width of 10.6 to 14.1 cm.

Mating Behaviour

The production of berried females in controlled condition is essential for that knowledge on mating behaviour is very much needed. Hence in the present study mating behaviour of *C.feriata* was studied. For convenient, the mating behaviour of *C.feriata i*s divided into five phases *viz.,* Pre-Moult Guarding (PMG), Moulting (M), Pre-Copulatory guarding (PCG), Mating or Copulation (C) and Post-Copulatory guarding (POCG). Premoult guarding is last for 92.0 hrs. Moulting last for 4.0 hrs. The Pre-copulatory guarding lasted 3.6 hrs. The copulation lasted 7.28 hrs and Post-copulatory guarding lasted 12.12 hrs. The total mating sequence lasts for 119.00hrs.The spawning of the female took 17.62 days after copulation.

Embryonic Development

The quality and survival of newly hatched zoeae will depend primarily on the embryonic development. So an attempt has been made to study the embryonic development in the portunid crab, *C.feriata.* The embryonic development of *C.feriata* is divided into six stages, *viz.*,

blastula, gastrula, eye placode, pigment, heart beat and freshly hatched first zoea. In blastula stage the eggs were round, golden yellow in colour and the diameter of the egg was 0.36mm – 0.37mm. In gastrula stage the eggs were round and deep yellow or yellowish orange in colour and the diameter of the egg was 0.38mm – 0.39mm. In eye placode stage the eggs were round orange in colour and the diameter of egg was 40mm – 41mm. In pigment stage the eggs were brown in colour and the diameter of the egg was 0.42mm – 0.43mm. In hear beat stage the eggs were dark brown or black in colour and the diameter of the egg was 0.44mm – 0.45mm.The freshly hatched I zoea moved freely in the water and its carapace length ranges from 1.05mm - 1.25mm.

Effect of Salinity on Larval Development

The salinity is particularly important because it represents ecological master factor for many aquatic organisms. The objective of this work was to study the effect of salinity on larval development of *C.feriata* in relation to survival and duration of larval stages. Survival was very limited for both 15 and 20‰ salinities. In 25‰ salinity, maximum survival was reported (33%) in zoea I and minimum (1%) in megalopa. In 30‰ salinity, survival was reasonable when compared to other salinities. Maximum survival was reported in zoea I (71%) and minimum survival was reported in megalopa stage (54%). In 35‰

salinity, survival was maximum when compared to other test salinities. Maximum survival of 95% was recorded in zoeal stage I. Minimum survival was recorded in megalopa stage (75%). In 40‰ salinity, maximum survival was recorded in zoea I (55%) and minimum was recorded in megalopa stage (32%). Development was very limited for both15 and 20‰ salinities. In 25‰ salinity, the zoeae I, II, III, IV,V, VI and megalopa required 4.70, 3.50, 3.40, 3.51,3.42,3.58 and 6.48 days, respectively. Total duration for complete larval development was around 28-30 days. In 30‰ salinity, almost all zoeal stages took approximately 3-4 days to reach next stage and VI zoea took 6.38 days to moult into megalopa. Overall duration for the complete metamorphosis was 25-27 days. In 35‰ salinity, each zoeal stage required 3-4 days to reach next stage. The time taken for complete metamorphosis was 22-25 days which was the lowest among all test salinities. In 40‰ salinity, each zoeal stage took 3-4 days to reach the next stage. The total larval development duration was 25-30 days, which was considered to be more than that of 30‰ and 35‰ salinities. Based on the study the optimum salinity range lies between 30-40‰ and optimum salinity was considered to be 30‰ for almost all larval stages.

Seed Production

To develop aquaculture activities mass seed production technology is essential. Hence in the present study an attempt was made to produce seeds in controlled condition. The complete larval development took a span of 22-26 days. According to Duncan's multiple range test the larval duration is more or less same for I & III zoeal stages. Similarly II, IV, V &VI zoeal stages are also similar. However, I & III and II, IV, V &VI zoeal stages are significantly varied between each other. A maximum of 95% of survival was observed during the first zoeal stage and thereafter the survival was gradually decreased. The survival percentage shows that mortality was high in all zoeal and megalopa stages. The survival rate of zoeal and megalopal stages are significantly varied each other.