CMFRI

Course Manual

Winter School on

Recent Advances in Breeding and Larviculture of Marine Finfish and Shellfish

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CRAB SEED PRODUCTION

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Introduction

The three commercially important genera, *Scylla*, *Portunus* and *Charybdis* are brachyuran crabs belonging to the family Portunidae. A number of species of these genera are widely distributed in the Indo-Pacific and is of significant importance in the fisheries of most countries located in that region.

Taxonomy

Phylum	:	Arthropoda
Class	:	Crustacea
Subclass	:	Malacostraca
Order	:	Decapoda
Suborder	:	Pleocyemata
Infraorder	:	Brachyura
Family	:	Portunidae
Subfamily	:	Portuninae
Genus (eg.)	:	Scylla
Species (eg.)	:	*Scylla serrata*

S. tranquebarica
S. olivacea
S. paramamosain

The blue swimmer crab *Portunus pelagicus* and the mud crab/ mangrove crab *Scylla serrata* are the most valuable crabs contributing to the crab fishery and trade in India. Other species, though contributing substantially to local fisheries, are of lesser economic significance. The exploitation of marine crab resource has been increasing consequent to the increased demand for crabs for export. Some empirical studies have shown that the crab fishery is close to its biological optimum. Farming of crabs and searanching are two options available for augmenting the production and sustain the fishery and wild population. Crab seed is not easily available from the wild; and if at all available, it should not be collected from the wild for the sake of conservation. To meet the requirement of crab seed for farming and sea ranching, dedicated crab hatcheries have been established or are being established in many countries.

External morphology of crab: (Type – Scylla spp.)

The body of crab is covered externally by a hard carapace which is chitinous in nature.

- In Scylla spp. There are 6 spines (serrations) between and 9 spines on either side of the eyes.
- The antennae and antennules are used for sensory perception.
- The crab has 4 pairs of legs, the first pair (chelate leg) has its dactylus developed as pincers or claws for grasping prey . The second and third pair of legs are simple in structure with out claws and used mainly for crawling. The fourth pair is paddle(oar) shaped and used for swimming.
- The abdomen is tucked under the ventral side of the carapace and having slender fused pleopods on it.
- Sexes are separate. In females the abdomen is triangular to semicircular depending on growth stages. Males have T – shaped abdomen and bigger chelipeds than females.

Courtship and mating

The male embraces the sexually mature female which is about to moult. After moulting, the male turns the female upside down so that their ventral surfaces meet. Then mating occurs and male transfers it spermatophores to the paired seminal receptacle (spermatheca) of the female.

Spawning

The eggs from ovary pass through a pair of short oviduct which opens in to the spermatheca. During the passage through spermatheca, eggs are fertilized by the sperm cells released from the spermatophores and gets attached to the ovigerous setae (pleopod hairs) of the abdominal flap. Although female portunid crabs sometimes become ovigerous (berried) in esturies, such individuals emigrate in to coastal marine waters, where they complete the incubation and hatching. The embryonic development of the fertilized egg is completed in the berry. There are nine developmental stages of the egg before hatching.

a. Precleavage stage – yolk fills entire egg.

b. Cleavage stage – cleavage furrows can be observed on the surface of embryo.

c. Blastula stage – dividing cells are of equal size, arranged spherically.

d. Gastrula stage – 'U' shaped band with optic lobes visible, translucent embryonic body outline is formed.

e. Naupliar stage – 3 pairs of appendages are visible.

f. Metanaupliar stage – optic lobes(eyes) become larger

g. Pigmented eye – eyes become pigmented.

h. Heart beat – heart starts to beat.

i. Prezoea – eye pigmentation is darker, abdomen and telson visible.

Depending on the stage of development of embryo the orange coloured eggs turn greyish orange and finally to dark grey during incubation on the pleopods. The incubation period may vary from 7 – 14 days depending on water temperature. Normally hatching of zoeae occurs on the 9^{th} or 10^{th} day.

Seed production.

Most of the portunid crabs are amenable to culture. They can be made to mature, mate and get berried in specialized broodstock rearing tanks. Berried females collected from the wild or captive broodstock developed in the hatchery can be used for seed production. Healthy ovigerous females with characteristic orange coloured berry are collected and brought to the hatchery in wide mouthed jerry cans with sea water. These crabs are kept in 1.5 t fiberglass tanks with seawater at 34 – 35 ppt salinity, 8.2 pH and 28 – 30^0 C temperature, and provided with continuous aeration. The crabs are disinfected, after two days, in 25ppm formalin bath for 30 minutes. The spawners are maintained in FRP tanks with cover, in filtered sea water and provided with 50% water exchange daily till the penultimate day of hatching. The berried crabs do not feed and hence no feeding is required for the mother crabs till hatching.

Hatching

The mother crabs are monitored daily. When the egg mass (berry) turns dark grey those crabs are transferred to separate hatching tanks with known volume of water .Mild aeration is provided in the hatching tank.. The carapace width and weight of the crabs are recorded before transferring the crabs to the hatching tanks. Hatching generally takes place during early morning hours. After full hatching, mother crab is removed from the tank and weighed again. This gives an idea of the weight of the egg mass (berry). Aeration in the hatching tank is stopped for a while to allow the empty eggshells and unhatched eggs to settle at the bottom. The empty eggshell and unhatched eggs are siphoned out without disturbing the live Zoeae in the water column and surface.. The total number of zoeae estimated by drawing representative samples. The number of zoeae produced per female in a single spawning ranges from 1- 4 million for *S. serrata* (depends on size of animal and weight of berry) and after a single mating a female can spawn at least three batches of eggs before next moult and mating.

The number of stages and larval morphology of portunid crabs may differ slightly from species to species. However they all follow a basic pattern of development. The *Scylla serrata* zoeae pass though five sub-stages before metamorphosing to the megalopa stage. Zoeae are with long dorsal spines and short lateral spines on the carapace.

In *Scylla serrata* there are five zoeal stages.

a. Zoea 1 – eyes not stalked (sessile), abdomen 5- segmented.
b. Zoea 2 – eyes stalked.
c. Zoea 3 – abdomen 6 segmented.
d. Zoea 4 – pleopod buds appear.
e. Zoea 5 – pleopod buds well developed.

The Zoeae are stocked at a density of 50 nos./L in green water system in FRP tanks where a culture of unicellular algae Marine chlorella/ *Nannochloropsis* (2 lakh cells/ ml) is maintained. The larvae are fed with marine rotifer (20 – 25 / ml) and Artemia nauplii (5 – 10 / ml) grown separately. Shrimp larval feed such as 'Encap' and 'Friipak' can also be used for feeding crab larvae especially during adverse cloudy or rainy weather when development of algae and consequently rotifer culture are affected. About 30 – 50 % water from the larval rearing tank is replaced daily with green water and live feed - rotifer and Artemia - added in the required density to ensure adequate supply of feed at any given time.

The duration of the zoeal stage is approximately 10 ± 2 days.

Zoea 5 moults to megalopa stage.

Megalopae are very similar to that of other portunids. Rostral spine present. Eyes project as far as the lateral margin of the carapace. Abdomen six segmented with dorsoventrally flattened telson. The megalopae in another 4 – 5 days metamorphose directly to the first crab instar. It resembles an adult crab in shape though in miniature form. The total duration of the larval development from Z 1 - to the 1st crab instar varies between 15 – 18 days. After several moults of progressively increasing interval the 1St crab instar grows in to juvenile and then adult crabs. The crab instars are transferred to nurseries for further rearing at a lesser density. In the nursery, crab instars are fed at least twice (total 10% of body wt.) a day with finely chopped meat of clams, shrimp, fish or pelleted shrimp feed depending on the requirements and availability. Water exchange up to 30% or more is advisable at least twice a day before feeding. Crab instars are highly cannibalistic, and to ensure a fair percentage of survival, during rearing, it is essential to provide maximum protection to the crablets. Hideouts are provided at the bottom of the tanks for this purpose. Ten to twelve day old crab instars attain a size of about 8mm to 10mm. In about a month they reach a size of 14- 19mm CW. Some baby crabs grow very fast – shooters, which should be harvested/segregated periodically to ensure maximum survival of the crablets.

Mass culture of live feed

Clean filtered sea water is pumped in to the tanks and fertilized with the following quantity of commercial fertilizers for every ton of water.

Ammonium sulphate – 100g
Urea - - 5 g
Super phosphate - 20 g
Mineral mix - 10 g

Fifty liters of Nannochloropsis at a cell concentration of 2 – 3 million cells/ml added as innoculum in approximately 950 l of fertilized water and vigorous aeration provided. A bloom of Nannochloropsis develops by the 4th day. This green water is pumped in to another tank and rotifer inoculated into it at a density of 25 no/ml. By the 8th day the rotifer density reaches around 200 – 250/ml. After stopping the aeration for some time the rotifers can be partially harvested for feeding the crab larvae. The collected rotifer is washed thoroughly before feeding. After harvesting a part of the rotifer along with the culture water, an equal quantity of Nannochloropsis green water grown as above may be pumped in to the rotifer tank to continue the batch culture for daily harvest. Such rotifer culture can be maintained for 3 – 4 weeks. Marine chlorella can also be used in place of Nannochloropsis.

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