# Seed Production of Mud Crab Scylla spp.

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## Crab farming

Mud crab farming is an important source of income for fishfarmers in the Philippines. The expanding export market for mud crab as an alternative for shrimp has led to intensified collection of wild seed for grow-out and has threatened the wild stocks. To ensure the sustainability of crab farming and reduce the fishing pressure on wild stocks, the SEAFDEC Aquaculture Department developed a technology for large-scale production of juvenile mud crabs, *Scylla serrata* (giant mud crab), *S. olivacea* (orange mud crab) and *S. tranquebarica* (purple mud crab). The methods are outlined below.

*Fig. 1a: Scylla serrata*

*Fig. 1b: Scylla olivacea*

*Fig. 1c: Scylla tranquebarica*

## Breeding

Pond-grown females of the mud crabs are obtained from crab dealers. The taxonomic identification of species was based on a scheme developed by Keenan et al[1]. The crabs are examined for ovarian maturity by looking through the transparent membrane between the junction of the first abdominal segment and carapace. Mature ovaries are dark orange. Crabs with immature ovaries (light yellow) are ablated on one eyestalk.

The crabs are held in a concrete tank with sand substrate and PVC pipes (20 cm diameter x 30 cm length) as shelters. They are fed mussels, squid and fish at 10-15% of body weight daily and a SEAFDEC-formulated diet[2] at 2%. Live marine annelids are offered to crabs once every 1-2 weeks asa supplement. We maintain water depth in the tanks at about 30 cm. The seawater used for the crab breeders and larvae is pre-treated in a reservoir with 10-20 ppm calcium hypochlorite and then neutralized with sodium thiosulfate after 12-24 h. The water in the tank is changed daily before feeding.

Eggs released by the female become attached to the pleopod hairs of the abdominal flap. Sampling for egg-carrying or berried females is done

Fig. 2. Examination of ovary color between the junction of the first abdominal segment and carapace

when water levels are reduced during the water change. Berried females are then transferred individually to 300-liter or 500-liter tank with aerated sea water at 32 ppt. Berried crabs sometimes lose some or all of their eggs due to fungal infection, failed fertilization, nutritional deficiency, or environmental stress. At longer incubation periods, the eggs may become infected with fungus and filamentous bacteria and infested with protozoans. These infections retard embryonic development and increase the egg mortality due to restricted oxygen exchange across the egg membrane[3,4]. To counteract fungal and ciliate infections we treat berried females with, 0.1 ppm Treflan (44% trifuralin) every three days in the hatching tank. This treatment has no adverse effect on the eggs and newly hatched zoeae.

Each spawning produces 0.8-4 million zoeae in 350-525 g *S. serrata*, 0.7-3 million zoeae in 240-300 g *S. tranquebarica*, and 0.4-2.7 million zoeae in 360-465 g *S. olivacea*. Hatching occurs 7-14 days after spawning at temperatures of 26.5-31°C.

## Larval rearing

Zoeae are stocked at a density of 50 individuals per liter in circular concrete tanks (4 m diameter x 1 m height) and fed with the rotifer *Brachionus rotundiformis* at a density of 10-15 rotifers/ml (Table 1). The microalga *Chlorella* sp. is maintained in the rearing tanks at 50,000 cells/ml as food for the rotifers. Brine shrimp *Artemia salina* nauplii are also given at 0.5-3/ml to zoea 3 and larger larvae. *Artemia* densities over 5/ml may not be economical to use in commercial-scale hatcheries.

The zoeae are reared at a salinity of 32-34 ppt and water temperature of 26-30.5°C, and a natural photoperiod of 11-13 hours light and 11-13 hours dark. The rearing water is replaced at a daily rate of 30% starting on day 3 and increasing to 80% as larvae grow bigger or when disease-causing luminescent bacteria are detected in the water and larvae.

## Nursery

Megalopa are nursed in concrete tanks or in net cages set in brackishwater ponds. To prevent or reduce cannibalism, the stocking density of 3-5 day old megalopa in nursery tanks is reduced to 1000-2000/ton of water. Black nets are placed at the bottom as substrates and some are suspended in the water column. Food consists of newly hatched and adult *Artemia*. As soon as the megalopa molt to crab stage stage, they are fed minced trash fish, mussel, or small shrimp *Acetes* twice daily ad libitum. About 30-50% of the volume of the rearing water (26-30 ppt) is replaced daily during the first 5 days and every two days thereafter.

Using several hatchery tanks to rear megalopa up to juveniles at low density is not cost-effective because these are better used for rearing the zoea, which have a faster turnover.

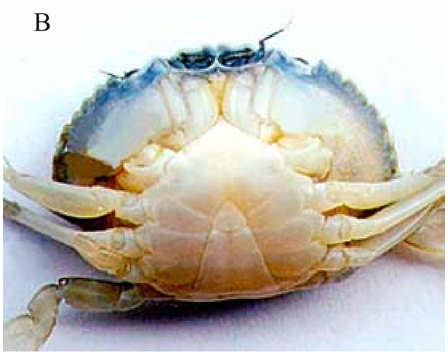
Ponds provide a wider surface area for the dispersion of megalopa provided that the ponds are predator-free and have substantial natural food. Nursery net cages (mesh size 1 mm; bottom surface area 20 $m^2$ are set in ponds for the megalopa. Bamboo poles support the cages and the bottom of the net is buried 3-5 cm into the pond soil. A good growth of natural food is obtained about a week after the application of organic fertilizer at one ton/ha and inorganic fertilizers, urea (45-0-0) at 75 kg/ha and ammonium phosphate 16-20-0) at the ratio of 1:2.

Megalopa to be transferred to net cages are packed in plastic bags at 200-300/liter. Megalopa are stocked at 30/$m^2$ and fed adult Artemia on the first day in net cages. Food is then changed to minced trash fish and mussel placed in feeding trays. Water depth is maintained at 60-80 cm. About 30% of the water is replaced 3-4 times a month.

Strategies to reduce cannibalism include size-grading, trimming of claws,

Fig. 3. Net cages set in brackiswater pond for the culture of megalopa to crab stage


Fig. 4. Mud crab juveniles subjected to trimming of claws (A) & removal of chelipeds (B)




removal of chelipeds[5,6], and provision of sufficient shelters. However, chelipeds are not removed from crabs larger than 2.5 cm in carapace width because growth may be affected. Trimming the claws and removal of chelipeds are tedious and are practical only for a small population of crabs.

The survival from zoea 1 to 3-4 day old megalopa is 3-7%. The survival from megalopa to juveniles (1-3 g body weight) after 30 days in hatchery tanks or pond cages is 30-50%. A considerable number of crabs for grow-out can be produced if the megalopa are nursed in net cages in ponds. Crabs that are about 1 g and 2 cm in carapace width can be stocked directly in grow-out ponds (Fig. 3). Hatchery-reared crabs have been grown to marketable size in ponds since late 1999.

The problems that we have encountered in the crab hatchery include: a) egg loss in berried females due to fungal infection, epibiotic fouling, and unfertilized eggs, b) luminescent bacteria, and c) cannibalism among megalopa. The methods described above are being refined to improve the survival from megalopa to crab stage so that the technology would become economically viable.

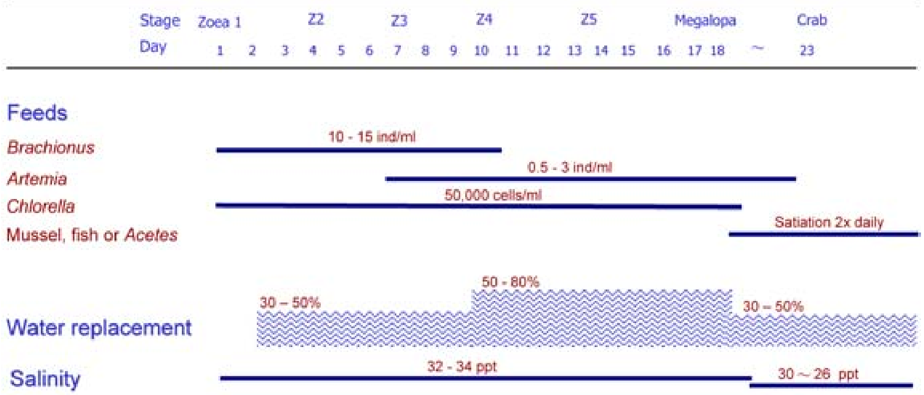
## Grow-out

Crab juveniles are grown to marketable size in earthen ponds, or in net or bamboo pens in mangroves or tidal zones. After the application of lime in earthen ponds, pest and predators are eradicated by the application of tobacco dust, tea seed or a combination of hydrated lime and ammonium sulfate. The inner side of pond dikes is enclosed with nets or bamboo mattings with 30-50 cm width plastic sheets along the top of the fence to prevent the escape of crabs.

In both ponds and pens, juveniles are stocked at 0.5-1.5 individuals per square metre[7,8]. Food items are fish, molluscs, crustaceans, waste materials such as animal hides entrails and fish offal at 10% of the crab biomass/day for the 1$^{st}$ month. Feeds are reduced to 8% on the 2$^{nd}$ month and 5% crab biomass/day on the 3$^{rd}$ month until the end of culture period (Triño et al., 1999). Water is maintained at 80 cm depth and is replenished during high tides. In ponds, a pump is used when water change is needed during neap tides. Partial harvesting is done when *S. olivacea* and *S. tranquebarica* reach $^3$200g and $^3$350 g for *S. serrata*. Total harvest is done after 4-5 months and a survival rate up to 86% can be achieved.

Fig. 5. Mud crab ponds with net enclosures

Table 1: Feeding and water management used in the culture of Scylla spp. larvae

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