

Biology of *M. rosenbergii*

Distribution

There are 150 species of *Macrobrachium* in the world, of which 49 are commercial. Twentyseven of the commercial species are found in Asia and the Pacific. Most live in freshwater. A few species live in brackishwater in the mouths of rivers.

Macrobrachium rosenbergii is found extensively in the tropical and subtropical waters of the Indo-Pacific region in Malaysia, Thailand, the Philippines, India, Shri Lanka, Bangladesh, Myanmar, Indonesia and Vietnam. They are generally found in freshwater, in ponds, rivers, lakes, ditches, canals, depressions, low-lying floodplains and river mouths. Most of the species spend their early life in brackishwater that is connected directly or indirectly with the sea. Some species complete their life cycle in freshwater, but these are not of commercial importance.

Prawns move upstream, entering lakes and even paddy fields, up to about 200 km from the sea. This type of migration is observed not only in *M. rosenbergii* but also in other species of *Macrobrachium*.

M. rosenbergii has been used in research more than any other species and has been introduced many new countries for commercial culture. Fujimura and Okamoto (1972) were successful in producing post-larvae (FL) of *M. rosenbergii* in large numbers in Hawaii in 1972. *M. rosenbergii* is being cultured in commercial quantities in many parts of the world, including Hawaii, Honduras, Mauritius, Taiwan, Thailand and the Philippines. Farms have also been developed in Costa Rica, Israel, Malaysia, and Mexico.

Subspecies of *Macrobrachium Rosenbergii*

Due to differences in climate, weather and natural environment, many subspecies of *M. rosenbergii* have evolved. Three varieties are generally observed in nature.

Blueclaw subspecies

This subspecies grows to a large size. The ratio of claw to body length is 1.6 ± 0.1 . The male is territorial, its breeding behaviour is complex and growth is comparatively slow.

Orange claw subspecies

This subspecies is a little bigger than the median size of the blueclaw variety and has orange-coloured claws. The ratio of claw to body length is 1.0 ± 0.05 . The rate of fertilization of eggs is comparatively slow, but growth is fast.

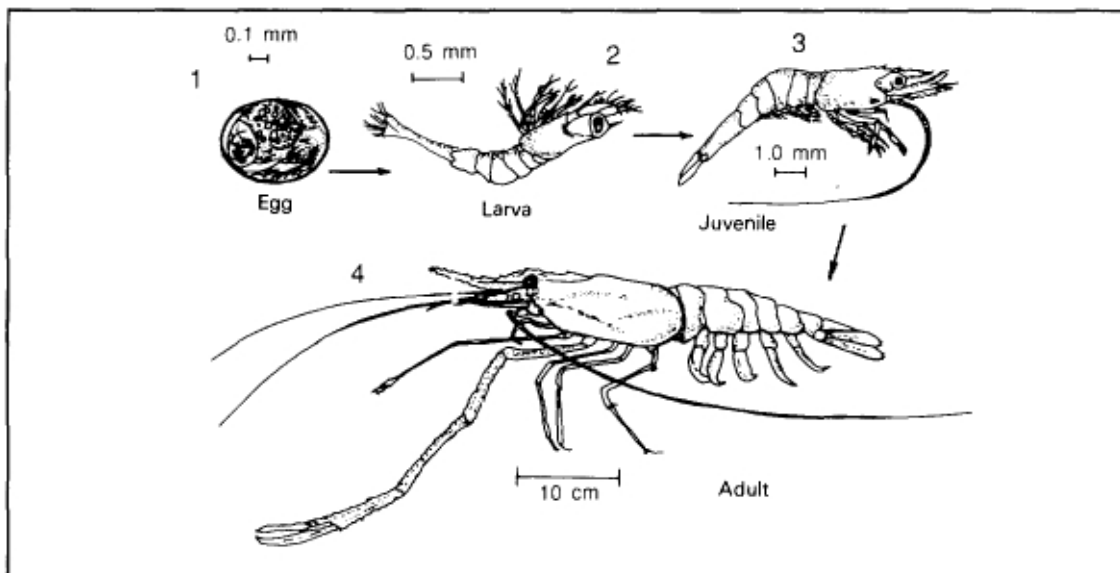
Small subspecies

This is the smallest of all the subspecies with spineless claws. The ratio of claw to body length is 0.5 ± 0.1 . At the time of copulation, these adopt the 'snake' mating strategy. Their growth is the slowest of the three varieties.

Life history

There are four stages in the life of a freshwater prawn, viz, egg, larva, juvenile and adult (see Figure 1). Like other crustaceans, the freshwater prawn moults. The number of moults and the durations of intermoult are not fixed, and depend on the environment, particularly temperature and the availability of food.

Fig. 1 The life cycle of *M. rosenbergii* after New and Singholka (1985)



In the natural environment, mating of *Macrobrachium* takes place all year round, although, due to environmental reasons, peak mating takes place only during certain periods of the year. A female prawn, with matured gonad, copulates just after moulting with a male prawn having a hard shell. During copulation, the male deposits a gelatinous mass, or spermatophore, on the underside of the thorax of the female, between her walking legs. The female prawn releases its eggs a few hours to a few days after copulation. The number of eggs depends on the size of the female. A fully matured female of 50-100 g can carry 50,000-100,000 eggs. But at first maturity, due to the female's small size, it lays only 5000-20,000 eggs.

As the eggs are extruded from the gonophore, they are fertilized by non-motile sperm retained in the spermatophore. The fertilized eggs are then transferred to a brood chamber on the underside of the abdominal region of the female, held in place by a thin membrane and kept aerated by vigorous movement of the abdominal appendages. Eggs are incubated in this way for 21 days and then hatch. In the laboratory, it has been observed that hatching takes place 20 days after copulation; it may even take 25-30 days if the temperature has remained below 28°C.

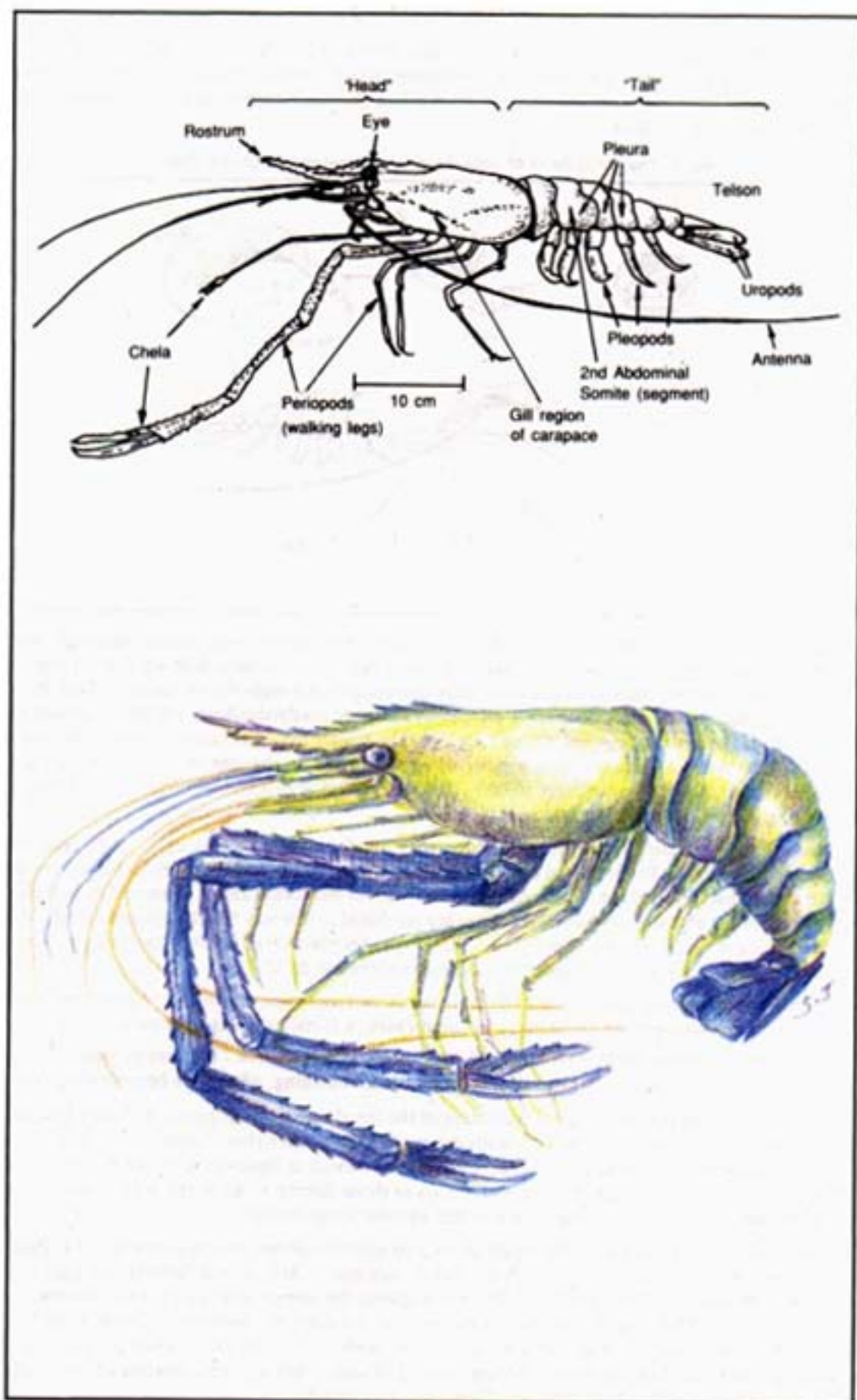
Ovaries frequently ripen again even while a female is carrying eggs. Immediately after hatching, the female can again release these eggs. In some cases, a female can lay eggs twice a month.

The eggs of the prawn are slightly elliptical, the longer axis being 0.6 - 0.7 mm in length. They are bright orange in colour until two or three days before hatching, when they become slate gray.

Larvae hatch during the night. Rapid movement of the female pleopods disperses the newly hatched larvae, which normally swim with their heads down and 'jump' when they contact a surface. Larvae need brackishwater to survive at this stage. Even if larvae hatch in freshwater, they will not survive if they are not put into brackishwater within two or three days. Larvae in the wild generally eat zooplankton, small insects and larvae of other aquatic invertebrates.

Larvae in a hatchery take a minimum of 26 days to metamorphose into post-larvae (PL). Post-larvae can tolerate a wide range of salinity, but freshwater is their normal habitat. And so, two to three weeks after metamorphosis, the PL move against the current and head towards freshwater canals and rivers. They abandon the planktonic habit at this stage and become omnivorous, feeding on aquatic insects and their larvae, phytoplankton, seeds of cereals, fruit, small mollusca and crustacea, fish flesh, slaughterhouse waste and animal remains. They move by crawling and generally swim with their dorsal side uppermost. They can swim rapidly.

Fig. 2 Grou anatomy of *M. rosenbergii* (after New and Singhoka 1965)



Morphology

Figure 2 shows the gross anatomy of the freshwater prawn. The body is divided into segments, each with its particular appendages. These divisions are, roughly

- The ‘head’ (cephalothorax), which is covered by a shell or ‘carapace’; and
- The tail (abdomen), which is clearly segmented.

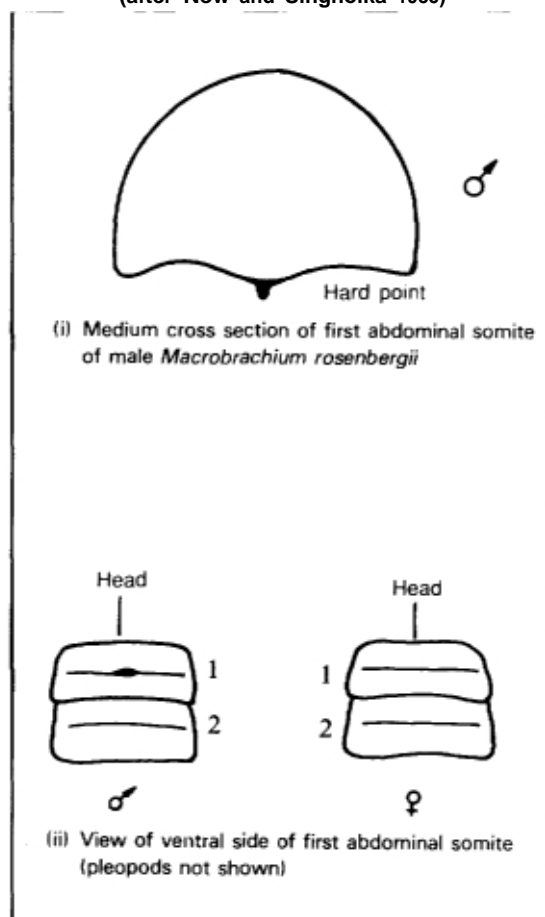
The major appendages are

- The ‘walking legs’ (perioods) and pleopods;
- The antennae, for sensing their environment; and
- The maxilla and maxillipeds, to grip and chop their food.

Fig. 3. Identifying characteristics of male (♂) and female (♀) *M. rosenbergii* (after New and Singholka 1985)

Among *M. rosenbergii*'s five pairs of walking legs, the second is the biggest and has a pincher (chela) at its tip. Both legs of this second pair are of the same size. Mature *M. rosenbergii* males are bigger than the females, with their cephalothorax larger and their second pair of thoracic legs comparatively longer and thicker. The cephalothorax of the male is also proportionately larger and the abdomen narrower than the female's. The genital pores of the male are situated at the base of the fifth pair of walking legs. In immature males, there is a raised hard point on the first segment of the abdominal part of the body (see Figure 3). Genital pores of the female are situated at the base of the second pair of thoracic legs. The abdominal pleura of the female are comparatively longer and the abdomen wider. The orange-coloured maturing gonad is easily visible. It is relatively easy to differentiate between deheaded freshwater prawn and marine shrimp. In freshwater prawn, the second abdominal pleuron overlaps the first and third pleura. In marine shrimp, the second pleuron overlaps only the third pleuron and is itself overlapped by the first.

Older *M. rosenbergii* juveniles and the adults are normally distinctively blue in colour. Occasionally they are brownish, with orange stripes. Brown or grey specimens are sometimes encountered. Colour seems to be related to the quality of soil and water in their environment.



Identifying characteristics

M. rosenbergii can be identified on the basis of following characteristics

- The carpus of the perioods is longer than the merus.
- **The second pair** of perioods in the male is thicker than in other species.
- There are 13 teeth in the lower part of the rostrum.
- The rostrum is long and slightly bent upward.
- Telson extends up to the end of the uropods.

Distinguishing characteristics of male and female

<i>Male</i>	<i>Female</i>
The second pair of periopods is quite long and has many spines.	The second pair is not so long and is spineless
The genital pore is situated at the base of the fifth periopod.	The genital pores are situated at the bases of the third periopods.
The appendix masculina is situated in the second abdominal appendages.	

A key to the larval stages of the freshwater prawn, *M. rosenbergii*

Before metamorphosis, the larva passes through eleven distinct stages. **At the first stage** it is less than 2 mm in length, from the tip of the rostrum to the end of the telson. **At metamorphosis**, it measures about 7 mm.

The following is a simplified key to the eleven larvae stages (Uno and Soo, 1969) of *M. rosenbergii* and is illustrated in Figure 4 (on facing page). The 'prominent characteristics' mentioned are some features which appear for the first time or only at the particular stage.

<i>Stage</i>	<i>Prominent characteristics</i>	<i>Days after hatching</i>
I	Sessile eyes	1 - 2
II	Stalked eyes	2 - 4
III	Uropods appear	4 - 7
IV	Two dorsal epigastric teeth at the base of the rostrum	7 - 12
V	Telson narrower and elongated	11 - 16
VI	Pleopod buds appear	15 - 21
VII	Pleopods biramous and bare	18 - 24
VIII	Pleopods with setae	22 - 28
IX	Endopods of pleopods with appendices internae	25 - 31
X	Three or four dorsal, teeth on rostrum	28 - 33
XI	Teeth on half of upper dorsal margin	31 - 50
Metamorphosis		
XII	POST-LARVAE: Teeth on upper and lower margin of rostrum (also behavioural changes, mainly in swimming). They are generally transparent at this stage, and have a slightly brown-coloured chromatophore on the head.	35 - 50

Fig. 4 *Macrobrachium rosenbergii* larvae. Stages 1 through 12
(after New and Singholka 1985)

