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A note on the dependence of juvenile marron, *Cherax tenuimanus* (Smith) (Decapoda: Parastacidae), on filter feeding

R.A. van den Berg,* H.J. Schoonbee and H.H. du Preez
Research Unit for Aquatic and Terrestrial Ecosystems, Department of Zoology, Rand Afrikaans University, P.O. Box 524, Johannesburg 2000, Republic of South Africa

* To whom correpondence should be addressed

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Problem areas in the production of *Cherax tenuimanus*, a freshwater crayfish (the 'marron') introduced to South Africa from Australia, are outlined. The high juvenile mortality rate problem is discussed. With reference to the morphology of the mouthparts of the juveniles, a type of diet is proposed which, it is suggested, will lower the mortality rate.

Daar word verwys na die probleemareas in die produksie van *Cherax tenuimanus*, die ingevoerde Australiese varswaterkreef (die 'marron'). Die probleem van 'n hoë mortaliteit gedurende die jong stadia van die lewensloop word bespreek. Met verwysing na die morfologie van die monddele word 'n tipe dieet voorgestel wat na verwagting die oorlewing sal verhoog.

Keywords: *Cherax tenuimanus*, freshwater crayfish, marron, rearing.

The Australian freshwater crayfish, *Cherax tenuimanus* (Smith) also known as marron, has become available in South Africa, subject to permit approval (Walmsley, 1987), for research and aquacultural purposes. Despite the existence of what appears to be a very lucrative market for this crayfish product in South Africa, its production thus far has remained at a very low level (Hecht, 1987; Walmsley, 1987). Cannibalism, sensitivity to low oxygen levels and high juvenile mortality rate have been identified as major problem areas in its aquaculture (Morrissy, 1976; 1979). Solutions have been proposed for the self-predation and low oxygen problems (Morrissy, 1979; 1984; Van den Berg & Schoonbee, 1989) but the high mortality rate for juveniles has thus far received little attention and has remained unsolved.

Morrissy (1976) attributes the high juvenile mortality rate to maternal predation, particularly by newly ecdysed females, and fighting as the very crowded young marron seek to establish themselves in the new environment, particularly with respect to shelter.

A batch of juveniles, kept under optimum conditions of space, shelter and protection from maternal predation in the laboratory of the Zoology Department at the Rand Afrikaans University, all died within six weeks. This focussed attention on juvenile diet, a factor apparently not considered by Morrissy (1976) as a potential cause of high juvenile mortality.

Although the adults are macro-molecular feeders (Caine, 1975; Van den Berg & Schoonbee, 1989) the juveniles grow up in their natural environment under conditions where detritus is freely available (Morrissy, 1980).

Therefore, as a first step in the investigation of the problem, it was necessary to ascertain whether or not juvenile marron possessed the mechanical ability to handle the laboratory-provided zooplankton and detritus as food. The structural features of the mouthparts of juvenile marron were thus investigated.

The juveniles that were selected for this study corresponded to the 'Phase 1' juveniles in the study of Morrissy (1976). They were completely free-living, had lost the 'humpback' larval stage, had long setae on the telson (in contrast to the pleopod attached larval forms which do not have these setae) and showed mouthpart feeding movements. The length from eye orbit to carapace posterior margin ranged from 3,5 mm to 3,8 mm in the 10 individuals investigated. The mouthparts of the juvenile crayfish were dissected out, cleared in 50% lactic acid and compared under the microscope to the mouthparts of adult crayfish as described by Van den Berg & Schoonbee (1989).

On comparing the anatomy of the mouthparts (maxillipeds, maxillae and mandibles) in terms of joint shape, seta shape and seta placement with that of the adults, no obvious differences could be found. Figure 1 shows, for example, the structure of maxilliped 2 of a juvenile marron which is comparable with the adult maxilliped 2 as described by Van den Berg & Schoonbee (1989).

A structural feature which can not be shown effectively in diagrammatic form, is the amount of sclerotization of the exoskeleton and particularly of the grinding surfaces such as the crista dentata on the ischium joint of maxilliped 3. In adult crayfish the mouthparts and working surfaces are very heavily sclerotized in contrast to those of the juveniles where the comparable exoskeletal structures are completely transparent and show no signs of sclerotization at all. According to Caine (1975), Manton (1977), and Van den Berg & Schoonbee (1989), it is the heavily sclerotized maxillipeds and mandibles which enable the adult marron to cut large pieces of food into smaller portions which can be fed into the mouth. The juveniles with unsclerotized mouthparts do not have this cutting ability and must rely on small pieces of food which occur in the detritus found in the environment in which marron live.

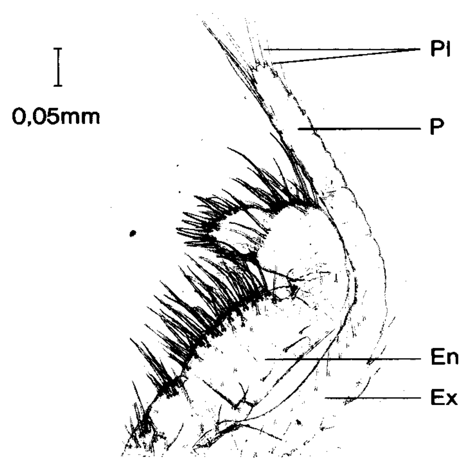

Figure 1 Aboral view of a left maxilliped 2 of a *Cherax tenuimanus* juvenile. En: endopodite, Ex: exopodite, P: palp, Pl: plumose setae.

Figure 2 shows the insertion of setae on the anterior edge of the palp shown in Figure 1. The general morphology corresponds very closely to comparable structures found in the adults. However, considering the size of the juvenile structure, it becomes clear that a very fine sieve is formed by the feather-shaped setae on the palp. The distances between the rami on the shaft in Figure 3 are ± 0,002 mm and if the setae are arranged to overlap, even smaller spaces are formed. The juveniles are therefore provided with a fan-like sieve which enables them to filter small organisms such as crustacean larvae, big protozoa, unicellular algae and clusters of bacteria on detritus particles from their aqueous environment.

Figure 2 Plumose setae on anterior edge of palp shown in Figure 1. P: palp, Pl: plumose seta.

Figure 3 Plumose setae enlarged. R: rami, S: shaft.

Adult marron are macro-particle feeders (Caine, 1975; Van den Berg & Schoonbee, 1989) and this capacity has thus far been utilized in the laboratories of the Rand Afrikaans University to maintain the *Cherax* stock. Fish pieces, earthworms, sweet-potato leaves, various species of aquatic plants, dog food pellets, trout pellets and lucerne have all been successfully fed to the adults. Uneaten food, having accumulated for two days, is normally siphoned off, removing most of the detrital material in the aquaria. Juveniles were kept under identical conditions in order to prevent the uneaten food from decaying and affecting the oxygen level of the water. It is now clear that the process of siphoning off the unused food also removes the minute plants, animals and detrital material apparently required by the juveniles. The mortality of juveniles mentioned above was therefore most probably due to starvation.

For the maintenance of juvenile marron under laboratory conditions, the correct particle size and type of food will have to be provided. This requirement is not so obvious in nature or under aquacultural practices in farm dams because organic material falling into the water or added to the water in the process of feeding the marron, is eventually broken down to micro-particles which mix with the micro-organisms to form the detritus on which the juveniles feed.

The balance between living and non-living material in the detritus may be very important because fermentation of an excessive amount of the non-living portion would deplete the oxygen in the water (Morrissy, 1979). One must therefore add to the list of factors that contribute to juvenile mortality the factors of food type and particle size.

Although adult marron can presently be maintained for long periods of time in the laboratory, maintenance of the juvenile remains a problem. A diet for juveniles is presently being sought which will contain the minimum of decaying material together with an adequate amount of filterable live planktonic organisms, and which would be suitable for promoting growth to the stage at which they develop the ability to feed on macro-material.

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