

10. HATCHERY FEEDS FOR THE MUD CRAB *SCYLLA SERRATA*: TOWARDS A NUTRITIONALLY COMPLETE DIET

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There has been increasing interest in the aquaculture of mud crabs (*Scylla* spp.) both in Australia and throughout Asia. In Australia, the lack of technology for the hatchery production of crablets has been one of the main constraints to developing a mud crab grow-out industry. Recently, the Bribie Island Aquaculture Research Centre (BIARC) conducted an Australian Centre for International Agricultural Research (ACIAR) funded project aimed to develop techniques for the aquaculture production of the crab. The hatchery component of this project identified larval nutrition as a critical factor in the mass production of crablets. The culture of mud crab larvae is currently based on a diet of the brine shrimp, *Artemia* spp., particularly in the late larval instars. Declining survival near the end of the larval cycle and a high incidence of failure to complete the first metamorphosis indicate a possible nutritional deficiency.

Commercially exploited sources of *Artemia* occur throughout the world and it is well documented that the nutritional content of newly hatched nauplii varies considerably among the types sourced from different geographic locations. When newly hatched nauplii are being used, therefore, the selection of *Artemia* type for feeding cultured marine larvae is critical to supplying an appropriate nutritional profile. Additionally, the natural harvest of *Artemia* cysts has recently been declining and has resulted in rising cyst prices and some cyst types becoming unavailable. A series of experiments was conducted at BIARC to investigate nutritional factors influencing the value of *Artemia* nauplii as feed for mud crab, *S. serrata*, larvae.

The experiments compared the survival and growth of mud crab larvae fed nine types of *Artemia* nauplii hatched from cysts. The cysts were sourced

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from San Francisco Bay, Great Salt Lakes, China, Vietnam and other locations unspecified by the supplying companies. The influence of nutritionally enhancing *Artemia* nauplii of different types with a commercial lipid emulsion (Super Selco, INVE Aquaculture) and selected microalgae species (*Nannochloropsis oculata* and Tahitian *Isochrysis* sp.) was also investigated. All diets were biochemically analysed for protein, lipid, ash and gross energy, as well as for fatty acid and amino acid profiles and vitamins A, E and C.

Only three of the nine *Artemia* types assayed in this experiment were able to support development of a significant proportion (>40%) of larvae through to the megalopa stage: one from China, one from Vietnam and the other a graded type (AF grade, INVE Aquaculture) sourced from an unspecified location. Similar survival performance of all *Artemia* treatments was observed initially with a point of divergence between 'good' and 'poor' treatments occurring around day 12 (Figure 10.1). Following the point of divergence, larvae from the poorer performing treatments suffered a high incidence of moult death syndrome (MDS), an inability to complete the moulting process at the first metamorphosis.

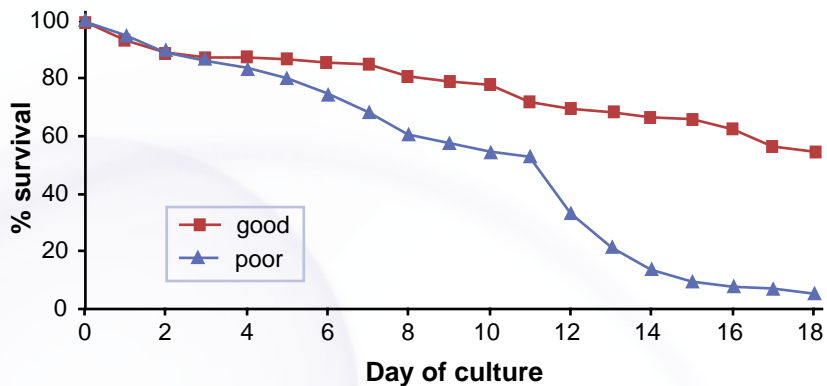


Figure 10.1. Survival of mud crab larvae fed 'good' and 'poor' *Artemia* types.

Neither larval survival nor growth were significantly affected by enrichment of nauplii with a prepared lipid emulsion (Figure 10.2) or selected microalgae species used alone and in combination in the larval culture medium.

Biochemical analyses confirmed that the lipid emulsion enrichment technique increased levels of the fatty acids DHA and EPA and others in the different *Artemia* types. However, the experimental results indicated that a simple elevation of these particular fatty acids in the diet does not correct the apparent nutritional deficiency of the nauplii.

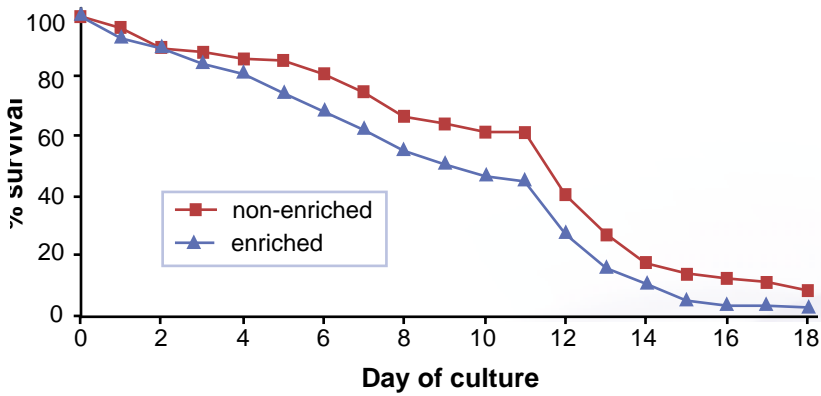


Figure 10.2. Survival of mud crab larvae fed enriched and non-enriched *Artemia* nauplii.

All biochemical data have now been collected and are being statistically analysed with the aim of identifying the critical limiting components, or class of components, in the larval diet. A preliminary statistical treatment of the incomplete data-set indicated that phospholipid content of the *Artemia* is positively correlated with mud crab larval survival and is also strongly represented in the multiple parameter model for mortality rate.

The simplest solution for a mud crab hatchery is to secure a source of high-nutrition *Artemia* cysts. In the short term this seems to be a poor option due to low availability and high prices. The three best-performing cyst types identified in this study are not commercially available. The longer-term solution is to use information on the nutritional requirements generated from this study to customise an enrichment formulation for crab larvae. Alternatively, a particulate dietary supplement — one that specifically corrects the deficiency in the standard *Artemia* diet — could be formulated

to feed direct to the larvae. There is already information indicating that crab larvae ingest inert micro-particulate diets and that some improvement in larval performance can be achieved. One further option is to explore the use of other live food sources, such as copepods, that are potentially a nutritionally complete prey item for crab larvae.

The production of crabs is set to undergo rapid development, and investors in Australia are already involved. Overseas, mud crab aquaculture continues to grow in popularity leading to a strong demand for crablets and therefore hatchery production. Determining the critical nutritional requirements of the larvae is an important step towards developing reliable hatchery techniques.