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Spat Production of the Greenshell™ mussel

Perna canaliculus

in

New Zealand

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ABSTRACT

The research presented in this thesis was undertaken in order to develop an understanding of the biology of *Perna canaliculus* sufficient to allow for commercial hatchery based production of Greenshell™ mussel spat. Hatchery production is an alternative to unreliable and inconsistent wild spat collection.

In a *Perna canaliculus* population followed for one year spawning occurred in early spring and late summer. Three quantitative histological measures of gonad maturity utilising image analysis technology and a qualitative classification system were compared. Measuring the relative surface area comprised of gametes on histological sections was found to be the most reliable method. A practical gonad visual index to determine the reproductive condition of adults for the selection of broodstock was developed and found to be highly effective as a means of predicting induced spawning success. Serotonin was not effective for inducing spawning of *Perna canaliculus*. Temperature shock and the use of stripped gametes was however found to be a reliable spawning induction method.

Relative gamete concentration, gamete age, temperature, sperm half life and gamete contact times were all found to have effects on fertilisation success for *Perna canaliculus*. Sperm concentration and the conditions of sperm aging were particularly important. Fertilisation kinetics of *Perna canaliculus* gametes modelled using the Vogel-Czihak-Chang-Wolf method suggested that 5% of sperm-egg contacts lead to successful fertilisation.

Broodstock management protocols that could be used to condition the adult of *Perna canaliculus* were investigated in order to enhance and prolong the natural reproductive season. Research suggested that for successful broodstock conditioning animals should already have begun gametogenesis at the time conditioning is commenced. Successful conditioning of *Perna canaliculus* was achieved at temperatures between 10 and 16°C over a period of about 50 days. A diet ration above 2-3% of the dry meat mass per day is suggested. A trial examining non-algal diet supplements suggest a mixture of yeast and lipid emulsion may have some potential value. Photoperiod manipulation did not effect the reproductive condition of *Perna canaliculus*.

The yield of veliger larvae was significantly enhanced if embryo culture water was treated with 1.0 mg/l EDTA. Veliger yield was not significantly affected at densities below 50 embryos/ml.

Perna canaliculus larvae grew most rapidly and survived well at the salinity of 35 ppt. Larvae grew most rapidly when cultured at low densities. Experiments suggest that early larvae can be cultured at 5-10/ml, however late stage larvae grew most rapidly when cultured at 1/ml. *Perna canaliculus* larvae displayed best growth and good survival if fed a mixed flagellate-diatom diet comprising *Isochrysis galbana* (T-Iso) and *Chaetoceros calcitrans*. The optimal diet ration, as a function of larval size, increased from about 20 cells/ μ l *Isochrysis galbana* (T-Iso) to around 150 cells/ μ l through the larval development period.

Thyroxine between the concentrations of 10^{-5} and 10^{-8} M did not have an observable effect on larval developmental rate or eye spot development. Down welling settlement systems were found to be generally successful for *Perna canaliculus* larvae. L-DOPA was also demonstrated to enhance the settlement and metamorphosis of *Perna canaliculus* pediveligers.

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