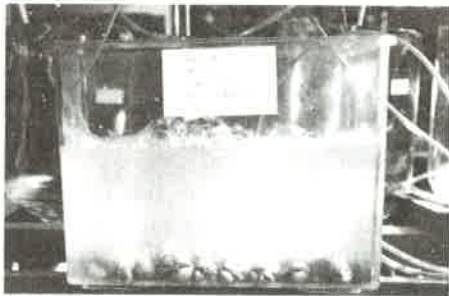


# Cockle (*Anadara granosa*) Seed Produced in the Laboratory, Malaysia

Peninsular Malaysia is the world's largest producer of the blood cockle, *Anadara granosa* (actually an arc shell, Family Arcidae), with more than 3,000 ha of coastal mudflats currently under cultivation. Cockle production in 1981 exceeded US\$30 million and in 1982 more than 40,000 t were exported to neighboring countries.

The Malaysian cockle industry is based entirely on a natural seed supply. In



1

recent years a number of factors have contributed to periodic shortfalls of seed supply, which not only threatened the country's position as a leading cockle producing nation but also adversely affected the livelihood of a number of coastal villages, such as Kuala Juru in Penang, West Malaysia, where cockle culture provided the major source of income.

In response to problems posed by the fluctuating natural seed supply and with the aim of generating employment and income among the poor rural fishermen, the International Labor Organization and through it, the Government of the Netherlands have funded a three-year research program by scientists from the Universiti Sains Malaysia. The program aims to develop the technology for the production of seed of the cockle and other commercially important bivalve species and to assist in the subsequent transfer of these technologies to the fishermen of Kuala Juru and other nearby villages through the setting up of hatcheries for bivalve seed production.

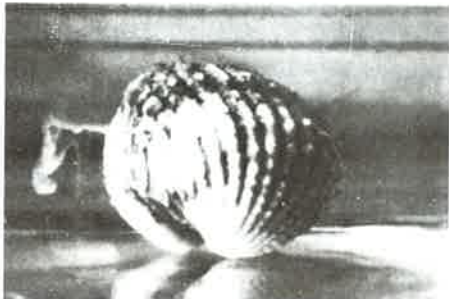
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WONG TAT-MENG  
and  
LIM TECK-GHEE

School of Biological Sciences & Centre for  
Policy Research  
Universiti Sains Malaysia  
Pulau Pinang, Malaysia



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1. Mass spawning of *A. granosa* on second exposure to warm temperature. 2. Females spawning. 3. Male spawning. 4. Early umbo veliger of *A. granosa*. 5. 52-day juveniles.

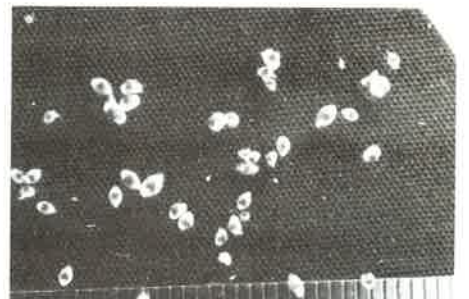
The program began in October 1982 and by December 1984, the scientific team led by the authors, working in collaboration with Mr. Ng Fong-Onn from the nearby Fisheries Research Institute, successfully produced spat from eggs previously induced-spawned in the University's Muka Head laboratory. Thermal shock was used to induce spawning artificially in field ripened cockles. Spawning was consistently induced by alternate immersion of gravid cockles in water at 16-18°C and 30-32°C for periods of 1.5-2 hours. Spawning took place soon after the second exposure to the higher temperature.

Mature eggs measured approximately 55 µm in diameter. Cell division began within 10-15 minutes after fertilization and the trochophore larvae were moving actively after four hours. Straight-hinged larvae (D-stage) were seen after 22 hours; soon after the larvae began to feed.

Reared on a diet of microalgae (*Isochrysis* sp.), larval development proceeded through the umbo stage after 13 days and settled after 21-22 days with shell lengths varying between 230 and 250 µm. Water temperature ranged from 26-30°C. After 28-30 days, the spat developed the characteristic



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ribs on the shell and assumed the adult form. Postsettlement culture was carried out using an upwelling system with feed (consisting of mixed brown cells) injected into the intake point at periodic intervals. Juveniles showed excellent growth and shell lengths of 2.5 mm were attained after a further 30 days.

Currently studies are in progress to determine the conditions of temperature, salinity and feed for optimal growth and survival. Besides the cockle, other commercially important species, such as the razor clam (*Solen brevis*), have also been induced to spawn and larvae reared to the adult stage. Breeding biology, induced spawning and larval development studies have also recently been extended to other bivalve species, such as the short-neck clam (*Paphia undulata*), and a number of fan shells (Family Pinnidae).