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(Noumea, New Caledonia, 6-10 August 1990)

ICLARM COASTAL AQUACULTURE CENTRE STATUS REPORT



**Report to the Twenty-second Regional
Technical Meeting on Fisheries**

SOUTH PACIFIC COMMISSION
Noumea, New Caledonia, 6-10 August 1990

New grants and support for the CAC

The Coastal Aquaculture Centre and Giant Clam Mariculture Project have benefited from a number of supporting grants which have been confirmed in recent months.

The Skaggs Foundation has provided a grant of US\$15,000 for development of the Nusa Tupe Field Station (see below) and ocean nursery facilities.

The London-based Commonwealth Fund for Technical Cooperation (CFTC) will provide the Project with the services of a senior level Mariculture Advisor for a period of two years in the first instance. The appointee, who is expected to arrive in October, will oversee all of ICLARM's work on ocean nursery and grow-out systems for giant clams, both in the Solomon Islands and regionally.

The United States Peace Corps and the United Kingdom's Voluntary Service Overseas (VSO) will each provide a volunteer for two years. The Peace Corps volunteer will primarily be responsible for the village-based ocean nurseries in the eastern part of the Solomon Islands (those areas accessible by boat from the CAC) and will take over the work formerly handled by Hugh Govan. The VSO appointee will manage the Nusa Tupe Field Station and be responsible for village-based ocean nurseries in the Western Province.

The Australian International Development Assistance Bureau (AIDAB) has made a grant of A\$65,000 per year for a regional study of predation of giant clams. The grant is for one year in the first instance, renewable for a second year subject to progress and availability of funding. The project will be done on a collaborative basis between ICLARM, a University of the South Pacific group led by Dr Alison Haynes, the James Cook University group led by Dr. J.S. Lucas and four participating groups selected from within the current participants in the Giant Clam Research Group. Hugh Govan has been appointed to a position of Assistant Research Scientist to co-ordinate the project. The grant provides substantial funding for travel and some equipment for all participating groups. Expression of interest in participating in the research would be welcome.

The rationale for the project is that within the next few years many giant clam hatcheries will become operational and hatchery-reared spat will be transferred to ocean nurseries and thence to grow-out sites where they remain until harvested. However, the tropical Indo-Pacific coral reefs, lagoons and shelves can be sub-divided into a great range of habitats which are suitable, in varying degrees, for giant clam cultivation. In particular, while some habitats offer excellent conditions for the growth of clams they also harbour large numbers of predators, particularly gastropod snails but also various crustaceans and fishes, which are able to enter the protective nursery cages or enclosures and then prey upon juvenile clams.

Some of the species are exceptionally voracious and can rapidly kill large numbers of clams in a short time. However, our knowledge of the identity of these predators and understanding of their ecology is sparse. Clams become progressively more resistant to predators as they increase in size but the "safe" sizes are currently poorly understood. The different clam species are likely to have different responses to predators and exhibit different survival rates but these details are also unknown.

A little recognised but obvious feature of giant clam culture is that survival rates are basically more important to success than growth rates. A slow growing clam can, for example, be harvested a few years later but a dead clam offers no further potential. However, there are remarkably few reports on survival rates of giant clams either under natural or cultivated conditions.

The International Centre for Ocean Development (ICOD) has made a grant of C\$175,000 over two years for "Expansion of Giant Clam Production of the Coastal Aquaculture Centre". The grant is disbursed through the regional Forum Fisheries Agency and will permit a trebling of the productive capacity of the CAC by way of increased pumping and tank capacities, a continuous power supply, improved sea-going facilities and substantial funds for additional staffing and operational costs. An immediate vacancy exists for a Scientific Assistant recruited from within the member countries of the South Pacific Forum.

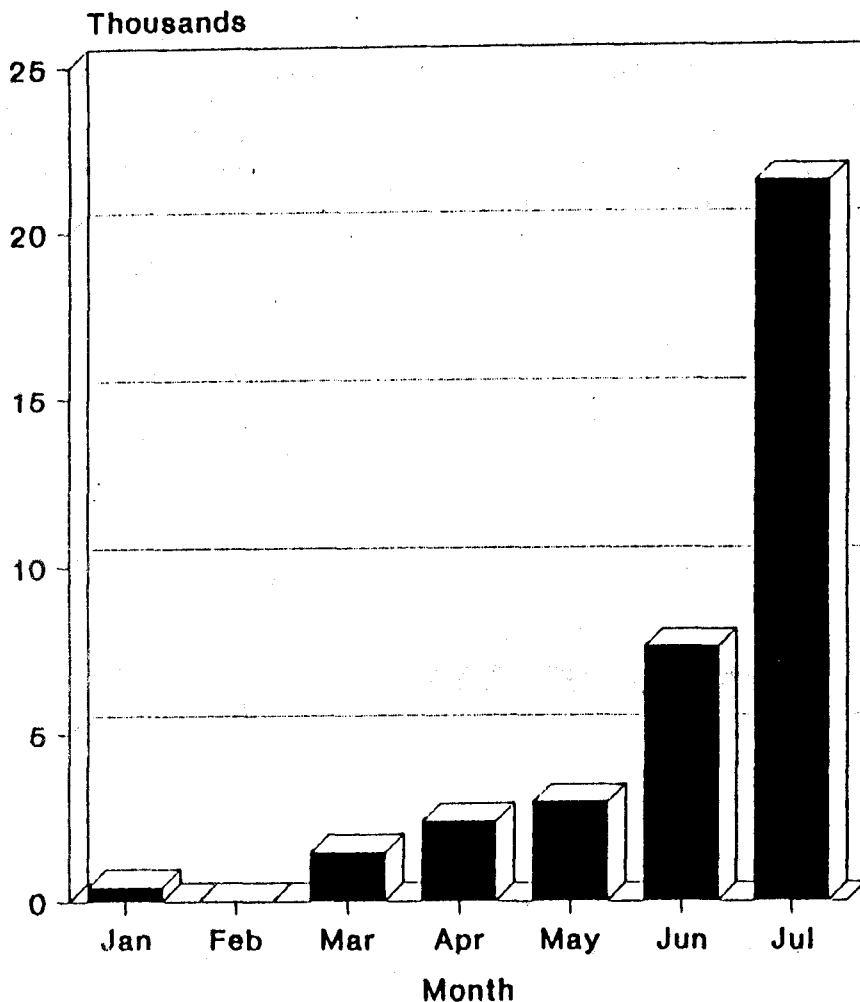
Giant clam cultivation techniques.

During 1989 larval rearing techniques for *Tridacna gigas* at the CAC were greatly improved and very high survival rates through metamorphosis were attained as a result of a combination of artificial feeds and good husbandry techniques. However, production of spat was relatively poor, principally as a result of heavy mortality of spat in the 3-10 mm size range. This was attributed to heavy overgrowths of a blue-green algae which

smothered the clams. The problem was overcome by the use of a combination of grazers, principally surgeon fish, salt-acclimated tilapia and a variety of herbivorous gastropods from families such as Modulidae, Cerithiidae, Aplysiidae and Bullidae. The invertebrates conveniently settle naturally in the tanks and raceways while the fish are caught either by beach seine in sea grass beds or with the use of traps placed on the reef at the CAC.

Spat production is now in excess of 20,000 9 mm spat per month (Fig 1) and is expected to stabilize at this level until the tank system is expanded or techniques further improved.

Monthly Production of Juvenile Clams into the Ocean Nursery 1990



Giant clam culture facilities at the CAC

In March, the Fisheries Division of the Solomon Islands Government supplied a new 4" diesel-driven Yanmar pump to the CAC, providing a further backup for the existing 4" and 2" pumps.

A number of new tanks and raceways have been constructed during the first 4 months of 1990. A set of twelve small (1.0 m x 0.5 m) canvacon raceways with cement substrata have been constructed. These are arranged in 4 groups of 3 raceways and are raised on timber frames for ease of working. They will permit a greater range of experiments on conditions affecting growth and survival in the nurseries.

Five "canvacon" circular tanks with galvanised sheet steel walls have been completed. These have been constructed using double-width canvacon (3.63 m wide) to give a tank width of 2.5 m and depth of 0.5 m. The bases of the tanks have been lined with cement. Materials cost about US\$32.

A D-ended, in-ground continuous raceway, dubbed the "hippodrome", has been constructed. The walls are lined with chicken wire and cement. The parallel-sided raceways are 2.5 m long x 1.25 m wide joined by a 1.25 m semicircle at each end. There is a standpipe drain at each end of the central divider. Using a set of simple "monks", the outflow from the online tank/raceway complex is diverted through the hippodrome (Fig 2). Spat are thriving in the system and it thus represents an effective use of the waste water from the system

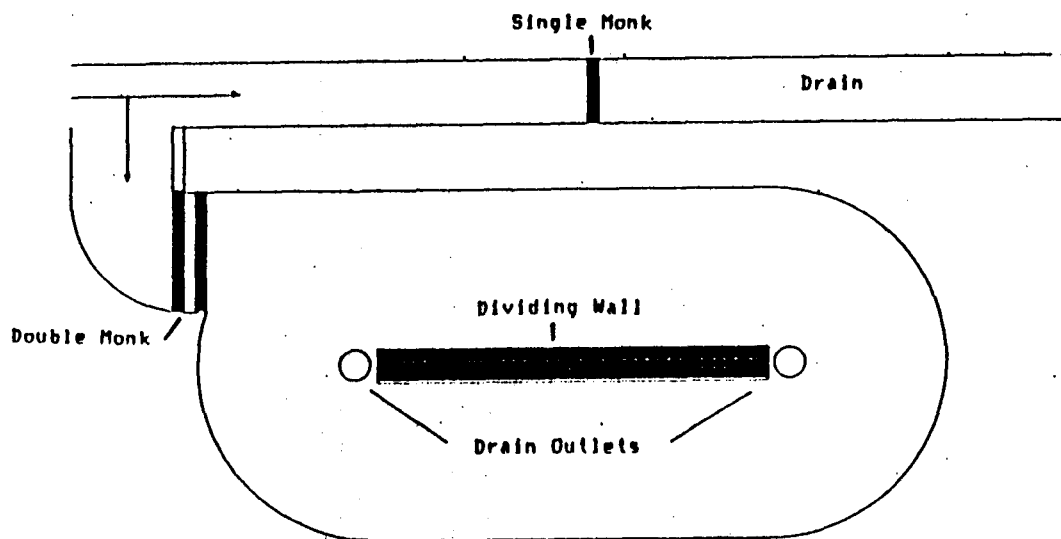


Figure 2. Plan view of D-ended continuous raceway at the CAC.

Additionally, a new design of 10 m² circular tanks constructed from breeze blocks, with a modest amount of reinforcing rods has been perfected. These cost US\$230 each for materials and can be built by semiskilled labour.

All of these tanks represent additional space for rearing spat through the 2-9 mm size range as this is currently the limiting factor in production of juveniles at the CAC.

Using the ICOD/FFA funding, an additional 30 breeze-block tanks plus two more "hippodromes" will be constructed over the next 18 months to give a total of 500 m² of tank space at the CAC. Output is expected to rise to 750,000 six month old spat per year by 1992. Two additional 4" pumps will be installed.

A new floating catamaran-style ocean nursery has been designed and tested in the relatively exposed waters at the CAC. In the first test 1000 *Tridacna gigas* spat grew from 9 mm to 20 mm in 40 days with 98% survival. Subsequent test have confirmed that spectacular growth and survival rates are attainable and a construction programme is underway to expand the fleet of catamarans.

First international shipment of larval giant clams

On Wednesday, April 4, 1990, Prof. Ed Gomez, leader of the giant clam project at the Marine Science Institute, University of Philippines, left the CAC with over 2 million ten-day old *T.gigas* pediveligers packed into 10 plastic bags. Each bag contained approximately 200,000 larvae in one litre of 1 µm filtered UV sterilized seawater, with 1 ppm chloramphenicol. The bags were inflated with oxygen and sealed with wire ties. Prof. Gomez carried four of the bags in his hand luggage and six were packed in an insulated cold-box which travelled in the hold. His journey to Manila via Port Moresby and Singapore lasted approximately 34 hours. On arrival at Manila airport the plastic bags were opened, reinflated with oxygen and then transported by road to the Marine Science Institute's research station at Bolinao, where they were counted and transferred to three settlement tanks where they will go through a six month quarantine. By April 9, 15-20% of the larvae were estimated to have survived and metamorphosed successfully. It was expected that the University of Philippines should harvest 15,000-60,000 two-month old juveniles from this batch, but it appears that most succumbed in a heatwave in May when intake water temperatures rose to 34°C.

This initial attempt indicates that transporting *T.gigas* larvae between countries is feasible. Ecologically it is sounder than the transfer of settled juveniles or adult clams because the chances of transfer of disease organisms is much smaller. For the recipient organisation it is easier and cheaper to maintain very

small juveniles in quarantine conditions than equivalent numbers of large post-settlement juveniles. Transport costs are also much lower.

In the future the CAC will carry out more trials on the transport of *T.gigas* larvae and early juveniles, including the hermetic sealing of plastic bags, enabling them to be transported flat, allowing for greater surface area for gas exchange and eliminating leakage. Our preference is currently for shipping metamorphosed juveniles as there is a window of approximately two weeks after metamorphosis during which the juveniles can easily be flushed from the holding tanks and shipped out, with the expectation that up to 20% will survive to the first visible and easily-countable stage of 8 weeks. Currently the CAC can produce on a monthly basis far more larvae than can be settled in our tank system and will consider requests for these from countries where *T.gigas* has recently become extinct or where insufficient broodstock are available to maintain a regular spawning schedule.

New field station to be developed

ICLARM has completed an Agreement with the Provincial Government of Western Province, Solomon Islands, for the development of a field station at Nusa Tupe near Gizo. Nusa Tupe (which translates to "Coconut Crab Island") is the site of the Gizo air-strip and is about 1.5 km offshore from Gizo and has no permanent inhabitants. The field station site is on the south-east corner of the island fronting an exclusive marine leasehold of about 13 ha of shallow sheltered reef. The area has strong tidal flushing and very high water clarity.

The Station will be managed by a Scientific Assistant, provided by UK Voluntary Service Overseas in the first instance, supported by a caretaker/field hand. The Western Province Fisheries Department will assign a Fisheries Officer to the station on a full-time basis and provide office space in Gizo.

Facilities at the Station will consist of houses for the manager and a caretaker/field hand and a small work-shop, store and "laboratory". Buildings and boats are to be funded from the Skaggs Foundation grant.

The Station will be ICLARM's primary venue for work on selective breeding and on nursery and growout systems and will also serve as a distribution point for giant clam seed in the Western Province.

Processing and product development

Dr. Russell Parry of the Overseas Development Natural Resources Institute (ODNRI) in London worked at the CAC for two months from February to April, investigating the properties of *Tridacna gigas* muscle and mantle flesh.

A comprehensive report is being prepared covering morphometrics and chemical composition of the mantle and adductor muscle, iced and frozen storage of mantle and adductor and accompanying textural changes, drip losses, effects of prolonged storage, effects of cooking and the preparation of dried adductor and mantle.

This work plus previous work on *T. derasa* adductor and mantle at ODNRI by T. Sanders in 1987 and subsequent work at the CAC confirms that it is possible to produce good quality dried kaibashira ("dried white ligament") from *T. gigas*. A relatively sophisticated but inexpensive smoking/drying kiln was constructed in Honiara for this work.

ICLARM consultant Lynda Cowan is scheduled to visit Japan, Taiwan, Hong Kong and Singapore in May to investigate the range of shellfish products which are consumed, their prices, their preparation for consumption and the manner in which they are processed.

The reports on these investigations will be released as soon as they are completed. All of this work has been funded by the UK Overseas Development Administration through their Fiji-based British Development Division in the Pacific (BDDP).

Socio-economic studies

ICLARM has entered into a formal Memorandum of Understanding with the Centre for Development Studies (CDS) of the University of Bergen to undertake collaborative studies. The initial focus is on "Economic, social and legal aspects of coastal aquaculture in the Indo-Pacific Region" and a proposal for support of the work has been drawn up by Drs. Edvard Hviding of CDS and John Munro of ICLARM. Dr. Hviding has previously worked in the Solomon Islands on traditional management of resources of the Marovo Lagoon and will return to the Solomons in late 1990 to investigate socio-economic factors affecting the current village-based giant clam ocean nursery trials.

Collaboration with University of Ghent

A memorandum of Understanding has been exchanged between ICLARM and the University of Ghent to facilitate collaborative research. The University of Ghent team, Dr P. Sorgeloos and Mr Peter Coutteau are involved in the development of a yeast-based microdiet for bivalves. A protocol for testing the diet against the CAC's standard 50:50 of Frippak Booster and freeze-dried *Tetraselmis suecica* will be implemented in October.

Reef fish ranching and reserves

A small SPREP-funded project designed to examine the movements of reef fishes within the CAC's exclusive marine leaseholding is being undertaken. Following delivery of the fish tags and construction of a fleet of ten Antillean Z-traps, a total of several hundred fish have been tagged to date.

Pearl oyster cultivation

The CAC is planning to launch a project aimed primarily at mass cultivation of black-lip, and gold-lip pearl oysters *Pinctada margaritifera* and *P. maxima*. It is hoped that Mark Gervis will be able to launch a preparatory study starting in November but this is subject to confirmation of financial support for the work.