



RESEARCH NOTES AND REPORTS

Support for the Tongan pearl industry

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In May 2008, SPC's Aquaculture Officer went to Tonga to provide assistance to two projects aimed at stimulating the small-scale half pearl (mabe) industry in Tonga's Vava'u group.

A pearl shell carving training workshop was organised by SPC in Vava'u and involved local craftsman and woman who wished to improve their pearl shell and mabe handicrafts production. Tokerau Jim, a master carver from Rarotonga, Cook Islands, was contracted by SPC to deliver the highest possible quality, hands-on, training.

Following the workshop, a hatchery rearing run of the winged pearl oyster (*Pteria penguin*) was undertaken in Tongatapu at the Sopa mariculture center. This was conducted as part of an Australian Centre for International Agricultural Research (ACIAR)-funded project lead by Paul Southgate of James Cook University (JCU), Australia. The spat produced will be used to supply the Vava'u pearl farmers and thus increase the supply of pearl oysters to the industry and addressing a current bottleneck. They will also be used in experiments to refine culture and mabe production methods.

History of pearl farming in Tonga

Cultured pearls in the Pacific are dominated by the black pearl, which is produced from the black-lip pearl oyster (*Pinctada margaritifera*). In Tonga, pearl

oyster culture began in the early 1960s. In 1975, an experimental venture was set up by the Tongan government. Broodstock of the winged pearl oyster, *Pteria penguin*, were imported from Japan for initial culture trials. The FAO South Pacific Aquaculture Development Project (SPADP) provided assistance in 1989 in carrying out stock assessment, spat collection surveys and undertaking preliminary pearl production.

Commercial feasibility of pearl farming in Tonga was initiated in 1993. Japanese specialists estimated that an area of approximately 850 ha in the Vava'u islands could be farmed for half-pearl production, supporting annual production of around 750,000 pearls, with approximately 30% of these being first-grade. They assumed a value of around USD 30 each for first-grade half-pearls, and therefore a potential annual revenue from an area of 850 ha of around USD 7.5 million (Finau 2005).

Tonga is in a relatively unique position to diversify the range of pearl products because Vava'u has *Pteria penguin*, from which half-pearl (mabe) can be produced. One of the advantages of producing half-pearls is the lower capital and technological investment required (compared with round pearl production) and the value-added opportunities through jewellery and handicrafts. Already there is a small but thriving niche market selling mabe pearls and pearl shell handicrafts to tourists in Vava'u.

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Transferring unique carving technologies from Rarotonga to Vava’u

SPC’s Aquaculture Section targets livelihood opportunities. Mabe pearls and carved shell products are one of the lucrative opportunities supporting sustainable and profitable small-scale and rural development, especially in areas where tourism is developing.

In June 2006, in Kiribati, SPC’s Aquaculture Section, together with JCU, organised a similar carving workshop to introduce the basics of those techniques (Teitelbaum 2007). This present carving workshop was a more advanced course and had two major goals: 1) to provide an overview of the fundamentals involved in pearl jewellery and handicraft (tools and craftsmanship, jewellery and handicraft design, pearl handicraft preparation and setting and marketing techniques) and 2) to pay particular attention to the domestic market opportunities and local cultural carving and handicraft traditions of the Vava’u.

Tokerau Jim (www.tokeraujim.com) the master carver hired for this exercise, runs a successful business in the Cook Islands. For the occasion, he brought in some specific tools that he uses in his workshop in Rarotonga. The Taurus ring saw and the Foredom hand drill were the most noticeable technological improvement that were brought to Vava’u.

Traditionally, carvers use hand-grinders and hacksaws to produce their crafts, taking over 30 minutes to cut shapes from a shell when a ring saw can do the same job in less than a minute. Furthermore, the Foredom hand drill (with a 45,000 rpm rate compared with 30–33,000 rpm for a standard hand drill) allows carvers to be much more precise in their motifs and carvings.

Over this three-day event, trainees learned how to handle the new tools and how to produce better quality products with a true finished luster on them. Drawing and cutting shapes, designing pendants, earrings or whole shell art was demonstrated. Half-pearls (mabe) were also used for the carving exercises. Tokerau Jim demonstrated how to best use each shell and each mabe to reveal its best colour and true nature. Thanks to Tokerau Jim, trainees also learned how to incorporate traditional Tongan motifs into their carvings, thus producing uniquely Tongan products.

One of the bottlenecks to handicraft activity is the lack of supply of mabe and pearl shells, which limits handicraft production. How can handicraft and mabe production be improved given the current state of farming in Vava’u?

The need for spat

Recently, pearl farmers from Vava’u (regrouped under the Pearl Grower Association PGA) have



Carved mabe pearl and shell (photo: A. Teitelbaum).



Turtle carved from trochus shell (photo: A. Teitelbaum).

only grown a limited number of oysters that result from natural spat collection. Poor recruitment of spat to spat collectors has resulted in the harvesting of adult oysters from the wild, which has further impacted recruitment. Natural spat fall of *Pteria penguin* in Vava'u is now extremely limited.

ACIAR is funding a new research project involving collaboration between JCU, Tonga's Fisheries Division and SPC. The project will focus on the development of appropriate hatchery culture techniques for *Pteria penguin* and the use of hatchery-propagated oysters for pearl production in support of the Tongan cultured pearl industry. This project links in with SPC's Pacific Aquaculture Plan.

Further development of the pearl industry in Tonga is hindered by a lack of knowledge of *Pteria penguin* culture requirements and methods for optimising pearl production from this species. For example, only one preliminary study has reported on hatchery or nursery culture of *Pteria penguin* (Beer 1999), and while limited information is available relating to half-pearl production from the related *Pteria sterna* (Ruiz-Rubio et al. 2006), similar information is not yet available for *Pteria penguin*. Research is required to optimise culture methodology and pearl production from *Pteria penguin* as a basis for sustainable industry development. The ACIAR project will address the following major points:

- Hatchery culture of *Pteria penguin* and optimisation of hatchery culture techniques;
- Nursery culture and grow-out, optimising culture techniques;
- Half-pearl production and aspects affecting pearl quality (position, location, time);
- Training of Tonga Fisheries Department staff in culture methods and pearl production; and
- Training farmers and members of PGA.

Production of high quality half-pearl from *Pteria penguin* in Tonga has been clearly demonstrated and existing pearl farming expertise in Tonga provides considerable opportunity for this project to have immediate impact.

A successful spawning at SOPU mariculture facilities

In May 2008, the hatchery at Sopusu was upgraded and a hatchery run with *Pteria penguin* was conducted by Tonga Fisheries aquaculture staff assisted by one of the authors (A. Teitelbaum, SPC), Paul Southgate and Andrew Beer from JCU.

A batch of 30 broodstock was induced to spawn using thermal "shock", and sufficient eggs were produced to allow stocking of all available tanks in the hatchery. The temperature requirement of most pearl oyster larvae is between 26°C and 29°C,



Andrew Beer and Ve'a Kava draining down a hatchery tank stocked with *Pteria penguin* larvae (photo: A. Teitelbaum).



Overview of the Sopusu pearl oyster hatchery. Note the spawning tanks with broodstock in the foreground (photo: A. Beer).

but ambient water temperature in the larval culture tanks reached as low as 20°C overnight. This problem was rectified with a heat-exchange system where 40–45°C water was pumped from a heated “header tank” through a hose that ran through each of the larval culture tanks. This system helped maintain tank temperatures between 26°C and 30°C.

A large proportion of the micro-algae fed to larvae was provided as a commercially available algal concentrate obtained from Reed Mariculture in the USA. The species used were *Pavlova* sp. and T-ISO. The encouraging results indicate that algal concentrates may be of considerable benefit to hatcheries in the region by reducing the requirement to culture live micro-algae for larval pearl oyster culture. This would simplify hatchery production and reduce the need for specialised culture facilities and technical capacity.

More than 500,000 eyed larvae were placed into settlement tanks, and spat collectors containing spat were transferred to an ocean-based longline two weeks later. About 60,000 spat were harvested from spat collectors in September 2008, and were used to establish nursery culture experiments adjacent to the Sopa aquaculture facility and in Vava’u.

Both the spawning and larval rearing run of *Pteria penguin* and the shell carving workshop complemented each other in the sense that they assisted in increasing the supply of spat to the industry in

Vava’u as well assisting in diversification of the products of the Tongan pearling industry. In the near future this sustainable activity should gain in popularity and provide greater opportunity for alternative livelihood in Tonga.

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A small-scale floating raft farm for cultured *Pteria penguin* in Vava’u (Photo: A. Teitelbaum).