An Evaluation of Giant-Clam Farming in Solomon Islands: a Bioeconomic Analysis of *Tridacna crocea* and *T. derasa*

Robyn Lynette Hean
B.Ec (Hons) (Tasmania)

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Certification

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that, to the best of my knowledge, any help received in preparing this thesis, and all sources used, have been acknowledged.

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Abstract

Giant clams (*Tridacnidae*) offer small holders (village farmers) throughout the Indo-Pacific good prospects for commercial culture to satisfy their increasing dependence on the cash economy. Giant-clam farming is emerging as a village-based export industry in Solomon Islands as a result of an extensive program of trials run by the International Center for Living Aquatic Resources Management (ICLARM) and funded by the Australian Centre for International Agricultural Research (ACIAR) and other donors. ICLARM believes that funding should continue until a thorough assessment of the economic viability of the emerging industry is complete or until the industry is fully commercialised. As a precursor to future funding, however, there is significant need for a comprehensive economic evaluation of research and development activities. This thesis goes some way to achieving this goal.

In this thesis, a conceptual model of the evaluation problem is developed, with emphasis on the potential supply of cultured giant clams from a village farm. A bioeconomic model is designed, calibrated and implemented. The biophysical submodel describes the average growth of an individual giant clam and survival within the population. The biophysical submodel is used by the economic submodel, which describes the costs and revenues associated with farming a giant-clam population from planting through to harvest, to estimate profitability of the farming system.

The bioeconomic model is a general model that could be implemented for several commercial giant-clam species at different locations throughout the Indo-Pacific, although only two species farmed in Solomon Islands are considered here. These species are *Tridacna crocea*, the preferred species for the aquarium market, and *T. derasa*, the species that appears to have the best potential for the seafood market.

The bioeconomic model is used in a normative analysis to explore optimal management strategies for village farmers producing giant clams for the aquarium and seafood markets. The normative study provides a benchmark against which current practices can be evaluated. The potential supply of giant clams from Solomon Islands is then estimated under optimal management conditions and assumptions regarding

adoption rates. The bioeconomic model is also used to investigate the possible externalities imposed by forestry, through sedimentation, on optimal management of the farming operation. Although this part of the study was constrained by limited scientific information about the effect of sediments, it provides an example of how the model can be applied.

The key finding of the normative analysis indicates maximum profit is obtained when labour usage is most intensive. For both species, optimal management involves very good husbandry. For aquarium clams, the cycle-length is very short and thinning is not undertaken. For seafood clams, the cycle-length is longer and thinning is required due to crowding as the clams grow. In general, these results are consistent with the extension advice provided to village farmers by ICLARM. However, the scale of the giant-clam operation may be constrained by labour availability. Labour and cycle-length are substitute inputs in production so village farmers not interested in maximising profit can use less labour and a longer cycle-length, and have more time available for other activities.

Conservative estimates of the adoption of giant-clam farming suggest potential supply from Solomon Islands for the aquarium market is unrealistically high and may need to be curtailed by contracts limiting the number of aquarium farmers or their level of production. Although farming for the aquarium market is more profitable, large-scale adoption will depend on development of the seafood market.

Simulation modelling of the sediment problem, whereby turbidity imposes an external cost on village farmers in the form of lost profits, while nutrient deposition provides an external benefit in the form of gained profits, is undertaken to illustrate how the model can be used to study externalities. Sedimentation that increases nutrient deposition is likely to also increase turbidity, and the benefit of the former may be outweighed by the cost of the later.

The results of these applications are dependent on given parameters and model assumptions, some of which are based on limited data. Further research that improves parameter estimation will enhance the predictive ability of the bioeconomic model developed here.

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