

Giant Clams in the Sustainable Development of the South Pacific

Socioeconomic Issues in Mariculture and Conservation

**Editor
C. Tisdell**



Australian Centre for International Agricultural Research,
Canberra, Australia, 1992

The Authors

T'eo I.J. Fairbairn

Consultant, 21 Highland Close, Charlestown, 2290, Australia, and Research Fellow, Centre for South Pacific Studies, University of New South Wales, Kensington, NSW 2033, Australia.

Carunia Firdausy

Research Fellow, National Centre for Economics and Development, Indonesian Institute of Sciences (PEP-LIPI), PO Box 310, Jakarta 10002, Indonesia.

Kenneth M. Menz

Australian Centre for International Agricultural Research, GPO Box 1571, Canberra, ACT 2601.

Nancy J. Pollock

Department of Anthropology, Victoria University of Wellington, PO Box 600, Wellington, New Zealand.

Luca Tacconi

Department of Economics and Management, Australian Defence Force Academy, University of New South Wales, Canberra, ACT 2600, Australia.

Contribution completed while at Department of Economics, University of Queensland.

Clem Tisdell

Department of Economics, The University of Queensland, Brisbane, Australia, 4072.

Veikila Vuki

Department of Oceanography, University of Southampton, Highfield, Southampton S09 5NH, England.

On leave from the Institute Marine Resources, University of South Pacific, Suva, Fiji.

René Wittenberg

Berg Strasse 13, 7980 Ravensburg, Torkenweiler, Germany.

Contribution completed while at the University of Queensland.

14 Exports and Export Markets for Giant Clam Meat from the South Pacific: Fiji, Tonga and Western Samoa

Luca Tacconi

Clem Tisdell

Abstract

This chapter explores the giant clam meat export experience of Fiji, Tonga and Western Samoa. This is done by reporting on interviews conducted during fieldwork in these countries and by presenting secondary data. For Fiji, the introduction of an export ban for giant clam products meant the interruption of an (unsustainable) export of more than 30 tonnes of clam meat per year. A future clam mariculture industry could therefore look towards at least recapturing this share of the export market. Western Samoa and, to a lesser extent, Tonga have limited experience in clam export due to limited natural availability of clam stocks. In Tonga, there is however some commercial export taking place in the Vava'u group. For export purposes, the Vava'u group appears to be in a better position than the Ha'apai group because of favourable air links to overseas markets.

Introduction

As discussed by Tacconi and Tisdell in Chapter 13, there is only limited demand for giant clam meat in Fiji, Tonga and Western Samoa. The identification of export markets for clam products and likely levels of demand therefore becomes important, if giant clam culture is to bring significant economic benefits to the people of the South Pacific states.

Several studies have reviewed and assessed export markets for giant clam products (e.g. Shang et al. 1991; Chapter 17 this volume; Stanton 1990; Dawson 1986). The objective of this chapter is to assemble information on the export experience of Fiji, Tonga and Western Samoa and draw implications from it for potential export of cultured clams from these countries. Instead of directly surveying overseas markets, this chapter relies on the knowledge of overseas markets available to local seafood exporters and uses statistical information available on giant clam exports from the countries considered. It makes use of the results of interviews with local exporters, secondary data collected during fieldwork in the period of 28 August–3 October 1991 and other secondary sources. The position for Fiji, Tonga and Western Samoa is considered in separate Sections.

Giant clam exports by Fiji

Of the three countries considered, Fiji has had the largest level of commercial exports of giant clams. However, commercial exploitation of tridacnids for export has been discontinued in Fiji because the Fisheries Division found it to be the most serious cause of clam stock depletion. A 10-year export ban on clam meat was imposed by the Fijian Government in December 1988. However, there has been no attempt to regulate exploitation for the domestic market and for subsistence consumption.

Detailed data on quantities of clam meat exports are available since only 1984, when export licensing was first introduced, and are presented in Table 14.1.

Table 14.1 Quantities exported of giant clam meat from Fiji, 1984-88.

Year	Weight (kg)
1984	7276.5
1985	20794.7
1986	16806.0
1987	5490.0 ^a
1988	38493.0

^aData available only for the period September–December
Sources: Fiji Fisheries Division (1986a); Fiji Fisheries Division (1987); and Fiji Fisheries Division Files

In 1984, licensed exports for giant clam meat (mantle and muscle) amounted to 7276.5 kg. The countries of destination were New Zealand ('meat'), Australia ('mantle' and 'muscle') and Taiwan ('muscle'). It is thought that the produce shipped to Australia was being re-exported to Asia. A sample shipment was also sent to Japan (15 kg). In 1985, a large increase in exports was registered. Export for the year were 20794 kg and were distributed as reported in Table 14.2. Also small quantities of clam mantle were sent as test marketing samples to Canada, Australia, Hong Kong, Singapore, New Zealand and Japan in the period 1985-1988. Unfortunately, the outcomes of these tests are not known.

In the first seven months of 1986, total exports amounted to 11316 kg. In the same year, from the end of August to December a further 5490 kg were exported. A sharp increase in exports occurred in 1988, the last year of exports of clam meat. From the files of the Fisheries Division, total licensed exports amounted to 38493 kg, an average of just over 3 tonnes per month.

Exporters were not required to disclose the price received by them for their exports of clam meat when applying for export permits. However, the Fiji Fisheries

Division suggested that these prices ranged between F\$20/kg and F\$40/kg for the muscle, as a commercial operator was reported to purchase the muscle in Suva for F\$7-10.5/kg during the period 1985-86 (Fiji Fisheries Division 1986b).

Three major commercial operators who had been active in the export of clam products were interviewed. They reported FOB (free on board) export prices for the muscle ranging from between F\$12 kg (1986-87) to F\$26 kg in 1988. These operators used their boats to collect clams and also bought from local fishermen. The common practice was to export the adductor muscle and to sell the mantle locally for F\$0.5-2/kg. Limited exports of mantle, as samples and for commercial purposes (at an FOB price of F\$1.5/kg), were reported by these operators.

The above-mentioned exporters (and a fish exporter) thought they could export sizeable quantities of clam adductor muscle (according to one operator up to 3 tonnes per week) to countries such as Taiwan, Japan, Korea and USA. The extent to which the export price of clam muscle (F\$20-40/kg depending on quality of the muscle) is sensitive to variation in the quantities exported is not known, but one operator believed that he could export up to 20 tonnes a year without affecting this price.

The above price level appears to be consistent with the prices for giant clam muscle reported by Shang et al. (1991) for Taiwan. Shang et al. estimated that the price for adductor muscle in Taiwan ranged from between US\$7.69/kg for muscle of less than 100 g in weight, to US\$30.77/kg for muscle of more than 400 g. However, muscles of the largest size can be expected only in clams which are many years old.

It is generally agreed that size and weight of the muscle of the giant clam increase with the clam's age. *T. gigas* and *T. derasa*, the largest species of clams, have the largest muscles and, apart possibly from *T. squamosa*, are likely to be the only species worth farming commercially if the main purpose of the mariculture is to market the muscle, which is currently the only giant clam product having a ready market in Taiwan (Shang et al. 1990).

Shang et al. (1990, p. 11) report that a 5-year-old *Tridacna gigas* (the fastest-growing giant clam) could yield an adductor muscle of 290 g (470 g for a 7-year-old). This may be an overestimate of the actual weight/age ratio for adductor muscle, according to data derived from research at the Orpheus Island Research Station, James Cook University. The average wet weight for the muscles of ten 5-year-old *Tridacna gigas* was found to be 54.81 g (standard error 13.88). The mean dry weight was 12.99 g (standard error 2.99) (P. Lee, pers comm. with L. Tacconi). Moreover, the data of Watson and Heslinga (1988, p.222) indicate that *T. derasa* would have to be at least 7 years in age before its adductor muscle could exceed 100 g.

If farmed *T. gigas* or *T. derasa* are not kept longer than 10 years before marketing, top prices per kilogram for clam adductor muscle are unlikely to be obtained. There are always strong economic pressures not to hold such resources for a very long period of time even if their price per unit tends to rise with age. This is because, after a point, the growth rate of giant clams as a function of age tapers off, mortality continues (even if at a somewhat reduced rate in older clams) and the rate of interest (or returns from alternative investment opportunities) places pressure on commercial operators to turn over their investment periodically. Furthermore, especially in newly established farms, liquidity and cash-flow considerations may dictate that clam stocks be sold at as early an age as gives a satisfactory return rather than waiting for higher returns. Nevertheless, though it may not pay to hold clams in mariculture long enough to obtain the top price for the adductor muscle, it can be profitable to hold them long enough to obtain an intermediate price, a price which of course will be considerably less at the farm-gate than the wholesale or retail price at the place where the end-use of the adductor muscle is to occur.

Preliminary Australian evidence indicates that giant clams (*T. gigas*) can be profitably produced for meat at farm-gate prices which in practice seem achievable in existing or potential markets (Tisdell et al., unpublished data). Such sales are assumed to be based solely on the meat of older clams which can be divided, if so desired for separate sale, into adductor muscle and mantle, a practice previously followed by Fijian exporters. These estimates of profitability are not based upon the supply of giant clams for the Japanese sashimi or sushi market. In Japan, current interest in using giant clams for these purposes is mostly confined to the Ryukyus in the far south of the country. This demand is best satisfied by the supply of *T. crocea* rather than the species currently being favoured for mariculture in Fiji, namely *T. derasa* and *T. gigas*, which are best suited to supply giant clam adductor muscle.

Fiji has had no experience in exporting *T. crocea* which does not occur naturally in Fijian waters. *T. crocea* clams need to be air-freighted to serve the Japanese market and this might be best done in the shell. It would be difficult for Fiji to compete in the market, even though clams to serve this market can be harvested at a relatively young age. If this export market is viable for exporters, strong competition can be expected from the Philippines which has primarily exported *T. crocea* to Japan and which is located within the natural distribution of the species.

In addition to the above, farmed supplies from the Ryukyus are likely to come on stream in Japan. Land-based, or virtually land-based farming operations for *T. crocea* are a possibility there. 'Reefarm', at Cairns in northern Australia, has used land-based tanks to produce all of its *T. crocea* to a stage where they have been sold for sashimi to the Japanese, or to supply the aquarium trade. While this can be done for *T. gigas* and *T. derasa*, the Japanese do not find these species to be very suitable for sashimi.

For mariculture, *T. gigas* has some advantages over *T. derasa* considering the type of export markets which Fiji has supplied in the past. It has the largest adductor muscle and is the most rapidly growing of all clams. Another advantage is that it can be grown in intertidal culture, which is preferred over subtidal culture by

most Fijians (see Chapters 2 and 3). Subtidal culture is the only form of ocean culture to which *T. derasa* is suited. However, it may be that *T. gigas* is not as hardy as *T. derasa* and seems to have become extinct in Fiji—whether due to natural causes or overexploitation by humans is unknown. It has now been reintroduced using stock from the James Cook University Research Station, near Townsville, Australia, with a view to its eventual use for commercial and subsistence purposes and for restocking of reefs.

Whether giant clam adductor muscle might be a close substitute for other seafood products, and therefore the extent of market competition that it might face, is another question worth while considering. A previous exporter of giant clam meat suggested that adductor muscles in the size range of 20–200 g would be in competition with scallops but that muscles over 200 g would have their own separate market and would attract higher prices. However, another exporter thought that clam muscle would be in competition with abalone rather than scallops. The extent to which giant clam meat can substitute other seafood products remains uncertain (see Stanton 1990).

Table 14.2 indicates that the weight of mantle of giant clams exported from Fiji in 1985 approached that of muscle. The categories 'meat' and 'mantle and muscle' do not differentiate between the two components so it is difficult to be precise about the exact composition of the exports. The use made of the exported mantle is unclear but much of it seems to have been consumed by Pacific Islands immigrants in New Zealand, Australia, USA and Canada. This is known to be the case in New Zealand as discussed, *inter alia*, in Chapters 16 and 17. Some mantle may have also been used in manufacturing, e.g. for flavouring manufactured soups (Tisdell 1989).

While Pacific Island immigrants to more developed countries may represent the main existing market for giant clam meat, the potential Taiwanese and Hong Kong markets should not be neglected. Nevertheless, previous studies may have tended to overstress these markets to the detriment of the immigrant markets (Dawson and Philipson 1989).

Direct exports of giant clam meat to Japan by Fiji in 1985 were insignificant. This is not surprising given the unsuitability of Fijian clam products to the Japanese market. Unless Japanese requirements change, Fiji and other South Pacific nations do not appear well placed to achieve export sales of clam products in Japan.

Giant clam exports from Tonga

Detailed statistical information on export of giant clams from Tonga is not available. McKoy (1980) reports that a private operator was engaged in clam meat exports in the mid 1970s, but this business ceased in 1977 because of insufficient natural stocks. From anecdotal evidence, it seems that another exporter was involved in heavy short-term exploitation of clam stocks in the Ha'apai group.

Table 14.2 Distribution of giant clam exports from Fiji by products and by country of destination (1985).

By product	Weight (kg)
Mantle	6355
Muscle	7180
Meat	3341
Mantle/muscle	3823

By country	Weight (kg) product
New Zealand	7970 (mainly mantle)
Australia	5291 (mainly muscle for re-export)
Taiwan	1824 (muscle)
Hong Kong	1280 (muscle)
USA	421 (muscle)
Canada	100 (mantle)

Source: Fiji Fisheries Division (1986a).

The Government of Tonga has not introduced a ban on the export of clam products. However, because of limited natural stock, there is little export of giant clam meat and this activity is not perceived as threat to clam stocks.

Currently, there appears to be no commercial exporter in Tongatapu. Friendly Island Marketing Co-operative Ltd, based in Nuku'alofa, exported small quantities of frozen muscle and mantle to Hawaii during the period 1986-87. They discontinued exporting 'because there was not enough supply'. Records of export prices and quantities were not available.

A returned migrant from the USA reported that, in two successive trips in 1986 and 1987, he sold two tonnes of frozen clam meat to the Tongan community in California. The clams were sold in less than a month at a price of US\$10/kg on the first occasion US\$11/kg on the second trip. This might indicate the price-level that could be obtained for commercial exports to the Pacific community on the West Coast of the USA. The size of this market needs to be determined.

Limited exports were also reported to have taken place from the Ha'apai group to PagoPago (American Samoa). This export activity was interrupted in 1982 when the air service between Ha'apai and PagoPago was suspended. The export price for mantle was T\$6/kg (T\$/A\$1) but records are not available for the price of the muscle and for the quantities exported, which were defined by the exporter as being 'limited'. Sporadic export of whole clam meat to PagoPago was also reported

from the northern archipelago of Vava'u. Export of about 50 kg per week took place for about two years until March 1991, when it was discontinued 'because of non-profitable prices in PagoPago'. The purchasing price in Vava'u was T\$/5kg and CIF export price received was US\$6/kg (approximately T\$11/kg).

A commercial operator is currently exporting giant clam meat from Vava'u. This middleman has a special agreement with a number of fishermen. They sell all their catch to the operator who exports the best quality fish once a week with a chartered plane, and sells locally the catch that cannot be marketed overseas. Undisclosed quantities of adductor muscle are exported 'via PagoPago to Japan, London and Frankfurt'. Sales are arranged through fish-brokers and not directly to customers. The export price was not disclosed.

As noted by Tacconi and Tisdell (Chapter 13), a large share of the clam meat, sold at local markets in Tonga is probably sent by relatives to Tongans living overseas. This may well account for the largest share of clam meat exported by Tonga, as some interviewees hypothesised that up to 50 percent of the clams marketed in Nuku'alofa might be sent overseas. These exports are not likely to be officially recorded.

The impact of this unofficial export activity on the Tongan natural stock of giant clams cannot be assessed. In fact, given its 'underground' character, it is extremely difficult to gauge the size of this 'market'. Also, it is doubtful that an export ban imposed to protect the natural stock of clam would work. At present, the Tongan Ministry of Fisheries is not contemplating introducing a ban on exports, though other conservation measures are to be implemented (Fairbairn Chapter 8, Tacconi and Tisdell Chapter 12).

Giant clam exports from Western Samoa

There is little evidence to suggest that commercial exports of clams on a sizeable scale have ever taken place from Western Samoa. However, the commercial clam farm based in Namu'a island has received enquiries from a New Zealand chain of food stores on the availability of supplies of giant clam meat, suggesting some New Zealand interest in importing clam products (see also Chapter 17).

Further discussion and conclusion

In Fiji, an industry farming giant clams might at least hope to fill the gap in supply of clam meat for export created by the ban imposed in 1988 on exports of wild clams. This gap could be around 38 tonnes a year since exports in 1988 were 38.5 tonnes. The composition of these exports in terms of mantle and muscle is not known precisely but the figures for 1985 (see Table 14.2) indicate that exports consist of about half muscle and half mantle. Assuming that Fijian exporters received F\$20/kg for muscle (a conservative figure) the value of muscle exports annually would be F\$380000. If they receive F\$5/kg for mantle, the value of

exports on this account would be F\$95000. Thus, the total value of Fijian exports of clam meat would be F\$475 000. It seems, therefore, that annual export markets valued at least a half million Fijian dollars could be re-acquired as a result of clam culture. However, growers could expect to receive only about half of this sum, given the type of mark-up which has prevailed in the past.

To supply the level of exports of clam meat which were achieved by Fiji in 1988, a large number of clams would need to be grown in Fiji. The number required to supply the market would depend on the species and their age at harvest. Main exports were previously dependent on *T. derasa* and current plans of the Fisheries Division are to foster its use for farming or culture, although introduction of *T. gigas* is a longer term possibility. Let us therefore base our estimates on the cultivation of *T. derasa* and assume that it is held for 6 years, a period which maximises biomass production both for adductor muscle and soft tissues according to the estimates of Watson and Heslinga (1988).

On average, a 6-year-old *T. derasa* has an adductor muscle weight of 81.7 g according to the estimates of Heslinga and Watson (1988, p. 222). Therefore, to supply 19 tonnes of muscle (the estimated quantity of Fijian exports of clam muscle in 1988), 232558 6-year-old giant clams would be required. These clams would more than meet the requirements for mantle from export since for 6-year-old clams the ratio of soft tissue to muscle is approximately 0.5. Thus, a considerable amount of mantle in excess of export requirements would need to be absorbed by the local market unless the export market for mantle could be expanded.

The above estimate of the number of 6-year-old clams required to meet the annual export market does not allow for drip loss. For muscle this is probably of the order of 5–10 per cent. If it is 10 per cent, then around 250000 6-year-old clams would need to be harvested annually to satisfy export requirements.

The number of seed clams that would have to be grown out each year to satisfy this end requirement will depend on mortality rates. It seems that mortality rates for *T. derasa* are lower than those for *T. gigas* when both are grown under suitable ecological conditions (see Munro 1988, p. 219). For 2-year-old seed clams about 95 per cent can be expected to survive to 6 years of age when they are used for ocean stocking. The survival rate of 1-year-old seed clams will be lower than that of 2-year-old clams. Suppose it is 90 per cent. Then, over 275000 1-year old *T. derasa* would need to be committed to ocean culture commercially to meet Fiji's export needs, assuming that previous export levels of demand can be re-established. This would call for about three large farms handling 100000 clams annually or around 28 smaller farms handling around 10000 clams annually but even small sized units could conceivably be economic in the Fijian situation in semi-subsistence communities.¹ It is clear that if Fiji can re-establish its previous export market that this, in

¹If the plan of the Fisheries Division to supply households with 600 seed clams was followed, more than 400 households would need to engage in clam culture to meet 1989 export levels of clam meat.

conjunction with its domestic market, could provide an economically sound basis for the establishment of an industry based on the mariculture of giant clams.

With respect to Tonga, the Vava'u group seems to be favoured for the eventual establishment of commercial giant clam farming. An existing exporter of giant clam meat may provide needed market knowledge and local contacts and knowledge. Also, compared with the Ha'apai group, Vava'u has easy access to cheaper international transport through the American Samoa airport of PagoPago. Tonga has good prospects for expanding its exports of giant clam meat as a result of giant clam mariculture.

Acknowledgments

Research for this chapter has been supported in part by ACIAR (Project No 8823). We are grateful to all those mentioned in the acknowledgments to Chapter 13 who provided valuable assistance with this research. The usual caveat applies, namely that we alone are responsible for the views expressed in this chapter.

References

- Dawson, R.F. 1986. Report of a study for giant clam products in Taiwan, Japan, Hong Kong and Singapore. South Pacific Forum Fisheries Agency Report 86/37.
- Dawson, R.F., and Philipson, P.W. 1989. The market for giant clams in Japan, Taiwan, Hong Kong and Singapore. In: Philipson, P.W., ed., the marketing of marine products for the South Pacific. Suva, University of the South Pacific, Institute of Pacific Studies, 90-123.
- Fiji Fisheries Division 1986a. The culture of the giant clam (*Tridacna* spp.) for food and restocking of tropical reefs. Suva, Ministry of Primary Industries, Progress Report No. 4.
- 1986b. Fisheries resource profiles: information for development planning. Suva, Ministry of Primary Industries.
- 1987. The culture of the giant clam (*Tridacna* spp.) for food and restocking of tropical reefs. Suva, Ministry of Primary Industries, Progress Report No. 5.
- McKoy, J.L. 1980. Biology, exploitation and management of giant clams (Tridacnidae) in the Kingdom of Tonga. Nuku'alofa, Fisheries Division, Fisheries Bulletin No. 1.
- Munro, J.L. 1988. Growth, mortality and potential aquaculture production of *Tridacna gigas* and *T. derasa*. In: Copland, J.W., and Lucas, J.S., ed., Giant clams in Asia and the Pacific. Canberra, ACIAR Monograph No. 9, 218-220.
- Shang, Y.C., Tisdell, C., and Ping Sun, L. 1991. Report on a market survey of giant clam products in selected countries. University of Hawaii, Center for Tropical and Sub-tropical Agriculture, S.286.
- Stanton, J. 1990. Evaluation of international trade statistics on giant clams and related products and the market for giant clam meat. Brisbane, University of Queensland, Department of Economics Research Reports and Papers in Economics of Giant Clam Mariculture, No. 9.
- Tacconi, L., and Tisdell, C. 1992a. Domestic markets and demand for giant clam meat in the South Pacific Islands—Fiji, Tonga and Western Samoa. Brisbane, University of Queensland, Department of Economics Research Reports and Papers in Economics of Giant Clam Mariculture, No. 29.
- 1992b. Institutional factors and giant clam culture and conservation in the South Pacific—observations from Fiji, Tonga and Western Samoa. Brisbane, University of Queensland, Department of Economics Research Reports and Papers in Economics of Giant Clam Mariculture, No. 32.

- Tisdell, C.A. 1989. Pacific giant clams and their products: an overview of demand and supply. In: Campbell, H., Menz, K., and Waugh, G., ed., Economics of fishery management in the Pacific islands region. Canberra, ACIAR, 100-104.
- Tisdell, C.A., and Wittenberg, R. 1990. The potential market for giant clam meat in New Zealand: results of interviews with Pacific island immigrants. Brisbane, University of Queensland, Department of Economics Research Reports and Papers in Economics of Giant Clam Mariculture, No. 15.
- Watson, T.C., and Helsinga, G.A. 1988. Optimal harvest age for *Tridacna derasa*, maximising biological production. In: Copland, J.W., and Lucas, J.S. ed., Giant clams in Asia and the Pacific. Canberra, ACIAR Monograph No. 9, 221-224.