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Domestic Markets and Demand for Giant Clam Meat in the South Pacific Islands – Fiji, Tonga and Western Samoa

by

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[1] Research for this paper has been undertaken as a part of Australian Centre for International Agricultural Research (ACIAR) Project 8823, 'Economics of Giant Clam Mariculture'.

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The technical feasibility of culturing giant clams for food and for restocking tropical reefs was established in an earlier ACIAR project. This project is studying the economics of giant clam mariculture, to determine the potential for an industry. Researchers will evaluate international trade statistics on giant clams, establish whether there is a substantial market for them and where the major overseas markets would be. They will determine the industry prospects for Australia, New Zealand and South Pacific countries, and which countries have property right factors that are most favourable for commercial-scale giant clam mariculture. Estimates will be made of production/cost functions intrinsic in both the nursery and growth phases of clam mariculture, with special attention to such factors as economies of scale and sensitivity of production levels to market prices.

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Domestic Markets and Demand for Giant Clam Meat in the South Pacific Islands – Fiji, Tonga and Western Samoa

TABLE OF CONTENTS **Page No**

Domestic Markets and Demand for Giant Clam Meat in the South Pacific Islands – Fiji, Tonga and Western Samoa

ABSTRACT

The paper analyses the domestic markets and demand for giant clams in Fiji, Tonga and Western Samoa. For the three countries, historical trends in giant clam marketing are presented. The potential domestic markets for giant clam meat are then considered. The demand by the tourist sector (e g. hotels and restaurant) is found to be very limited in Fiji and almost non-existent in Tonga and Western Samoa. Demand by private consumers may be sufficient to support a very small clam maricultural industry. Consumer's preferences for giant clams are also considered for Fiji.

Keywords: Demand and supply of giant clam, domestic market of giant clam, giant clam, South Pacific, Fiji, Tonga, Western Samoa, mariculture,

JEL Classification: Q57, Q21, Q22

Domestic Markets and Demand for Giant Clam Meat in the South Pacific Islands – Fiji, Tonga and Western Samoa

1. INTRODUCTION

The objective of this paper is to assess the domestic demand and markets for giant clam meat in Fiji, Tonga and Western Samoa. After several years of research, introduction of and extension of giant clam farming is now going to be promoted by Fisheries Divisions of Pacific countries. An economic assessment of the economic potential of domestic markets, export markets and production conditions is therefore needed. This paper addresses the former issue; the latter two topics will be addressed in separate papers.

The structure of the fish markets and the amount of information available about these varies across the three countries. In order to give a clearer picture of the specific conditions of each country, the paper presents each country separately.

This report is based on information and·data collected in Fiji, Tonga and Western Samoa during the period 26 August - 3 October 1991. Exchange rates at the time of the survey are reported in Appendix A.

2. THE FIJIAN MARKET FOR GIANT CLAMS

The species of giant clams still naturally found in Fijian waters are *Tridacna derasa, T. maxima, T. squamosa* and *T. Tevoroa.* However, only the first two species, according to The (Fiji) Fisheries Division's Annual Reports, are found on the market. Table 1 presents data on quantities and prices for giant clams marketed in Fiji during the period 1980-90. Some comments about these data are needed. It appears that over the eleven years considered the total quantity of clams marketed has not varied greatly. However some changes have occurred. Since 1986 marketed quantities of *T. maxima* have increased several-fold, whereas the opposite trend is clear for *T. derasa.* These latter species were the object of an intensive export trade between 1984 and 1988, and was partly responsible for the apparent over-exploitation of *T. derasa.* The large quantities of *T. derasa* marketed in 1987 (and to some extent in 1986 and 1988) were mainly by the National Marketing Authority (the commercial arm of the Fijian Army). It mainly exported the adductor muscle selling the frozen mantle on

the local market.

Table 1: Quantities and Prices of Giant Clams Marketed in Fiji

Year	Species	Quantity (Tonne)	Mean Price (F$/kg.)
1990	*T. derasa*	2.09	3.8
	T. maxima	9.27	2.67
1989	*T. derasa*	4.26	1.26
	T. maxima	9.75	2.59
1988	*T. derasa*	14.81	2.09
	T. maxima	7.29	2.64
1987	*T. derasa*	22.86	2.17
	T. maxima	4.27	1.70
1986	*T. derasa*	12.36	2.11
	T. maxima	1.38	2.34
1985	Both species	16.54	2.04
1984	Both species	7.73	1.80
1983	Both species	12.70	2.00
1982	Both species	11.96	2.00
1981	Both species	13.41	2.00
1980	Both species	13.83	1.10

Source of data: Fiji Fisheries Division, Annual Reports and Files

It should be noted that the supply of clam meat almost doubled between 1986 and 1987 without impact on the price. This might indicate that the demand for clam meat is fairly elastic and a sizeable increase in supply does not greatly affect the price.

A word of caution about the estimation of the mean prices presented in Table 1 is necessary. Giant clams are sold on the market both in shell and without shell, making the estimation of the mean price fairly difficult and subject to broad approximation. The prices reported in the Table should be considered as the price of in-shell clams (Sogovale, pers. comm.). In fact, in the Fisheries Division's Annual Reports the price per kilogram of other shellfish includes the shell, as for example for *Batissa violacea* locally known as *Kai* (a freshwater shellfish). If the meat price per kilogram reported in Table 1 is taken as whole weight price adopting a ratio of 0.16 for meat weight/total weight, the net price of *T. derasa* meat for the year 1990 would be approximately F$24. This is a high price indeed, but it is not too different from the one

recorded by the Marketing Authority in Tonga for live clams.

[1] According to a former employee, the Fijian National Marketing Authority was selling frozen clam mantle in 1986-87 for prices ranging between F$0.5 and 1.5. The interviewee also remarked that NMA ‘had a hard time selling the totality of clam meat'. Whether that was due to an oversupply of clam meat or to marketing problems is an open question.

In relation to Table 1, it should also be noted that for the year 1984 the data was extracted from Fijian Fisheries Division's files and not from Annual Reports like all the rest of the data. This could be partly responsible for the sizeable difference in the recorded quantity of clam meat marketed in 1984 compared to 1983 and 1985.

The quantities marketed, as reported in Table 1, refer to commercial sales at municipal markets, road-side markets, hotels and restaurants, and other shops such as supermarkets and butcher shops. Local trade (e.g. at village level) and subsistence consumption are not measured. Fisheries Division (1986) 'guess-estimated' subsistence consumption to be about 40 tonnes a year.

2.1 The potential domestic market

The potential of the domestic Fijian market to absorb clam meat cannot be estimated in precise quantitative terms. Nevertheless, this section presents data and information collected during fieldwork, in order to provide a picture of the ‘possible’ market potential and raises some issues that should be taken into account in developing the giant clam mariculture industry.

A giant clam producer in Fiji, the export market aside, can market his produce to domestic consumers and to the hotels and restaurants which mainly cater for overseas tourists and to a limited extent for domestic tourists.

2.1.1 The ‘hotel and restaurant' trade

In the current research on the aspects of giant clam marketing, testing of the possible acceptability of clam products in restaurants and hotels has been undertaken (e.g. Cowan, 1988) and it has been suggested that the potential size of this market is worth examination,

[1] During field work conducted for this report, at the Saturday fish market in Suva only one large clam of approximately 30-35cm was sold for F$13 Taking a meat weight of 500-700gm, the price for clam meat would be in the range of F$18-26/kg

because tourists might show considerable interest in exotic food (Hambrey, 1991). Several hotels and restaurants were surveyed in Fiji, in relation to their use of giant clam meat but before presenting the details of the survey it is helpful to consider some characteristics of the structure of the fish market in Fiji.

The marketing structure has changed considerably over the past decade. According to the Fiji Fisheries Division (1990), in 1978 about 50% of total fish produce (i.e. fish, shellfish, etc.) was marketed through municipal markets and the other 50% through other outlets (i.e. shops, restaurants, hotels, butchers, supermarkets and cafes). In 1990, municipal markets accounted for only 16% of the total market. The composition of the marketed produce had also changed. While in 1978 non- fish products (e.g. crabs, bivalves) accounted for only 3% of the market, this figure had risen to 19% in 1990. Within the category of non-fish sales, hotels and restaurants have increased their share over recent years, as indicated in Table 2.

Table 2: Volumes of non-fish sales (metric tonnes)

Year	Municipal Markets	Other Outlets	Total	Hotels & Restaurants	%
1987	1336.89	590.31	1927.20	33.94	1.8
1990	1298.05	536.70	1834.75	101.81	5.5

Source: Data from Fiji Fisheries Annual Reports 1990 and 1987

Non-finned seafood purchased by the hotel and restaurant trade consists almost exclusively of crustaceans. Crustaceans are the most expensive non-finned fish produce and accounted for about 70% of the value of non-finned fish marketed in 1990. Given that the share of restaurants and hotels in this produce was about 45%, their (approximate) total share of the non-finned fish market was around 31% in 1990 for a total value of about F$1,073,300.

If the giant clam mariculture industry could access this market, it would have good prospects for expansion. From Table 2 the fast growth in demand from the hotels and restaurants is clear. However, from the data and information collected it seems that the likely share of giant

clam products in this market is and would be quite limited. Giant clams have been available on the Fijian market over the last few years, but the quantities sold through hotels and restaurants has been small. According to Fiji Fisheries Division Annual Reports, in 1987 and in 1990, giant clams (*T. derasa*) sold by hotels and restaurants were only 80kg, or less than 1% of the total marketed quantity. This is in sharp contrast, for example, to the situation for lobster. In fact, demand by tourists for this product is very high and the share (by value) of hotels and restaurants in lobster sales was 46% in 1987 and 61% in 1990. This data seems to indicate little interest by this sector in giant clams. This deduction is supported by the interviews conducted with managers of hotels and restaurants.

The approximate number of hotels in Fiji is 84. They range in size from large international hotels with more than 400 beds to little isolated resorts which accommodate only a few guests. Nine hotels, representing about 10% of the total number of hotels in Fiji, were contacted. Given that six hotels in the sample are amongst the largest in Fiji, two are medium-sized ones and only one is of small size, they account for a market-share much in excess of 10%. It should also be noted that many small hotels do not provide restaurant facilities. Of the nine hotels contacted, only three were presently serving giant clams. Only one had giant clams on the menu on a regular basis and this was served as 'seafood salad' at F$4 per portion. Of the other two hotels, one served giant clams at its Saturday night banquets while the other one only served clams every 2-4 months at special receptions. The hotel serving clams on a regular basis is located at Sigotaka (south-west coast of Viti Levu) and buys directly from fishermen at a price in the range of F$3-4.50kg. They use about 40-50kg giant clam meat 'almost' every week. They have been serving clam meat for the last eight years. Clam meat supply is said to be sufficient to their needs and they could not increase sales.

Of the other two hotels, one, located in Naoli, found clam meats supply sufficient to satisfy their needs, and was buying clams directly from fishermen at a price of F$5kg. The manager of the other hotel found clam meat difficult to find on the Suva market. However, they consume, when available, only 2-3kg per week. Clam meat is served raw in coconut milk and it appears to be popular with Japanese tourists. The clientele of this hotel consists of Japanese (50%) and European tourists (50%).

Of the other six hotels, only one, based on the south-west coast of Viti Levu had tried giant clam meat in the past. The local fishermen were not providing a regular supply and clam

meat was said not to be very popular with European tourists, who make up 99% of the guests of that hotel. The remaining five hotels were not using giant clam meat and as far as the present staff knows, they have not used it in recent years. One of the reasons given was that the chefs, of Indian and European origin, do not like or do not know giant clam meat.

Among the major 36 restaurants in Fiji, 13 were contacted. None of them had giant clam meat on the menu. Only one restaurant, of the three specializing in seafood, had used clam meat in the past but was now finding it difficult to buy fresh, good quality clam meat. This restaurant, based in Suva, used to use about 10kg of clams a week, buying those at F$3-4/kg. The adductor muscle was the only part served, marinated in lemon juice. The mantle was found to be difficult to prepare for European tourists. The muscle was sold at F$3.50 per portion and six portions could be prepared with one kg of muscle.

Four Indian restaurants did not serve clam meat as it is not a traditional Indian dish and customers would not ask for it. The same applies to three 'Continental' restaurants. Out of twenty-five Chinese restaurants, six were contacted. Again some answered that clams are not part of their traditional diet. Some knew giant clams but said that there was no demand for it.

Giant clams were known to the manager of an Italian resort but he said that there was insufficient supply and that they 'are banned'. However, this answer probably arose from little knowledge of the clam market (scarce interest in it?) as most of the clams presently sold in Fiji are marketed at the Lautoka market reasonably close to the mentioned resort.

From the evidence presented above, it does not seem that a giant clam mariculture industry could expect to sell a reasonable share of its produce to the hotel and restaurant sector, at least given the present knowledge that this sector has of the clam products. The development of new clam products might attract more interest from this sector.

2.1.2 The Fijian Consumer Market

As already noted, the Fisheries Division estimates that subsistence consumption of giant claims could be of ground forty tonnes a year, and the quantity of marketed clams are of the order of ten tonnes a year. Indian people appear not to like giant clam meat and even if there can be occasional exceptions it can be safely assumed that only Fijians consume clam meat. At the 1986 census, the Fijian population was estimated to be 329,305. Approximately 60% of Fijians live in rural areas, i.e. about 197,000. If we take the estimated 40 tonnes of

subsistence clam meat consumption to be consumed in rural areas, this gives an average annual per capita clam meat consumption of 203g per rural Fijian. In urban areas, taking the 1986 figure of marketed clam meat, per capita consumption would be 104g, These are only very rough figures but certainly establish that the contribution of clam meat to the local diet is minimal. While this may not be so in some villages, we are concerned here with the aggregate level. Jansen (1990) reports that in 1984 the average per capita fish consumption was 41 5 kg per Fijian but the contribution of shellfish was limited. The Fijian household was on average consuming 0 5 baskets of shellfish a week. If the basket has an average weight of 2kg of shellfish (as it was found during fieldwork at the fish market in Suva) the net meat weight is about 320g. With an average household of 6.4 members, as used by Jansen (1990), per capita annual consumption of shellfish in urban areas is 1300g.

Given that giant clams are only a small proportion of the shellfish marketed[2], the average per capita consumption of giant clams, estimated above, is in line with the results of Jansen (1990). The question to be addressed is whether this consumption would rise as a result of an increased supply of clam meat and what would be the price paid per unit of the increased supply. To find a tentative answer to these questions, retailers and consumers were interviewed.

The structure of the clam meat market is relatively simple. Women and men collect clams on the reefs close to their villages. Then it is usually the women who sell the clams and other products at the fish market (weekly in Suva). Clam meat was also sold through supermarkets and butcher shops. Two supermarkets were contacted in Suva. Only one used to sell giant clam meat, but it has stopped as ‘there is no supply’. It received pre-cooked mantle (the muscle was apparently sold to someone else, possibly for export) from the Lau group from individual fishermen. The quantity bought (at F$3.20kg) was about·50kg every fortnight. The retail price was F$4.50kg.

The manager of the fish section of the supermarket thought that the maximum retail price could be about F$4.75 and that they could not increase sales to much more than 50kg fortnightly. However, if ‘the quality was good, some increase in sales could be achieved’.

[2] Ranking by quantity of shellfish sold ln Fiji in 1990:

1)	*B. violecea*	mt	1175.63
2)	*A. cornea*	mt	88.06
3)	*Tridacnida*	mt	11.36

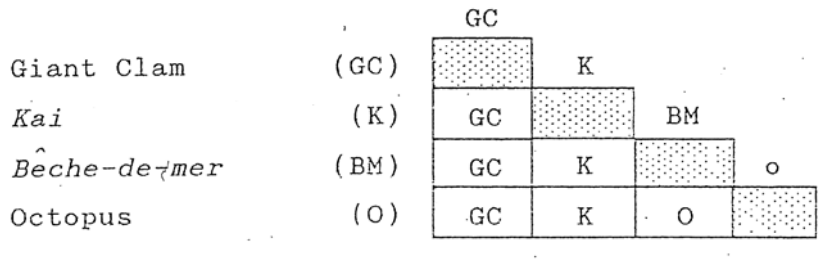
Five butcher shops were also contacted. Two of them did not deal in fish. The other three were selling fish (fresh and frozen fish, crustaceans) but not clam meat. According to them there is no market (or very little) for clam meat. Unfortunately; during the two weeks of fieldwork in Fiji, only one woman sold clams (one) at the market, so that it was impossible to interview a sample of market retailers She stressed the fact that the clam she was selling was so expensive (F$6 for a 30-35cm clam) because 'they are very difficult to find and that the clams left in the water are all very small'.

Fijian consumers were also interviewed to ascertain their preferences, frequency of consumption of clam meat and sources of supply. Seventy seven consumers were interviewed, but only sixty eight questionnaires will be considered here due to dubious results for nine of them. It should be stressed that the objective of this survey, given the limited number of consumers interviewed and the manner in which they were chosen (people encountered at the fish market), is not to draw conclusions that can be extended at the national level but simply to get some ideas, in a limited amount of time and with limited resource, on some issues that can affect the clam meat market.

To ascertain consumer preferences a pairwise ranking matrix was used.[3] Giant clam meat is not considered a substitute for finned fish, therefore in the ranking exercise, clam meat was compared with *Kai* (*B. Violacea*), *bêche-de-mer* and octopus, species which, like giant clams, have a marginal role in the local diet. Figure 1 shows an example of pairwise matrix ranking. Each species listed is compared with the others and a ranking of preferences can be established. The interviewee is asked to state if he/she 'prefers eating' giant clams or kai, giant clams or bêche-de-mer and so on. The answers are marked down in each box at the intersection of the row and column representing the two species considered. The dotted boxes arise because of the impossibility of comparing a species with itself. For example, the hypothetical consumer, whose answers are reported in Figure 1, would prefer giant clams (3 preferences) to kai (2 preferences), octopus (1 preference) and bêche-de-mer (0 preferences). This procedure allows the determination of the 'preferred' species by each interviewee. Thus the adoption of this methodology enables us to ascertain consumers' preferences independently of the influence of relative prices.

[3] For information on this methodology see International Institute for Environment and Development (1989).

Figure 1: Pairwise Matrix Ranking



Out of 68 consumers, eight (11.8%) did not 1ike clam meat, therefore, they were not tested for preferences. The remaining sixty consumers expressed their preferences as reported in Table 3

Table 3: Preference ranking for four species of non-finned fish

Number of Interviewees	First Preference	Percentage
30	Giant clams	50.0
22	Octopus	36.7
5	*Bêche-de-mer*	9.3
3	*Batissa violacea*	5.0
60		100.0

Note that of the four species tested, Fijian consumers prefer the giant clam the most. *Batissa violacea*, the most common bivalve, comes last with only 5% of first preferences

The frequency of consumption of giant clams was also considered in the survey and is reported in Table 4.

Table 4: Frequency of consumption of giant clams

Frequency	Number of consumers' preferences as expressed in pairwise ranking: Preferred Species	Non-preferred Species	Total
At least weekly	6	12	18
At least monthly	9	7	16
Less than monthly	5	9	14
When available on market	10	2	12
TOTAL	30	30	60

Thirty percent of the interviewees consumed clams at least once a week and more than fifty percent (56.66%) of them consumed clam meat at least monthly. The expressed preference for giant clams does not affect the frequency of consumption. To assess this relationship a Chi-square test was carried out and details of this analysis are reported in Appendix B.

The interviewees were also asked about the source of the clam meat consumed. The result is presented in Table 5.

Table 5: Source of Clam Meat Consumed and Frequency

Frequency	Source of Clam Meat: Buy PS	Buy NP	Collect PS	Collect NP	Gift PS	Gift NP	Composite PS	Composite NP
At least weekly	3	6	2	3	0	0	1	3
At least monthly	5	3	3	0	0	2	1	2
Less than monthly	2	1	2	3	1	1	0	4
When available on market	5	2	0	0	0	0	5	0
Subtotal	15	12	7	6	1	3	7	9
TOTAL	27		13		4		16	

Legend: PS: Preferred species as from pairwise ranking
NP: Non-preferred species as from pairwise ranking
Composite: combination of sources: e.g. buy and gift

Less than fifty percent of the interviewees were relying solely on the market as a source of clam meat. Of these, the majority, about 60%, consumed clam meat at least monthly. Again, of the interviewees that collected giant clams, the majority consumed giant clams at least monthly. A more uneven consumption pattern is evident for the groups that have Composite or Gift sources. Gifts of giant clams are usually sent from the village of origin and among the interviewees it appeared that gifts from the Lau group were quite frequent. One consumer received clams by plane almost every week from Lakeba. Consumers whose village of origin is in the Lau Group also appeared to be the keenest clam consumers, whereas people of inland villages, because of the geographical location, do not eat clam meat very often and sometimes they do not know how to prepare them.

Consumers were asked if the present supply of clam meat was sufficient for their needs. The distribution of the answers is presented in Tables 5 and 6. In Table 5, the answers from all interviewees are included, whereas Table 6 shows the answers of the interviewees whose exclusive source of clam meat is the market. As already remarked at the beginning of this section, the present results are purely exploratory given the limited size of the sample. In the pooled group presented in Table 6 it is interesting to note that for interviewees where giant clams are the preferred species, fifty percent of the interviewees stated that clam supply was sufficient for their needs.

Table 6: Distribution of answers to the question: 'can you find as much clam meat as you would like?' (All interviewees included)

	Preferred species		Not preferred species	
	Yes	No	Yes	No
At least once a week	5	1	5	7
At least once a month	5	4	2	5
Less than monthly	4	1	2	7
When available on market	1	9	0	2
Total	15	15	9	21

Table 7: Distribution of answers to the question: 'Can you find as much clam meat as you·would like?' (Clam buyers only included)

	Preferred species		Not preferred species	
	Yes	No	Yes	No
At least once a week	3	0	3	3
At least once a month	2	3	1	2
Less than monthly	1	1	0	1
When available on market	0	5	0	2
Total	6	9	4	8

Of this fifty per cent, the majority is concentrated in the consumption categories 'At least once a week' and 'At least once a month'. This suggests that when consumers are really interested in clam meat, they can usually find enough supply of it. In the category of 'Not preferred species', the majority of consumers did not find clam meat supply sufficient. The percentage of those unable to find as much clam meat as they like, rises for those who consume clam meat only occasionally ('Less than monthly' and 'When available on market'). The influence of preferences seems to arise also in Table 7, where buyers in the category 'At least once a week' declared that they could find enough clam meat and all consumers grouped under 'When available on the·market' said they did not have sufficient supply. From the two tables scarcity of supply seems dominant. Sixty per cent of the interviewees (Table 6) declared that clam meat supply was not sufficient. As expected, this percentage is slightly higher (63%) for Table 7, where only 'buyers' of clam meat are considered.

Several interviewees pointed out that giant clam meat is presently expensive. This was already noted above. In-shell clams can reach a price of over F$20kg. Even if clams are regarded by some consumers as a delicacy, it cannot be assumed that maricultured giant clams sold on the market in sizeable quantities would attract a price any (or much) higher than for example that of fish or substitutes such as *B. violacae* (*Kai*). The weighted mean price of fish in 1990 was F$3.28kg. Taking the edible percentage of whole weight fish to be 80%, the price for net meat weight would be F$3.94kg. The maximum fish price reported for 1990 is F$5.14kg. That yields a net meat price of F$6.17kg. As was remarked by one

interviewee, ‘two dollars’ worth of *kai* (one ‘heap’) provides a meal for a family of four and this is much cheaper than giant clams’. The net weight price of kai reported during fieldwork was F$2.50kg. This price should be kept as a reference point when planning the marketing of clam meat locally in substantial quantities.

3. THE TONGAN MARKET FOR GIANT CLAMS

Five species of giant clams were found in Tonga: *T. derasa, T. squamosa, T. tevoro, T. maxima* and *H. hippopus*. The latter appears however, to have become extinct in Tongan waters (Manu et al., 1989).

Statistics on fish landings have been collected in Tonga for only a few months (starting date: 1 July 1991) therefore, it is not possible, as for Fiji, to consider the trend in clam meat marketing over the recent years. McKoy (1980) reported the following estimated landings of clam meat in the Tongatapu group (whole weight):

1974	24,090kg	1977	88,096kg
1975	41,344kg	1978	153,293kg
1976	83,450kg		

Taking the landings for 1976 and assuming a ratio of meat/whole weight on the range 0.07 to 0.17 the annual per capita clam meat consumption in Tongatapu (population 57,000 in 1976) would be 102-235g. This figure is similar to that of Fiji. However, the twofold increase in landings between 1976 and 1978 would bring per capita consumption up to 182-417g.

The only other data available is that of the survey of fish landings started by the Ministry of Fisheries in July 1991. During the first ten-week period of the survey, giant clams were on the market quite regularly (Table 8).

Table 8: Frequency, quantities and prices of giant clams marketed in Nuku'alfa, commencing 1 July 1991

Survey Week No.	No. of market days in the week	No. of days in which clams were sold	Quantity* (No. of baskets or or strings)	Price+ (per unit) (T$)
1	6	5	B 5	5
			B17	10
			S 9	10
2	6	3	B20	5
3	5	3	B 5	5
			B 5	10
4	6	5	B 2	4
			B33	5
			B20	10
5	6	5	B22	5
			B18	10
6	5	2	B13	10
7	6	2	B15	10
8	3	2	B 1	5
			B19	10
9	1	0	-	-
10	5	2	B13	5
			B31	10

Source: Ministry of Fisheries Files
Legend: B = basket
S = string

* total quantity is slightly underestimated as landings for 3 days were not clearly reported in Fisheries Files and were therefore excluded

+ Price is whole weight for baskets, kg/net weight for strings

It was reported by some of the interviewees (fishermen and market retailers) that in winter less diving for clams takes place compared with the summer months when the water is warmer. Thus, the quantities reported in Table 8 could give an underestimate of likely annual landings of giant clams in Tongatapu. Also, the fish landings survey is just new and it is likely that with experience, some improvements and refinements in data collection could give better estimates of actual landings.

Taking the average weight of a basket of giant clams worth T$10 to be 8kg (as found from fieldwork) and that of a T$5 basket to be 4kg, the total whole weight quantity of giant clams marketed over the ten-week period is estimated to be 1508kg. Clams sold in baskets are of limited sizes (ranging from 10cm to 20cm). It was found that the net weight of an 8kg basket was 560g. This gives a ratio of meat/whole weight of 0.07. The net clam meat weight (adopting a ratio in the range 0.07 – 0.16) over the ten-week period would be approximately 105-241kg. Including the ‘strings' (they are giant clams sold on a string of approximate

weight 2kg) the total net weight would be 123-259kg. The annual landings would therefore, be in the range of 639-1346.8kg. This represents only 5% of the landings estimated by McKoy (1980) and would give only 19g annual per capita consumption. The extent to which this is an underestimation of actual landings and the extent of the eventual decrease of landings due to overexploitation can only be assessed when further data from the Ministry of Fisheries is available.

It is unfortunate that McKoy (1980) did not report the market price for clam meat. This would have allowed a comparison with current prices. During fieldwork a wide range of prices was found to exist. Live clams sold in a 'basket' recorded a price of T$17.8kg. Large clams (e.g. *T. derasa* over 30cm) attracted a price ranging from T$10 to T$14. A clam bought for T$10 yielded 750g of meat, thus attracting a net weight price of T$13.3. Fisheries data shows that clams sold on a string may be worth T$10kg. The above-mentioned prices are for fresh clam meat. During a market day, frozen giant clams (33 bags of 1kg each) were being sold for T$5kg. They had been fished in Ha'pai and sent by boat to the Nuku'alofa market. This discrepancy in prices could be due to the fact that the latter clams were not as fresh as the former ones, their colour being 'yellowish'. They had been fished several days before their actual marketing.

By observing the marketing of giant clams at the shellfish market in Nuku'alofa one might get the impression that clams are not a scarce product. For instance, on 12 September 1991, twenty-five 'baskets' (T$5 each), ten large clams and fifteen medium sized clams were counted. The market started at 8 00am and at 1 00pm about half of the produce had been sold. Later in the afternoon some of the clams were still unsold. An interview undertaken with one of the market retailers revealed that it happens often that there are unsold clams at the end of the day (the most common species sold were *T squamosa* and *T maxima*). This apparent limited demand for clam meat is partly due to the fact that they are expensive in comparison to other fish products. At the time of the fieldwork, the average price of fish was T$2-3kg. The relatively high price for clam meat may be due to at least two factors. The first one is the economic scarcity of giant clams. It is important to differentiate between physical and economic scarcity (e.g. Dewes, 1989). Physical scarcity refers to·the physical availability of a resource, i.e. if it is easy to find in nature. The physical availability of giant clams is presently lower than in the past (Hanu, 1989). Economic scarcity refers to the availability of a resource in order to satisfy the needs of customers. Physical scarcity does not imply economic scarcity

as the resource may have a close substitute. Thus the price of a resource is not determined by physical scarcity but by economic scarcity. The high relative price of giant clams in Tonga may therefore indicate local economic scarcity. However, another factor may be playing a relatively important influence on the price of clam meat. According to market retailers and fishermen, a substantial share (some hypothesised up to 50%) of the clams fished in Tonga are sent to Tongans who have migrated to countries such as New Zealand, Australia and the USA. The purchasing power of these expatriates is much higher than that of the Tongans living at home, who might find the price of clams too high.

It should also be noted that even without taking into account the influence of expatriate Tongans, the price of clam meat as measured in Nuku'alofa is largely urban determined. It does not reflect economic scarcity in rural villages. Wage income is concentrated in Nuku'alofa, the capital of the Kingdom, and it attracts migration from the rest of the archipelago. Giant clams fished in the Tongatapu and Ha'apai archipelagos appear to be marked in Nuku'alofa where according to fishermen and retailers interviewed ‘people pay higher prices for giant clams’.

According to a fisherman from Tongatapu most of the clams are sold in Nuku'alofa and rarely in the village. When they are sold in the village, the price asked for is normally lower ‘because of social obligations’. The Nuku'alofa market is also supplied from the Ha'apai group. At least three operators were identified as supplying this market. One operator, based in Pangai (administrative centre of Ha'apai) buys the clams from 15-20 fishermen, mainly from the island of Uiha and neighbouring islands. The clams taken out of the shell are kept in a freezer until there is a sufficient quantity (50 – 100kg) to be sent by ship to Nuku'alofa. This happens on average once a week. This retailer also sells locally for T$5.5kg. However, he affirmed that local people buy for relatives in Nuku'alofa. The latter send the money to Ha'apai thinking that clam meat is cheaper there. In his opinion, local people cannot afford to buy clams at that price.

Two more operators, one based in Ha'apai and the other in Nuku'alofa, use their own fishing boats to trade in clam meat. The operator based in Ha'apai, whose main activity is deep-sea fishing, collects clams and also buys them from fishermen living on the islands between Pangai and Tongatapu. Clams are mainly collected in summer when he can sell up to 100-200kg of frozen clam meat per week. The purchase price is approximately T$2.50 and the retail price is T$5kg. The other operator based in Nuku'alofa, collects clams in the Ha'apai

group in summer (October to February) and sells about 100-200kg clam meat per week at the Nuku'alofa market.

The Vava'u archipelago was also surveyed and it was found that only one fish shop, owned by local fish exporter, was retailing undisclosed (but very limited) quantities of clam meat (mantle) for T$7kg. The adductor muscle is exported. This business has an agreement with several fishermen to buy 'all' their catches, and this includes giant clams. An informal local market for clam meat might exist but because of the limited time available it could not be assessed.

The retailers contacted in Tonga could not assess whether they could increase clam meat sales, but the prevalent feeling was that the demand for giant clam meat was being·satisfied. The limited number of restaurants and hotels catering for the small number of overseas visitors to Tonga (39,350 in 1987) does not deal in clam meat. However, it would only be a limited possible outlet for a domestic clam industry.

4. THE WESTERN SAMOA MARKET FOR GIANT CLAMS[4]

Two species of giant clam are found in Western Samoa: *T. squamosa* and *T. maxima*. *Hippopus hippopus* has become extinct. Statistics on fish landings are scanty but those available for recent years reveal·a worrisome decline in inshore fish landings, including those of giant clams. The period 1986-90, for which consistent data is available (except for 1988, yet to be databased), shows a sharp decline in the total weight of inshore finned fish marketed in April from 246 Mt in 1986, to 49 Mt in 1991 (FA0,1990). According to FAO, factors such as change in the marketing structure, increase in domestic consumption in villages and a decrease in the artisanal fishing effort might have contributed to this dramatic decline. However, they alone are considered not sufficient to explain that decline, and stock depletion is thought to be the most important factor.

A sharp decline in quantities marketed has also been recorded for giant clams: from 10Mt (whole weight) in 1986 to 0.1Mt in 1990. In 1990, a further 0.3Mt appear to have been sold through hotels, restaurants and other shops. Estimates of giant clam use in subsistence are not available.·From preliminary results from the survey being conducted as part of the current

[4] This report was prepared before cyclone Val struck W. Samoa in December 1991. The implications of such an event for giant clam farming in this country are not yet known.

FAO resource assessment project, it seems that giant clam catches are very sporadic (Zann, pers. comm.).

From consumption estimates provided by Zann et al. (1984), daily per capita consumption of invertebrates was approximately 43g (net weight) in rural areas and 26g in urban areas. Per capita finned fish consumption was estimated at 203g/day in rural areas and 80g/day in urban areas. If it is assumed that the edible weight of finned fish is 80% of whole weight (Jansen, 1990), invertebrates consumption would account for about 20% of total fish consumption in rural areas and 29% in urban areas. Zann et al. (1984) estimates that fish (finned and invertebrates) provided about 82% of the minimum daily protein requirements in rural areas and 35% in urban areas. However, it should be noted that if the 80% recoverable weight for finned fish is applied, these estimates would be reduced to 65% in rural areas and 30% for urban areas. These should however, be considered as estimates for 1991 in annual per capita fish consumption are in the range of 25-35 kg for rural areas and 15-20 kg for urban areas (Zann, pers. comm.). These are approximately 28-38% of previous estimates for rural areas and 39-52% of previous estimates for urban areas. To what extent has the statistical assessment been improved and/or consumption changed?

A survey detailing consumption of all items in the diet (and not just fish) could give more reliable estimates.

Zann et al. (1984) also provides an estimate of the shares of different invertebrates in consumption. Miscellaneous bivalves (which includes giant clams) accounted for 9% of invertebrates consumption, following in importance sea cucumber gonads (49%) sea urchin gonads (14%) and sea cucumber bodies (11%). Adopting consumption estimates provided by Zann et al. (1984), bivalves would have given a contribution of approximately 1.2% to the local diet in rural areas and about 0.8% in urban areas. The contribution of giant clams to the diet is very marginal as they represent a fraction of invertebrates consumed. In 1986, they accounted for about 27% of the invertebrates marketed at the Apia fish market. Their share had declined to 1.8% in 1990. This decrease happened amid a general reduction in the quantity of marketed invertebrates through the Apia fish market from a total of 37.1Mt in 1986 to 5.6Mt in 1990.

If the decline in marketed giant clams is due to stock depletion, as postulated by FAO (1990) and as appears to be so from further details reported in Tacconi and Tisdell (1992a), and not

to a change in marketing structure, it seems that a clam maricultural project could look at filling the apparent gap in supply of about 10Mt a year (i.e. difference between the quantity of giant clams marketed in 1986 and that marketed in 1990). In terms of net meat weight this amount at about 1000-2000kg, depending on the factor (0.1-0.2) adopted to calculate net meat weight. This market could be most likely satisfied by one farm.

If clams (*T derasa*) are harvested at six years of age, the supply of 10Mt (whole weight) would require approximately 2,300 clams (individual weight of about 4 3 kg; see Munro, 1988). The number of clams to be introduced in the farm every year could vary from approximately 15,300 (maximum?) to 7,600 (minimum?) if cumulative mortality rate at the end of the sixth year are respectively 85% and 70%.[5]

The likely retail price for these clams is difficult to assess. In interviews with fishermen, current prices are reported to be about WS $30 and more for large clams, WS $10.30 for medium clams and WS $5 for small clams. However, these prices may not hold if substantial quantities of giant clams are re-introduced on the market. Details for prices from Fisheries' files are scanty and difficult to interpret. In 1986, the price appeared to be in the range of WS$6-15. This should refer to whole weight clams but as often in the survey forms they appeared to be prices 'per clam' so that it is difficult to estimate the price per kg.

Ten 'other retail outlets' (i.e. hotels, restaurants and shops) that were reported to have sold about 0 3Mt in 1990 were contacted. None of them had had any supply of clams recently (one retailer noted that supply had stopped at the time of cyclone Ofa in February 1990). They expressed the view that interest in clams is very limited and that even if supply was continuous they were not able to indicate approximate sales.

A commercial farm is already operating in Western Samoa and the size of the internal market does not seem to justify, at this stage, a further expansion of clam farming.

The above analysis, combined with the fact that giant clams are only a marginal item in the local diet, seems to support Zann's view that the Fisheries Division should probably prioritise its commitments and reduce its resources devoted to giant clam farming (Zann, pers. comm.). This need not imply a complete withdrawal of government support for giant clam farming. For example, a joint-venture with the already existing commercial farm in Western Samoa

[5] This is an approximation of data reported in Munro (1988).

could be considered. The Fisheries Division, for example, could provide the expertise for the hatchery phase of operations.

5. CONCLUSION

The main finding of this report is that local markets and demand do not appear to be sufficient in themselves to justify a large giant clam farming industry in the South Pacific countries visited. There appears to be limited unsatisfied local demand for giant clams, the size of which is difficult to exactly quantify. The contribution of giant clams to the local diet is relatively limited. A large local market for giant clam meat at prices sufficient to cover the costs of farming giant clams does not seem to exist in the South Pacific countries visited. The main prospects for a·giant claim mariculture industry would be the export market. The economic prospects for such exports need careful examination before it is decided to allocate a considerable amount of resources to the industry.

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7. REFERENCES

Cowan L. (1988) 'Use of giant clams in Japanese cuisine,' pp. 256-57 in J.W. Copland and J. Lucas, *Giant Clams in Asia and the Pacific*, ACIAR: Canberra.

Dewes, P.A. (1989) 'The wood fuel crisis reconsidered: observation on the dynamics of abundance and scarcity', *World Development,* 17(8), 1159-1172.

FAO (1989) 'A review of the statistics on commercial landings of fish and invertebrates in Western Samoa', Apia, draft.

Fiji Fisheries Division (1986), *Fisheries Resource Profiles: Information for Development Planning,* Ministry of Primary Industries: Suva.

Fiji Fisheries Division (1980 - 1990) *Annual Report*, Ministry of Primary Industries: Suva.

Fisheries Division (1986) *The Culture of the Giant Clam (Tridacna spp) Food and Restocking of Tropical Reefs*, Progress Report Number 6, Ministry of Primary Industries: Fiji.

Hambrey J. (1991) 'Estimation of farm-gate value of giant clam (*Tridacna gigas*): products of source in the Solomon Islands' *Economics of Village Based Giant Clam Farming in the Solomons*, Working Paper No 1.

International Institute for Environment and Development (1989) 'RRA Notes, No 7', IIED: London.

Jansen, A.A. (1990) 'Fish consumption' pp. 451-71 in A.A. Jansen, S. Parkinson, A.F.S. Robertson (eds) *Food and Nutrition in Fiji: A Historical Review – Volume I*. Fiji School of Medicine and The University of the South Pacific: Suva.

Manu, N., H. Aloua and S. Langi (1989) The Abundance of Giant Clams (*Tridacnidae*) in the Ha'apai Island Group, Kingdom of Tonga. Mimeo.

McKoy, J.L. (1980). 'Biology, Exploitation and Management of Giant Clams (*Tridacnidae*) in the Kingdom of Tonga', *Fisheries Bulletin No 1*, Fisheries Division: Nuku'alofa.

Munro, J.L. (1988) 'Growth, mortality and potential aquaculture production of *Tridacna Gigas* and *T. derasa*', pp. 218-220 in J.W. Copland and J. Lucas *op. cit*.

Tacconi, L., C. Tisdell (1992a) 'Institutional Factors and Giant Clam Production and Conservation in the South-Pacific - Fiji, Tonga and Western Samoa', *Research Reports and Papers in Economics of Giant Clam Mariculture* (No. 32), The University of Queensland.

Tacconi, L., C. Tisdell (1992b) 'Economics of Giant Clam Production in the South Pacific - Fiji, Tonga and Western Samoa', *Research Reports and Papers in Economics of Giant Clam Mariculture* (No 30), The University of Queensland.

Zann, L.P., L. Bell, and T. Su'a (1984) *A Preliminary Survey of the Inshore Fisheries of Upolu Island, Western Samoa*, Institute of Marine Resources, USP: Suva

APPENDIX A

Exchange Rates at the time of fieldwork

Fiji: F$/A$ = 0.9

Tonga: Pa'anga (T$)/A$ = 1

Western Samoa: Tala (Ws$)/A$ = 0.6

APPENDIX B

Chi-square Test

To perform the Chi-square test, the categories 'Less than monthly' and 'When available on market' were grouped together. This was done for three reasons. Firstly, it was just one investigator out of four who collected six answers 'When available on market'. His personal judgement of the interviewee answer or the way in which the question was posed could influence the outcome of the survey. Second, in carrying out Chi-square tests the use of very small sample groups (less than five) should be avoided and groups should be clustered together. Third, complementary to the previous one, 'When available on market' is interpreted as occasional consumption and can be grouped with 'Less than monthly'. The Chi-square statistic was 3.24 and is not significant at the 10% confidence level. The frequency of consumption may be influenced by other variables such as income, island of origin (i.e. where giant clams are consumed on a regular basis) and general preference for seafood compared with other food items.

APPENDIX C

Persons met during fieldwork

FIJI

Tim Adams	Acting Director, Fisheries Division
Esaroma Ledua	Fisheries Officer, Fisheries Division
Subodh Sharma	Fisheries Officer, Fisheries Division
Hamidan Bibi	Senior Fisheries Assistant, Fisheries Division
Tone Sogovale	Senior Fisheries Assistant, Fisheries Division
Apisai SeseHa	Senior Fisheries Assistant, FisheriesDivision
Johnson Seeto	Director, Marine Institute, University of the South Pacific
Robert Gillet	Project Manager, UNDP

TONGA

Sione Mangisi	Director, Ministry of Fisheries
Taniela Koloa	Principal Fisheries Officer, Ministry of Fisheries
Ulunga Fa'anunu	Head of Aquaculture, Ministry of Fisheries
Naita Hanu	Giant Clam Project Leader, Ministry of Fisheries
Tupou Tupou	Fisheries Assistant, Ministry of Fisheries

WESTERN SAMOA

Ueta Fa'asili	Chief Fisheries Officer, Fisheries Division
Leon Zann	Fisheries Resources Advisor, FAO/UNDP
Dan Su'a	Senior Marine Biologist, Fisheries Division
Ameto Kalolo	Fisheries Division Assistant, Fisheries Division

Many thanks go especially to all the people that have accepted to be interviewed during fieldwork

Research Reports and Papers in: Economics of Giant Clam Mariculture

Previous Working Papers

1. "Market for Giant Clam Shells: Report on a Survey of Retailers and Wholesalers in Southeast Queensland, Australia." Clem Tisdell with the assistance of Rene Wittenberg, November, 1989.
2. "Seafarming as a Part of Indonesia's Economic Development Strategy - Seaweed and Giant Clam Mariculture as Cases." Carunia Firdausy and Clem Tisdell, November, 1989.
3. "Market for Giant Clams as Aquarium Specimens: Report on a Survey of Retailers of Supplies for Saltwater Aquariums, Southeast Queensland, Australia." Clem Tisdell with the assistance of Rene Wittenberg, November, 1989.
4. "Aquaculture as a Use of the Coastal Zone: Environmental and Economic Aspects, Giant Clam Farming as a Development." Clem Tisdell, December, 1989.
5. "Pacific Giant Clams and their Products: An Overview of Demand and Supply Factors." Clem Tisdell, December, 1989.
6. "Marine Property Rights in Relation to Giant Clam Mariculture in the Kingdom of Tonga." Dr T'eo I.J. Fairbairn, February, 1990.
7. "Exploring the Demand for Farmed Giant Clams and Their Components: Approaches and Problems." Clem Tisdell, February, 1990.
8. "Report on possible Demand for Giant Clam Meat by Tongan Descendants in Australia: Inferences from interviews conducted in the Brisbane Area". Clem Tisdell and Rene Wittenberg, February, 1990.
9. "Evaluation of International Trade Statistics on Giant Clams and Related Products and the Market for Giant Clam Meat." Dr John Stanton, March, 1990.
10. "Assessing Species for Mariculture in Developing Countries: A Review of Economic Considerations." Carunia Firdausy and Clem Tisdell, April, 1990.
11. "An Analysis of the Cost of Producing Giant Clam (Tridacna gigas) Seed in Australia." Tisdell, C.A., Lucas, J.S. and Thomas, W.R., May, 1990.
12. "Marine Property Rights Fiji: Implications for the Development of Giant Clam Mariculture." Dr T'eo I.J. Fairbairn, August, 1990.
13. "Reef and Lagoon Tenure in the Republic of Vanuatu and Prospects for Mariculture Development". Dr T'eo I.J. Fairbairn, August, 1990.
14. Progress Report No. 1 to ACIAR, Project No. 8823. Professor Clem Tisdell, August, 1990.
15. "The Potential Market for Giant Clam Meat in New Zealand: Results of Interviews with Pacific Island Immigrants." Clem Tisdell and Rene Wittenberg, October, 1990.
16. "The Potential Demand for Giant Clams in Indonesia and Their Status: A Report on a Survey of Four Coastal Villages in Bali and Java." Carunia Firdausy and Clem Tisdell, November, 1990.
17. "Traditional Reef and Lagoon Tenure in Western Samoa and Its Implications for Giant Clam Mariculture." Dr T'eo I.J. Fairbairn, February, 1991.
18. "Ocean Culture of Giant Clams (*Tridacna gigas*): An Economic Analysis." C.A. Tisdell, J.R. Barker, J.S. Lucas, L. Tacconi and W.R. Thomas, February, 1991.
19. "Aid for Village-Based Rural Projects in LDCs: Experiences, Project Appraisal and Selection, ACIAR and Giant Clam Culture as a Case". Luca Tacconi and Clem Tisdell, March, 1991.
20. "Customary Marine Tenure in the South Pacific Region and Implications for Giant Clam Mariculture". Dr T'eo I.J Fairbairn, April, 1991.
21. "ACIAR-Supported Research on the Culture of Giant Clams (Tridacnidae): A Multi-Faceted Economic Assessment of Research Benefits (Draft Appraisal)". Professor Clem Tisdell, April, 1991.
22. "Economics of Ocean Culture of Giant Clams: Internal Rate of Return Analysis for *Tridacna gigas"*. Tisdell, C.A., Tacconi, L., Barker, J.R. and Lucas, J.S., April, 1991.
23. "Socio-Economic Aspects of Giant Clams in The Lau Group, Fiji, and Farming Prospects: Results of Field Research". Veikila Vuki, Clem Tisdell and Luca Tacconi, June, 1991.

24. “Subsistence Economic Activities and Prospects for Clam Farming in Ono-i-Lau, Fiji: Socio-Economic Factors”. Veikila Vuki, Clem Tisdell and Luca Tacconi, June, 1991.
25. “Giant Clams in Tuvalu: Prospects for Development”. Luca Tacconi and Clem Tisdell, July, 1991.
26. “A Report on the Test Marketing of Giant Clams as Aquarium Specimens in Brisbane, Australia”. Clem Tisdell, November, 1991.
27. “Economic Returns from Farming Different Types of Seaweed (Eucheuma) and for Farms of sizes in Nusa Penida, Bali, Indonesia.” Carunia Mulya Firdausy and Clem Tisdell, December 1991.
28. “The Market for Giant Clams as Aquarium Specimens in Sydney and Melbourne: Results of a Telephone Survey of Retail Outlets.” Clem Tisdell and Thea Vinnicombe, January 1992.
29. “Domestic Markets and Demand for Giant Clam Meat in the South Pacific islands - Fiji, Tonga and Western Samoa”. Luca Tacconi and Clem Tisdell, January 1992.
30. Economics of Giant Clam Production in the South Pacific - Fiji, Tonga and Western Samoa”. Luca Tacconi and Clem Tisdell, February 1992.
31. “Exports and Export Markets for Giant Clam Products in the South Pacific: Fiji, Tonga and Western Samoa". Luca Tacconi and Clem Tisdell, March 1992.
32. “Institutional Factors and Giant Clam Culture and Conservation in the South Pacific: Observations from Fiji, Tonga and Western Samoa”. Luca Tacconi and Clem Tisdell, March 1992.
33. “Giant Clams in Wallis: Prospects for Development”. Nancy J. Pollock, May 1992.
34. “Current and Potential Markets for Giant Clam Meat in Fiji - A Case Study of the Market in Suva”. Vina Ram, August, 1992.
35. “Interest of Asian Restaurants in Queensland in Using Giant Clam Meat in their Cuisine and Their Knowledge of It.” Clem Tisdell, September, 1992.
36. “Notes on the Use of Giant Clam Meat for Food in Taiwan”. Clem Tisdell and Cheng Ho Chen, October 1992.
37. “Interest of Japanese Restaurants in Brisbane in Using Giant Clam Meat in their Cuisine and their Knowledge of It”. Clem Tisdell and Yoshihiro Kuronuma. November, 1992.
38. “Business Strategies for Commercial Giant Clam Growing”. Clem Tisdell and Jeremy Barker, December, 1992.
39. “Giant Clams in Japanese Cuisine - Brisbane Trials and Use in the Ryukyus”. Clem Tisdell and Yoshihiro Kuronuma, December, 1992.
40. “Final Report and ACIAR Project No. 8823 (ROU 259) 'Economics of Giant Clam (Tridacnid) Mariculture”. Clem Tisdell, March, 1993.