ISSN: 1034-4294

RESEARCH REPORTS IN THE ECONOMICS OF GIANT CLAM MARICULTURE

Working Paper No. 23

Socio-economic Aspects of Giant Clams in the Lau Group, Fiji, and Farming Prospects: Results of Field Research

by

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THE UNIVERSITY OF QUEENSLAND

ISSN 1034-4294

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Veikila Vuki, Clem Tisdell[2] and Luca Tacconi

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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 Clam Mariculture'.

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RESEARCH REPORTS AND PAPERS IN ECONOMICS OF GIANT CLAM MARICULTURE are published by the Department of Economics, University of Queensland, St Lucia, Queensland 4067, Australia, as part of Australian Centre for International Agricultural Research Project 8823 of which Professor Clem Tisdell is the Project Leader. Views expressed in these reports and papers are those of their authors and not necessarily of any of the organizations associated with the Project. They should not be reproduced in whole or in part without the written permission of the Project Leader. It is planned to publish contributions to the series over the next 3 - 4 years.

Research for the project *Economics of Giant Clam Mariculture* (Project 8823) is sponsored by the Australian Centre for International Agricultural Research (ACIAR), G.P.O. Box 1571, Canberra, A.C.T. 2601, Australia. The following is a brief outline of the Project:

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.

Commissioned Organization: University of Queensland.

Collaborators: James Cook University, Townsville, Queensland; South Pacific Trade Commission, Australia; Ministry of Primary Industries, Fiji; Ministry of Natural Resources and Development, Kiribati; Silliman University, Philippines; Ministry of Agriculture, Fisheries and Forests, Tonga; Forum Fisheries Agency, South Pacific; ICLARM, Manila, Philippines.

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Socio-Economic Aspects of Giant Clams in the Lau Group, Fiji, and Farming Prospects: Results of Field Research

ABSTRACT

Reports the result of a survey of villagers on the islands of Lakeba, Tuvuca, Cicia, Balavu and two islands of Ono-i-Lau, in the Lau Group, Fiji. Information was gathered about the presence of giant clam species, changes in their abundance, uses, harvesting methods and gender roles in harvesting. Other matters investigated were taste for clams, rules on harvesting and exchanging clams, interest in clam farming, likely role of men and women in clam farming, especially in subtidal versus intertidal farming, and the prospects for giant clam farming in the village communities. This paper reports the results on a village-by-village basis and overall.

Keywords: giant clam, Fiji, Lakeba Island, Lau group, harvesting of giant clams, gender roles, subtidal farming, intertidal farming

JEL Classifications: Q57, Q31

Socio-Economic Aspects of Giant Clams in the Lau Group, Fiji, and Farming Prospects: Results of Field Research

1. Background

1.1 Introduction

Giant clam population in the Pacific has decreased because of over-exploitation from both commercial and subsistence fishing. Biological research has made possible the culture of giant clams thus opening the way to eventual commercial and subsistence farming.

Successful implementation of clam farming projects at a village level depends not only on the economic viability of the enterprise but also on social factors. Traditional patterns of fishing rights, rules for fishing and exchanging the catch, taboos, gender roles and social commitments are some of the factors that could affect the outcomes of a project.

Field research was undertaken on the islands of Lakeba, Cicia, Tuvuca and Ono-i-Lau in the Lau Group (Fiji) during the period June-October 1990 in order to ascertain the species of giant clams present in the islands and their abundance, social and economic factors that could affect giant clam farming in the area. The actual survey was conducted by Ms Veikila Vuki in the Lauan dialect using a questionnaire suggested by Clem Tisdell. Ms Vuki was born and grew up in Ono-i-Lau, knows the people and the language and still has close relatives there.

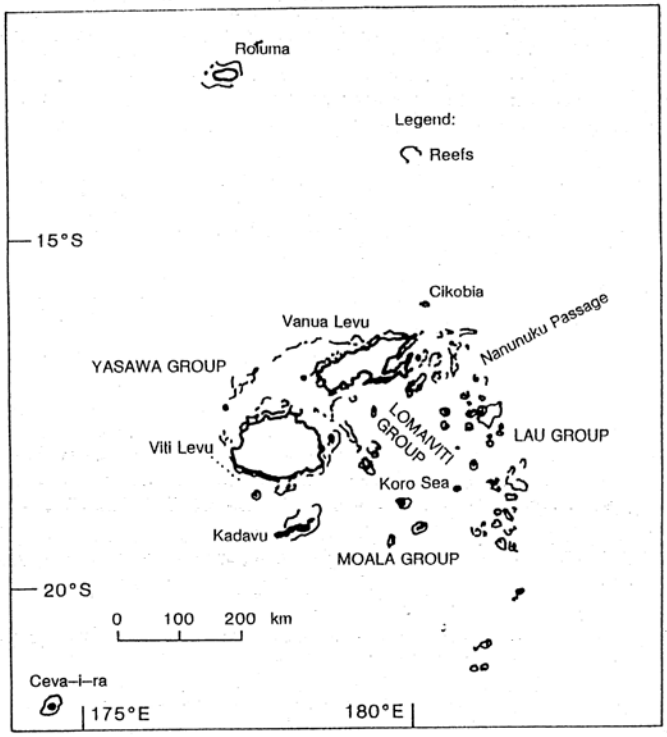
This paper presents the findings relative to the survey conducted in the villages of Tubou, Levuka and Waitabu on Lakeba island and some results for other islands in the Lau Group including Ono-i-Lau. The nature and location of the survey is described in the next sub-section. The results for Lakeba Island are presented (first some results for the whole island and then results for particular villages). This is followed by results for other islands in the Lau Group and finally results for the whole Lau Group are pooled. It is intended to complete a separate detailed paper for Ono-i-Lau in this series. The survey covered abundance of. clams in the area, traditional fishing rights and exchange rules, use of clams, consumption of clam meat, clam meat preparation, gender division of clam harvesting, and prospects for clam farming. The English version of the questionnaire is attached as Appendix A.

1.2 Location and Nature of the Survey

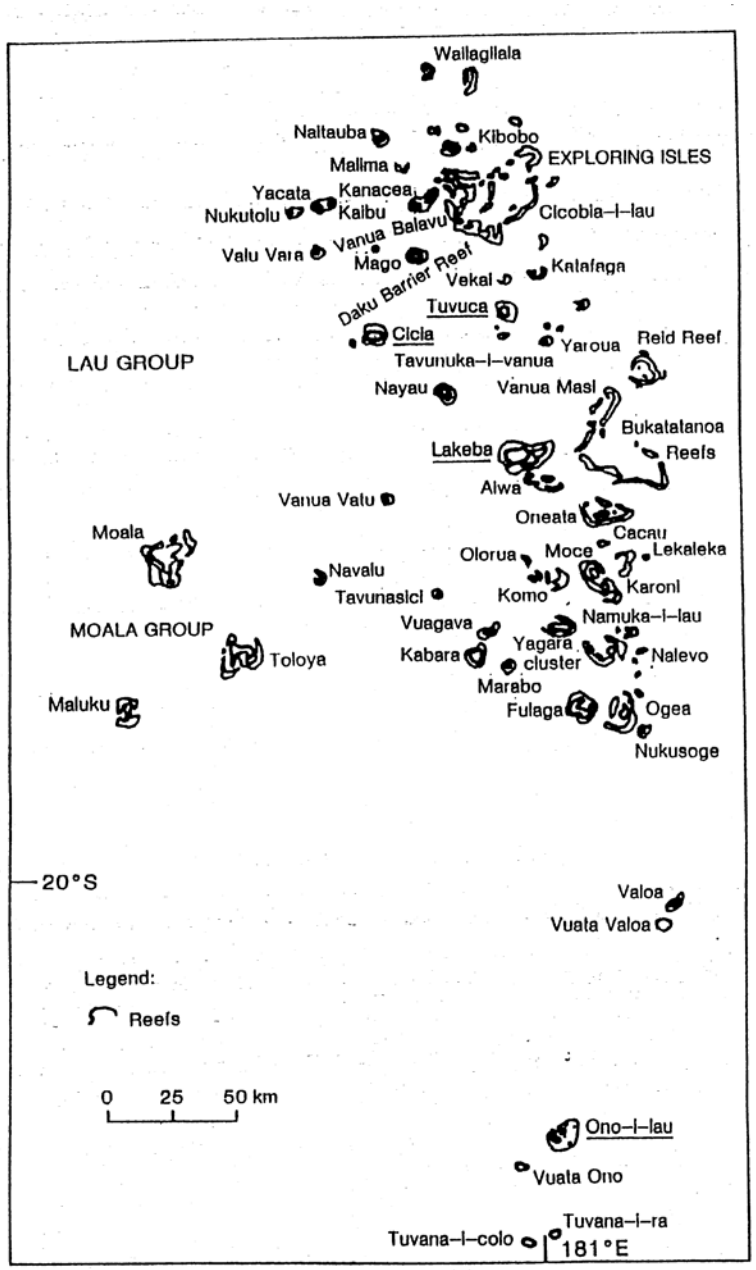
The Lau archipelago is situated in the eastern part of Fiji and comprises about 40 islands and over 250 islets. The total area is approximately 440 km^2, distributed over 113,900 km^2 of ocean, between 16°30' and 178-180° w. (See Maps 1 and 2).

The survey was conducted in the period June - October, 1990. The archipelago is isolated and boats and planes to the islands are not very frequent so this dictated the timing of the survey. Fijians with considerable experience in fishing and gleaning on Lauan reefs were selected with the help of the Fiji Fisheries Extension Officers (Lau). But difficulty was encountered when villagers were out gardening or fishing when the boat arrived on their island. Only those who were in their village at the time could be interviewed, since the boat only stayed a short while.

Surveys were conducted on the islands and in the villages in the Lau Group indicated in Table 1. In Map 2 the names of the islands concerned are underlined. As can be seen from Table 1, 48 persons were effectively interviewed most of whom were on Lakeba Island. Of these interviewed, 18 were females and 30 were males. While the numbers seem quite low in relation to other islands, there are only small populations on a number of the other islands e.g. at the 1986 census Matokana Village had 20 households and a population of 132.



Map 1: Fiji showing the Lau Group



Map 2: Lau Group Fiji. Islands included in the survey are underlined.

Table 1: Location of persons interviewed in the Lau Group

Island	Village	Number of interviewees
Lakeba	Tubou	10
	Waitabu	10
	Levuka	13
		33
Tuvuca	Only village	2
Cicia	Tarukua	2
Balavu	Deliconi	1
	Namalata	1
		2
Ono-i-Lau	Nukuni	1(chief)
	Matokana	8
		9

Let us consider the results broadly from Lakeba Island first and then from particular villages on Lakeba before discussing the results from other locations. But before doing this some background on Lakeba Island may be useful.

Lakeba Island lies in the central part of the archipelago and has a population of about 2,435 people and is the largest island of the group. It is an emergent island of 55.9 km^2, total lagoon area 82 km^2, and the lagoon around the island 0-10m deep with a sea surface temperature range from 27.9° to 29.3° centigrade.

The villages of Lakeba consist of fishing communities. Villagers often visit Bukatatanoa reefs (a major reef just off Lakeba) and the surrounding barrier and fringing reefs of Lakeba and Aiwa. The major production activities are fishing and agriculture (copra and growing of root crops like yam). Fishing vessels such as Food & Agriculture Organisation (FAO) designed 28ft vessels and fibreglass punts are normally operated by fishermen.

Seaweed farming is no longer undertaken in the villages surveyed. Jayant Prakash, the past Fisheries Officer, who was initially involved in seaweed farming in the Lau group believed that, due to the isolation of the Lau group, it was better to redirect his program of seaweed farming to other parts of Fiji, such as the Western Division and the Lomaivito group (Prakash, 1990 pers.com.).

2. Results of The Lakeba Island Survey - General Features

2.1 Clam Species

Four species of giant clams are present in the waters of Lakeba island. The local people distinguish them by their shape and size. They can also distinguish the different species by stating whether the clam species is firmly attached to the coral substrate or not. The name "katavatu" (*Tridacna maxima*) literally means "firmly attached to coral substrates" and "cega" (*Tridacna squamosa*) means fluted clam. The species are:

- - Katavatu (Tridacna maxima)
- - Cega (Tridacna squamosa)
- - Vasua dina (*Tridacna derasa*)
- - Vasua lokaloka (*Tridacna crocea*).

While the first three species where reported by all respondents, *T. crocea* was reported by only one respondent (from the village of Levuka) who said that this species of clam is now very rare.

2.2 Fishing Rights

Fijian communities hold tribal ownership of fishing rights on customary fishing areas (Fairbairn, 1990). This traditional ownership was recognised by the interviewees in Lakeba island. Respondents reported that the villages' fishing rights ‘fall within the Lakeba customary ground and are not divided’. This seems to imply that within Lakeba island there is not division of fishing rights between villages. Also, it was pointed out that families might have exclusive rights to particular reef areas. Note that a family in this context is probably a land-owning unit. It is usually smaller than a mataqali. There appear not to be set rules for clam harvesting as almost all respondents affirmed that 'everyone can take as many clams as needed'. It was however observed by one respondent in Tubou village that clam harvesting is supposed to be for subsistence purposes and not for commercial exploitation.

As far as the Native Land and Fisheries Commission Registry is concerned, the fishing ground is communally owned and is registered under the "vanua" (land) of Lakeba. This simply means that it is registered as belonging to the people of Lakeba. In reality, each village has a boundary. Members of one village cannot just go and fish on reefs close to the next village. Boundaries are like unwritten laws and are a mark of respect for those in the

next village. It is like a territory, "you fish in yours and I fish in mine". If one member of one village decides to go fishing in the next village's reefs then he has to follow protocol. Before going fishing he has to present whales tooth (tabua) or kava to the chief of the next village to ask for permission. If protocols are not followed then there can be problems of fighting with each other. More problems have come up due to conflict of interest between commercial fishermen and subsistence fishermen.

In Lakeba Island, particular sharing rules or taboos on consumption of clam meat were not observed; it was usually noted by the villagers that 'you might share the catch if you wish'.

2.3 Traditional Harvesting

Both women and men collect giant clams, but women mostly limit their activities to the reef flats whereas men fish in deeper waters. It was however reported that women too dive to collect giant clams. Women usually collect *T. maxima* and *T. squamosa* from the reef flats and tidal pools, while men gather *T. derasa* from deeper waters. The smaller size of clams collected by women (reported by some interviewees) appeared to be due to the different species harvested by the two sexes.

Two methods are used to harvest giant clams in deeper waters: free diving and the clam fishing line method.

Free diving, practiced by women and men, requires goggles or a mask and a knife to take the meat out of the shell which is normally left at the bottom of the sea.

The fishing line involves a rope with a piece of metal or rock tied to one end while the other end is tied to the canoe. The diver takes the rock and drops it onto a clam which then closes on the line. The fisherman can then pull the rope up into the canoe with the clam.

2.4 Use of Giant Clams

Giant clam meat is very much appreciated by the majority of the islanders who consume it raw or cooked. All the three species are appreciated, but some people prefer *T. maxima* and *T. squamosa*, eaten as ‘kokoda’ (marinated in lemon juice), for their ‘sweet taste’.

In the Lauan group giant clams may be cooked in any of the following ways:

1. By wrapping giant clam meat in banana leaves, baking it in an underground oven and then simmering it in coconut milk.
2. Boiling the meat in coconut milk or water with salt and onions added.
3. Boiling the meat in thick coconut milk with curry added for flavour.
4. Cooking the meat in coconut milk with edible leaves added such as those of cassava and sweet potato. Other seafood such as trochus and fish may be added so as to provide a seafood stew.
5. Giant clam meat may be boiled in water and then cut into cubes and served with lemon and chilies.
6. Giant clams may be cooked with ripe bananas or plantains in coconut milk.
7. Giant clam meat may be wrapped in banana leaves and boiled in coconut milk.

Giant clam meat is also eaten raw, either without preparation (au nature]) or with preparation. Cubed raw clam meat may be marinated in lemon or lime juice, and salt added according to taste. It may be served with thick coconut milk.

Giant clam gardens are also a common feature of Lauan villages. Clams harvested with the fishing line method are in fact often placed in clam gardens ready for consumption when weather conditions are poor and for when there is a ceremony or a feast in the village. Clams are also much appreciated as 'take away' food by the villagers when out fishing in grounds distant from the village. Fisherwomen and fishermen will take cassava and lemon with them when they go fishing. Whenever they are hungry, they will simply use their knife and get the meat of giant clams, remove the kidney and squeeze the lemon into the shell. They cut the clam meat into pieces and marinate it for a few minutes in lemon juice - it is then ready for a meal (a fisherman's delight).

The shells of the clams have several uses in Fijian villages. They are useful for terracing Fijian 'bures' or houses, as ornaments and ash trays, serving dishes for pigs and chickens, for flower gardens and to make fish fences.

3. Results Of The Lakeba Island Survey By Individual Villages Surveyed

3.1 Tubou Village

Tubou has a population of approximately 704 people and ten interviews were conducted. Four respondents were males and six female. The ages ranged from 23 to 60 years with six

interviewees having a fishing experience in the area of more than 10 years and up to 40 years.

3.1.1 Abundance of clams and taste for clam meat

All the respondents recognised that giant clams are now less abundant than in the past. An increase in fishing activities, both for consumption and for commercial purposes, was cited as the cause of the decrease in clam stocks.

Probably due to the scarcity of clams on the reef nearby Tubou village, only one respondent out of seven had noticed juvenile clams on the reefs. Another respondent indicated that she had seen 'small fish' eating clams.

From Table 2, we can see that 70% of the respondents like clam eat and that perception of supply being scarce is not strictly related to a 'taste factor'. Two of the three respondents who said they had sufficient supply of giant clams turned out to be the largest consumers of clam meat in the sample, with one consuming 2kg once a week and the other consuming 2kg twice a week. The other respondents who liked clam meat consumed it once a month and ate about 1 to 2 kilograms each time.

Table 2: Taste for clam meat and scarcity of supply: Number of responses – Tubou

	Yes	No
Do you like clam meat?	7	3
Do you have enough supply?*	3	6

*One interviewee did not answer the question as she did not like clams

All the three clam species are appreciated by the villagers. However one respondent indicated that 'Cega is nice because it is sweet'.

3.1.2 Rules on harvesting and exchange of clams

It was reported by some respondents that the village marine tenure rights 'fall within the Lakeba customary ground and it is not divided'. This appears to imply that there is no division of rights between villages. It was also pointed out that 'families' might have exclusive rights to particular reef areas. But families, land-owning units, may only have "exclusive rights to the area" because they own an island which is surrounded by coral reefs. The reefs are owned communally and it is out of respect for the owner of the island that others do not have the right of access to the reefs around the island. Some owners of the

island may not allow people to fish in the area because of people stealing coconuts or crops from the island even though they are meant to be fishing instead of collecting coconuts from the land. However, these rights appear not to influence clam harvesting as all the respondents asserted that everybody in the village can take whatever quantity is needed.

In Tubou there are no set rules for exchange or sharing of clams and some respondents reported that 'you might share if you wish'. Only one respondent said that clam collection was supposed to be for consumption and not for commercial purposes.

3.1.3 Traditional clam harvesting, implications for clam farming and interest in clam farming.

Traditionally, both women and men collect giant clams but women limit themselves to the reef flats where they collect *T. maxima* and *T. squamosa* (and other shellfish and fish) from shallow tidal pools. Women also dive but this is rare. Men dive for spear-fishing and to collect clams, mainly *T. derasa*.

Most of the respondents (7 out of 10) agreed that if intertidal clams were being farmed, then women would look after them. Only one respondent (male) suggested that men might be more involved in farming clams than women. However, the reason for this was not made clear. It was probably not for his own interest (as a male) because he suggested that the village was not interested in clam farming.

Subtidal clam farming (*T. derasa*) does not appeal to the villagers. In fact six respondents out of nine saw it as disadvantageous to the village. Only three women suggested that subtidal farming would not be a disadvantage for the village and men could look after the clams. Their answers appear not to take into account the time schedule that men have to follow in their working of gardens, fishing and social activities. In fact, men indicated that subtidal farming would take a lot of time and would be a constraint on their activities.

From the sample interviews, it seems that in Tubou there is not much interest in farming giant clams. Sixty percent of the respondents (7 respondents) expressed no interest in clam farming, claiming that it would involve a lot of work and might disrupt community life. Those who thought clam farming could be a worthwhile operation noted that it would increase the depleted clam stocks and in one case that 'it would be an income source for our children' (female respondent).

From this small sample it is difficult to ascertain the reasons for slight interest in farming clams. It is likely that it depends on a combination of factors. Three respondents who did not like to eat clams expressed no interest in farming them. Out of six respondents who had insufficient supply of clams, three expressed interest in farming clams. Only one respondent, out of three having enough clam meat, was interested in clam farming. Also, there does not appear to be any clear relationship between relative dependence on land or sea resources and willingness to farm clams.

Factors such as perception of the amount of work involved in clam farming, need to increase income, social and family commitments might all play a role in villagers' interest in farming clams.

3.2 Waitabu Village

3.2.1 Background

Waitabu has a population of approximately 146 people and ten interviews were conducted. Seven respondents were male and three were female. Their ages ranged from 23 years to 68 years. All interviewees had been living in the village since childhood.

3.2.2 Abundance of clams and taste for clam meat

All respondents in Waitabu village indicated that giant clams were not less abundant than in the past and 7 out of 10 respondents had seen juveniles on the reef. Consequently, clam supply was reported to be sufficient to satisfy village needs. The average consumption of clam meat is higher in Waitabu than in Tubou, where clams are scarcer than in the past. In Waitabu clam meat is consumed on a weekly basis, up to three meals per week, whereas in Tubou clam meat is consumed on average once or twice a month. In Waitabu, all respondents but one liked clam meat.

3.2.3 Traditional clam harvesting and implications for clam farming, and interest in clam farming.

In Waitabu, as in Tubou, there are not special rules for harvesting and exchange of giant clams. Both women and men collect clams, women from the reef flats and men from deeper water.

All respondents suggested that intertidal farming of giant clams would be best suited to

women. Subtidal farming is not seen as a disadvantage for the community (as it was in Tubou). Four men out of six thought that both women and men should look after subtidal clams (*T. derasa*) whereas two suggested that men should look after the clams as they do ‘lots of diving'.

Two women out of three regarded subtidal farming as best suited to men and only one suggested that both men and women should look after the clams. The answer is probably influenced by the inclination of the individual woman to dive. A woman that does not dive would see men as best equipped to attend subtidal clams.

In Waitabu village, even if supply of clam meat is considered sufficient, all respondents (9 out of 10 interviewees) answered positively to the question tis your village seriously interested in farming giant clams?'. The reasons given or the interest are reported in Table 3. A woman also said that 'interest in farming and its success will be to the future generation's advantage'.

Table 3: Reasons for interest in clam farming – Waitabu

It will increase clam stock for subsistence use	Interested in seeing how it is done	It will increase income
I		
I	I	
I	I	
I		
I		
I		
	I	
I		I

This asserted interest in clam farming is not an assurance of success of an eventual project. People lack knowledge of clam farming and a deeper assessment of village needs and constraints (e.g. time allocation) would be required before starting a project.

One of the factors that could explain a greater interest in clam farming in Waitabu compared to Tubou is the fact that Waitabu people appear to be more dependent on sea resources than Tubou villagers. In Waitabu, six respondents indicated they were more dependent on sea resources than on land resources, and four interviewees were dependent on both. In Tubou, only three respondents depended on sea resources and six on both land and sea resources.

3.3 Levuka Village

3.3.1 Background

Levuka has a population of approximately 162 people. Thirteen interviews were conducted, nine with males and four with females ranging in age from 23 to 63 years. Only two interviewees had had less than ten years fishing experience in the area.

3.3.2 Abundance of clams and taste for clam meat

One respondent indicated that in the area the species *T. crocea* can be found but it is very rare - this was the only indication of the presence of *T. crocea* in Lakeba island.

All respondents observed that giant clams are less abundant now than in the past. Increased fishing activities for subsistence purposes seem to be the major cause of depletion (indicated by all - respondents but one), but fishing for commercial reasons has also contributed to stock depletion (cause suggested by four respondents).

Clam meat is very much appreciated (10 out of thirteen villagers liked clam meat) but present consumption is much lower than in the past due to stock depletion. One villager pointed out that his family used to consume clam meat daily (1-2 kg) but now they have clam meat once a week. However, the majority of the respondents (9 out of 13) consume clam meat only once a month (2 kg per meal). This change in diet (it would be interesting to analyse what they substitute for clam meat) has obviously been brought about by reduced availability of clam meat. In fact all interviewees stated that clam supply was insufficient.

3.3.3 Traditional clam harvesting and implications for clam farming

Intertidal clam farming was seen by all respondents as an activity appropriate for women, as they already spend part of their time gleaning on the reef flats.

It was believed by three respondents out of thirteen that subtidal farming would be disruptive of village activities as ‘it requires too much time’.

The other respondents (10), which did not see subtidal farming as disadvantageous for village life, suggested in large part that both women and men should take part in subtidal farming.

Table 4: Who should take part in subtidal farming

	Respondent's gender					
	Male			Female		
	Male	Female	Both	Male	Female	Both
Number of responses	1		6	1		2

Amongst the villagers interviewed there was clear interest in farming giant clams. In fact 9 out of 13 villagers expressed interest in such activity. Four respondents were not interested in clam farming; three of them did not like giant clams, the only three in the sample, and were mostly dependent on land resources, again the only three in the sample. The reason given for the lack of interest in clam farming was that such activity would be time consuming and could 'coincide with other village activities'.

Interest in farming clams was justified by the respondents on the basis that it would boost local stocks for subsistence consumption. One villager indicated that excess production could also be sold and provide an extra source of income.

Table 5: Interest in clam farming, taste for clam and nature of resource dependence – Levuka.

Interested in farming?		**Do you like clam meat?**		**Resource dependence**		
Yes	No	Yes	No	Land	Sea	Both
	I		I	I		
I			I			I
	I		I	I		
	I		I	I		
I		I			I	
I		I			I	
I		I			I	
I		I			I	
I		I			I	
I		I				I
I		I			I	
I		I			I	
I		I				I

In implementing a project to develop giant clam culture, account should be taken of the fact that the villagers sometimes use poison to fish and this could jeopardise the smooth running of the project (as indicated by one villager). Also, concern was expressed that the organisational structure should be appropriately identified. It would be a mistake to assume that the 'village community' will take care of the project. Specific groups should be

considered for project implementation, such as women's group, fishermen's group or others to be formed.

4. Results For Villages Other Than Those On Lakeba Island

4.1 Tuvuca Island

4.1.1 Background

There is only one village on Tuvuca island and its population is 196 people. The island is surrounded by a barrier reef The main sources of income are fish, rootcrops and handicrafts. The people of Tuvuca are coastal dwellers and are a fishing community.

Two villagers were interviewed (one female and one male). Both of them had had a long period of fishing experience in the area.

4.1.2 Clam species present and abundance

Three species were reported:

- T. maxima
- T. derasa
- T. squamosa

Clams are less common than in the past, especially *T. derasa*. The reason for the reduced availability, as stated by the interviewees, is overfishing.

Clam meat consumption is low, in fact in one case meat was consumed only once a month (2kg) and in the other case meat was consumed on a weekly basis (1 - 2kg).

4.1 3 Fishing activities and methods

They follow the same pattern as described for Lakeba Island:

- women collect on reef flats
- men in deeper water

4.1.4 Abundance of clams and interest in farming

Both interviewees agreed that clam meat was scarce and that they were interested in farming giant clams. Both villagers mostly depended on marine resources even though a degree of farming is present.

Subtidal farming of (*T. derasa*) did not appear to pose a problem for the villagers. However, the male respondent asserted that subtidal farming should be undertaken by men, whereas the female villager thought that both men and women should be involved in subtidal farming. These opposing views could reflect gender interest on the control of resources. But, in relation to intertidal farming, both villagers agreed that women would be better suited to culture intertidal species.

Villagers were interested in clam farming to increase the supply of clam meat for subsistence purposes and also to benefit future generations.

4.2 Cicia Island - Tarukua Village

The population of Tarukua is 203. Cicia island has a total population of 1283. The island is surrounded by a barrier reef and a few fringing reefs.

It has one of the major copra stations in the Lau Group. The islanders work on the plantation which covers a large part of the island. Fishing activities include gleaning by women, hand-lining and gill netting. The major sources of income are copra, trochus, fish and root crops. Income from these are mainly used for education and medical expenses.

Two interviews were carried out, one with a male and the other with a female. Both had a long period of fishing experience in the area. Species present are *T. maxima, T. squamosa, T. derasa and T. crocea*. All species are less common due to overfishing. The villagers use poison to kill fish and this could have an impact on clams. The female interviewee did not like clams but both villagers agreed that supply of clam meat is insufficient. However, meat consumed appears not to be a good indicator of clam scarcity. The female villager consumed clam meat monthly (2kg) whereas the other interviewee, who liked clams, was eating clams weekly.

Both villagers expressed interest in clam farming, and thought that subtidal farming would not be a problem. Both women and men should look after the clams.

The use of fish poison on the reef could cause problems for clam farming.

Both interviewees were mostly dependent on land resources for their income.

The male was interested in clam farming for subsistence purposes, whereas the female was interested both for subsistence and commercial purposes.

The reef is owned according to ‘Native customary rights' and families and individuals have no exclusive rights.

4.3 Balavu Island

Two persons only from this island were interviewed - one from Daliconi village and the other from Namalata village.

The respondent from Daliconi village was a male, 66 years old; He said all species (*T.maxima, T. squamosa, T.derasa*) are less common than in the past and have almost disappeared. Supply is not sufficient. He would like 8/l0kg per week.

He suggested that men look after a clam project as women are already busy (with children and cooking, etc). ‘Interest should be directed not on farming for short-term objectives, but rather for long-term ones: future generations.' He suggested that it would be best to start with a pilot project.

In Namalata village the sole interviewee was a male. As in the previous village, clams were said to be less abundant. He thought women would be better suited to looking after giant clams. He was interested in clam farming as an alternative source of income to provide cash in order to educate children.

4.4 Ono-i-Lau Group

4.4.1 Nukuni village

There was one interviewee, a 72 year-old chief. He said clams were still common, although less abundant than in the past. In summary his remarks were:

- women should look after an intertidal project
- young men could be involved in a subtidal project interested in commercial farming of clams as the price of copra is not adequate.

- a taboo could be introduced to prevent anyone from fishing cultured clams. He said however that theft could be a problem.

4.4.2 Matokana village

In Matokana (Ms Vuki's home village), eight interviews were conducted (4 women and 4 men). All villagers had many years (> 10) of fishing experience. Species reported are: *T. maxima, T. derasa, T. squamosa, T.'tevoro'*. Clams are less abundant than in the past but still common. *T. derasa* is probably the species least available. It was reported that *T. derasa* is less common due to commercial exploitation.

All villagers agreed that clam supply was sufficient, however some (4) noted that they would like to have even more clams. Clam meat consumption; is relatively high ranging from one meal a week (2kg) up to 3 - 5 meals when the weather is poor (and they are unable to go fishing).

All interviewees agreed that women are better suited to intertidal clam farming. It was recognised that subtidal farming could a problem as it involves lots of time and only one group (young men) could take part in it. Even if giant clams are still common in the wild, all the villagers interviewed (8) expressed interest in farming clams. However, it should be noted that only one villager expressed interest in farming them for subsistence purposes. Two interviewees (women) explicitly explained that there were enough clams in the wild for subsistence purposes.

Interest in clam farming is mostly explained by the fact that clams are considered a good alternative source of income, especially because of low and fluctuating copra prices. One respondent expressed some concern about the difficulties of selling clams, as their island is isolated from the market. An eventual clam farming project appears to have some hope for success in this island only if supported by an adequate marketing structure. It is however doubtful that this could be economically viable. Cost of production, storage and transport should be analysed and compared to the market price for clam meat, possibly in Suva.

Marine rights are recognised as regulated by Native land rights. However one villager said 'exclusive rights might be recognised especially for chiefs and if someone has land near the reef, but usually there is free access by the villagers'.

In Matokana village, sharing of products is a practice still observed - a respondent observed,

'you share, like it or not'.

5. Results Of The Survey For The Whole Lau Group

The number of interviews was 49, but one (No. 49) was completed only in part. Taking only 48 interviews as effective, 18 interviewees were female and 30 were males. All the respondents had significant fishing experience in their area: 41 had more than 10 years' experience and some up to 50 years' experience. Most of the villagers interviewed were heavily dependent on the sea for their livelihood. Of the 48, 27 depended almost entirely on marine resources, 13 were dependent both on marine and land resources and 6 depended on land resources.

Abundance of clams

38 out of 48 respondents stated that clams are less abundant than in the past. Abundance has not changed in the village of Waitabu (Lakeba Island), in the opinion of the 10 villagers interviewed there. But in all other villages (remaining 38 respondents) clam populations were said to have declined.

Taste for clam meat

39 out of 48 respondents said that they like clam meat. The overall results are summarised in Table 6. While about 80 per cent of respondents liked clam meat, about 20 per cent did not. Most of those not liking clam meat were on Lakeba Island.

Table 6: Frequency of responses by respondents to the question 'Do you like clam meat?'

Island	Village	Yes	No
Lakeba	- Tubou	7	3
	- Waitabu	9	1
	- Levuka	9	4
		25	8
Tuvuca		2	0
Cicia	- Tarukua	1	1
Balavu	- (Deliconi & Namalata)	2	0
Ono-i-Lau	- Nukuni	1	0
	- Matokana	8	0
		9	0
All island	Total villages	39	9

Supply of clams

21 respondents said that their supply of clams is sufficient. Of these, 10 were from the village of Waitabu (Lakeba Island), and 7 from Matokana (Ono-i-Lau).

Collection of clams

All interviewees confirmed that both men and women collect clams. Women mainly collect clams from the reef flats but sometimes also, according to 10 respondents, from deeper waters. Men collect clams only in deeper waters.

Farming of clams - intertidal

44 respondents stated that women are better suited to intertidal farming of clams than men. Only three respondents (male) suggested that men should look after intertidal farms.

Farming of clams - subtidal

16 interviewees thought that subtidal farming of clams could cause disruption to village life. On the whole this method of farming was less favoured than intertidal farming.

Interest in clam farming

Except in one village Tubou (located on Lakeba Island) most respondents expressed an interest in giant clam farming. Overall 79 per cent of respondents were interested in clam farming. The results overall are given in Table 7. Although the sample is small, interest on Lakeba Island in clam farming, a larger island, seems to be less than on the smaller islands in the Lau Group. This may be because villagers on Lakeba Island are less dependent on marine resources than those on smaller islands. The main reason given for lack of interest in clam farming is that it may be too disruptive of village life. This may be interpreted to mean that its opportunity cost could be too high - men may have to sacrifice time tending their gardens or women may need to give up time used for gleaning on the reef. Three reasons were given for interest in clam farming (1) to provide supplies for subsistence (2) to provide commercial possibilities and (3) to ensure a stock of clams for future generations (bequest value). Interestingly enough commercial possibilities tended to be given more emphasis on the smaller island in the Lau Group, presumably because the villagers have very few opportunities for earning cash. But the motive to earn cash is not necessarily an individualistic selfish one. Sharing and community goals still remain strong on the smaller islands in the Lau Group.

Table 7: Number of Respondents expressing an interest in giant clam farming

Island	Village	Number	Total number of respondents
Lakeba	- Tubou	4	10
	- Waitabu	0	10
	- Levuka	10	13
		23	33
Tuvuca		2	2
Cicia	- Tarukua	2	2
Balavu	- Deliconi	1	1
	- Namalata	1	1
		2	2
Ono-I-Lau	- Nukuni	1	1
	- Matokana	8	8
		9	9
All islands	Total villages	38	48

6. Implications Of The Socio-Economic Study For Giant Clam Mariculture Developments In The Lau Group

What is the motivation of Lauans to farm giant clams? Is it for money? The village way of life is based on sharing and not necessarily on whether one has acquired material possessions. If a goal is set, for example, building a church, community hall, scholarship funds, housing projects, it could perhaps create an incentive to farm giant clams. There are some exceptions of course, like the entrepreneur who would jump at an opportunity to farm giant clams. Several pilot projects need to be set up to assess the viability of clam farming in the Lau Group.

One needs to take note of the lessons learnt from seaweed farming in the Lau Group. How successful was the venture? What were the problems encountered in trying to establish those farms and getting them going.

- Issues that need to be addressed are:
- the remoteness of the island group and transport, market reliability and reliability of farmers in supplying the market,
- it may be necessary to have commercial farms to
- ensure continuous supply of giant clam meat to the market,
- alternative clam products to fresh or frozen meat such as smoked or died and possibilities for clam shell products which might support cottage industries in the villages need investigation.

Other factors which will have to be considered are the finance of clam seed supplies and equipment for farming such as boats or diving equipment if subtidal farming is adopted.

There are still many questions to be answered about the economic viability of giant clam farming in the Lau Group. There is clearly interest in the possibility of such farming in the Group but the economics of subsistence and commercial farming in the area has yet to be proven. In that respect it should be noted that villagers in many of the smaller islands in the Lau Group are especially interested in the commercial prospects for such farming. Study of these prospects would seem to require an investigation of the potential urban market for giant clams in Fiji and a study of transport systems and costs. It might also be noted that intertidal clam farming is likely to be more suited to the villages than subtidal farming, e.g. using *T. derasa*. There is also a need to more carefully study prospects for farming at the village level

taking into account village customs, current economic activities, sociological factors and existing demands on available time. A later paper dealing in particular with Ono-i-Lau will give special attention to these matters.

APPENDIX A

English version of a questionnaire used in a survey of villagers in the Lau Group, Fiji, in connection with research into the socio-economic aspects of giant clams and prospects for farming them.

Name and location of village

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Respondent(s) Name and status

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……..

Age:

When did you start fishing in your area?

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1. What species (types) of giant clams are available to the village? Please list and describe these.

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2. How abundant or common are the above species? Are they less abundant than in the past?

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3. Have any species of giant clam disappeared from your village or almost so? If yes, please indicate species and indicate why this has happened.

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4. How often does your family eat clam meat? How much does it eat? Please indicate quantity daily, weekly or monthly.

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5. Are you fond of clam meat? Yes/No
   If yes, can you indicate how fond you are of it, say in relation to other sea food?

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6. Which species of clam do you prefer to eat? Explain.

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7. At present do you get as much clam meat as you would like for consumption by your family? Yes/No

   If No, how much greater supply would you like to have? What types of clam would you like to have more of?

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8. How do you prepare clams for eating? What recipes are used in your village for preparing clam meat for eating?

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9. Who collects clams? Men or women or both? If both, is there a difference in the size, type or species of clam harvested by the sexes or in the places from where they are collected?

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10. Do women in your village generally confine their marine harvesting activities to the reef flats and shallow areas? Do they only take clams from these areas? Please explain your answer.

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11. In your village are there any rules or customs governing the harvesting of giant clams? Please explain your answer.

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12. What rules if any govern the exchange or sharing of giant clams harvested in the village area?

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13. What marine land rights (property rights) does your village claim?

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14. Can families or individuals have exclusive rights to particular reef areas?

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15. Do men in your village like to dive and work under water? Explain.

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16. Do men sometimes take giant clams from deeper water? If yes, how do they obtain them?

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17. Giant clams, depending upon the species, can be grown intertidally or subtidally. Do you think in your village women rather than men might be more involved in looking after farmed clams on the reef flats?

Yes/No. Explain.

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18. The farming of some species of clams involve a lot of diving, e.g. *Tridacna derasa.* Would you see that as a disadvantage in your village? Please explain. If such a species was to be farmed would you see it as being looked after by men or women or both? Please explain.

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19. Is your village seriously interested in farming giant clams? Yes/No.

Why? In particular, if yes, do you see the clams as principally being for local subsistence use?

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20. Do you consider that the amount of interest and the social arrangements in your village are likely to make the farming of giant clams a success? You should remember that there may be several years between the time when clam seed is grown out in the ocean and the time when these clams can be harvested? Please explain your answer.

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21. Is the village involved in any farming? Yes/No

Please state types of farming if any. Is the village involved in seaweed farming? Yes/No. Why?

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22. Are there any factors that we might have overlooked that would have a bearing on the likely success or otherwise of clam farming indicate these.

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23. Please forward any additional information on use of shells and of giant clams in the past (or present).

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24. Any stories or legends about giant clams?

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25. Is there any taboo on giant clams at certain times of the year?

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26. Did you hear any stories or hear of old people talking about a species of giant clam that has become extinct?

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27. Have you seen juvenile giant clams in your reefs?

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28. Have you seen anything eating giant clams?

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29. Why do you call species of giant clams their different names?

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30. Are you more dependent on fisheries resource or land resources as your main source of income?

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……

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.
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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.