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RESEARCH REPORTS IN THE ECONOMICS OF GIANT CLAM MARICULTURE

Working Paper No. 15

**The Potential Market for Giant Clam Meat in
New Zealand: Results of Interviews with Pacific
Island Immigrants**

by

Clem Tisdell and René Wittenberg

October 1990



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MARICULTURE**

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**The Potential Market for Giant Clam Meat in New Zealand:
Results of Interviews with Pacific Island Immigrants¹**

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Clem Tisdell and René Wittenberg²

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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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The Potential Market for Giant Clam Meat in New Zealand: Results of Interviews with Pacific Island Immigrants

ABSTRACT

As part of an examination of the potential market for giant clam meat, the Pacific Islander community in New Zealand was considered. Pacific Islander descendants were interviewed between 2nd July and 13th July, 1990 in both Auckland and Wellington, which have the highest concentration of Pacific Islanders in New Zealand.

As a result of these interviews the size of the potential market for giant clam meat amongst New Zealand Pacific Islanders was estimated at up to 3,120 tonnes annually with a potential retail value of NZ\$31.2 m. This would make this potential New Zealand market four times as large as that of Australia and also much larger than estimated market sizes for both Japan and Taiwan in terms of meat weight.

Keywords: Giant Clam recipes, Giant clam availability in New Zealand, Pacific Islanders and giant clams, migrant Polynesians in New Zealand.

JEL Classification: Q57, Q31

The Potential Market for Giant Clam Meat in New Zealand: Results of Interviews with Pacific Island Immigrants

1. Introduction

Studies of the potential market for the meat of farmed giant clams have in the past concentrated on East Asian countries, especially the more developed or newly industrializing countries in this region: Japan, Taiwan, Hong Kong and to some extent Singapore and Malaysia (Dawson and Philipson, 1989; Center for Tropical and Subtropical Aquaculture, 1990). By comparison the potential of other Pacific Basin countries to absorb exports of giant clam meat have been virtually ignored. While some marketing studies have been done in Hawaii, this is the exception rather than the rule. Considerable numbers of Pacific Islanders have migrated to New Zealand, the USA (especially California and to a lesser extent to Australia. We speculated earlier that these migrants and their offspring could provide a sizeable and ready market in the Pacific Basin for exports of giant clam meat. Our survey of Pacific Islanders in Australia lent support to our hypothesis that this was a promising market. Pacific Islanders on the whole rate giant clam meat highly as a product, eat all the meat (except the kidneys) and Pacific Island migrants appear to be prepared to pay a price for the product at least similar if not higher than that paid for high quality fish. The clam is so highly regarded by some of these migrant groups that it is especially sought after for inclusion in feasts for special occasions.

New Zealand has the largest population of migrant Polynesians in the world and possibly the largest Pacific Islander migrant population in the world. However, the migrant population of Pacific Islanders in the USA, especially of Micronesians, is high. The purpose of this paper is to report the results of a market survey of Pacific Islanders in New Zealand concerning their demand for giant clam meat. Given its ethnic composition, location and close Pacific Island links, it seemed likely that New Zealand could be a major market for exports of giant clam meat from the Pacific Islands. Giant Clams do not occur in New Zealand waters principally, it seems, because the natural environmental conditions, e.g. water temperature, number of sunlight hours in winter, are unfavourable to them.

The survey, the results of which are reported here, was undertaken in July, 1990. The questionnaire reproduced in Appendix A formed the basis of interviews which were conducted by René Wittenberg. In all, 36 Pacific Islander residents of New Zealand were interviewed in depth: 10 Samoans, 10 Tongans, 4 Cook Islanders, 3 Niueans, 4 Tokelauans and 3 Fijians, representing each of the major Islander migrant groups. It was impossible to draw the sample in a random manner.

The Pacific Islanders who were interviewed were all selected because of their close and constant association with the Pacific Islander community at large. In particular Pacific Islanders from Pacific Islander Educational Resource centres, Pacific Islander Employment Training centres, a Samoan Newspaper, the Ministry of Pacific Islander Affairs, various Pacific Islander clubs and associations, the Tongan King's residence and a number of Pacific Islander consulates were approached by telephone and then suitable arrangements for further interviews were undertaken. The respondents were knowledgeable not only on the subject of the giant clam, but also due to their links with Pacific Islanders in New Zealand were able to provide valuable information about the possible demand for giant clam meat by the Pacific Islander community generally.

2. Population Statistics of Pacific Islanders in New Zealand

The population of Pacific Islanders in New Zealand (excluding Maoris) has increased steadily since 1951 when they numbered 3,600 in the census (Source: Beaumont, C.H. (1988) and New Zealand Yearbook 1988). In the last census taken in 1986, Pacific Islanders numbered 127,735 and formed 3.9 of the total New Zealand population of 3,263,283. The projected number of Pacific Islanders for the 1991 census is 167,700.

The Pacific Islander populations mentioned include both individuals of a single Pacific Island ethnic origin and those of partial Pacific Island origin. The latter includes persons of Pacific Island Polynesian origin and some other ethnic origin, whilst the former includes only persons of Pacific Island Polynesian origin.

Pacific Island groupings in New Zealand consist mainly of people of Polynesian heritage drawn from six Pacific nations. The main groups and their percentages of the Pacific Island population of New Zealand are:

Samoans (51.3%) Cook Islanders (25.5%) Tongans (10.3%)

Nuieans (9.5%) Tokelauans (1.9%) Fijians (1.5%).

Most Pacific Islanders have settled in the two urban centres of Auckland and Wellington. Approximately 64.1% reside in Auckland, a further 16.1% live in Wellington, while the remainder are scattered around the North and South Island. Auckland, as was mentioned repeatedly by both Pacific Islanders and New Zealanders, is the largest Pacific Islander city in the world, with a Pacific Islander population in excess of 100,000 today. While the Fijian capital, Suva, does have a population of 118,000 which exceeds the Auckland Pacific Islander population, a very large percentage of the Fijian's in Suva are of Indian descent and not of Pacific Islander origin. Therefore, Auckland may still be considered to have the largest Pacific Islander urban community in the world.

Three of New Zealand's major Pacific Islander groups, (the Cook Islanders, Nuieans and Tokelauans) have populations in New Zealand far in excess of those in their native countries. Only 36.3% of the Cook Island population, 17.7% of the Nuiean population and 40.4% of the Tokelauan population still live in their native countries.

Regarding the possible market for giant clam meat amongst Pacific Islanders in New Zealand, the age distribution of the New Zealand Pacific Islander population warrants careful consideration. Pacific Islander generations, either born or raised in New Zealand have, in many instances, adapted to the New Zealand style of food and lost the taste for, or interest in, their traditional foods. However, the nature of the upbringing of young Pacific Islanders may influence their possible interest in foods like the giant clam. If the upbringing of Pacific Islanders in New Zealand has followed Island traditions, chances are that they would readily eat traditional foods and so would be likely also to eat giant clams. Whereas New Zealand born Pacific Islanders not brought up in the traditional manner would be less likely to buy or to eat giant clam meat.

The age distribution of Pacific Islanders in New Zealand is shown in the Table 1.

Table 1 Age distribution of Pacific Islanders in New Zealand in percentages

<hr/>							
Age group							
	0-9	10-19	20-29	30-39	40-49	50-59	60+
<hr/>							
%	22.2	21.1	20.5	17.7	9.8	6.1	3.4
<hr/>							

As shown in Table 1, 43.3% of Pacific Islanders are below the age of twenty. Members of this age group (0-19) might be expected to be more reluctant to include giant clam meat into their diet. However, traditional upbringing and regular family activities such as feasts, will ensure that at least a sizeable proportion (possibly 50% or more) of this younger age group would be inclined to eat giant clam meat.

3. Samoans

The Samoan community, with 62,553 members, accounts for more than 51% of the total Pacific Islander population in New Zealand. The largest number of Pacific Islanders interviewed in New Zealand were Samoans. All of the Samoans interviewed originated from Western Samoa, although some American Samoans have migrated to New Zealand. Most American Samoan emigrants have moved either to Hawaii or the West Coast of the United States of America. Both of these locations could in future studies indicate another significant market for giant clam meat.

In total detailed interviews were held with ten Western Samoans. They had been residing in New Zealand for between 2 and 41 years and all had consumed giant clam meat.

The Samoan name for the giant clam is 'Faisua' and they do not have different names for different species. There are only two species of giant clam found in Samoa, namely, *T. maxima* and *T. squamosa* (Munro, 1989, p. 546). None of the respondents were able to differentiate between the giant clam species consumed in Samoa. This lack of ability to distinguish between the various giant clam species was apparent among all samples of the six

of the Pacific Islander groups interviewed. If this lack of preference for the meat of one giant clam species rather than another holds true, then the New Zealand market will not restrict the type of giant clam grown.

Samoan respondents on the whole preferred to eat smaller sized clams because these are tenderer than larger sized clams. Nevertheless, they readily consume giant clams of all sizes available.

Their strongly preferred way of eating giant clam meat is raw. Samoans suggested the following recipes for the preparation of giant clam meat:

1. Chopped into small pieces, then soaked in lime juice and a little bit of vinegar, with onions and soya sauce.
2. Raw with coconut milk, lemon Juice and some salt.
3. Raw with salt and vinegar.

When the giant clam is cooked before eating, the meat can be:

1. Chopped up into small pieces and cooked in a casserole with salt, pepper, onions and coconut cream.
2. Steamed or fried in butter with seasoning and then eaten with caviar, salted crackers and port.

This last recipe might be of interest to speciality gourmet restaurants, who might be interested in giant clams as an 'exotic' food. This 'delicacy' or 'exotic shellfish' prospect could make the meat attractive in the lucrative speciality European market or the East Asian market. As might have been noted, the above recipes are not all traditional recipes but have been developed and modified to take advantage of ingredients made available as a result of European contact.

None of the Samoans interviewed had eaten dried clam meat. The Samoans, like all of the Pacific Islanders who were interviewed, consumed the whole clam, minus the kidney, which, when eaten, tastes very bitter.

Three out of the ten Samoans interviewed had eaten giant clam meat in New Zealand, but that had been a few years previously. One Samoan explained that a relative had obtained giant clam meat at a communal market – a market where a lot of Pacific Islanders in New Zealand go to buy their food (e.g. taro and other vegetables, seafood, etc.). The other two Samoans

had obtained the clam meat through visits to relatives, or had brought it back when returning from visits to Samoa.

No one spoken to had recently been able to obtain giant clam meat. Even when they had done so earlier, it occurred very rarely and infrequently.

The ten Samoan respondents welcomed the possibility of being able to buy giant clam meat in New Zealand.

All of the Samoans interviewed have active and constant contact with the Samoan community in New Zealand. The respondents included individuals from the Samoan Consulate, the Pacific Islander Educational Resource Centre, the Samoan star Newspaper and members of Samoan clubs. They were asked whether they thought that other Samoans in the community would be willing to buy giant clam meat if it were available in New Zealand. All believed that this would be so and pointed out that there would be a considerable demand for the giant clam meat amongst Pacific Islanders in general. The product is known to them, is considered a delicacy and thus would form an important part of their traditional family feasts which occur on weekends, usually on Sundays. Seven out of the ten respondents said they would like to purchase giant clam meat at least once a week and the most enthusiastic prospective purchaser wanted to buy it as often as three times a week. The other three Samoans said that they would wish to buy giant clam meat on a regular basis ranging from at least six times a year to at least once a month.

Quantities which they would intend to purchase on each occasion ranged from at 1kg up to 5kg for a family of about five people. Generally, however, quantities of round 2kg per family would appear to be the normal size of each purchase.

The prices given in this report are all in New Zealand dollars, unless otherwise stated. The exchange was \$A1:\$NZ1.3 at the time of the survey. Samoans said they would be willing to pay between NZ\$2.50/kg and NZ\$10.00/kg for giant clam meat. The average price suggested was in the range NZ\$5.00/kg to NZ\$7.50/kg. This price was somewhat less on average than what other Pacific Islanders were prepared to pay.

Samoans indicated that they preferred to purchase fresh giant clam meat rather than meat in frozen or other forms. This is because traditionally clam meat is eaten very fresh in Samoa. All Samoan respondents did however indicate that they would buy frozen giant clam meat if

fresh clam meat was not available. All of the Samoans said that they would not be interested in purchasing dried clam meat. Considering the willingness of Samoans to purchase giant clam meat if it were available, it is not surprising that six out of the ten Samoans interviewed considered giant clam meat to be excellent, three out of the ten rated it as an above average product and only one person regarded giant clam meat as an average product.

4. Tongans

The Tongan community with 12,534 members is the third largest of the Pacific Islander groups in New Zealand. Altogether ten Tongans were interviewed. Like Samoans they were most enthusiastic about the prospect of being able to buy giant clam meat in New Zealand. The Tongan respondents had been resident in New Zealand for between 4 and 27 years and all had consumed giant clam meat at some time.

The general Tongan name for the giant clam is 'Vasua'. Unlike other Pacific Islanders interviewed, the Tongans were the only ones to identify different species or types of giant clams by different names. Three species of Tridacnidae can be found in the Kingdom of Tonga, *T. maxima*, *T. derasa* and *T. squamosa* (Munro, 1989, p. 546). 'Tokanoa', 'Matahele' and 'Kukukuku' are the most common names given to different types of the giant clams. (For an explanation of names see Tisdell and Wittenberg, 1990). However an elderly lady, who was living at the Tongan King's residence in Auckland, also provided some other names. The giant clams were referred to as 'Kelea', 'Topulangi', 'Elili', 'Mehungo', 'Too' and 'Ohule'. What these names stand for or if they actually refer to giant clams is not known to us, but they could possibly refer to different recipes or preparations of giant clam meat. The preferred giant clam for consumption is the smaller clam (Kukukuku), whose tenderness makes it more appealing for eating. Nevertheless, larger sized clams (Tokanoa) are still eaten.

The Tongans in New Zealand have a diverse range of recipes for giant clam meat. Favourite recipes including these for raw giant clam meat were reported to be:

1. Raw, sliced giant clam with onions, tomatoes and coconut cream.
2. Marinated with lemon juice and coconut cream.
3. Cooked in coconut milk and water together with onions and then curry.
4. Baked in an earth oven with taro leaves and a coconut cream mixture.

In general smaller clams tend to be consumed raw, whereas larger giant clams, which are considered to be tougher (especially their mantle), are cooked or baked to tenderise them. Again, like all other Pacific Islanders, Tongans consume all of the meat of the giant clam except the kidney.

Some of the Tongans interviewed had actually obtained giant clam meat in New Zealand, but none had done so recently. Two main sources of past supply were mentioned. One person had actually sold giant clam meat in Auckland. The other source was from relatives who brought it with them when they came over from Tonga on a visit. To our knowledge, no one was actually selling giant clam meat in New Zealand during the time of our survey. It was impossible to identify persons who had previously sold giant clam meat. However, from our discussion with the Pacific Islanders, it appears that the giant clam meat sold in New Zealand originated in Fiji. It did not include the adductor muscle. The giant clams were sold frozen in plastic blister packs (possibly weighing about half a kilogram) for NZ\$8 per packet. This appears to have taken place about two to three years ago and is consistent with reports that following the coup led by Colonel Rambuka in Fiji, giant clam meat was sold by Fiji on overseas markets.

The giant clam meat which was sold appears to have been quite popular and sold out relatively quickly despite the price of NZ\$8 per half kg. This giant clam meat (which was reputed to have been of only average quality and did not include the adductor muscle) was sold out completely, according to one Pacific Islander, as soon as this source became known to the Pacific Islanders. This case indicates the popularity of giant clam meat amongst Pacific Islanders.

Many migrants from Pacific Islands tend to base the prices which they say they are willing to pay for giant clam meat on the prices they would pay in their country of origin. We were informed that prices for giant clam meat have been increasing steadily in Tonga as giant clams have become scarcer. Increasing scarcity of giant clams in the Pacific Islands has resulted in giant clam becoming dearer than fish, even in the Pacific Islands.

Tongans interviewed were willing to pay prices for giant clam meat ranging from NZ\$3.50 up to NZ\$20.00/kg. The person who quoted NZ\$20.00/kg would only be prepared to pay this much for fresh clam meat, while he would be prepared to pay NZ\$15.00 for frozen clam meat. Generally NZ\$10.00/kg appears to be an acceptable price for giant clam meat among

the Tongans interviewed. As might be expected, all Tongans interviewed responded favourably when asked if they would be interested in purchasing giant clam meat in New Zealand. Nine out of ten Tongans interviewed would prefer to buy fresh clam meat, but would buy frozen clam meat if fresh clam meat is not available. Only one Tongan wanted to buy dried clam meat.

Both the price of clam meat and the income of Pacific in New Zealand will limit quantities of giant clam meat purchased. In New Zealand, Pacific Islanders, by and large, are part of the unskilled workforce, thus receiving a much lower wage than the average New Zealander. An economic downturn in New Zealand has particularly affected the employment of unskilled workers and thus the proportion of unemployed Pacific Islanders is much higher than the average. Even though diminished levels of income restrict the purchasing power of Pacific Islanders in New Zealand, they have a strong preference for fish and food products especially for the traditional family feasts held on weekends, and as a part of their feasts. The giant clam is considered to be a delicacy and would take pride of place at such feasts and one can expect purchases by Pacific Islanders even when their income is low. Thus, one elderly Tongan lady stated that she would buy the giant clam every day if she had the monetary means, but as she does not have the means, she would restrict her purchases to between 2-3kg/week.

A Tongan lady from the Tongan King's residence stated that the seventeen to twenty people living there would consume roughly 30kg/week for which they would be prepared to pay up to NZ\$10.00/kg. The ten Tongan respondents said they would buy giant clam meat on a weekly to fortnightly basis in quantities ranging from 1-5kg. Typically, a Tongan family could be expected to consume about 2.5kg/week of giant clam meat, judging from the responses obtained. Tongans in general rated giant clam eat very highly as a food item. Seven out of the ten respondents rated it an excellent product, two out of the ten considered it to be an above average product, while only one person considered it an average product.

5. Cook Islanders

The Cook Island community in New Zealand numbers 31,092, which makes it the second largest Pacific Islander group in New Zealand. Four Cook Islanders were interviewed but none of them appeared to share the enthusiasm of other Pacific Islanders for giant clams. The four Cook Island respondents had been in New Zealand between 10 and 34 years and have returned to the Cook Islands on numerous occasions. Three out of the four Cook Islanders

rate the giant clam as an average product and one went as far as referring to it as a below average product. Nevertheless, all of the four Cook Islanders would seek to buy giant clam meat in New Zealand.

Two Cook Islanders have eaten giant clams in New Zealand and they still have them sent over by plane from relatives in the Cook Islands. The three giant clam species which can be found in the Cook Islands, which are in the south-east extremity of the natural range of the Tridacnidae family, are *T. derasa* (introduced from Palau recently), *T. maxima* and *T. squamosa* (Munro, 1989, p. 546).

The Cook Islanders refer to the giant clam as 'Paua'. This is very interesting because the Maoris also have a shellfish which they refer to as 'Paua', even though giant clams do not occur in New Zealand and since their migration from other Pacific Islands several hundred years ago, they have not had the opportunity to eat giant clams. Since their migration path appears to have been from the Cook Islands, it is not surprising that common words exist both for the Cook Islanders and the Maoris.

The Maori 'Paua' is a species of abalone found in New Zealand which is very popular amongst the Maoris for eating. According to one Pacific Islander, a Samoan, the Paua is very similar in taste to the giant clam and thus it is his belief, that the giant clam could become quite popular amongst Maoris. Because of the ancestral links that the Maoris have with the Pacific Islanders and the high proportion of fish in their diet, there is little reason to doubt that giant clam meat would not be accepted into the Maori community. If that was the case, the potential market for giant clam in New Zealand would increase dramatically as the Maoris form 2.4% of the total population. However, at this stage this is pure speculation and something which requires trial sales or taste testing to substantiate.

The Cook Islander respondents overwhelmingly preferred to consume smaller-sized giant clam but they do eat larger ones nevertheless. One Cook Islander said that back in the Cook Islands the meat of the large clams was actually fed to the pigs.

When the clams are consumed they are eaten in many different ways. The giant clam is salted or dried in the Cook Islands, but the usual way of consumption is raw or cooked.

1. When eaten raw it is normally: diced and lemon juice is added.
2. When cooked, it is prepared with taro leaves and coconut cream.

The entire clam excluding the kidney is consumed.

The kidney, according to one Cook Islander woman, is used in the Cook Islands for medicinal purposes. It is used for treating Leukaemia because of its claimed iron-enriching properties. This was the only time that the giant clam was mentioned by Pacific Islanders in these interviews for its medicinal use. If medicinal values can be attributed to any parts of the clam, it would greatly enhance the marketability and commercial value.

Fresh or frozen clams would be preferred by the Cook Islanders, but dried, salted and tinned clams would also be readily accepted.

The Cook Islanders interviewed would buy the giant clam meat occasionally, maybe once a month. However, two of them still appear to have ready access to giant clams in New Zealand and unless that source disappeared they would not be considering purchasing clam meat. Generally the quantities which would be purchased were up to 2kg a time. The price the Cook Islanders would be prepared to pay for the giant clam meat was in the range NZ\$5.00 - NZ\$10.00/kg.

6. Nuieans

There are 11,625 Nuieans living in New Zealand. They therefore form the fourth largest Pacific-Islander group in New Zealand. Altogether three Nuieans were interviewed and their period of residence in New Zealand ranged between 5 months and 25 years. They have all consumed giant clam meat and two of them have even eaten giant clam meat in New Zealand, which was imported privately from Rarotonga in the Cook Islands. Although not specifically mentioned in Munro (1989) or Heslinga (1989), Nuie, which lies between Tonga and the Cook Islands may have the three giant clam species of Tonga and the Cook Islands, namely *T. maxima*, *T. derasa* and *T. squamosa*.

The Nuiean name for giant clam is 'Gégé'.. (pronounced Nge-Nge) and is used for all giant clams irrespective of size, colour or shape. All three Nuieans interviewed prefer small to medium-sized clams rather than the less tender larger-size clams. However their opinions varied when it came to rating the giant clam as a food item. One Nuiean rated it average, one above average and one excellent. All Polynesian Pacific Islander recipes for preparing giant clam meat are very similar. Nuieans

1. usually eat clams raw having marinated them in lime juice and coconut cream.
2. They are also cooked. The meat is first steamed and then it is cooked in lemon juice and coconut cream in an earthen oven.

All the flesh of the clam except the kidney is used. The Cook Islanders preserve some of their clams in salt and although it is an effective preservative, the Nuieans feel that the salt absorbs the natural juices of the giant clam and thus spoils its flavour.

All three Nuieans would be interested in buying giant clam meat if it was exported to New Zealand. They would be interested in buying mainly fresh or frozen giant clam meat but they would be willing to try smoked, salted or tinned giant clam meat if it were available.

Giant clam meat would, it was said, be purchased mainly for feasting on festive occasions, e.g. special holiday celebrations, weddings and similar events. The quantity of giant clam meat consumed would depend on the occasion and the number of people attending and thus could vary between one and several kilos. For normal family consumption, Nuieans could be expected to buy about 1kg of giant clam meat monthly. The price they would find 'reasonable' for clam meat varied between NZ\$5.00 to NZ\$20.00/kg but all three of Nuieans were prepared to pay as much as \$10.00/kg.

7. Tokelauans

Tokelauans form the fifth largest Pacific Islander group in New Zealand and with 2,316 people make up 1.9% of the total Pacific Islander community of New Zealand. The four Tokelauans who were interviewed have resided in New Zealand for between 11 and 20 years.

The giant clam appears to be a favourite food item of Tokelauans in New Zealand. Three out of four respondents gave rated it as an excellent product while the remaining respondent considered it an average product. The Tokelauan name for the giant clam is 'fasua' or 'fahua' and is the only name given to the clam. Only one species of giant clam is found in Tokelauan waters, namely *T. maxima* (Munro, 1989,p. 54 7).

Generally small- to medium-sized clams (10 - 20cm) are preferred over larger-sized clams. However, if bigger clams are still tender and delicate, they are eaten also. Generally the clam meat is eaten raw or chopped into small pieces and cooked in coconut cream. It is also cooked as a curry and all of the edible parts of the clam (minus the kidney) are used.

Tokelauans would prefer to purchase frozen and fresh giant clam meat. All four respondents indicated that they would buy giant clam meat if it was exported to New Zealand.

Their suggested frequency of purchase of clam meat ranged from twice a week to once a month plus purchases on special social. Quantities which they said they were likely to purchase on each occasion varied between 2kg to 5kg, while the prices which they said they were willing to pay ranged from \$4.00/kg to \$10.00/kg. One Tokelauan indicated that he was so keen to buy the giant clam meat that price, within reason, was not very important.

Interestingly the number of Tokelauans, which the three respondents believed to be living in New Zealand exceeded official figures quite significantly. While officially there are 2,316 Tokelauans in New Zealand according to the 1986 Census, the respondents quoted figures ranging from 3,000 to 5,000. The New Zealand census might not include all 'illegal' immigrants and thus may underestimate the actual number of Pacific Islanders in the New Zealand population.

8. Fijians

The Fijian community is the smallest Pacific Islander community in New Zealand. The 1,875 Fijians make up roughly 1.5% of the Pacific Islander community in New Zealand. Because these figures are based on the 1986 Census, it is possible that after the coup in Fiji in 1987 that the numbers of Fijians in New Zealand has increased significantly. Three Fijians were interviewed and they had lived in New Zealand for between 15 months and 11 years.

In the Fijian language the larger giant clam is referred to a 'Vasua' while the smaller giant clam is called 'Katavatu'. Fiji still has stocks of *T. derasa*, *T. maxima* and *T. squamosa*. However *H. hippopus* and *T. gigas* which used, it seems, to occur there are thought to be extinct because of over exploitation. The three Fijians all classed the giant clam as an excellent food item.

Amongst this group of respondents there was no dominantly preferred size of clams for eating. Two of them indicated that they prefer larger-sized giant clams while the other respondent enjoyed smaller-sized giant clams. All said that nevertheless they would be content to eat any size of clam.

Fijians eat giant clam meat raw after marinating it in lemon juice and mixing it with spring

onions, chili and coconut cream. As well it is eaten cooked with coconut cream and vegetables. According to one Fijian, consumption habits differ between rural and urban areas in Fiji. In rural areas where no refrigeration is available, giant clam meat is quite often smoked to preserve it. In urban areas it is usually bought fresh at the local market and then eaten raw or cooked.

None of the three Fijians had been able to obtain giant clam meat in New Zealand. They were all very keen to buy imported giant clam meat either in fresh or frozen form if it became available in New Zealand. All three Fijians said they would like to buy giant clam meat regularly about once a week, in quantities varying from 1 to 4kg a week. The Fijians interviewed said that they would expect to pay between NZ\$5.00 and NZ\$12.00/kg for giant clam meat if it were available in New Zealand.

9. Market Potential For Giant Clam Meat Among Pacific Islanders In New Zealand

All 34 Pacific Islanders interviewed replied 'yes' when asked if they would be interested in buying imported giant clam meat in New Zealand. 20 Pacific Islanders considered it an excellent product, 6 considered it an above-average product, 7 an average product and only 1 person rated it below average.

Over three-quarters of Pacific Islanders interviewed considered giant clam meat to be an above-average to excellent product. This indicates the strong taste preference of Pacific Islanders for giant clam meat. The fact that giant clam meat is unavailable in New Zealand may, of course, make Pacific Island migrants more eager for it. But, as pointed out by many Pacific Islanders, second generation Pacific Islanders are likely to lose their taste for traditional foods such as giant clam meat as they adapt to New Zealand foods. Thus, any campaign to market giant clam meat in New Zealand is likely to be more successful if it is launched in the near future. Otherwise, with successive generations the number of descendants of Pacific Islanders still familiar with the giant clams will decrease.

At the moment the majority of Pacific Islanders are very keen to see giant clam meat imported into New Zealand.

According to the New Zealand 1986 Census the number of Pacific Islanders living in New

Zealand is 167,700. Allowing for the possibility that a number of second and third generation Pacific Islanders will not eat giant clam meat, that some Pacific Islanders may have little inclination to eat it, the following two population figures of consumers will be used to estimate market size:

a) 90,000 Pacific Islanders

b) 120,000 Pacific Islanders

Let us group these estimates of potential consumers into family units. A reasonable estimate for the size of a Pacific Islander family is five people. This coincides with the number suggested by the Pacific Islander respondents to this survey.

Therefore, the estimated number of family units of Pacific Islanders in New Zealand to consume giant clams is:

a) 90,000: $5 = 18,000$ or alternatively

b) 120,000: $5 = 24,000$

Most Pacific Islanders interviewed indicated that they would like to buy giant clams regularly (once a week) and in reasonable quantities 1-3kg/week. Therefore two alternative possible levels of giant clam consumption per family per week will be used

(I) 1.25kg/week per family and

(II) 2.50kg/week per family.

Thus, given these possibilities, the annual quantity of sales of giant clam meat would be the four alternatives:

a) (I) $18,000 \text{ families} \times 1.25\text{kg/week} \times 52 \text{ weeks/yr} = 1.170 \text{ tonnes/yr}$

(II) $18,000 \text{ families} \times 2.50\text{kg/week} \times 52 \text{ weeks/yr} = 2.340 \text{ tonnesLY£}$

b) (I) $24,000 \text{ families} \times 1.25\text{kg/week} \times 52 \text{ weeks/yr} = 1.560 \text{ tonnes/yr}$

(II) $24,000 \text{ families} \times 2.50\text{kg/week} \times 52 \text{ weeks/yr} = 3.120 \text{ tonnes/yr}$

This would imply for the entire Pacific Islander population of New Zealand of 167,700 an average annual level of consumption from (i) 7.0kg/person to b(ii) 18 7kg/person.

To calculate the likely value of giant clam market sales at the retail level, the three following prices/kg were used: NZ\$5.00/kg, NZ\$7.50/kg, NZ\$10.00/kg. The prices are within the ranges suggested by the Pacific Islanders interviewed. In considering their responses about prices Pacific Islanders quite often based their figures on prices they would have to pay in their native countries. According to respondents, prices have increased significantly in the Pacific Islands due to dwindling natural stocks of giant clams. Respondents, because of their knowledge of these prices had a reasonable idea of what price levels might prevail. Table 2 indicates the value of the giant clam sales at the alternative prices assumed and quantities of sales estimated. It suggests a gross value of retail sales annually ranging from NZ\$5.85 to NZ\$31.20m. The most favourable assumed scenario, namely 120,000 Pacific Islanders (willing to buy giant clam meat), at the rate of 2.5kg/week/family and paying a price of \$10.00/kg is certainly not an unrealistic possibility. This would mean the market in New Zealand, not considering the possibility of Maoris and pukehas (whites) purchasing the giant clam meat, would be worth up to and above NZ\$30.0 million annually in terms of retail sales.

Table 2 The potential retail value (NZ\$) of giant clam meat sales to Pacific Islander families (P.I.F.) for alternative quantities and prices

No. of families	18,000 P.I.		24,000 P.I.	
Consumption per year per family	1.25kg/ family	2.50kg/ family	1.25kg/ family	2.50kg/ family
Annual gross quantity sold to P.I.F. in New Zealand	Total quantity 1170t 2340t		Total quantity 1560t 3120t	
Prices/kg	NZ\$	NZ\$	NZ\$	NZ\$
NZ\$ 5.00/kg	5.85m	11.70m	7.8m	15.6m
NZ\$ 7.50/kg	8.775m	17.55m	11.7m	23.4m
NZ\$10.00/kg	11.70m	23.40m	15.60m	31.20m

From this information we can establish the number of harvested giant clams of various ages required to satisfy the estimated New Zealand. To do this we have selected three different ages for the harvested clams. The meat weights corresponding to these ages are as suggested by Munro (1988) for *T. gigas* and are given in Table 3 together with the number of harvested clams required to satisfy the market. The number of clams required of course varies with the estimated market size and the age of the clams. But it is clear that several hundred thousand would need to be harvested annually to satisfy the New Zealand and potential market. Possibly 20-30 sizeable clam farms putting down 100,000 or so clams per year would be needed to satisfy this market. This amount of growout is needed to compensate for mortality of clams when they are grown out in the ocean. For example, although 100,000 clams may be grown out due to natural mortalities only half of this number may survive if they are grown out for several years before harvesting.

Table 3 Total number of harvested clams of alternative ages and weights required to supply the four alternative levels of potential market demand in New Zealand.

Market demand Tonnes/year	Weight of Meat of individual clams at various ages		
	1.16kg(5yrs)	2.55kg(7yrs)	4.29kg(9yrs)
1170t	1,008,621	458,824	272,727
1560t	1,344,828	611,765	363,636
2340t	2,017,441	917,649	545,455
3120t	2,689,655	1,223,529	727,273

Note: Clam weights are for *T. gigas* as estimated by Munro (1988).

10. Import Restrictions

Since the only way in which giant clams are likely to be supplied to the New Zealand market is by import, we thought it important to consider restrictions which may prevent or hinder this import.

Three New Zealand government bodies - the Department of Health, the Fishing Industry

Board and the Ministry of Agriculture and Fisheries - were approached and questioned about any restrictions which could affect the import of giant clams to New Zealand.

Currently there are no specific import restrictions for shellfish designed to protect the New Zealand shellfish industry. However, there are qualitative restrictions placed upon any shellfish imports, similar to those imposed by the U.S. Food and Drug Administration. These qualitative measures are administered by the New Zealand Department of Health, whose responsibility it is to ensure that the quality of imported products meets acceptable New Zealand guidelines. These guidelines vary according to the form in which the shellfish is imported, i.e., frozen, chilled or tinned. Only when the imported shellfish has met all requirements can it be imported. To safeguard the quality and ensure the health of the imported mollusc flesh regular checks are made by the Department of Health. Aside from health standards, the only other barrier to the import of giant clam to New Zealand is the CITES agreement, to which New Zealand is a signatory. The Import and Export of Animals section of the Ministry of Agriculture and Fisheries is responsible for the implementation of the Trade in Endangered Species Act 1989, whose objective it is to enable New Zealand to fulfil its obligations under the CITES agreement.

According to this Act, no person shall trade in any specimen of an endangered, threatened, or exploited species into and from New Zealand, except via the appropriate permits or certificates which are laid down in this Act. Under Section 18 of this Act, species threatened by trade - under which category the giant clam falls- do not require a permit to be imported where 'an importer has been granted a permit to export or a certificate to re-export a specimen of the threatened species from the relevant authority of the country of export'.

In the case where 'a permit to export or a certificate to re-export a specimen of a threatened species is not required by the relevant authority of the country of export, the Director-General may grant a permit to import that specimen subject to such conditions as the Director-General thinks fit to impose'. Thus, in theory and practice, it should be possible to import giant clams into New Zealand provided that they are farmed and the necessary certificates are issued.

11. Concluding Observations

The results of this survey indicate that the potential market for giant clam meat in New Zealand is substantial. The size of the market in New Zealand amongst Pacific Islanders seems to be much larger than in Australia.

In a previous survey, which evaluated the possible demand for giant clam meat in Australia amongst Tongans (Tisdell and Wittenberg, 1990) the most optimistic estimate of the market size was 325 tonnes/yr. The market size for the entire Pacific Islander population in Australia could be about two and a half times that size, namely about 800 tonnes/yr. The largest potential market size for giant clam meat in New Zealand was estimated to be 3,120 tonnes/yr. This makes the market potential for giant clam meat sales in New Zealand amongst Pacific Islanders four times that of Australia. The New Zealand potential market is also much larger than that estimated for Okinawa (virtually the whole Japanese market at present) by Professor Yung C. Shang, namely 578 tonnes annually and for Taiwan 240 tonnes (Center for Tropical and Subtropical Aquaculture, 1990, pp. 1-4).

It seems that the New Zealand market could easily absorb the output of 30-40 large clam farms or, of course, the output of many more small farms or supplies from a large number of semi-subsistence enterprises in the Pacific.

As far as shipping and airline links are concerned, New Zealand is well placed in relation to Polynesia but it is much less satisfactorily located in relation to Melanesia and Micronesia. Thus the most suitable source of New Zealand supplies of giant clam from the Pacific Islands would, it seems, be Polynesia which has close links with New Zealand via transport, existing trade and cultural links. But environmental conditions for growing giant clams may be on the whole somewhat less favourable in Polynesia than in Melanesia, e.g. the Solomon Islands, and parts of Micronesia.

Nevertheless, farming does seem possible in Polynesia, e.g. in Tonga, Cook Islands, Fiji and Samoa. Experiments and trials by governments in these countries designed to spearhead giant clam mariculture are already well under way.

12. Acknowledgments

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APPENDIX A

CONFIDENTIAL

July, 1990

QUESTIONNAIRE FOR NEW ZEALAND PACIFIC ISLANDERS. REGARDING GIANT CLAM MEAT CONSUMPTION

- 1) Name, address and telephone number of respondent

.....
.....
.....

- 2) From which country do you originate from or are a descendant of?

.....
.....

- 3) How long have you been residing in New Zealand?

.....
.....

- 4) Have you ever consumed giant clam meat?

.....
.....

- 5) a) Do you know the names of the giant clams, which you have eaten? (eg. Hippo clam or Tridacna gigas)

.....
.....
.....

- b) Are there any varieties, which you like best?

.....
.....
.....

- 6) What is the preferred size of the clam you eat?

.....
.....

7) a) How do you prepare the giant clam meat?

.....
.....
.....

b) Do you know of any other recipe for giant clams?

.....
.....
.....

8) What parts of the giant clam do you use (eg. mantle, adductor muscle, whole clam) for eating?

.....
.....

9) Have you been able to obtain giant clam meat in New Zealand?

Yes

No

a) If yes, where do you get it from?

.....
.....
.....

b) If no, do you know where it might be sold?

.....
.....
.....

10) As you may know, it is now possible to farm giant clams. If, there was someone farming giant clams in Australia, would you be interested in buying giant clam meat from them, if it was exported to New Zealand?

.....
.....
.....

11) Would you be interested in purchasing fresh clam meat, frozen clam meat or dried clam meat? Please elaborate.

.....
.....
.....
.....

12) a) Would you buy the clam meat on a regular basis or just occasionally? (eg. How many times per year) Please elaborate

.....

.....

.....

b) What quantities of giant clam meat would you buy?

.....

.....

.....

13) What would you regard as a reasonable giant clam meat per kilo?

(please specify: a) whole clam, mantle or adductor muscle

b) fresh, frozen or dried)

.....

.....

.....

14) How highly do you rate clam meat as a food item?

- a. Excellent product ()
- b. Above average product ()
- c. Average product ()
- d. Below average product ()
- e. Do not know ()

15) In what other areas of New Zealand do you think there might be Pacific Islanders, who are interested in purchasing giant clam meat and how many Pacific Islanders live there?

.....

.....

.....

16) Do you have any contact address of Pacific Islander clubs or Associations in those areas? Please list

.....

.....

.....

.....

17) How many Pacific Islanders do you think currently reside in New Zealand?

.....

.....

.....

18) Would you like a complimentary copy of the report on this survey?

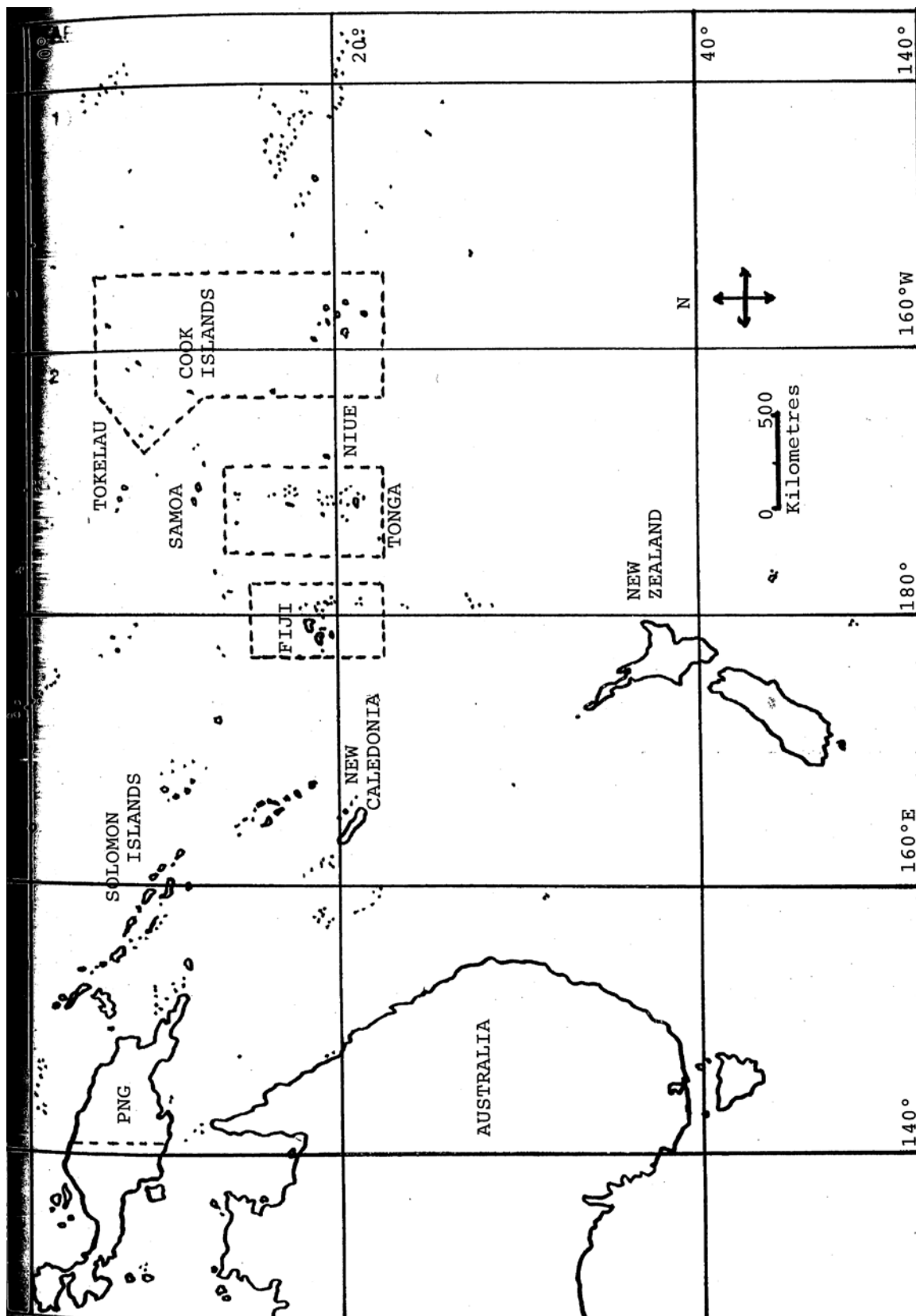
Yes

No

Thank you very much for your co-operation,

Clem Tisdell,
Department of Economics,
University of Queensland,
St. Lucia 4067.
Tel. (07) 377-2049

APPENDIX B - MAP OF THE SOUTH PACIFIC ISLANDS



APPENDIX C

SUMMARY OF BASIC PACIFIC ISLANDER RECIPES

1) In raw form

- a) As is, straight from the shell.
- b) Marinated in lime or lemon juice with variations of coconut cream, onions, tomatoes, vinegar, soya sauce or chili.

2) In cooked form

- a) Cooked with coconut cream plus vegetables and as a curry or casserole dish.
- b) Baked in an earthen oven with taro leaves and coconut cream.

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