

RESEARCH REPORTS IN THE ECONOMICS OF GIANT CLAM MARICULTURE

Working Paper No. 34

Current and Potential Markets for Giant Clam Meat
in Fiji – A Case Study of the Market in Suva

by

Vina Ram

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Vina Ram²

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¹ Research for this paper has been undertaken independently. It is included in this series to disseminate the results.

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

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Current and Potential Markets for Giant Clam Meat in Fiji – A Case Study of the Market in Suva

ABSTRACT

Among a variety of shellfish and sea molluscs, giant clams (*Tridacna* spp.) have provided an important source of food to the people of the maritime Islands of the South Pacific. However, as a result of increased harvesting, stocks have declined rapidly with some species almost becoming extinct in certain parts of the Western Pacific Ocean (such as *Tridacna gigas*) with others being endangered. With the possible threat of their becoming extinct, international trade in giant clams has been banned in many countries, including Fiji. .

On the other hand efforts have been made to mariculture giant clam in the hope to restock some of the heavily exploited areas, and also to introduce clams in other new areas in order to provide a continued subsistence supply and also to possibly establish commercial farming.

Successful implementation of commercial clam culture will depend a lot on the effective demand for the product in the domestic and international market. Studies have been carried out in various countries including Australia, New Zealand, Taiwan, Japan and USA on the market prospects for giant clams (Shang et al. 1991). The current study also aims to focus on the current status and the future prospects for market of giant clams in Fiji.

Keywords: Suva, South Pacific, mariculture, demand and supply of giant clams.

JEL Classification: Q57, Q22, Q21

Current and Potential Markets for Giant Clam Meat in Fiji – A Case Study of the Market in Suva

1. Background

1.1 Introduction

Among a variety of shellfish and sea molluscs, giant clams (*Tridacna* spp.) have provided an important source of food to the people of the maritime Islands of the South Pacific. However, as a result of increased harvesting, stocks have declined rapidly with some species almost becoming extinct in certain parts of the Western Pacific Ocean (such as *Tridacna gigas*) with others being endangered. With the possible threat of their becoming extinct, international trade in giant clams has been banned in many countries, including Fiji. .

On the other hand efforts have been made to mariculture giant clam in the hope to restock some of the heavily exploited areas, and also to introduce clams in other new areas in order to provide a continued subsistence supply and also to possibly establish commercial farming.

Successful implementation of commercial clam culture will depend a lot on the effective demand for the product in the domestic and international market. Studies have been carried out in various countries including Australia, New Zealand, Taiwan, Japan and USA on the market prospects for giant clams (Shang et al. 1991). The current study also aims to focus on the current status and the future prospects for market of giant clams in Fiji.

1.2 Methodology

The study was primarily carried out in Suva from Mid-August to Mid-November 1991. Structured questionnaires were used to interview consumers at the Suva Municipal Market and beside the Nabukalou Creek where most of the fish and fisheries products are sold. (Refer to Appendix I). .

It was envisaged that consumers would be selected at different towns throughout Fiji but due to time and budget constraints it was not possible. Instead, consumers buying or enquiring about giant clams, fish and other marine products were chosen as the target group within the allotted time. The survey was conducted on Saturdays from 9.30 am to 11.30 am as being the peak period for sale of giant clams, fish and other fisheries products at the market. Informal

discussions were held at the market with women selling giant clam meat. Market survey data and reports by the Fisheries Department were also consulted.

Supermarkets, restaurants and butcher shops were also studied using an interview schedule.

With regard to the export market, interviews were carried out with former giant clam exporters and current exporters of fresh fish and bêche-de-mer, to get an indication of possible interest in giant clam trade.

A major constraint during interviews was that some respondents had to recall their past experience, as a result it was difficult to gather any documentary evidence from them eg. exporters, supermarkets, and butcher shops where giant clam trade did not represent a major part of their business.

2. Results of The Survey

2.1 Municipal market area

Both men and women vendors were selling giant clam, the majority being women vendors who sold clam meat with other food items such as root crops and vegetables, whereas men sold whole clam meat inside the shell, together with fish.

During the three month period, the majority of the sellers (80%) were from Verata area (in particular from Ucunivanua and Burewai villages) which is on the eastern coast of Viti Levu. The vendors from the area claimed that giant clams, mostly *T. derasa* commonly known as *Vasua dina* are still abundant in the area and to a lesser extent *T. squamosa* (cega) is also found. On average there were about 8 to 10 vendors each week from the area selling approximately 12 to 15 pieces of clam meat each. Giant clams are also an important part of their subsistence diet.

The area unfortunately did not fall in the Giant Clam Project Field Survey by the Fisheries Division to confirm the vendors claim on resource status especially when the Fisheries Reports do not report any sale of *T. squamosa* at the market. However, it seems that the rate of exploitation is quite high, they being the largest domestic suppliers to the urban market on a regular basis.

Collecting clams has been part of the normal daily activities if weather is good. Clams are

collected for the market while gathering subsistence foods, and kept near the coast until the market day (mostly Saturdays). Before the clams are brought to the market, meat is taken out from the shells and put inside a bucket of water. This saves women from carrying bulky shells in hired carriers to the market. Shells are kept either near the shore or brought home for terracing the garden. Sometimes shells are also discarded on the reef.

A small shell market does exist in Fiji where consumers are generally tourists, hotel and restaurant operators. The latter mostly utilize the shells as serving dishes, ash trays or for ornamental purposes.

From the survey at the market, the majority of male vendors were fishermen from Beqa who not only sold clams but fish also. Most of them brought the fish and live clams in their outboard motor punts to the Nabukalou Creek and sold them as live clams. It was observed that the number of people interested in live clams was much higher than clam meat which was already taken out of the shell.

The oriental people preferred to buy live clam and the stock of live clam was sold much faster than clam meat already de-shelled, which gave an indication on consumer awareness for quality.

Table 1. below gives the results of the survey at the market.

Table 1. Results of the Survey at the Suva Municipal Market and the Nabukalou Creek Area.

Date	Total No. of Vendors observed	Total No. of shells or pieces of clam meat sold.
17-8-91	10	60
24-8-91	7	62
31-8-91	12	58
07-9-91	5	30
14-9-91	8	50
21-9-91	10	35
28-9-91	12	60
5-10-91	14	110
12-10-91	8	60
19-10-91	7	95
26-10-91	12	85
02-11-91	10	90
09-11-91	7	60
16-11-91	10	68

Size of clam meat ranged from 12cm to about 30cm, with the majority of meat pieces around 20cm. Prices ranged from \$3.00 to \$8 per piece of meat, with weight generally ranging from 500g to 1kg. The dominant species sold was *T. derasa* and only twice *T. squamosa* was also noticed. There was no *T. maxima* sold during the entire period of the survey.

The Fisheries Division Market Survey estimate for domestic sale of giant clams over the years is given below (Table 2). The results indicate an increase in sales of clam meat in the early 1980s when the documented export industry took off. In 1984 and 1985 the domestic sales declined through the municipal market because most clams would have been sold to the exporters.

However in 1986, again the market supply increased and then dropped again in 1987 and 1988. This latter decline has been basically as a result of political instability in the country.

On the other hand in 1989 and 1990, the municipal market supply increased again. This could be explained as the result of the ban on exports. Those villagers who became dependent on the giant clams as a source of income, probably had to re-direct their supply to the domestic

market.

Table 2. Municipal Market Sales of Giant Clams

Year	Total Sales (kg)
1978	8,000
1979	6,800
1980	13,830
1981	13,410
1982	11,960
1983	12,700
1984	8,350
1985	8,410
1986	12,360
1987	7,980
1988	8,970
1989	13,540
1990	10,780

Source: Fisheries Division, Annual Reports 1987-1990, Fisheries Division, 1987:24

2.2 Supermarkets

The five largest supermarkets in Suva were interviewed :-

- Apteds Ltd.
- Bajpai's Supermarket
- B. Kumar Supermarket
- Morris Hedstrom Ltd.
- R.B. Patel Centerpoint Supermarket.

Results indicated that R.B. Patel, Bajpai's and B. Kumar Supermarket generally have dominance of Indian customers who do not have any notable demand for giant clams. In 1988, R.B. Patel Centerpoint in Laucala Beach Estate had sold clam meat (mantle) only once on a trial basis. According to the Manager interviewed, 10kg of mantle was supplied by

Feeders Fiji Ltd. at \$2.00 per kg and retailed at \$3.50 per kg. The demand for frozen mantle was quite low with over 5kg being thrown away because of spoilage.

Bajpai's Supermarket in Nabua and B. Kumar Supermarket in Raiwasa have never engaged in selling giant clam meat, claiming that their supermarkets cater generally for Indian consumers.

On the other hand, the Morris Hedstrom Food Hall in Downtown Suva and the Apteds Supermarket in Flagstaff were the major retailers in clam meat around 1986 to 1988. Clam meat consisting of mantle was supplied to Morris Hedstrom by Feeders Ltd. where price ranged from \$2.00 to \$2.50 per kg and sold for \$4.00 to \$4.50 per kg.

According to the Food Hall Manager, Morris Hedstrom, total sales over the entire period was about 60kg. With regard to demand, the manager indicated that in comparison with other sea foods, the demand was quite low as people did not like frozen clam meat and also the quality of supply was not good.

Apteds Ltd. based at Flagstaff specialises in selling fresh and chilled seafoods. The supply was mostly from Savusavu but some clam meat was also bought from the National Marketing Authority. The buying price for mantle ranged from \$1.00 to \$1.50 per kg and the selling price was around \$3.00. Muscle was bought at \$5.00 per kg and sold at around \$10.00 to \$12.00 per kg.

Interviews at Apteds indicated that local people preferred whole giant clam rather than separately, whereas other customers, predominantly expatriates of Asian origin including Taiwanese and Japanese bought muscle only. Sometimes, the excess mantle was used by the Old Mill Cottage Restaurant owned by the company for clam meat in coconut cream or "Vasua ni lolo". Over the entire period from 1986 to early 1989 Apteds had sold over 150 kg of giant clam meat.

With regard to interest in marketing of giant clams if it became available again, Apteds Ltd. which sells a variety of seafoods indicated that they still have interest to sell fresh and chilled giant clam meat. According to the supervisor-in-charge of seafoods, the buying price preferred for muscle was around \$5.00 per kg and mantle was \$2.00 per kg, whereas at the Morris Hedstrom buying price preferred for whole clam including muscle was \$2.00 to \$3.00 per kg. The Manager indicated that this level of price would enable the selling price to be

around \$4.00 to \$5.00 per kg after packaging which is the average price of the fish foods and other meat sold at the supermarket, in order to attract customers for giant clam as a comparable commodity in relation to price. However, it is difficult to determine the real substitutability of these commodities.

R.B. Centerpoint indicated that in future if the quality of supply improved, the supermarket would give it another try. Bajpai's and B. Kumar indicated that if the Consumers show interest or enquire about it, they would be willing to sell.

2.3 *Restaurants*

Restaurants in Suva specialising in seafoods were interviewed. Tiko's Floating Restaurant which basically sells a variety of sea foods indicated that giant clam is either bought from the Suva Market or supplied by fishermen directly to the restaurant from their punts. The restaurant had a preference for bigger clams which have a large muscle, as they only use the muscle which is served raw in lemon juice as an appetiser or entree dish. Prices paid per clam ranged from \$5.00 to \$8.00. Mantle is discarded as there is no demand for it.

At the Travelodge Hotel, Suva which operates two large restaurants, an interview with the Head Chef indicated that giant clam has never been used in any food preparation. The Old Mill Cottage Restaurant in Carnavon Street however used to sell giant clam mantle cooked in coconut. The supply of clam meat to the restaurant was from Apteds Ltd., the parent company. The restaurant has not used clam meat for some time now because it is not readily available. According to the interview, the demand for "Vasua ni lola" was moderate as people who were familiar with the dish only ordered it as the main course.

Most Chinese Restaurants in Suva selling a *bêche-de-mer* dish indicated that giant clam meat would be a new food to introduce in restaurants. They were of the opinion that the muscle would definitely have a demand, but since it has been an expensive commodity and not readily available, it did not appear on their menu.

Three restaurants interviewed, the Ming Palace, Sichuan Pavilion and the Great Wok of China indicated their interest in giant clam muscle if it became available one of the manager's indicated that with an increase in the number of Oriental tourists and expatriates over the last three years, there would be a definite demand for food preparation using the muscle.

2.4. Butcher shops

All four butcher shops in the city, the Whaleys Butchery, Tebara Halal Meats, Nausori Meat Co. and Leylands Ltd. were interviewed. Except for Leylands, none of the other butcher shops ever engaged in selling giant clam meat.

According to the Assistant Manager of Leylands, giant clam meat was sold from 1986 to 1988. The supply over the entire period was on an irregular basis with approximately 20kg sold per week.

Over the three year period in total about three tonnes of clam meat consisting largely of mantle was sold, with a price ranging for \$2.50 to \$3.00 per kg. The mantle was mostly supplied by the National Marketing Authority and Feeders Fiji Ltd. Some supply of clam meat including muscle also came from Savusavu.

Prices paid for clam meat ranged from \$1.50 to \$2.00 per kg. According to the interview at Leylands in town, the assistant manager also indicated that there was enough demand for the clam meat. Clam meat was sold both frozen and chilled. The majority of the customers were Fijians and Pacific Islanders. However, when the ban on exports was imposed in early 1989, the supply was stopped from the National Marketing Authority and Feeders Fiji Ltd.

With regard to interest in clams if it became available, the assistant Manager indicated that there would be a definite interest to sell providing the buying price for whole clam meat including the muscle ranged between \$2.00 to \$3.00 per kg for medium sized clams. He added that giant clam meat prices depended a lot on the availability of other seafoods such as squid, mussels and octopus in his shop.

2.5. Domestic consumption pattern

Using a structured questionnaire the consumption pattern of people living in the Suva area was determined. Although the sample size is rather small to be used as a representative of the entire population of clam eaters, in Suva nevertheless, it gives an indication of the current trend in demand for clam meat in the domestic market.

Eighty people were interviewed of which 55 were females and 25 males, of which 65 were Fijians and the rest, part-European, Pacific Islanders and Chinese. 20 Indians were asked whether they ate giant clams or not. Out of the 20 interviewed only one indicated that he had

tried after hearing from a friend and reading about it in the newspaper. On the other hand, in an informal discussion with Indian people involved in the giant clam industry or having sufficient knowledge about it, the majority of them indicated that they had tried eating giant clam cooked in coconut cream and the taste was good. However, they did not buy from the market because they were not sure about the quality of the product, but they had occasionally consumed clam meat if it was available otherwise i.e. supermarket and village suppliers.

Most of the Fijians interviewed originally came from the outer Islands. Only 37% indicated that Viti Levu was their island of origin.

The following are some of the survey findings based on the questionnaire :-

When asked about the regularity of consumption of giant clams, the majority of the respondents indicated that they ate clam meat whenever it was available. Since it did not appear as a regular food item, most of them indicated when they had last eaten clam meat which ranged from last year to last week.

Very few of the respondents could recall or estimate the weight of the clam meat as meat bought from the market or gathered by friends and relatives are never weighed. Sizes of clams ranged from smali (referring to either *T. maxima* (katavatu)) or small *T. derasa* (vasua dina) less than 15cm, to medium (15-25cm) to big (over 30cm). Most people indicated that they usually bought 1 to 2 medium sized clam meat, which was sufficient for their family's immediate consumption.

All people interviewed ate both the adductor muscle and the mantle. Although they all preferred the muscle, they liked the mantle too because it provided the bulk of clam meat. Some indicated that the gonads were also eaten raw with lemon juice and salt.

Eighty percent of the people interviewed could not indicate their order of preference for the different species that are available because they did not have the chance to try the different species. 20% indicated preference for *T. maxima* (katavatu) because it is "sweet" and has more tender meat compared to other species. However, during the survey there was no *T. maxima* sighted, but most people had eaten it some time back or on the Western Side i.e. Nadi and Lautoka, where it is more readily available. Most people knew about *T. derasa* (vasua dina) and only a few about *T. squamosa* (cega).

In terms of preference, both *T. derasa* and *T. maxima* species seemed to be equally liked. Generally talking to the younger urban consumers, it was found that they did not know the difference between the various species. All they said was that they knew of giant clams as just one kind of shellfish or bivalve.

It was obvious that *T. derasa* had the highest consumption rate because it was the most readily available species at the market during the interview.

Responses varied when asked about the last consumption of clam meat. Some of the responses were, last week, three months ago, during last visit to the islands, last Easter, last Christmas, and a few years back. It is therefore obvious that the variety of species of giant clam population has declined that people do not get the chance to know more about other species simply because it is no longer available.

With regard to source of supply, 60% of the respondents indicated that they buy from the market, about 6% collected themselves if they went to their island village and about 15% indicated that friends and relatives send it over. Of the people interviewed only about 8% had ever bought clam meat from Apteds or Leylands.

The majority of the consumers indicated that prices paid per clam or clam meat ranged from \$2.00 to \$7.00. Most medium sized clams sold at the market during the survey were sold for either \$4.00 or \$5.00 per piece. People generally do not seek clam meat because it is not readily available. Some however, indicated that they buy clam only when they visit the market for other things, indicating that there is no major reliance on clam as a regular food source. In the urban areas it is eaten as a delicacy usually for Sunday lunch after church.

On the other hand, most people indicated that fish is their preferred seafood. When comparing clams to other marine foods besides fish, 40% indicated first preference for giant clams as a bivalve.

The majority of the people who consumed giant clam indicated that they usually made "kokoda" - raw clam meat marinated in coconut cream and lemon juice or ate raw meat sprinkled with salt and lemon juice. Clam meat cooked in coconut cream "lolo" was also a very popular style of preparing clam meat.

On the possible future consumption pattern if clam meat became available, most responded

that they would eat clam meat more often, e.g. once a week or once a month: On the other hand 15% responded that they would collect their own which also indicates the possibility of increased subsistence harvesting.

If clam meat became readily available again, the quantity of clam meat people would buy would therefore increase with shift in consumer demand as a result of increased consumption. The average quantity a person would buy ranged from 1 to 3 clams (medium size) which would be enough for a meal, unlike fish which may be kept for later consumption.

Prices people would be willing to pay varied from \$1.00 per clam to \$6.00 per clam (medium size) or approximately 1kg weight of clam meat. This level of price is however much lower than what the initial Makogai Clam Project cost estimates for a 1kg clam indicate. According to the Clam Officer at the Fisheries Department, a 30cm shell size clam (1kg) would cost around \$8 to \$10.

On the other hand it is difficult at this stage to gauge the price level people would be really willing to pay if clam became available at a cost around \$8 to \$10 per kg.

With the rate of exploitation of natural production being so high, the clam population would rapidly decline, therefore prices are likely to increase further for clam meat in the near future.

If supply increased gradually from mariculture production, it is likely that higher prices may be maintained for some time in the local market. This might ease the high set-up cost and other overheads of the project. However, as the supply of clams would increase through time, prices are also likely to go down accompanied with lower cost of production. A more thorough study could be done to forecast the optimal price level and supply and demand pattern to make the giant clam mariculture a viable industry in the domestic market.

Furthermore, clam meat would need to be compared to other marine foods such as mud crabs, prawns and other bivalves to find out the degree of substitution. For example, mud crabs are another commodity which is heavily exploited. The excess demand indicated by prices going up also shows that like giant clams, the mud crabs would sooner or later become an endangered species. Will the clams from mariculture then be used to substitute the mud crabs at any stage?

Currently mud crabs fetch a price between \$12 – \$15 per kg at the local market and are

considered as a high value commodity. However, if supply was greatly reduced, consumers would look for an alternative as a substitute. The closest substitutes are crustaceans like prawns and lobsters but these commodities are already available in very limited quantities at the municipal markets. Most of the supply is consumed by the hotels and restaurants catering for tourists.

Thus looking at the current state of market demand for giant clams and mud-crabs, it is evident that they are not substitutes for each other. The demand for mud crabs is mostly by Indian consumers whereas giant clams are consumed largely by Fijians.

On the other hand, if resources were threatened and ultimately depleted, the choice of marine foods besides tin fish for Indian consumers would be limited to fresh water shellfish *Batissa violacea* as they also do not generally consume other fisheries products like octopus, bêche-de-mer, cockles, etc. The closest substitute in such a case would be giant clams. However, one cannot say for certain that such a trend would take place but there is more than likely chance that it may if the Indian consumers became more aware of the giant clam meat.

Furthermore, the introduction of giant clams through mariculture is most likely going to be at the community or household level. This may mean that there may be some degree of self-sufficiency in clam meat in the rural areas where the likely mariculture grounds would be located. Thus the demand for clam meat would be limited to the urban markets only. Based on the nature of operations either commercial or semi-commercial, there would be a need for government assistance in setting up the industry.

3. Export Market

An interview schedule was used as a guide to gather information on trade in giant clams, and discussions were held with some current exporters of bêche-de-mer and fresh fish.

Trade in giant clams has existed since the colonial days, but there was no documentary evidence available on exports during the survey. It is believed that Asian vessels occasionally poached giant clams, as it is a commodity that has long been sought in the Asian markets.

The Fisheries Department records on giant clam exports are given below in Table 3.

Table 3. Exports of Giant Clams in Weight

Year	(Kg.)
1982	None
1983	None
1984	7276.5
1985	20794.7
1986	11379.0
1987	N/A
1988	N/A

N/A = (Not available)

Source: Fisheries Division, 1987. p.24.

There has been no direct regulation on exploitation of giant clams until the early 1980s, when giant clams were declared internationally an endangered species. As a result, direct regulations on giant clam exports was laid down by the government, where export licences were issued and export guidelines on its exploitation with regard to size and quantity were established.

Around the mid-1980s, most other giant clam exporting countries had banned trade in giant clam. Therefore recorded exports from Fiji increased tremendously. The industry had some set-backs in 1987 and 1988 following the Military Coup because of trade bans and strikes. However, by early 1989, Fiji also became a signatory to the CITES Convention and imposed a total ban on export of giant clams.

The National Marketing Authority (NMA), Feeders Fiji Ltd, Wasawasa Fishing Co., Fiji Co-operative Association and Seafoods South Pacific Co. were among the giant clam exporters interviewed.

The former Marketing Manager of the NMA gave an account of exports of giant clams by the NMA, as the current management did not have adequate knowledge about the previous operation of the Authority.

The NMA employed a Fisheries vessel to collect giant clams from the islands, mostly from the Lau group and Kadavu, whereby the clam meat (both the muscle and mantle) was collected and the villagers were paid by the NMA officers on board. The vessel also collected clam meat from other NMA Centres located in Labasa, Savusavu and Lautoka. Prices paid at the collection sites varied from \$1.00 - \$3.00 per kg. Sometimes the muscle and mantle were separated, where the mantle fetched a price of \$0.50 to \$1.00 per kg and muscle \$3.00 - \$5.00 per kg.

Statistics on NMA sales were not available due to change in the management of the Authority. However, mantle was largely sold to retail outlets and government institutions, while muscle was exported.

Wasawasa Fishing Co. (now operating as Fresh Fish Ltd.) indicated that exports of clam by the company started around 1983 and stopped when the ban on trade in giant clams was imposed. According to the General Manager, over the period of 6 years the company would have exported in excess of 40t. of giant clam, mostly consisting of muscle at an average price of US\$20 per kg.

Muscles were packed in medium sized cardboard boxes and frozen for export. The manager indicated that about 25% of the catch was supplied by the villagers with prices ranging from \$5.00 to \$9.00 per kg for muscle which was exported mainly to Taiwan, and \$0.50 - \$1.00 for the mantle which was sold locally.

The General Manager of Feeders Fiji Ltd. indicated that his company had engaged in exports of giant clam since 1982 and stopped exporting when the ban was imposed. However, trade had declined after the Military Coup in 1987. The supply was from the fishermen in the outer islands, and was also collected by Feeders vessels. According to the General Manager, suppliers were paid between \$4.00 to \$6.00 per clam. However, he did not disclose the total quantity exported over the period.

Pacific Seafoods Ltd. based in Lautoka was engaged in the giant clam trade from 1985 until the ban in early 1989. According to the manager, each year the company exported

approximately 10t. of giant clams mostly to Taiwan and Hong Kong. Some supply also came from Tonga for the Company. Likewise, Fiji Co-operative was also engaged in exports of giant clams from 1986 to 1988, with supplies from co-operative groups around Fiji.

The major markets for all the exporters were Taiwan and Hong Kong followed by Australia, New Zealand and Japan. All exporters indicated a high demand for the muscle.

Two exporters in particular expressed concern over the clam size that is anticipated under mariculture production. They indicated preference for muscle alone to be around 200 - 250 g in weight in order to fetch the optimal price. This indicates their preference for large shells and trade in large size clams.

There were some mixed feelings when asked about the impact of the ban on exports. None of them had any major impact because most of the exporters were also engaged in exports of tuna and deep-sea snappers. Although the giant clam muscle was a high value and low volume commodity, none of the exporters were led to shut down as a result of the ban.

All the exporters interviewed still showed an interest in engaging in exports of giant clams if it became available, while South Pacific Seafoods further indicated their interest in farming giant clam as well. All of them indicated that they would target their previous markets again if they were to engage in trade.

On the other side, an interview with five current exporters of *bêche-de-mer*, Tacko Fiji Ltd., Fishy Affairs Ltd., Yon Tong Co. Ltd., CaCo Fisheries Fiji Ltd., and Pacific Seafood Co. Ltd indicated that they also have an interest in exporting giant clams as there is a definite market for clams in Hong Kong, Taiwan, and Singapore. All indicated interest because giant clam muscles are high value products compared to *bêche-de-mer*.

The concern from some exporters, however, was the size and the possible price levels of muscle for export. There was some concern expressed over the shorter term period of harvesting where one kg of shell meat would take about five years to grow, and which would have a much smaller muscle. The question of a possible competition with the scallop market was also raised by some exporters. Therefore in analysing the economic viability of the project, one would also need to understand the behaviour of the scallop market as well, and to determine the extent of impact, if any, it might have on the clam market.

4. Discussion

From the analysis of consumption patterns of giant clams it is obvious that the commodity does not now appear as a normal marine food diet for the majority of the urban dwellers, because it is not readily available. For the urban Fijians it has become a delicacy which people consume it whenever it is available; whereas according to the market vendors or wherever it is available, it is still consumed as a subsistence diet (Vuki et.al. 1991). Some inland people interviewed indicated that there was no special preference for clams, because they have not been accustomed to eating clams.

According to the Fisheries Division stock assessment survey, there is a definite decline in the giant clam population, thus eventually leading to reduction in supply. Some of the younger people interviewed indicated that they could not distinguish the various species except the *T. maxima* (katavatu), which is generally smaller in size and found among the rocks.

The reduction in supply has obviously increased the prices from \$0.50 to \$1.00 per shell to \$5.00 to \$8.00 within a 5 year period. Some people also indicated that with prices of clam being high, now they prefer to buy fish which has a similar price and which can provide a meal, where as a piece of clam meat may not be sufficient for a meal.

In comparison to other fisheries products such as crabs, prawns, lobsters and fresh water shellfish, giant clam has not been a commercial commodity domestically. Partly because of lack of demand in urban areas and the problem of transportation of bulky shells, it often did not appear at the market place. It was seen basically as a commodity consumed at the subsistence level.

However, with an increase in urban migration of island people, thus creating a demand for it, giant clams together with other sea foods like sea urchins, spider shells, chiton, etc. have increased tremendously over the recent years. While the stock assessment surveys indicate a decline in resources, the supply at the domestic market (refer to Table 2.) does not actually correspond to the decline. Instead, it shows a somewhat steady supply with only some minor fluctuations. This can be explained by the increased rate of commercial exploitation as a result of increase in value of the clams.

Discussions also indicated that although people favoured giant clam meat, they did not buy it because it was expensive. Sometimes relatives brought it over from the island or one made a

point of eating clams when visiting the island village.

The most preferred form of preparation of clam meat has been 'kokoda', clam meat marinated in lemon juice and coconut cream, or just eaten raw with lemon juice. Both of these forms of preparation require the meat to be fresh and in good quality. Previously clam meat, mostly consisting of mantle was available at the retail outlets, which was frozen and generally had a very poor handling which led to a low quality product and high spoilage. Exporters were mostly interested in the muscle which had a high value compared to the mantle, which was around \$0.50 to \$1.00 per kg only.

With regard to the Indian consumers, 95% of the people interviewed did not eat giant clam, simply because they had never tried it, or because they do not know much about it or the look does not appeal to them. Some being vegetarian simply would not eat clams at all.

However, for non-vegetarian Indians, there is no "taboo" or religious prohibition. Most people are not aware simply because they do not have a history of giant clam consumption. Those who had tried it had a very favourable response and with awareness and good post-harvest handling and packaging, it can attract more Indian consumers than at present.

The giant clam presents a similar case to that of tilapia, where it was not considered as a high value product because of limited demand as a result of lack of knowledge about the commodity. However, since the culture of tilapia it has become a marketable commodity which fetches an almost equal price to that of other reef species.

Supply of giant clam meat by other retail outlets such as hotels, supermarkets and restaurants relied much on the export trade, where the increased export of muscle meant increased sale of mantle to some of these outlets. Therefore if trade in giant clam resumes, these outlets would become operational again since most of these outlets had an effective demand except when the quality was poor.

The overall limited use of clam meat in restaurants has been because of a lack of demand for giant clam by customers. On the other hand, as the economy expands with increasing Asian expatriates and tourists, the scene is likely to change to one where the supply could be secured and the clam meat can appear on a regular menu of some of the restaurants, particularly those specialising in seafoods.

Analysis of the export market gives an interesting response. The majority of the exporters enjoyed an open free trade during the early years of trade. However, they are very reluctant to disclose the nature of their past experience. Most of them had enjoyed collection of giant clams e.g. *T. gigas* which had large muscles weighing between 200 - 300g. Records on prices paid to the islanders are also very sparse. It is only after the early 1980s when giant clam trade was regulated by Government that information became more readily available.

In the 1980s Fiji was one of the few countries exporting the giant clams, therefore exports fetched the highest prices possible. The lack of data from individual exporters also restricts study of the economic analysis of the possible clam industry.

However, certain inferences can be made, from the above preliminary survey. Firstly, one cannot expect the nature of trade to be on a similar pattern under mariculture production. The suppliers' conditions would be more restrictive in that they would need to evaluate the project to determine the optimal level of production, size of harvest, costs involved, etc. Pricing patterns will therefore be different compared with natural production based on open access system.

The level of commercialisation and success of the project will directly depend upon the government objectives and intervention. Lessons also must be learnt from the past experiences of other fisheries and aquaculture development projects based on a household level of production in the islands.

The social attitude and lifestyle which is basically semi-subsistence in nature of the target group or community must be taken into account. For example, the Rural Fisheries Development Project has had limited success because of the lack of motivation from the villagers towards commercial operations. Fishing has been basically a part-time activity carried out when there was need for food and cash; i.e. some level of perceived income. Thus, the demand for cash is limited and fishermen are not profit orientated. Likewise, in the seaweed industry, although the major problem here related to export markets, a semi-processing plant could not be established to maintain the industry because of the limited supply which fell short of the level needed to set up a semi-processing plant. The limited supply was as a result of small farmers who regulated their own production based on their demand for cash. This again indicates their part-time nature of operations and the fact that farmers were not profit motivated.

Therefore to establish a giant clam mariculture industry one needs to consider these social and cultural factors. It is likely that the giant clam industry may also exhibit on similar trend.

An alternative to small-scale household operations is the establishment of a limited number (based on the market demand) of large scale enterprises under joint-venture operations with local communities. Again the social and economic impact on the communities and the nature of joint-ventures would need to be scrutinised carefully before adopting such option.

On the other side, it would be interesting to study the scallop market and its impact on the clam export market as a substitute commodity. Also for the domestic market a comparative study with other fisheries products such as crabs and lobsters i.e. commodities that are either threatened or not readily available to majority of the consumers need to be carried out to see the impact if any, it has on the demand pattern for giant clam from mariculture production in Fiji. An analysis of other bivalves would also give an indication of the substitutability. The trends in supply and demand and the status of the particular resources would also assist in forecasting the demand pattern of giant clam from mariculture production.

5. Concluding observations

From a preliminary investigation of the Suva market which is the largest urban market in Fiji, it is evident that an unsatisfied demand does exist for giant clams. Therefore, production under mariculture would definitely have a demand in the urban and export markets. It is however difficult to determine exactly what the level of demand would be initially but it is evident from the survey that demand would increase if the giant clam product was promoted carefully into the market.

Current consumption pattern indicates that the majority of the people do not have ready access to clam meat because of the decline in stock over the years. However, wherever clam is available, there is increased commercial exploitation because of its high value compared to some years back. For example the price of one kg of clam meat has more than doubled within the last five years.

Currently, the supply of clams is largely restricted to the municipal markets, where women and men sell clam meat together with other products. Market days for clams are also limited to Saturdays, when most people visit the market. This further confirms the lack of availability

of clam meat to consumers at large, and those who generally buy their food items from the supermarkets, butcher shops or from other retail outlets.

Furthermore, results from the survey also indicate the lack of adequate knowledge about the commodity. Unless people are made aware about the clam, its taste, nutritive value, etc. it may become a strange commodity to the majority of the people, including those whose ancestors once survived on it as part of their staple diet. Some form of consumer awareness program should be mounted to expose the commodity to the general public before it enters the market.

Post-harvest technology also needs to be improved not only for the export but also for the domestic market, as most people prefer to eat raw clam meat rather than cooked.

With regard to exports of clam meat from Fiji, results from the survey indicate a positive response by exporters of fish and other marine products. Interest still lies in the export of muscle, which is a low volume and high value commodity. The developed transportation infrastructure for fresh fish exports also provides an adequate transportation system for the export of clam meat, whether fresh, chilled, or frozen.

Several other factors need to be taken into account when considering the economic viability of the mariculture projects in the outer islands. Firstly, the mode of production at the community or household level where production may be on a semi-subsistence basis. Will such production system provide a steady supply to fulfil the demand at the market place? The impact of the ownership of the farms such as whether it will be a self-regulated production or a joint venture, and the degree of government intervention, etc. need to be assessed. This could also assist towards determining more realistic production costs and price levels, which can further help towards assessing the marketability of the product.

On the other hand, if the production is commercially oriented and also targets the export markets, i.e. based on enterprises scale operations, it is likely that there will be competition with other exporting countries and also with other fisheries products which are close substitutes, like the scallop and mussel. Thus, the relationship with other exporting countries and the substitutability of clams and other possible bottle necks to the industry will need to be assessed.

Use of other parts of the clam such as the shells and mantle needs to be further explored. This

is particularly important, for production of larger shells as they are quite bulky compared to scallop shells. Uses of clam shells will greatly facilitate the economic viability of the giant clam mariculture project. Markets needs to be explored on the use of the clam shells as currently, shells from natural production have very limited demand in Fiji.

However, like other Asian countries, shells could be used as a form of serving dish, ash trays, decoration and for other ornamental purposes. Study on the possible uses of shells would greatly facilitate the economics of the giant clam mariculture project.

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APPENDIX

CONSUMPTION OF GIANT CLAMS IN FIJI – QUESTIONNAIRE

Place Date

Ethnic Group

Sex (i) M (ii) F Island of Origin:

1. Do you eat giant clams (vasua) (i) Yes

(ii) No

If no,why

.....

2. How often do you eat clam meat?

.....

3. How much clam meat does your family eat?

i. Weight of clam meat

ii. Size of clams

iii. No. of clams

4. What part of clam do you eat or buy?

i. Adductor muscle

ii. Mantle

iii. Both (i) and (ii)

5. List order of preference of the different species.

- i. katavatu
- ii. cega
- iii. vasua dina
- iv. vasua lokaloka
- v. Tevoro

6. Which species do you eat or buy most?

.....

Why?

7. When did you last eat clam meat?

.....

8. From where do you buy or get your clam meat?

.....

9. What price do you pay per kg. or per clam.

.....

.....

10. If clam is not available, what do you buy instead?

.....

11. How do you rank giant clam in comparison to:
- i. fish as food
 -
 - ii. other shellfish as food
 -
12. How do you cook your clam meat?
-
13. If supply of clam increased again, how much clam meat would you buy?
-
-
14. How often would you buy?
-
15. What price are you willing to pay for :
- i. per kg. clam meat
 - ii. per clam

END

Thank you for your co-operation.

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Demand for Giant Clam (Export Market)

Interview Schedule ·

1. From when to when (time period) did you export giant clams?
2. Countries of destination.
3. What quantities did you export?
 per week?
 per month?
4. What price?
5. How was the export arranged i.e. transportation?
6. Where did you get your supply from?
7. How much did you pay the suppliers?
8. Was there enough demand for the product? What was the demand pattern like?
9. Did the ban on export have any impact on your business?
10. If the Giant Clams become available do you have interest in exporting it again?
.....
.....
11. In your opinion, what prices will be economical for you?
12. Where will you market the products?
13. What quantities and size of clam do you prefer?
14. How do you compare the demand for Giant Clams to demand for bêche-de-mer?

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Demand for Giant Clam (Domestic Market)

Interview schedule

1. From when to when (time period) did you sell Giant Clam? (Are you still selling Giant Clams)
2. What quantities did you sell:
 per week?
 per month?
3. What price?
4. Where did you get your supply from?
5. How much did you pay the suppliers.
6. Was there enough demand for' the product? What was the demand pattern like? Who are your consumers?
7. Did the ban on Exports have any impact on your sale of Giant Clams.
8. If Giant Clams become available, do you have interest in selling it again?
9. In your opinion, what prices are you willing to offer to the suppliers?
10. What quantities and size of clam do you prefer?
11. Do you sell bêche-de-mer? If so, how do you compare it with Giant clam?
12. Was/is selling Giant Clams a profitable business?
13. What is the supply/demand for canned clam meat like?

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