

RESEARCH REPORTS IN THE ECONOMICS OF GIANT CLAM MARICULTURE

Working Paper No. 16

The Potential Demand for Giant Clams in
Indonesia and their Status: A Report on a
Survey of Four Coastal Villages in Bali and Java

by

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and

Clem Tisdell

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ISSN 1034-4294

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Carunia Firdausy and Clem Tisdell²

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¹ This Series, Research Reports and Papers in the Economics of Giant Clam Mariculture, is supported by the Australian Centre for International Agricultural Research (ACIAR) Project 8823 and published by the Department of Economics, University of Queensland, Queensland 4072, Australia. (See next page for more information)

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

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

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

Commissioned Organization: University of Queensland.

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

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The Potential Demand for Giant Clams in Indonesia and their Status: A Report on a Survey of Four Coastal Villages in Bali and Java

ABSTRACT

This paper examines the status of and the potential demand for giant clams in four coastal villages in Bali and Java, Indonesia. Data were obtained from direct interviews with 228 household heads and completed in the period April-July, 1990 using a standardised questionnaire. It was found that in the areas surveyed, natural stocks of giant clams have been severely depleted due to overexploitation. Results indicate that the demand for giant clam meat by Indonesian coastal dwellers is substantial and coastal dwellers are positively interested in adopting giant clam mariculture both for subsistence, semi-subsistence and for small-scale commercial purposes. However, they have little or no knowledge about this mariculture. Given the favourable attitude of interviewees to clam mariculture, the economics of such mariculture in Indonesia merits further investigation as do suitable farming techniques adapted to the Indonesian situation. In the absence of giant clam mariculture in Indonesia, it is difficult to see how adequate supplies of giant clams for direct use and for traditional industries such as the tile industry can be found and sustained.

Keywords: Demand for giant clams in Indonesia, Bali, Java, giant clam mariculture, Indonesia.

JEL Classification: Q57, Q31

The Potential Demand for Giant Clams in Indonesia and their Status: A Report on a Survey of Four Coastal Villages in Bali and Java

1. INTRODUCTION

Giant clams (Tridacnidae) have been an important traditional source of food and of income for many coastal Indonesian people. Since 1987, however, exploitation of natural stocks of giant clam has been prohibited by the Indonesian Government. This is because natural stocks of giant clams, particularly of those species growing to the largest size (*T. gigas* and *T. derasa*), have been seriously depleted as a result of over-harvesting by man (Atmawidjaja, 1987; Brown and Muskanofola, 1985; Panggabean, 1987).

Interest has been expressed in Indonesia in the mariculture of giant clams both for reseeding depleted areas and for straightforward farming for food production (including commercial purposes). Biological research for the farming of giant clams is being conducted at Diponegoro University, Central Java and the Indonesian National Institute of Oceanology, Jakarta. Unfortunately, information on markets, likely costs, and returns and the willingness of coastal dwellers to become involved in giant clam mariculture in Indonesia had not been collected previous to this survey of villages in Bali and in Java. The viability of giant clam farming will depend on its socio-economic value.

This paper aims specifically: (1) to investigate the potential demand for giant clam products in Indonesia with particular reference to coastal dwellers in the four villages surveyed; (2) to examine the willingness of coastal dwellers to establish giant clam mariculture; (3) to determine socio-economic factors which might favour or interfere with the establishment of clam mariculture in Indonesia. Data and information presented in this paper are based on survey carried out in four coastal villages in Indonesia in the second quarter of 1990 by Carunia Firdausy with local research assistants using the questionnaires designed by Tisdell shown in Appendix A.

2. METHOD AND NATURE OF THE SURVEY

Four coastal villages were selected for in depth study. They were Jungut Batu and Ped in Nusapenidi Sub-district, Bali; and Bulu and Ujung Batu villages in Jepara Sub-district,

Central Java. These four research villages were selected on the basis of prior information¹ about the suitability of these locations for giant clam mariculture. Furthermore, coastal dwellers in these villages were known to have been involved in giant clam harvesting activity for many years.

The data was collected by direct interviews using a standardised questionnaire (see Appendix A) and was designed to determine (1) the abundance of giant clams in these locations and changes in their abundance; (2) the knowledge of villagers of giant clams; (3) quantities of clam meat coastal dwellers are prepared to buy; (4) the acceptable prices and the type of product they are looking for; and (5) the extent to which the villagers would be willing to mariculture clams and for what purposes (e.g. subsistence, market purposes etc.).

About 15 per cent of total household heads in each sample village in Bali were chosen randomly². Household heads were grouped on the basis of their occupation. Only households with seaweed farmers and fishermen were interviewed using the clam questionnaire. The total number of household heads in Indonesia interviewed using the clam questionnaire was 228. This consisted of 195 seaweed farmers in Bali and of 33 fishermen in Jepara, Central Java.

Apart from using the questionnaire, information was also obtained from (1) interviews with two researchers who do biological research on giant clams, namely, Dr. Lachmuddin Syarani at Diponegoro University, Semarang, Indonesia and Mrs. Maria Panggabean at Indonesian National Institute of Oceanology, Jakarta. (2) interviews with sellers of giant clam meat at Jepara market; and (3) interviews with a clam shell collector, souvenir shopkeepers and clam shell street retailers.

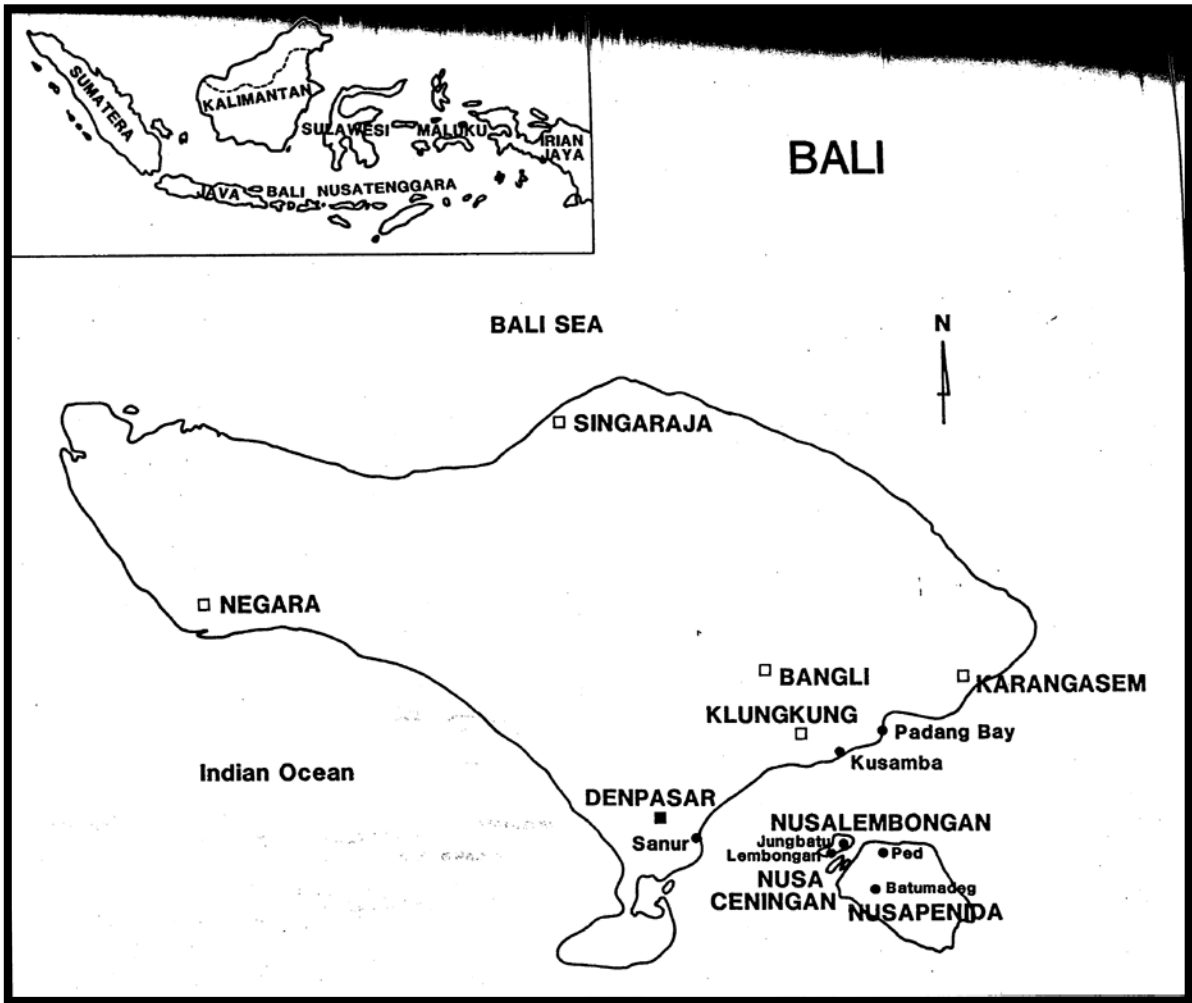
3. BACKGROUND INFORMATION ON VILLAGES SURVEYED

The villages of Ped and Jungut Batu are situated respectively on the islands of Nusa Penida and Nusa Lembongan off the southeast coast of the mainland island of Bali (see Map 1 and 2). They can be reached by local boat transport from Bali from Sanur beach (a two hour journey) or from Padang Bai (a one hour journey). The main economic activities of households in these two villages at the time of survey were seaweed mariculture (particularly

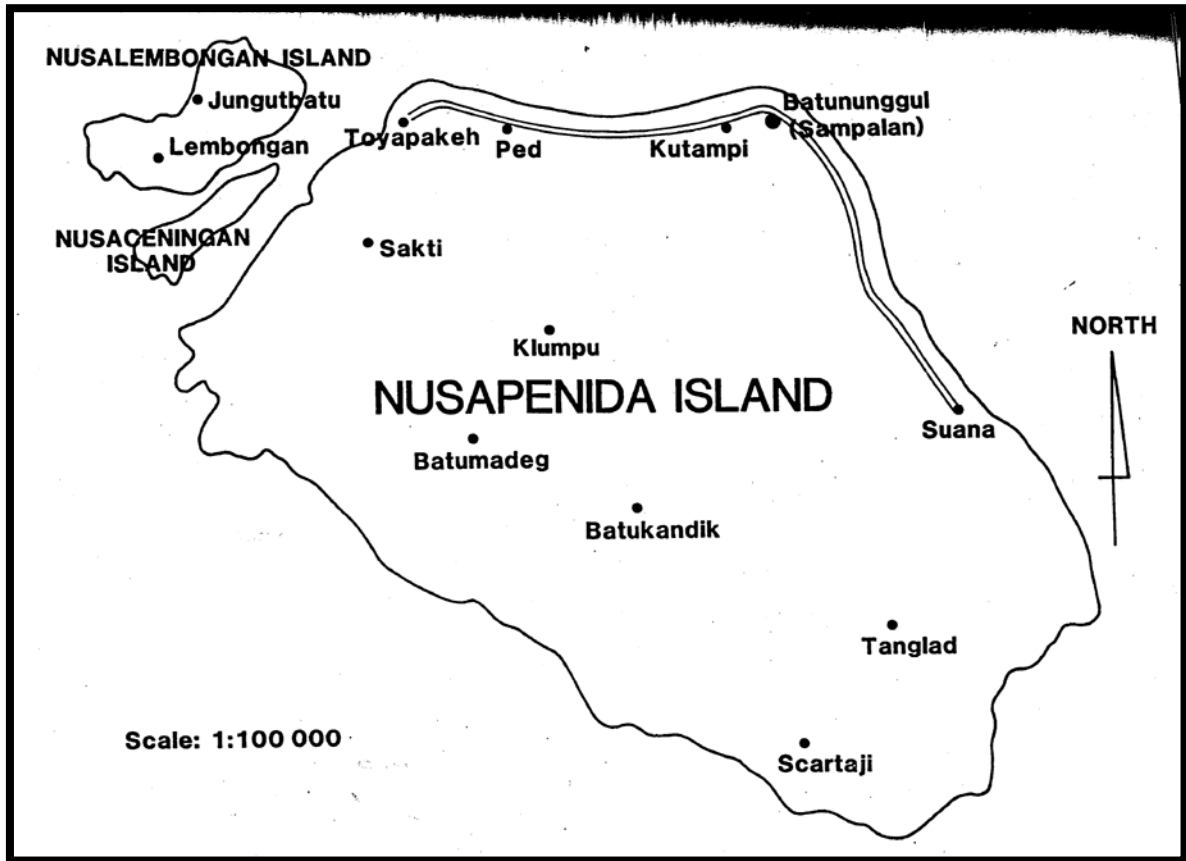
¹ This information was obtained from a pilot survey carried out between November 1988 and January 1989.

² For the two villages Ujung Batu and Bulu at Jepara, Central Java, only a total of 33 household heads were interviewed due to time limitations on the visit of Carunia Firdausy to Indonesia.

cultivation of *Eucheuma cottonii* and *Eucheuma spinosum*), and to a lesser extent land-based farming and tourism. Almost 90 per cent of households in these villages engage in seaweed mariculture. Seaweed farming is the only form of aquaculture which has been practised in these villages.



Map 1: The island of Bali showing the location of Nusapenida Islands (Nusapenida Subdistrict)



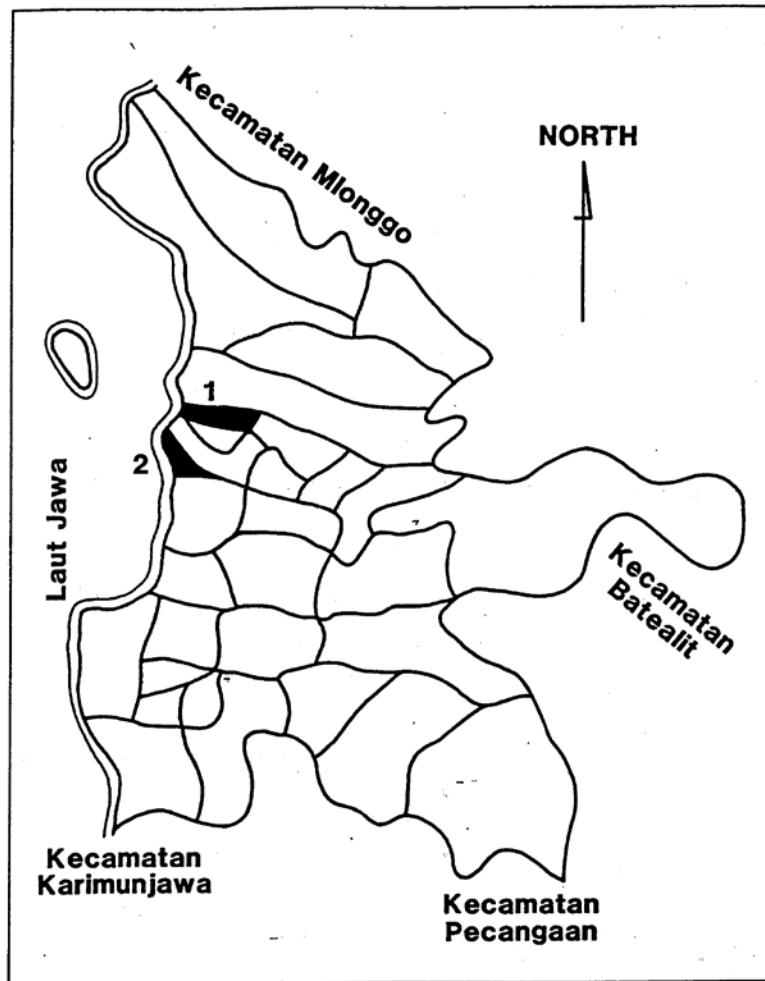
Map 2: Location of survey villages (Jungutbatu and Ped) in Nusapenida Subdistrict, Bali.

These communities in Bali have utilised natural stocks of giant clams for their meat, shells or both in the past. Clam meat was utilised for food, while clam shells were sold to shell collectors for the teraso industries. However, following the commencement of seaweed culture in these villages in 1983 giant clam collection was discontinued. This is because seaweed cultivation is a more profitable use of time of coastal dwellers and takes most of their available working time. In any case, seaweed has brought coastal dwellers greater income and provides employment opportunities for coastal dwellers.

The other two surveyed villages (Ujung Batu and Bulu villages) are located on the north coast of Central Java near the small town of Jepara which is about 80 km east of Semarang, Central Java (see Map 3 and 4).



Map 3: Central Java showing the location of Jebara and Karimunjawa Islands



1 is Ujungbatu Village
2 is Bulu Village

Map 4: Survey villages (Ujungbatu and Bulu) in Jepara Subdistrict, Central Java.

No seaweed cultivation occurs in these villages. The major economic activities in these villages are fishing and collection of giant clams. However, recently further development of prawn aquaculture has occurred which provide limited employment opportunities for these coastal rural villagers.

Because of the heavy exploitation of giant clam stocks in the vicinity of Jepara, collection has moved from this area to grounds in Karimun Jawa, a group of islands about 100 km north of Jepara (see Map 3). Apart from these villagers exploiting the Karimun Jawa grounds, they sometimes go as far as Bangka and Belitung islands in South Sumatra to collect clam shells. Collectors are formed into many groups consisting of 5 to 10 persons in each group. These

groups are financed and employed by professional clam collectors (middlemen). In return, fishermen in these groups are obliged to sell their clam shells to the financing clam middlemen.

4. KNOWLEDGE OF GIANT CLAMS AND THEIR NATURAL AVAILABILITY IN VILLAGES SURVEYED

Giant clams, known locally in Indonesia as 'Kima', appear to be well recognised only by Indonesian coastal dwellers. From the survey, it was found that the majority of the household heads in the coastal villages sampled are familiar with giant clams. They know giant clams because they used to utilise both their meat and shells.

Only those seaweed farmers who were formerly non-coastal dwellers in Bali asserted that they do not know what giant clams are (Table 1). This group had recently migrated to coastal areas of Nusapenida to work as seaweed farmers. From this, it may be inferred that giant clams are not well known to Indonesians from inland areas.

Table 1. Percentage distribution of responses to the question 'Do you know giant clams?' and 'Are giant clams still available in your village?'

Village	Do you know Giant Clams ?		Are Giant Clams still Available in your village ?			
	Yes	No	Yes	Rare	No	Do not know
Nusa Penida, Bali						
Jungut Batu N = 101	80.2	19.8	21.0	47.5	11.7	19.8
Ped N = 94	73.4	26.6	15.9	47.9	9.6	26.6
Jepara, Central Java						
Ujung Batu N = 18	100.0	-	5.6	27.8	54.4	12.2
Bulu N = 15	100.0	-	13.3	26.7	53.3	6.7

Note : N is the number of household heads responding
 Source : Based on survey data collected April-July, 1990

Giant clams were reported to be very scarce in the survey areas at the time of the survey. In two coastal villages in Bali, for example, more than 47 per cent of household heads responding felt that giant clams had become rare compared with situation 5 to 10 years ago. Also, it was stated that in order to collect giant clams, it is necessary to go further afield and into deeper water. The sizes of living clams which can now be found are only, small (10-15 cm in length).

Extreme depletions of clam stocks was evident from two coastal villages in Jepara. More than 50 per cent of households responding believed that no clam stocks were available any longer in the areas of these villages (Table 1). This indicates that giant clams have been grossly overharvested in these areas.

5. THE UTILISATION OF GIANT CLAMS BY VILLAGERS PAST AND PRESENT

Traditionally (prior to 1970) clam meat and clam shells were utilised by villagers in villages surveyed solely for subsistence purposes. Coastal dwellers harvested clams for food consumption especially when the fish catch was low or the weather was unsuitable for going fishing (the non-fishing season). They collected live giant clams (both small and large) as needed for consumption or sometimes they stored the clams near the seashore in the shallow water until they were required for consumption. Very many discarded clam shells can be seen in the villages surveyed, presumably discarded after the meat was removed for consumption.

Furthermore, clam shells are collected for livestock troughs and water containers for people. Coastal people put large giant clams near wells, or outside their houses to collect rain water. They also utilised clam shells for building house walls and for fences.

Beginning in the 1970s, villagers started trading both clam meat and clam shells in local coastal markets and so clams become to be used for semi-subsistence purposes. Market trading still occurs in Jepara (even though quantities now available for trading are small compared to the past), but not in Bali. Coastal dwellers in Bali stopped harvesting giant clams from natural stocks in 1983 after seaweed culture was adopted.

Clam meat is sold in dried forms in Jepara markets (Central Java). At the time of survey, clam meat which had been salted and partially dried was sold at a price of 2500 rupiah

(Indonesian currency unit) per kg (1 US \$ = Rp. 1825) in the market and retailed at a price of Rp. 3000 per kg. This product is mostly supplied from Karimun Jawa. Fresh clam meat does not appear to be available in Jepara markets or elsewhere (Bombat shopkeeper, pers. comm.). This indicates that no substantial stock of giant clams now exist in the area. As will be apparent later, coastal villagers who know giant clam like the cooked fresh meat of it.

Buyers of salted 'dried' clam are households in Jepara and its surrounding areas. It is said that demand for salted 'dried' clams is not strong.

Shells of giant clams are still collected for a variety of purposes such as ornaments, ashtrays, jewellery, teraso and teralux floor tiles. Four collectors (traders) sell clam shells to the floor-tile industry in Central Java, Jakarta, and East Java. According to Mr. Asik (a trader engaged in selling clam shells for more than 20 years), demand for giant shell clams for this industry has risen. Every fortnight, about 10 to 20 tons of processed clam shells³ are demanded by the floor-tile industry in Jakarta. The price of these processed clam shells was Rp. 250 per kg at the time of survey.

Other market outlets for clam shells are souvenir shops and retailers catering for tourists in the beach areas. These outlets sell clam shells, other seashells and corals. Domestic tourists and local householders are the main purchasers of these products in the Jepara area. They buy clam shells for decorating their home gardens, ponds, and aquariums, and for ashtrays and ornaments in the house. At the time of survey, the retail price of clam shells varied from Rp. 500 to Rp. 5000 each depending on the size of shells, species and appearance of the shells.

The shells of the following species are being sold: *T. gigas*, *T. squamosa*, *H. porcellanus* and *H. hippopus*. *T. gigas* shells are usually purchased for outside landscaping outside houses e.g. around ponds.

6. PREFERENCES FOR GIANT CLAM MEAT AND METHODS OF ITS PREPARATION FOR EATING

The meat of the giant clam can be divided into two components, namely, the adductor muscle and the mantle. Most household heads surveyed like to consume the whole lot of the clam's meat (except the kidney). However, the muscle and the gonad are liked best and are sought

³ The clam shells are separated, broken into tiny pieces, and sorted prior to sale.

after. More than 70 percent of households sampled do like to eat the muscle and gonad of giant clams (Table 2). Household heads prefer these two parts because they are not hard or rubbery in texture, and have a similar taste and texture to squid. Nevertheless, more than half of the respondents said that they also like to eat the mantle of giant clams. It is clear that in these villages the whole clam would be eaten.

Table 2 The percentage of household head responding who have consumed clam meat and their preferences

Villages	Have you ever consumed giant clam meat ?		Do you like it ?		Which part of *) clam meat do you like (most) ?		
	Yes	No	Yes	No	Mantle	Muscle	Gonad
Nusa penida, Bali							
Jungut Batu							
N = 101	77.2 (78)	22.8 (23)	88.5 (69)	11.5 (9)	62.8 (49)	73.1 (57)	88.5 (69)
Ped							
N = 94	68.1 (64)	31.9 (30)	89.1 (57)	10.9 (7)	59.4 (38)	76.6 (49)	89.1 (57)
Jepara, Central Java							
Ujung Batu							
N = 18	83.3 (15)	16.7 (3)	86.7 (13)	13.3 (2)	53.3 (8)	66.7 (10)	86.7 (13)
Bulu							
N = 15	73.3 (11)	26.7 (4)	81.8 (9)	18.2 (2)	63.6 (7)	81.8 (9)	90.1 (10)

Note : N is the total household heads responding.

*) the percentages across do not add up to 100 because some households sampled like more than one part of the clam's meat. Figures in brackets are the number of households responding.

Source : Based on survey data collected April-July 1990.

Not all coastal households sampled have consumed and/or like to consume giant clam meat (Table 2). Where it has not been consumed, it has mostly been because of lack of opportunity. A proportionately higher number of households in Bali compared to those in Jepara have not consumed clam meat. This is because some responding household heads in

Bali previously worked in the non-coastal agricultural sector. They migrated from inland areas relatively recently to these coastal villages in Bali to operate seaweed farms. However, these households may be willing to try clam meat if it is available and if they like it to purchase it in the future.

On the other hand, there are household heads who have tried clam meat but do not want to eat it. This is not necessarily because they dislike its taste, but often because they develop allergic reactions from eating it.

The way in which Indonesian coastal people prepare giant clams for cooking is as follows: first, sand and dirt and foreign matter are removed by washing and the byssal attachment and kidney are discarded. Then, the flesh is cut into pieces boiled and further cooked according to various recipes. Coastal dwellers of Indonesia apparently never consumed clam meat raw.⁴ They always boil clam meat before further cooking it. Boiling is said to be required to soften meat and to minimise its strong smell and bitterness. If more clam meat than needed is collected, household heads dry and salt the extra quantity and sell it in the markets.

Four main recipes are used for preparing the boiled clam meat. It is (1) included in soup with mixed vegetables; (2) fried on its own with some salts; (3) fried and mixed with some additions (soyabean sauce, chillies, onions, and tomatoes); or (4) grilled with some sauces added. All these dishes are eaten with rice.

7. DEMAND FOR GIANT CLAM MEAT BY COASTAL HOUSEHOLD DWELLERS

Previously existing demand for giant clam meat and shells was based on natural stocks. Information about whether coastal dwellers would be willing to purchase clam meat should it become available at the market from clam farms was sought. Household heads in the survey villages were asked “If clam meat is available at the market through clam mariculture, would you like to buy it regularly? Yes/no. If yes, how many clams would you like to buy? If no, why not?”

The results indicate that most of household heads are willing to purchase clam meat (fresh and/or dried) if it is available in the market from clam farms (Table 3). In Jungut Batu

⁴ Note that this differs from the practice in Polynesia where consumption of clam meat is often preferred raw (Tisdell and Wittenberg, 1990).

village, for example, the percentage of household heads who are willing to purchase giant clams (both small and/or large) is about 83.2 per cent (84 household heads out of 101 samples). Some household heads who never consumed clams because of their unavailability, are willing to purchase clam meat if it is available in the markets. The number of clams which would be consumed regularly would depend very much on their price, the family's size and needs.

A family with 6 children, for instance, was prepared to purchase 5 small clams (15 cm in length) or three big clams regularly (twice or three times in a week).

Table 3. Percentage distribution of household heads according to the number of giant clams which will be consumed regularly if clams are commercially available at the market through clam mariculture

Villages	The number of giant clams which household heads would buy regularly						Would not buy clam meat at the market
	Small			Large			
	1	2	up to 5	1	2	3	
Nusa Penida, Bali							
Jungut Batu N = 101	18.8	22.8	4.9	26.7	6	4	16.8
Ped N = 94	15.9	25.5	7.4	22.3	5.3	3.2	20.2
Jepara, Central Java							
Ujung Batu N = 18	-	27.8	11.1	33.3	11.1	-	16.7
Bulu N = 15	13.3	20.0	-	20.0	20.0	-	26.7

Note : N is total household heads responding
Percentages do not add up to 100 due to rounding.

Source : Based on survey data collected April - July 1990

Purchases of clam meats, however, would be affected by its price. If the price of clam meat per kg is higher than fish, many household respondents would rather buy fish than clam meat. Thus the price of clam meat compared to that of fish may be critical for the quantity of sales of clam meat. Fish sells in the villages at an average price of 1500 rupiah/kg (US\$ 1 = Rp. 1825). Thus, if the price of clam meat is Rp. 3000/kg as was the case in Jepara markets at the time of the survey, most household heads would rather buy fish than clam meat.

In brief, there is a demand for giant clam meat by the Indonesian coastal dwellers surveyed. However, the extent of their purchases would be strongly influenced by price. A high market price for clam meat relative to the price of fish would lead to a low quantity of demand for giant clam meat. The situation might be similar for Indonesia as a whole, but the extent to which this is so requires further investigation.

8. KNOWLEDGE OF GIANT CLAM MARICULTURE AND INTEREST IN PURSUING IT

While knowledge of giant clams was widespread, no households sampled in the survey villages had heard that giant clams can be maricultured. This certainly is not very surprising since most coastal rural dwellers in Indonesia are illiterate or almost so and rely heavily on agricultural extension workers to provide information about innovations in agriculture and fisheries since the rural extension workers in the villages did not know of clam mariculture, coastal dwellers received no knowledge about it.

Once household heads were told by the interviewers that giant clams can be maricultured, they showed great interest in involvement in culturing giant clams. Household samples in Bali asserted that they would be prepared to mariculture clams in conjunction with seaweed or separately. Most household heads would be interested to mariculture giant clams not only for their own consumption but also for small-scale commercial sales. More than 80 per cent of household heads said that they would be willing to establish clam mariculture for both their own consumption and for commercial sales that is, for semi-subsistence. A small number of household heads sampled, however, only wanted to culture clams for small-scale marketing and not for their own consumption. These household heads were actually those who were allergic to clam meat. The percentage distribution of household respondents interested and not interested in establishing clam mariculture is presented in Table 4.

Table 4 Percentage distribution of responding household heads interested in clam mariculture and their purpose of such mariculture

village	Are you interested in mariculturing clams ? (%)		What would be the purpose of such mariculture ? (%)		
	Yes	No	own consump	commercial sales	both purposes
Nusa penida, Bali					
Jungut Batu N = 101	93.1 (94)	6.9 (7)	- Nil	11.7 (11)	88.3 (83)
Ped N = 94	94.7 (89)	5.3 (5)	- Nil	15.7 (14)	84.3 (75)
Jepara, Central Java					
Ujung Batu N = 18	88.9 (16)	11.1 (2)	- Nil	18.8 (3)	81.2 (13)
Bulu N = 15	93.3 (14)	6.7 (1)	- Nil	14.3 (2)	85.7 (12)

Note : N is the total household heads sampled;
The number in brackets is number of household heads responding.

Source : Based on survey data collected April-July 1990.

From Table 4 it can also be seen that there are some coastal household heads who are not interested in mariculturing clams. These household heads are mostly those who are elderly (over 60 years). Many feel that they are not now strong enough to culture clams. Household heads with small families are also uncertain about culturing clams because they are afraid they have insufficient family labour to manage it well.

Although a large number of the villagers surveyed said that they would be willing to try giant clam culture in principle, their actual behaviour would be conditioned by many considerations. These would include costs of production, level of returns, market size, management factors, location and availability of suitable grow-out areas. Household heads would be prepared to try culture of clams if the cost of establishing clam culture is not too

high eg. is comparable to the costs of seaweed culture.

9. SOCIO-ECONOMIC ISSUES OF GIANT CLAM MARICULTURE IN RESEARCH VILLAGES: SOME OBSERVATIONS

The development of giant clam mariculture seems possible in our survey areas, especially those in Bali. The marine areas at Jungut Batu and Ped in Nusa Penida, Bali seem to be technically, biologically and environmentally suitable. In these areas, the seawater is clear and salty (no rivers flow into the surrounding sea) and adequate sunlight is received. In addition, the extent of water pollution appears to be minimal compared to the villages in Jepara. Seaweed⁵ can grow relatively well in Bali and it is worth investigating the likely benefit of mixed farming involving clams and seaweed.

However, the success or otherwise of giant clam farming will depend on a wide range of factors. These include economic, ecological and social factors (for more details see Tisdell, 1986, 1989, 1990; Firdausy and Tisdell, 1989, 1990; Tisdell and Menz, 1988;).

The factor most likely to restrict the establishment of clam farms in the surveyed areas is the economic one. This, for instance, includes consideration of markets, production costs, management, technology and infrastructures. Should low production cost technology (extensive farming methods) be adopted in preference to high technology production cost methods (intensive methods)? Also, should the tourist industry which exist in these areas be moved to other locations? There is some competition between tourism and aquaculture for coastal space.

Although the opportunity cost of labour at the village level might be low or negligible, farmers would have the costs of purchasing juvenile clams, placing juveniles in grow-out positions, protecting them initially, checking and removing predators and harvesting. Furthermore, they will initially have to hold their clams as a rule for a number of years before they are sold and they obtain returns-. This contrasts with the situation for seaweed in which cash inflows from sales occur only after a few weeks. This raises the question of whether successful clam mariculture may require investment from outside the village and if so how villagers can be involved in clam growing operations.

⁵ Seaweed can grow fast if the seawater is free from pollution. This might also be the case for clams.

Coastal property rights in Indonesia are not complex because marine areas do not have traditional owners (tribal, village, family owners) recognised by the Indonesian Government. All marine areas officially belong to the Indonesian Government so that it is possible for investors to lease areas from it. Nevertheless, if investors do invest in aquaculture near a village, the success of the enterprise may be dependent on village involvement e.g. through arrangements for 1pharing of production, share-farming. However, village cooperatives like those operating in relation to seaweed culture could also be effective in overcoming capital and other economic constraints on individual villagers wishing to grow clams.

10. CONCLUDING REMARKS

The demand for giant clam meat by Indonesian coastal dwellers appears to be substantial judging from the responses of those interviewed. But, of course, we cannot simply extrapolate these results to Indonesia as a whole. Furthermore, we do not know at this time the exact relationship between the demand of villagers for clam meat and its price, nor the species likely to be favoured for consumption in Indonesia or the species likely to be most suitable for production in different locations in Indonesia.

It is clear that coastal dwellers are very interested in the possibility of farming giant clams. But we are not sure at this stage exactly of the culture method(s) which it would be most appropriate for villagers to adopt for giant clams, nor of the costs and returns which villagers in Indonesia can expect from their cultivation.

Moreover, the economics of including giant clams in polyculture (e.g. with seaweeds, or other molluses) is worthy of investigation in the Indonesian context. Nevertheless, the results of this study lead one to be optimistic about the long-term possibility of giant clam mariculture in Indonesia. Both subsistence and market demand exists for giant clam meat, shells are in demand locally, some forms of mariculture such as seaweed farming have been successful in Indonesia and the coastal villagers interviewed were interested in principle in trying giant clam mariculture. Given the depleted natural stocks of giant clams, farming in Indonesia seems the only possible way to sustain supplies of giant clam meat and supply shells for tourist industry, for general use and for the tile trade.

11. ACKNOWLEDGMENTS

We wish to thank the Australian International Development Assistance Bureau (AIDAB) and, the Australian Centre for International Agricultural research (ACIAR Research Project No. 8823) for financing the survey and this research. Also, we thank the Indonesian Government and the Heads of villages surveyed for allowing the investigations to be carried out in Bali and Jepara, Central Java. Special thanks go to all respondents in the villages surveyed for their kind cooperation in answering questionnaires as well as three field research assistants, namely, I Made Suryantha, Gusti Puja and I Ketut suta.

12. REFERENCES

- Atmawidjaja, R., 1987. *Conservation and management of the marine environment in the Jakarta Bay*, Directorate of Forest Protection and Nature Conservation, Jakarta.
- Brown, J.H. and Muskanofola, M.R., 1985. An investigation of stocks of giant clams (family Tridacnidae) in Java and of their utilization and potential, *Aquaculture and Fisheries Management*, 1: 25-39.
- Firdausy, C.M. and Tisdell, C.A., 1989. Seafarming as a part of Indonesia's economic development strategy - seaweed and giant clam mariculture as cases, *Research Reports or Papers in Economics of Giant Clam Mariculture*, Department of Economics, The University of Queensland, No. 2: 1-35.
- Firdausy, C.M. and Tisdell, C.A., 1990. Assessing species for mariculture in developing countries. *Research Reports and Papers in Economics of Giant Clam Mariculture*, Department of Economics, The University of Queensland, No. 10: 1-35.
- Panggabean, M.G.L., 1987. The status of Tridacnid clam and its preliminary culture stock on Pari Islands, *Biotrop Special Publication*, No. 30: 53-62.
- Tisdell, C. and Wittenberg, R., 1990. Report on possible demand for giant clam meat by Tongan descendants in Australia: Inferences from interviews conducted in the Brisbane area, *Research Reports and Papers in Economics of Giant Clam Mariculture*, Department of Economics, The University of Queensland, No. 8: 1-27.

- Tisdell, C.A., 1986. The economic and socio-economic potential of giant clam (Tridacnid) culture: A review. Research report or occasional paper, Department of Economics, The University of Newcastle, Australia, 128: 1-115.
- Tisdell, C.A., 1989. Pacific giant clams and their products: An overview of demand and supply factors, Discussion Paper in Economics, Department of Economics, The University of Queensland, Australia, No. 7, July: 1-12.
- Tisdell, C.A., 1990. Exploring the demand for farmed giant clams and their components: approaches and problems, *Research Reports and Papers in Economics of Giant Clam Mariculture*, Department of Economics, The University of Queensland, No. 7, February 1-18.
- Tisdell, C.A., and Menz, K., 1988. Socioeconomic aspects of Giant clam Mariculture, in J.W. Copland and J.S. Lucas (eds), *Giant Clams in Asia and the Pacific*, Australian Centre for International Agricultural Research (ACIAR), Canberra, Australia: 246-249.

APPENDIX A

QUESTIONNAIRE FOR COASTAL DWELLERS IN SURVEY VILLAGES REGARDING GIANT CLAMS

1. Do you know giant clams ? Yes/No.

2. Are there any giant clams in your area? Yes/No.
If yes, do you consider them to be common or rare?
Are they less common than in the past? Why is that so?
If No: were giant clams present in the past? When?
Were they common?
.....
.....
.....
.....

3. Do you use giant clams ? Yes/No.
If yes, for what? If not, why not?
.....
.....
.....

4. Do you ever eat giant clams ? Yes/No.
If yes, do you like them? What part of the giant clam's meat do you like the most?
How do you cook it?
If No, why don't you like .giant clam meat?
.....
.....
.....
.....

5. If giant clam meat were available at the market through clam mariculture, would you like to buy it regularly? Yes/No.
If Yes, how many clams would you wish to purchase?
If not, why not? Please explain
.....
.....
.....

6. Have you heard that it may be possible to mariculture giant clams? Yes/No.
If yes, where did you obtain your information from?

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

7. Giant clams can be maricultured in conjunction with seaweed. Are you interested to culture giant clams and seaweed jointly? Yes/No.

8. If you wish to culture giant clams, why do you want to do it?

- a. own consumption
- b. commercial sales
- c. both a and b.
- d. other

Research Reports and Papers in: Economics of Giant Clam Mariculture

Previous Working Papers

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

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