

The University of the South Pacific

Technical Report

**SOCIO-ECONOMIC OF EUCHEMA SEAWEED
FARMING IN KIRIBATI.**

by

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Atoll Research Programme
University of the South Pacific
Tarawa, KIRIBATI

1994

PREFACE

Atoll Research Programme (ARP, now called) was formerly the Atoll Research Unit, then Atoll Research and Development Unit. It was formerly part of the Institute of Marine Resources and now a crucial component of Marine Studies Programme (MSP) of the University of the South Pacific. MSP is based in Suva, Fiji, while ARP is based in Tarawa, Kiribati.

ARP is based on an inter-disciplinary approach to research and analysis of the complex ecological, economic, environmental, social and cultural problems confronting the atoll nations of the Pacific. The programme also seeks to identify solutions by participating in the formulation of policy and project intervention. The specific role of ARP is to assist atoll countries of the University region in the development and implementation of marine related projects and other areas which the atoll countries consider a priority for their development and advancement. There have been much activities going on since the Programme moved to its present location in 1992.

ARP is doing its best to serve atoll countries in the region as stated above but the distance makes it a bit difficult to make regular physical contacts. However, some projects have been drawn up for atolls outside Kiribati. More effort is being made to concentrate activities outside Kiribati and more funds have been pumped in to allow more travels to the atolls. The size of staff is likely to expand to cope with an increasing number of activities in the neighbouring atolls. The present positions are also planned to be upgraded as to increase the manpower capability of the Programme.

ARP is presently staffed by:

- . The Manager/Research Fellow
- . Research Assistant/Project Officer
- . Field Assistant (Ciguatera Fish Poisoning Project, contracted)
- . Volunteers/Field Assistants (2)
- . Mechanic/Technician
- . Administrative Clerical Typist
- . Cleaner
- . Watchmen (2)

COOP students from the University of Victoria, British Columbia, Canada have been on a three-month attachment. The scheme focuses on marine related issues such as pollution, benthic assessment and identification.

A voluntary scheme was initiated by ARP in response to the need to cope with various activities on fish conservation, and management and over exploitation of the marine resources. The scheme also aims at exposing high school-leavers to data collection and sampling techniques and other activities undertaken by ARP. Canadian Government funded the first trial back in 1992/1993 while the current one is being funded by New Zealand Government. ARP is very grateful to these governments and those who wish to support this scheme.

ACKNOWLEDGMENTS

The interview was conducted by Mr. Terib'aa Tabee who joined Atoll Research Programme in late 1992 to early 1993 as a temporary research assistant. Many thanks to the seaweed farmers on the outer islands for their time and assistance in providing information upon which the report is based. Outer island Fisheries Assistants assisted and supported Mr. Tabee during the survey, thank you very much.

Production figures for the three islands visited were obtained from the Atoll Seaweed Company with permission from Bruce Stewart and Teboranga Tioti.

Other reports relating to seaweed farming were obtained from James Uan of the Fisheries Division. Tiemaua Tebaitongo assisted in making some of the reports available to one of the authors. Other relevant documents were borrowed from Kiribati Fisheries Division Library with permission from Tekaua Toakai. Teitioma Ukenio, a Fisheries Assistant on Abemama was consulted for details on the status of seaweed farming on the island.

Temakei Tebano, Fellow and Manager of the Atoll Research Programme reviewed the first draft of the report while Professor Robin South did the final review.

Kam bati n rabwa.

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1. BACKGROUND

Geographically, the Republic of Kiribati, formerly the Gilbert Islands, is situated in the Central Pacific between 172 and 176° East Longitude and between 4° North and 3° South latitude. It is comprised of 33 coral atolls, widely spread over 7,700,000 km² of the Central Pacific, and is one of the largest maritime states in the South Pacific, with a population of 72,335 (Kiribati Government 1993).

Independent in 1979, the Republic is governed by democratically by a House of Assembly, Te M'aneaba ni Maungatabu, whose primary goal is one of economic independence through exploitation and development of the national resources in a manner complementing traditional values, such that the standard of living of 72,000 people can be sustained with reduced dependence on foreign aid and without depletion of the resources. Attention is also being given to readdress the population imbalance created by urban drift to South Tarawa, through development of rural outer islands whose isolated cohesive communities are dependent on increasingly intensive subsistence activities.

Kiribati consists of three main island groups. The Gilbert Group - is located in the western side of the Pacific Ocean, consisting of 16 low lying atolls, which includes Tarawa, the administrative centre. The Line Islands, situated in the far eastern Pacific Ocean, is a chain of 8 atolls which include Christmas Island (Kiritimati), one of the largest atolls in the world. The Phoenix Group, a cluster of 8 small atolls, which are subject to chronic droughts are located between the two groups. Discussion focuses on the Kiribati Group.

1.1. The Gilbert Group:

The 16 atolls are divided into Northern, Central and Southern Gilberts. A notable characteristic is in the dialects and one could easily distinguish between the Northern and Southern dialects.

The islands are further classified as reef and lagoon islands. Usually coral atolls are defined as 'ring shaped coral reefs enclosing a lagoon' (The Pocket Oxford Dictionary of current English, 1992, 8th edition cited in Taniera, 1993). However, not all islands in Kiribati have lagoons and are called reef islands (eg Tamana, Arorae and Kuria). Reef islands are generally small in size and range from 4.73 km² to 19.1 km². Lagoon islands vary from 11.1 km² to as high as 37.6 km² (Taniera, 1993). "The identity and quantity of the major marine organisms varies greatly, depending on an island's size and nature,.... as well as social factors (Zann, undated:3).

1.2. Importance of marine resources

Exploitation of the country's marine resources is the main focus of development in order to increase foreign earnings, provide employment and upgrade subsistence-style living. For the majority of I-Kiribati (people of Kiribati), not employed by Government, copra

represents virtually the sole source of income and provides the country with limited export earnings. With severe land-use limitations Kiribati must by definition look to the sea for its future.

The main categories of fisheries resources in Kiribati include: 1) lagoonal and reef, or "inshore" fishery; 2) the "offshore" fishery, which includes both the pelagic and near-shore deep water fisheries; and 3) mariculture or aquaculture of finfish and seaweed (Thaman and Tebano, 1994:17).

2. INTRODUCTION

The key to sustainable development and progress toward self-reliance lies in the rational exploitation of the country's available productive resources. The broad objective of the country is to give high priority to resource development. Therefore, Fisheries and Marine Resources Sector is aimed to ensure a long term sustainable yield and commercial fishing and subsistence production, thereby meeting export targets and better trade performance.

The objectives of the Fisheries Division that concern seaweed farming are:-

to develop a viable commercial fisheries and marine resources sector including organised farming in the outer islands and the marketing of seaweed overseas;

to diversify marine export opportunities with greater involvement of the private sector to enhance local entrepreneurship in the sector (Kiribati Government, 1992).

Mariculture is not new in Kiribati but seaweed farming is. Giant clam (*Tridacna*) farming was widely practiced. Before a colonial era some portions of the sea (at ocean and lagoon sides) were traditionally owned by a clan or family but this became less effective when Britain declared that everything below high tide mark was crown land. This declaration is about to be discarded and traditional practices are respected and re-instituted.

As the economy of Kiribati becomes more and more cash- oriented, more and more "quick money making" items are being looked into. After the exhaustion of phosphate from Banaba in early 1970's, and as Kiribati becomes heavily reliant on copra and fish as its main export commodities, other products have been added, *Euchema* seaweed is one.

Among other species tried, *Euchema* was found more favourable than other species. The Fisheries Department was involved in the initial trials and implementation of the project. The commercialisation of seaweed farming has taken very slow but positive steps towards achieving its goal, overseas marketing.

The report will discuss the socio-economic of seaweed farming, the problems encountered by farmers and probable solutions for the advancement of the industry. The report is based on the following:-

1. What are the social and economic factors of seaweed farming?
2. Does seaweed farming affect the standard of living of I-Kiribati?
3. What are other factors or products apart from seaweed that raise the standard of living?
4. What are the major problems affecting the output of seaweed products?
5. What benefits do seaweed farmers get from growing seaweed?
6. Are these benefits sufficient to meet the labor involved in farming seaweeds.

3. METHODOLOGY

The study was conducted by the Atoll Research Program of the University of the South Pacific, as part of a larger project to understand and document atoll life and culture. Data was gathered within the context of traditional manners and practices.

Three lagoon islands were visited. Each island was visited for a week. Interviews were conducted according to the length of stay on an island. Interviews lasted from one hour to several hours, key informants were revisited for further information.

4. SEAWEED FARMING

4.1 Research Work

Euchema was introduced to Kiritimati (Christmas Island) in the Line and Phoenix Group in 1977 by the University of Hawaii. Growth on Kiritimati was good, but after an eighteen-month pilot project carried out by the Fisheries Division, the seaweed was transferred to Tarawa in 1982, since wave action in Kiritimati lagoon was found to limit commercial production (Anon. 1987).

Trial cultures indicated that seaweed will not grow ubiquitously throughout the lagoon. Seasonality has been observed giving high and low growth periods. Monitoring programmes have been conducted and maintained for a minimum of one year to assess the seasonality factor. Introduced seaweed was found to grow well in the shallow lagoon reef areas of certain Kiribati atolls (Anon. 1987).

The technology required to farm and prepare this seaweed for export is relatively simple and appears to be compatible with the subsistence activities widely practiced by the rural I-Kiribati (Anon. 1987).

The farming method developed by the Fisheries Division, a variation of that practiced in the Philippines, utilises horizontally positioned nylon fishing line stretched in 7 to 10 metres lengths between mangrove stakes embedded in the sand/coral fragment substrate. Hand-sized pieces of a mature plant are attached to the lines. 30 to 40 plants are grown on each line and a farming group or family might position 30 to 50 lines in one week. The seaweed will grow to 'maturity' or harvestable size in 8 to 12 (average 10) weeks, variable depending on the location (Anon, 1987).

4.2. Environmental parameters for a farm

The basic prerequisites for a suitable farming environment in Kiribati include the presence of seawater recently oceanic in origin, circulating or agitated through tidal or wind driven motions, in areas where wave action is non-destructive. The shallow lagoon areas of reasonable proximity to villages should be accessible by boat, canoe or on foot at low tide. The most common areas are found in shallow water (0.5 m deep) bordering the lagoon flats that dry out at low spring tides. This termed the lagoonal upper sub littoral zone (Anon. 1987).

Certain environmental parameters must be first met prior to the establishment of a farm. These include the availability of the lagoon, the availability of the seeds/seaweed farms in the lagoon, the suitability of the lagoon (good site selection) for growing and the availability of the technology (Raobati, 1985).

The following is an extract on "Environmental conditions for seaweed farming (Source Summary of Kiribati Eucheuma seaweed cultivation project Fisheries Division, June 1984):

1. Current, preferable; good proximity within a lagoon to incoming ocean water (nutrient rich); low level wave action stimulating to growth
2. Substrate; coarse sand/coral fragments/patchy live coral, to enable positioning of stakes, and indicates reasonable water-flow; mud/silt usually indicates little flow - long residence time; presence of other algae with high species diversity (all V except green) usually suggests good water fertility.
3. Wave action: destructive at high levels, but also very stimulatory to growth

4. Sun damage: in a boat, keep covered and moist (out-board fuel destructive); up to one hour partial exposure at lowest spring tides, non destructive
5. Water depth: non specific, but practical knee depth at low tides to enable work; diving for weed in practical
6. Predators: Siganids (rabbit fish) most destructive, if present not much one can do practically, unless seasonal, then high + low periods productivity; Turtles, especially in proximity to *Thalassia* (turtle grass beds), but with more intensive farming (ie. greater than experimental stages), reduced pressure; Echinoderm/mollusc, usually controllable by visiting and cleaning area regularly.
7. Epiphytes: low level, no problem; high level, seasonal growth of large "greens" encircling the lines and *Euchema*, imperative that clearance takes place early or otherwise problem in removing without breaking *Euchema*, in poorer growing conditions, can get fine thread-like "red" growing all over surface; no control just remove infected plants.
8. Fresh water supply: information on water-use limited at present; if centralised washing area then significant requirement, but here in Kiribati even though limited availability, envisage no problems.

4.3. Site selection

Euchema seaweed will grow at profitable levels on most of the lagoon islands in the Gilbert Group. The seaweed will grow profusely in one season eg. January to March. On the other hand it would grow poorly from September to December due to epiphytic infection. It will tolerate good water cover and water flow of up to 5 knots but will not stand high wave disturbance and turbidity (Raobati, 1985).

Proximity to home, suitable protection from poachers and turtles, and loss due to breakages and damage to branches when the harvest is overdue must not be forgotten when considering a good site (Raobati, 1985).

4.4. Commercialisation

It was not until 1986 that 44 metric tons of *Euchema alvarezii* was sold to Coast Biological Ltd in New Zealand. By 1987 645 farmers were involved in *Euchema* planting with a production of 130.8 metric tons over a three-year period.

4.5. Drying and Producing a high Quality Export Product

The fresh seaweed is harvested, put in a boat or canoe and transported to the shore where they are laid out on specially designed racks for drying. Allowed to dry thoroughly for a week and protected during periods of heavy rain, the seaweed is ready for local sale (Anon. 1987).

The drying methods generally used on all islands are basically the same. The widely used ones include:

- a) drying the seaweed on a mat in the sun
- b) hanging seaweeds on a line
- c) oven drying

The easiest are a) and b) while c) is more favourable during rainy seasons. The product is ready when the moisture content is between 33 and 35%.

5. FARMING ON OUTER ISLANDS

The project aims to encourage private sector investment in seaweed farming in order to establish a fully commercial venture with the assistance of the Fisheries Division. Then, having established stable production on trial islands, Fisheries Division aims to assist in export market development, and eventual further expansion of production to other potential islands.

The necessary research and the establishment of production farms (which originated on Christmas and Fanning Islands before being taken to Tarawa) has been conducted by the Fisheries Division.

The privatization of the industry has occurred and Atoll Seaweed Co. is now handling all matters regarding seaweed marketing.

5.1. ABEMAMA

Abemama has a population of 3,243 with a total number of households of 538, and an average number of people per square K is 6. (1990 Census). Abemama has a land area of 27.4 km² and a lagoon area of 153 km². Abemama has a medium sized lagoon with a uniformly deep area (25 m) in the centre by a shallower area which contains numerous coral and sand patches, especially to the west and north (Mees *et al*, 1988). The surrounding reef is small,

especially in the west where it dries out (0.5 - 1.5 m). The two passages on the western reef allow big boats enter the lagoon.

The introduction of seaweed farming occurred in 1983 conducted by Fisheries Division. Commercialisation took place in 1986 when there were 24 farmers and produced 1.5 metric tons (Mees *et al* 1988). Abemama is one of the three outer islands (after Tarawa itself) where seaweed farming had expanded and intensified. Trial shipments had been taken to Tarawa. With an increase in price (45 - 58 cents) of dried seaweed, farmers were further motivated and thus concentrated more on planting seaweed than cutting copra. Their income had improved a bit.

5.1.1 Factors affecting seaweed farming

According to interviewees seaweed production had slowed down somewhat due to:-

- i. Natural Disasters - Occasional Westerlies
- Heavy rainfall
- Exposure to direct sunlight during extreme spring tides
- ii. Tedious labor involved often discourages farmers;
- iii. Long distance between farms and homes compounded by transport problems;
- iv. Lack of proper equipment required for planting;
- v. A drastic drop in price from 58 cents to 33 cents (effective from 1992 now currently used) has disappointed farmers.

5.1.2. General problems related to seaweed farming

A. Equipment

Lack of proper equipment required for planting seaweed has been experienced. In the initial trials of seaweed farming, monolines with a breaking strain of at least 100 lbs, raffia, seaweed bags and seedlings were donated to the farmers from the Fisheries Division. Locally available materials used did not last long and were often neglected. Fisheries Assistants admitted that essential equipment from the Fisheries Division (then) often take time reaching the outer islands.

B. Overdue Payment to Farmers

Currently, farmers weigh seaweed at the Government Station and are paid from Abamakoro Trading Limited. Atoll Seaweed then reimburses Abamakoro. This was a

measure to ensure that prompt payment is carried out. In the past seaweed farmers had to wait for at least a week before they can get their money.

C. Seasonality

For the three year period (1991-1993) the overall growth of seaweed on the island has been very encouraging. However, this is no longer the case. Stakes with empty lines can be seen everywhere and farmers complained that torrential rainfall had caused very poor growth, others do not think so and continue maintaining their farms.

D. Lack of cultivar

Farmers often experience shortage of seaweed seedlings. The main cause of the problem is that they tend to sell as much seaweed as possible and underestimating how much they would require for replanting.

E. Inadequate Storage Facility

The seaweed storage shed is located at Tanimainiku, several kilometres away from Kariatebike, the Government station, where the Fisheries Assistant lives. The shed is constructed of cement and imported materials. One incident of break-in has been reported and a substantial amount of dried seaweed was stolen.

Two storage sheds built out of local materials were constructed at Tabiang village by the seaweed farmers themselves back in 1991. These had not been properly maintained and thus could not be used after a year. A seaweed agent was recruited in December 1993 and dwells in this village. The sheds had been maintained since then.

A possibility of relocating the two storage sheds to Kariatebike next to the existing one as a means of mitigating distance problem was suggested by some farmers. The recruitment of a night watchman as part of the plan would minimise the problem of break-ins, however, the question of who will pay him/her is another question to be answered.

F. Transport

Most farmers face transportation problems. Dried seaweed is being transported on motorbikes and bicycles. Only those who have these means of transportation could bring their seaweed at the weighing times, the others have to borrow the vehicles which in most cases is a difficult thing to do or else they cart their seaweed to the shed. Perhaps Atoll Seaweed Company could hire the Island Council's pick-up truck during weighing times. However, one question remains to be answered, where would the hire of the truck come from? Will the money be collected from those who use the service or ASC bears the cost of hire?

5.1.3. General comments from farmers

- (a) Farmers propose to establish a seaweed association which should handle all matters regarding seaweed problems;
- (b) The Island Council be approached to consider setting up by-laws that will empower farmers collect the breakages being washed ashore during by bad weather;
- (c) The price of seaweed be raised and maintained;
- (d) Assistance to farmers be provided in terms of materials and equipment by the Government or Atoll Seaweed Company Ltd.
- (e) A more efficient system of payment be sought to avoid delays.

5.1.4. Competing products

"The identity and quantity of the major marine organisms eaten varied greatly, depending on an island's size and nature (atoll or reef island), its marine habitats, the area of reef and lagoon, and the productivity of surrounding water, as well as social factors, community structure, fishermen's skills and specialties and the nature and size of the fishing unit. On those atolls with well-developed lagoons, the lagoonal and reef fish are usually the staples, but on reef islands flying fish and tunas are more important (Zann 1982).

Fish, copra, beach-de-mer and shellfish are some of the products competing with seaweed. Other minor products include sour toddy, small scale bakeries and handicrafts. These provide basic needs for the people of Abemama.

(a) Copra:

Prior to the commercialisation of seaweed, copra accounted for about half of the total export. This is one of the major competing commodity to seaweed on the island. Abemama has been known to be one of the highest copra producing island in the Gilberts. Every household makes copra. However, the current drop in copra price from 35 cents to 30 cents has a positive effect on seaweed. (While the report is edited the newly elected Government had announced an increase in copra price from 30 cents to 40 cents per kilogram). A drop in price will significantly affect the level of seaweed production.

(b) Bech-de-mer:

Bech-de-mer is collected on Abemama. It is not a major competing product since the stock is very limited in size. Those employed in the trade have shown their dissatisfaction with some of the main operators who appear to be not being fair to them, however, some income is being generated.

(c) Fresh and salted fish:

Fish provides the major source of protein thus the demand for fresh fish is high. Only few fishermen are involved in small scale commercial fishing. In the past when the Outer Island commercial fisheries was in operation on Abemama fishing pressure was very high. The project faced a lot of financial problems, one being very little revenue generated from the venture and thus operational costs exceed returns. The ice plant facility is now defunct and the fishermen look for alternative source of income. Some take seaweed farming while others go back to copra cutting.

Salted fish play a minor role in the generation of house income. Very often they are sent to relatives on South Tarawa to sell as the prices here are more attractive and the product is on demand.

(d) Shellfish:

Anadara maculosa, *Te bun* is abundant on Abemama. The shell is collected by church groups and sold to the neighbouring island, Aranuka and Kuria, as part of their fund raising activities.

The commercialisation of *Te bun* could be a threat to seaweed farming as people will tend to devote their time collecting it. Although, this resource appears to be abundant a long term exploitation on a commercial basis will soon deplete the stock, so it is very unlikely that it will in the future impact activities on seaweed. *Te bun* collectors may sometimes interfere with the activities of seaweed farmers but this can be sorted out between and among the parties concerned.

(e) Other sources of income:

Other minor sources of income include:-

- i. the selling of sour toddy (kaokioki)
- ii. bread making
- iii. handicraft making such as mats, baskets etc.

5.2. MAIANA:

Maiana Island is the closest island to Tarawa, the capital of Kiribati. It is about 29 kilometres south-west of Tarawa. It is situated at approximately 1 degree North latitude and 173 degrees East longitude. The total area (land, lagoon including its fringing reef) occupied by this atoll is 182.4 km². It has an average rainfall of 1539 mm. The population is 2,180 (1990 Census).

A small-medium sized shallow lagoon contains many coral patches (Mees *et al*, 1988). The surrounding reef shelves gradually widens on the western side. At the intertidal zone many bare rocks and dead corals are exposed during low tide at spring tide.

5.2.1. Seaweed Farming:

Seaweed was introduced in 1987 and was on an experimental basis until 1991. The objective of the project was to raise the standard of living of the people and to diversify marine export opportunities with greater involvement of the private sectors. Farms were abandoned in many parts of the lagoon despite the success of the trials. Numerous problems were encountered and are described later in the section.

5.2.2. Why grow seaweed?

Seaweed farming generates income and provides school fees and daily requirements. It also does not very long (6 to 8 weeks) before harvest. The amount of income depends entirely on the size of the farm. Preference over copra was expressed by farmers as it requires less care.

5.2.3. Why not grow seaweed?

On the other hand there are also people who admitted that due to heavy commitments they find no time participating in seaweed farming. Other excuses include:-

- i) Lack of available seedlings and the refusal of old farmers to donate seedling or cuttings;
- ii) Seaweed does not grow well in the lagoon area close to home;
- iii) Disappointed and lost interest after the destruction of their farms by strong westerly winds or other natural disasters;
- iv) Could not afford to buy their seedling from other farmers even at a very low price (3 cents per kg wet weight).

5.2.4. Factors affecting farming:

1. Torrential rainfall or very dry seasons.
2. Exposure of seaweed plants during spring tides.

3. Damage caused by strong westerly winds resulting in seaweed branches tied onto the lines breaking off and the whole bunch is set lose.
4. Predation.
5. Heavy usage of seaweed farm areas for other activities such as boating (for unloading cargoes and loading copra) and gillnetting.

5.2.5 Farmers Comments:

1. A large proportion of farmers expressed their concern over the present price. They think that the price should go up to match the amount of work put into raising the seaweed. A higher price will probably encourage more farmers to join in and the existing farmers to grow more.
2. Farmers want Atoll Seaweed Company to provide transportation to pick up dried seaweed which are piling up and awaiting collection.
3. Fisheries Division at Tanaea or Atoll Seaweed Co. should have abundant supply of the essential equipment and materials in store which can be distributed to those as quickly as possible to those who need them.
4. Farmers are dissatisfied when their dried seaweed is rejected and are informed by the Fisheries Assistants that their seaweed requires more drying.

5.2.6. Seaweed farming problems on Maiana

The major problems relating to seaweed farming on Maiana encountered both by farmers and Fisheries Assistants are storage facility, unavailability of equipment, rental fees, transport and overdue payments.

A. Storage facility:

The residential home of the Fisheries Assistant provided by the Island Council is now being used as a storage facility for dried seaweed. This has forced the Fisheries Assistant to look for accommodated elsewhere or to stay with his relatives at another village.

The current storage area provided by the Island Council is a room in what it used to be a classroom with a rental fee of 1 cent per kilogram of seaweed charged to all farmers that use the facility. Seaweed will continually be stored at the Fisheries Assistant's house until renovation work on the storage facility is completed by the Island Council.

B. Equipment/materials:

Seaweed farmers do not have proper sacks for weighing seaweed at the storage area. They use locally woven coconut leaf baskets which rot within weeks. The Fisheries Assistant claimed that a shortage of copra sacks is being experienced. He added that even at his house, seaweed are not packed in proper containers.

C. Rental fees:

A rental fee for storage was paid by producers and therefore for every kilogram produced a farmer receives 32 cents and 1 cent is given to the Island Council as rent.

D. Transport:

The Fisheries Assistant on Maiana does not consider transport a major problem to most farmers but it is certainly an issue for those living far off from the Island Council headquarter where most of the activities virtually take place and where the Fisheries Assistant is based. The issue needs to be addressed considering the amount of dried seaweed piling up at farmers' homes. The quality of the product will be affected if not stored in a dry clean place. Very often farmers lost most of the dried seaweed and this is one of the factors that discourages them from continuing farming.

E. Payment:

Prior to 1991 farmers get cash from Waysang Retail Shop at Tebiauea village. The major problem encountered by farmers was payment delays due to lack of money on hand at the shop, an acute problem persisting on the outer islands.

It was then thought that perhaps Abamakoro Trading Ltd. could solve the problem. Farmers weigh in their seaweed at the Fisheries Assistant's place, issued with a docket showing the amount of seaweed sold and its equivalent value. This apparently had improved the availability of cash required by the farmers. Perhaps this means of payment could solve a similar problem encountered by farmers on Abemama Island.

5.3 ABAIANG:

The land area of Abaiang is 17.48 square kilometres while its lagoon covers an area of 182.15 square kilometres. Its reef area is 74.2 square kilometres. A lagoon island with a large lagoon dotted with shallow coral and sandy patches which dry out during low tides at spring tide (Mees *et al*, 1988). The northern part of the lagoon is shallow with some deep areas whilst the eastern side and corner are particularly shallow and sandy. The reef is relatively shallow along the western of the atoll with a spit extending from the north west, but it shelves steeply (Mees *et al*, 1988).

In the 1990 census the population of Abaiang was 5,224 which is the second highest next to South Tarawa. It is reported as being the major producer of seaweed in the country.

5.3.1. Seaweed farming:

During the initial trials of seaweed farming, very few people were involved. Most people were engaged in copra cutting. After observing some farmers harvest their seaweed which generated a few hundred dollars (a huge amount in rural areas standard) a lot of people were impressed and therefore undertook seaweed farming.

During the September 5 - 12 visit in the year 1994, a decline in the production of seaweed was noted. This was due to various factors discussed later in the section. The only village actively involved with seaweed farming is Nuotaea.

5.3.2. Why grow seaweed?

The commercialisation of seaweed on Abaiang is a slow process. However, the people are motivated to engage themselves in the activity having seen that a farmer with a decent size of farm could earn substantial cash more than normally required by any rural household. The purchase of other important items beside foodstuffs is the motivation force behind farming seaweed on the island. Some even consider themselves living luxuriously, that is being able to afford to buy things which they will never dream of buying.

5.3.3. Why not grow seaweed?

The respondents claim that due to heavy commitments in the family seaweed farming was dropped. People are involved in other kinds of export industry which include *Tridacna maxima* harvesting and copra cutting.

5.3.4. Factors affecting seaweed farming?

A decline in seaweed production was reported by the Fisheries Assistant.

(a) Strict control on dried seaweed

Atoll Seaweed Co. Ltd considers a seaweed to be dry if the water content is between 25 to 30%. Recently a 5% water content has just been enforced. Most of the seaweeds have been rejected on the 5% water content.

(b) Seasonality

Farmers have observed both favourable and unfavourable growing seasons. This affects their enthusiasm to grow seaweed throughout the year.

(c) Storage facilities

Unlike Abemama and Maiana where only one storage shed exist, several storage facilities are available, which are either individually or communally owned.

5.3.5. Seaweed farming problems

(a) Competition

A drop in seaweed price will discourage a lot of farmers who naturally go back to copra cutting, fishing, or other less demanding money earning activities.

(i) Copra: remains the major produce on the island. [During the write up of the report, the price of copra has increased from 30 to 40 cents per kilogram more attractive than seaweed].

(ii) Fish: Fresh fish is being sold to the Te Mautari Ltd. Outer Island Commercial Fisheries Centre located at Tabontebike village. Fishermen express their reluctance to sell fish to TML as they would receive less.

(iii) Beach-de-mer: is being collected by few fishermen. The resource is limited and thus would not be is unlikely to be a threat to seaweed farming.

(iv) others include: sour toddy, film show, handicrafts.

(b) Natural Disasters

Strong westerly winds and bad weather often destroy farms. This discourages some farmers but many are still in the venture.

6. SEAWEED MARKETING:

6.1 Local markets

The only sole buyer of dried seaweed products existing in Kiribati is known as the Atoll Seaweed Company Limited owned by the Government. The Fisheries Assistants on the outer island act as agents. They collect dried seaweed from local farmers and ship them to Tarawa where the Company stores them prior to overseas shipment.

A more competitive price can be attained if more private or overseas businesses are encouraged to buy seaweed from farmers. More competition will allow more room for better and higher prices. This will not only foster higher income but a better standard of living and results in the achievement of the seaweed farming project.

6.2 Overseas markets

Atoll Seaweed Ltd buys dried seaweed from the farmers and exports them to New Zealand. There are obviously other overseas companies which are also keen to buy the product. Any buyer which can offer the highest and most stable price will be the best choice. The potential buyers are listed below:

Hong Kong:

- a) Sea Sources Marine Products (HK) Co. Ltd
6-14 Centre Street
General Building
Phone: 5-592286

- b) Summer Trading Company
Rm. 808-809, Wing Tuck Comm Centre
177-183 Wing Lok Street, West
Phone: 5-456035, 456036, 411689.

India:

- a) Apex International
104 Mittal Court B
224 Nariman Point
Bombay 400 021
Phone: 222962.

Japan:

- a) Fuji Chemical Industry Co. Ltd.
107, Nakanoshima
Wakayama
Phone: 0743-23-1247.

- b) Ina Food Industrial Co. Ltd
Nishi-Haruchika-Ina City
Nagano-Pre
Phone 02657(2) 7253.

7. GENERAL DISCUSSION AND RECOMMENDATIONS

A gradual change from subsistence farming to cash economy in Kiribati has a lot of impact on the lifestyle of people both in urban and rural areas especially on the outer islands. In the past people lived on healthy traditional foods such as giant taro or *b'ab'ai* (*Cyrtosperma chamissonis*), coconut, fish, toddy and many others. Now the children and even adults tend to prefer imported and canned foods such as sugar, rice, flour, corned beef, and many more. The rapid growth in human population compounds the problem of scarcity of readily available traditional foods to feed the many mouths. This in turn requires money for the purchase of imported and canned foods. The change in diet composition is the driving force behind venturing into money making activities such as copra, fishing, seaweed farming, to name a few.

The limited land area for agricultural activities or other developments will encourage people to look at the sea as the best alternative. Aquaculture of a few important species such as mullet, milkfish, giant clam and seaweed can generate substantial income to a household or even to the nation as a whole.

Seaweed farming has been introduced in some islands and more trials are being made on others. Although some income could be derived from such an activity, there are acute problems that need to be addressed and considered, some of which are beyond human being reach. A lot of input from the concerned parties including the government would be required to allow *Euchema* farming become one of the major export commodities of Kiribati.

The farmers interviewed pointed out that the price of dried seaweed should be increased so that they could still have some money on hand during off-seasons. Perhaps a review be made by the Government but this may be difficult in a case where there is only one buyer. Other overseas buyers beside the present one may be willing to offer a better price in which case competition between two or more buyers may be encouraged. One alternative is to bring in other strains which will grow during *Euchema* off-season. This of course does not overlook substantial research on the new strains, the lagoons' environmental, physical, chemical and biological conditions.

The transport problem which is common in all the three islands visited could be solved through several schemes. The company or whoever is responsible could erect several storage facilities across the island where two or three villages can share. This will minimise the long distance farmers have to travel in order to get their dried seaweed weighed in. The agent arranges the weighing times that suit the farmers. Another possible solution is to make the handcarts and bicycles readily available at cheap prices and given to the farmers who are willing to pay back a certain amount of money each time they sell their seaweed towards the

cost of the items. there are governments that can provide such things in the form of aid in kind or as gifts. Other alternatives could be easily considered as the need arises.

Overdue payments has been one of the constraints particularly when a needy farmer had to wait for several days which in rural terms is a long time since other sources of generating income is pretty scarce. It appears, however, that payment via Abamakoro Trading Ltd. temporarily solves the problem. This can continue for a long time as long as the company's operation on the island is not interrupted. Other alternatives have got to be envisioned before any shortcomings arise to avoid any further frustration by the farmers.

The price of copra which had gone up from 30 cents to 40 cents while this report undergoes editing or other commodities such as bech-der-mer or even fish products should not be seen as threat to seaweed farming. Rather they should be encouraged to be part of a house income activity to improve our living standard by being able to purchase our basic needs and to invest for the future of our children.

Living on an outer island is a challenge to everybody. Dependence on imported materials and tools can make things even worse. But one has got to be able to use locally available materials and tools in order to move forward. It is understandable that seaweed farmers face these problems which in most cases can not be helped. If the materials or tools are not available on Tarawa then nothing can be done. The use of local materials costs nothing except that they need to be replaced every now and then.

Predation on the seaweed is not a major problem. Triggerfish or other herbivorous fish will do insignificant damage in the existing farms as compared to other farms in other parts of the world. In addition natural disasters such as westerly winds, bad weather or torrential rainfall can in no way be controlled, they have to be taken and accepted as such.

The support of the Government is paramount at some point especially when it comes to national interest. Seaweed farming is presumed to have both bright and dark sides, however, the Government through its Ministry of Environment and Natural Resources Development has taken a positive step in initiating seaweed farming in the country. The project had been very successful in some lagoons and more trials will be carried out soon on the rest of lagoon islands. It is in this context that the problems associated with seaweed farming should not be left to the farmers and buyers of the product but the Government should take a leading role and to make sure that this venture attracts overseas markets. The Fisheries Assistants on the outer islands play a very crucial role in the implementation and management of farming activities on their respective islands. Their technical expertise and experience are vital in all aspects of farming.

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