

The Development of Open-Water Algae Farming in Zanzibar: Reflections on the Socioeconomic Impact

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# The Development of Open-water Algae Farming in Zanzibar: Reflections on the Socioeconomic Impact

This article outlines the development of commercial open-water algae farming in Zanzibar in a historic context, with special reference to actual events at the corporate level from the initiation of algae-farming to its present state. These events, which contain policies and intentions of implementation at the producer level, have an array of social implications for the algae-farming communities. The three aspects of these implications are delineated; (i) a changing mode of tenure rights of the farmed lagoon areas; (ii) a changing role for algae farmers, i.e. women; (iii) a qualitative change within the composition of indigenous productive activities, the latter being illustrated by a declining activity in agriculture. The article demonstrates the importance of the encounter between an indigenous livelihood system and infused incentives pertaining to divergent rationales of livelihood in socioeconomic development processes.

## INTRODUCTION

Open-water algae farming on a commercial basis is widely practiced throughout the world. The Philippines, Indonesia, Canada, Chile, are among the largest producers of carrageenan carrying algae (1). In recent years, Zanzibar has become yet another producer.

The development of algae farming in Zanzibar has a prehistory of algae culling, but commercial algae farming was not practiced until 1989. From 1989 onwards, the activity grew at an enormous rate both in terms of farming sites and in number of farmers. By 1991, it is estimated that around 10 000 people were directly involved in algae production and three to four times more than that number were more or less engaged, in not less than 19 different localities (2).



The spatial organization of algae farms outside the village of Paje. Space for productive alga farms has become scarce.  
Photo: P. Pettersson-Löfquist.

This very fast increment constituted a puzzle for social scientists: How was it possible that a mode of farming which had never been practiced in Zanzibar could develop so rapidly? This question was the starting point from which two field studies on the issue of algae farming and its social environment were carried out.

The field studies have provided a possible answer to the question. Initially, we can say that it is a complex process which contains both normative aspects and situational and context-dependent variables. The process is not confined to either/or but to both and, furthermore, is also influenced by the social and economic structure of Zanzibar, which is a major prerequisite for the occurrence of algae farming.

## THE DEVELOPMENT OF ALGAE FARMING IN ZANZIBAR

### The Period of Algae Culling

In Zanzibar, culling of wild growing species of algae for export began around 1950 (3). In 1951, approximately 400 tonnes, dry weight, of algae were exported, a figure which rose to 500–800 tonnes in 1969/70. The business was controlled by private businessmen operating through a system of middlemen, who purchased algae from fishermen in various shoreline localities.

From the early 1970s, the Zanzibar Government changed the system of handling the export. The Zanzibar State Trading Corporation (ZSTC) took over the business from private exporters. However, the new officials lacked relevant experience, which led to a significant decline in export tonnage (4).

The export of algae continued during the 1970s on a rather small scale, contributing to around 0.2% of the total value of domestic export (5). Most of the algae was collected on Pemba, but some came from the southern and eastern shores of Zanzibar Island (6).

Towards the end of the 1970s the export price of algae rose. The efforts to take advantage of the higher price led to an intensified culling of algae. In 1978, the export of algae and seashells reached a peak, being 2.36% of the total value of domestic export. The natural resources of algae slowly became depleted and the people who collected algae tried to compensate for this by mixing the algae with other species as well as other forms of organic material. As the quality of the algae declined, the price fell substantially and export activities soon came to a halt. After 1982, almost no algae were exported.

### The Development of Commercial Farming of Algae

During the period of culling in the mid-1970s, a marine biologist, Professor Mshigeni, made field observations on the distribution pattern of *Eucheuma* species and collected samples for taxonomic studies (7). Having heard of the practice of algae farming in the Philippines, he proposed the introduction of algae farming in Zanzibar (8).

With financial support from USAID, Professor Mshigeni ini-



Features and shape of an algae farm. Proprietorship of one farm does not indicate that adjacent farms are controlled by the same or to her related farmers. Rather, the distribution of farms indicate the overall and fast growth of the activity which means that a farmer may have farms at many different localities within the cultivated area. Photo: P. Pettersson-Löfquist.

tiated three pilot farms in 1983/84: one in Fumba on Zanzibar island, one on Pemba and one at Kigombe, close to Tanga on the Tanzanian mainland coast. The farming activities focused on indigenous *Eucheuma cottonii* and *E. spinosum*, but both attempts failed after some time.

However, increasing demand for *Eucheuma* on the world market, combined with insecure supplies of algae, made the major multinational algae processors, FMC and Hercules, look to Zanzibar as a potential producer.

With the liberalization of the Zanzibar economy during the latter part of the 1980s, and the collapse of ZSTC's monopoly on export commodities, private companies were allowed to become involved in export and import (9). The new Investment Act in 1986 was introduced with the explicit purpose of promoting foreign investments (10). These changes paved the way for FMC and Hercules to introduce commercial algae farming in Zanzibar.

They established contact with local purchasing and exporting companies and in November 1988 Zanzibar Agro-Seaweed Company Ltd. (Zascol), in affiliation with FMC, registered with the Zanzibar government, and a few months later Zanzibar East Africa Seaweed Company Ltd (Zanea), affiliated to Hercules, did likewise.

Zanea obtained farming inputs e.g. stocks of plastic cords and nylon ropes as well as know how, from Hercules, and experts on algae cultivation from the Philippines were stationed in Zanzibar. In February 1989, a pilot farm with *Eucheuma cottonii* brought from the Philippines was set up in Jambiani, on the southeast coast of Zanzibar. Farming went on for two months, but failed to reach a sufficiently high growth rate due to epiphytes. Zanea were close to abandoning the whole project but decided to try *Eucheuma spinosum*, a species which was believed to be easier to grow.

In June 1989, three kilos of *E. spinosum* were brought from the Philippines in a cool bag. A pilot farm with *E. spinosum* was set up in Jambiani. The algae grew well, therefore, it was decided to set up five pilot farms on various sites around the island in order to test the feasibility of the project and the interest of the local population. Soon a number of villagers in Jambiani had started their own farms. When the farms in Jambiani proved to be successful, farming started in Kiwengwa and from there spread to new areas.

In June 1989, Zascol initiated pilot farms in Paje, a neighboring village to Jambiani, using indigenous *E. cottonii*. But even here, farming activities failed due to epiphytes.

From the start Zascol chose to organize the farming on a company basis, i.e. they wanted to own the farms and employ people to work as wage laborers. The villagers, however, opposed such a solution. When the farming of *E. spinosum* turned out to be a success in Jambiani some villagers from Paje brought *E. spinosum* from Jambiani and started their own small farms.

During the fall of 1989, FMC advised Zascol to farm *E. spinosum* instead of *E. cottonii* and in February 1990 Zascol started *E. spinosum* farms in Paje. As more and more villagers started their own *E. spinosum* farms, Zascol abandoned the idea of incorporating the farming within the sphere of the company, and instead encouraged villagers to start their own farms. FMC provided Zascol with loans to buy inputs and to be able to purchase the first harvests.

Knowledge about the algae-farming activities on the south-east coast and the profits that could be made soon spread to other villages. This, in combination with an active search for new areas from the companies themselves, led to farming soon spreading to other areas. To facilitate the introduction of algae farming, Zascol raised the price paid to the farmers in late 1990, from 45 to 60 Tsh kg<sup>-1</sup> a price still prevailing in late 1993 (11). Even though Zanea disliked this measure, they had to raise the price to the same level in order to keep their farmers.

### The Present Situation of Algae Farming in Zanzibar

After an initial phase of expansion to 1991, when farming had spread to virtually every village on the east coast of Zanzibar Island, algae farming levelled out at an export amount of 2000 tonnes of algae; 1500 tonnes from Zanea and 500 tonnes from Zascol (12).

In the annual records of the total export there are no indicators of increased total production (Table 1).

Table 1. Exported quantity of *Eucheuma spinosum* from Zanzibar 1990 to 1993.

Year	Exported quantity tonnes
1990	261.3
1991	2492.8
1992	2123
1993	2044

Source: Commission of Fisheries, Zanzibar Mwani Uliosafirishwa Nje Ya Zanzibar.

The question which could be posed about the figures in Table 1 is whether stagnating export is due to stagnating demand on the world market or difficulties at the local levels related to enhancing interest and production capability among farmers? The latter explanation seems to be most likely since the managers of the purchasing companies estimate a viable demand of 5000 tonnes algae from Zanzibar. Thus far, they have not reached that amount, but are considering new areas for farming and intensified enhancement campaigns directed to algae farmers in present farming sites (13).

Another indicator of the growth of algae farming, apart from export figures, is the number of registered farmers, a figure which is much the same in 1993 compared to that of 1991. According to the companies' statistics there are 10 592 farmers registered. It is also estimated that every registered farmer gets assistance from 3–4 family members or other people.

The total number of people living in the farming area is estimated to be around 50 000; 28 000 people within Zascot's concession areas and 22 000 within Zanea's (14a); of this total number of people, around 50% are above school age. Counting the number of registered farmers, around 40% of the adults in these villages are algae farmers. If one adds the assistance from family members, then according to these calculations, all adult villagers in the area are in one way or another involved in algae farming. Consequently, in a case-study in one village in 1991, we estimated that around 90% of the adults were engaged in algae farming, but we also discovered that an overwhelming majority of farmers were women and that men mainly assisted during the harvest.

Thus, the figures presented in above reveal that in terms of number of farmers it appears that algae farming has reached its potential. A further expansion of algae farming would need increased productivity per farmer, which includes incentives such as raised payment, and improved farming techniques (14b).

## CHARACTERISTICS OF OPEN-WATER ALGAE FARMING

The shallow lagoons between the shore and the coral reef of eastern Zanzibar are favorable for cultivation of *Eucheuma spinosum*. All biological and physical requirements are met: i.e. unpolluted, clear seawater protected from strong winds and waves by the reef; a water temperature of 27–30°C; a firm sandy and rocky bottom with minor vegetation, and good water motion and exchange, submerging the algae also during low tide.

An algae farm consists of planting units, or modules, with strings on which algae plants are attached with plastic cords 10–20 cm apart. The strings sometimes called monolines are normally 3 m wide and fastened to stakes firmly stuck in the sea bottom. The strings are put 25–50 cm apart to form rectangular plots (Fig. 1).

When a plot is planted with seedlings it takes 40 days to reach a sufficient harvest size. The plants are reproduced vegetatively, thus, when harvesting, the stems of the plants are cut off and minor parts are left to grow for another 40 days. In the meantime, during the period when the algae are growing, the farmers have to weed and clean their farms from the epiphytes that hamper growth, and from drifting seagrass which catches onto the strings and if not removed may break them.

The work involved in algae farming is closely related to the dependence on the tidal cycle. The difference between low and high tide is substantial in Zanzibar, 4 m at most, which means that farming activities are only possible during low tide. The tidal cycle follows the lunar month with the low and high tides at their greatest disparity at full moon or new moon every second week, i.e. at spring tide. The smallest difference of low and high tide occurs at neap tide every second week between the spring tides. This fortnightly periodicity is intersected by daily low and high

tides twice a day with about 6 hrs time difference.

The tidal cycle affects algae cultivation in such a way that farming activities can only be carried out for one week twice a month with a working day in the lagoons of five to six hours.

When the harvest is carried to the village, the algae are laid on plaited palm leaves and left to dry in the sun for three days. The algae loses 80% of its original weight when dried. When dry it is put and stored in sacks until it is sold in the purchasing firms' local offices in the villages.

The algae farms are owned and farmed individually by villagers in the coastal communities. The necessary inputs of nylon strings and plastic cords are provided free of charge by the purchasing firms which, in turn, expect the farmers to sell to them. There are, however, no written contracts between the farmers and the companies apart from registration in the companies' files when inputs are distributed.

## SOCIAL CHANGE AND ALGAE FARMING

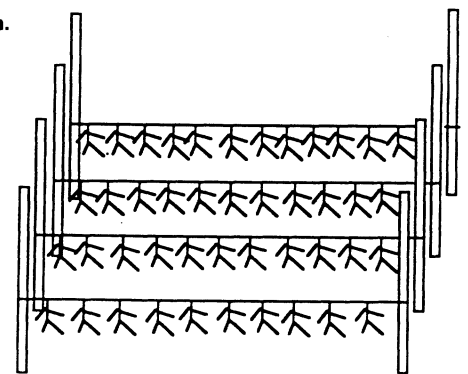
### Tenure Rights of the Algae Farming Area.

There has been no traditional use of the cultivable area, except for collection of shells and sea cucumbers. The latter being intensified in recent years due to the opening up of markets for sea cucumbers in the Far East; e.g. China and Hong Kong, and subsequently the species has become a commodity of monetary value. However, there are no specific indigenous tenure rights of the lagoon area other than intervillage rights. Thus, each coastal village has its own coastal zone, which reaches as far out to sea as is commonly viewed as the normal distance for canoefishing. Coastal zones are demarcated along the shore by reference to intervillage boundaries on land and certain reference points on the reef, e.g. openings in the reef. Specified intravillage tenure rights are generally nonexistent. All villagers have free and equal access to the algae-cultivable area.

The kind of communal tenure rights with which we are dealing here, have their parallel in eastern coastal agriculture, where formalized ownership of land is nonexistent (15–17). Farming land is acquired on the basis of agreement with adjacent farmers or with local authorities. The land can, however, never be individually owned, rather, practice shows that only permanent tree-crops, e.g. coconut palms, or permanent fences, e.g. stone walls, have any kind of *de jure* owner. Yet, farming land has gained customary status as more or less bound to its *de facto* proprietors. Nevertheless, on several occasions I was informed that land is not owned, only the planted crops and what the farmers build on the plot are his/her property.

Applied to algae farming a similar pattern seems to evolve. The ground, or sea bottom, where stakes are dug down, and where one chooses to locate an algae farm can, accordingly, never be looked upon as the property of a farmer. Here, as with agricultural land, the lagoon is subject to the community. Hence, only what is built and planted for algae production are the farmer's property.

Figure 1. An algae farm.



However, there are circumstances in which tenure rights to the lagoon do differ from those of agricultural land. These pertain to the fact that the algae purchasing companies hold governmental concession rights to a certain area of the lagoon. In a sense, this implies that a counterpart who does not take part in village life has influence on questions of tenure rights in the lagoon. An influence not based on mutual oral agreements at the local level, but on written formalized documents at higher central political and administrative levels. Hypothetically, a situation may evolve in which a company imposes farming in those areas in opposition to the local population (18).

The company registers algae farmers during the sale of products and/or when inputs for farming are distributed. Hence, there is a direct bond between purchaser and producer and ultimately to the rights of tenure. This latter feature of algae farming has similarities with what commonly is labeled “contract farming” (19). Contract farming, in its ordinary sense, requires a formal contract of amounts, quality, and cultivated acreage between purchaser and farmer, while the purchaser provides input materials and credit and the farmer retains control and tenure rights over his land. In algae farming, there is a more abstract “contract” pertaining to the concession documents, to which the local populations are implicitly associated. At the concrete level they are, for example, educated in appropriate farming techniques and quality control and subject to production enhancement campaigns.

To summarize this section, we can say that the indigenous tenure rights of the lagoon area have undergone a significant change towards an amalgamation of communal ownership and a more or less formalized contract-based proprietorship. However, this observation is not commonly conceived by the farmers themselves who generally state that their farming activities are still dependent upon indigenous notions of tenure rights.

### The Social Organization of Algae Farming

The social organization of algae farming has features similar to that of agricultural farming (20). The above-mentioned communal ownership is an aspect of this, but there are similarities also within the practice of algae farming itself; although algae farming is, principally, a female dominated and controlled activity while agriculture is not.

From this follows that the organization of algae farming diverges from agriculture in some respects, above all in two significant but interrelated aspects. First, it is normally a man who has control over the agricultural produce, selling it at the market and controlling the revenues. Algae farming, is a female dominated activity, and women both sell and keep the income and decide on the use of the revenues. In no case did I hear of a spouse claiming the right to his woman’s income. Instead, if such claims are expressed, it seems that they are based on a system of informal loans. Second, women are seldom if ever at the marketplace as vendors or customers, selling or buying agricultural products. This is related to the Muslim ethos, *sunna*, from which it follows that men are obliged to support their families and hold responsibility for daily purchases (21). If women want to sell their own produce they generally have to go through a middleman. Now, with the introduction of open-water algae farming women have altered this previous practice, thus, they are selling their own produce of dried algae directly to the companies without any middlemen. When women line up at the company offices to sell their produce, the situation sometimes resembles that of the marketplace; e.g. lots of people have gathered, there may be hawkers around, it is noisy, and the women may be dressed in their best clothes.

These features of algae farming entail a realization of a women’s autonomy in economic terms, but also their social and political autonomy. Women have gained respect for an activity which lies outside their customary domain and they are able to

contribute not only to their own well-being but also to the households as such. There are also indications of women who make use of their formal rights to divorce, when they are able to pay back the bride-wealth, *mahari*, and of women who choose to marry a man without being dependent on his ability to support a family.

But why then, did algae farming become a female activity? There are several reasons for this, which can be divided into two broad categories. First, there are the culturally significant or normative aspects, and, second, situational or context-bound aspects.

Initially algae farming was practiced by both men and women on more or less equal terms. They undertook the same tasks and maintained their own farms. However, towards the end of the initial phase of algae farming, which I elsewhere label the phase of innovation (unpubl. data), the farming practice was perceived, principally, as a female activity. Women state on the topic that men viewed algae farming as play, and that it was necessary for them to take over since men could not maintain a caring attitude towards the algae. Although this statement is a bit incisive and opportunistic, maintenance such as weeding is the principal task in algae farming, something which is also perceived as a female task in agriculture. In addition, algae farming is situated in an area where women are accustomed to collect shells, *chuwale*, *kombe*, and sea cucumbers, *majongo*, and where they go to spearfish octopus, *pwesa*, on the reef. They are also accustomed to work on the beach with the preparation of coconut husks for making coirropes. On the other hand, men do not traditionally work in these parts of the lagoon area. They generally go fishing by boat or by foot further out.

Women work among other women when they are in the agricultural fields. This practice may also have facilitated women’s participation in algae farming, where the plots lie agglomerated and where much of the work is done while talking and joking with each other.

These aspects of rather superficial similarities between agriculture and algae farming are neither necessary nor sufficient premises to explain why algae farming has become a female activity. But they are, nevertheless, ingredients in the complex of prerequisites which lie behind the rationale of why women turned to algae farming as a primary income-generating activity.

Turning to a more situational analysis, the introduction of algae farming came in a situation when trade had been liberalized and the local shops were “bursting” with consumer goods (22). Under these circumstances a cash income became increasingly important to sustain local life styles and living conditions, and would thus have played an important role in the rapid development of algae farming.

Men generally had a cash income of some sort and regularity, as did women, but female income was often significantly smaller and insufficient in relation to their aspirations (23). In this context of liberalization and monetization men continued with their occupational activities and women turned to algae farming. When the potential of algae farming to improve the lot of women became obvious, women turned to this activity.

The importance of algae farming at the community level and for women, are further illustrated by the changing composition of indigenous income-generating activities, especially in relation to the declining activity in agriculture.

### Declining Agriculture

Already in 1991, it was indicated that agricultural activities were diminishing, although it was not explicitly acknowledged at the time. During the field study 1993 I met no one who claimed that agriculture was practiced to the same extent as some years back or perceived this process as being problematic.

It seems that indigenous family agriculture as well as agri-

cultural output have declined drastically in recent years, mainly because of women's commitment to algae farming. In theory it would still be possible for women to uphold agricultural activities every second week, since algae farming is practiced in fortnightly cycles.

However, the incentives to continue agricultural activities have diminished as the women receive a substantial income from algae farming compared to revenues from agriculture (24). Moreover, women's preferences were, already in 1991, directed to activities performed in the village or in its vicinity, e.g. embroidering Muslim caps, *kofia*, and algae farming, rather than to agriculture, which was perceived as very laborious. But these village-bound activities had not at the time become viewed as viable alternatives to agriculture.

Material change such as the introduction of new occupational sectors might have lags regarding how soon changes will appear in indigenous sectors, in this case agriculture. It is likely that indigenous notions pertaining to an appropriate livelihood, e.g. to uphold agriculture, prevailed for some time before they decreased in the light of realized opportunities and in line with a preference for better working conditions.

It would appear natural that it is the older women who have been accustomed to working in the fields, and who may still recall the difficulties in obtaining food in the mid-1980s, who still attribute value to agricultural activities. They still cultivate small agricultural plots for subsistence, but they also admit that they do not work as much as they used to do and that food can be obtained from the village shops more easily today than some years back.

The gradual abandonment of family agriculture should not only be seen as women's withdrawal from this activity. However, their more or less collective act is probably crucial. The process must be seen as simultaneous to men's opportunities to acquire income through other sources than agriculture, such as increasing quarrying of limestone and extraction of lime chalk for the construction sector (unpubl. data).

Since women have become self-supporting to a greater extent, male capital has been freed and opportunities to make innovative investments in agricultural lands have become possible. In 1993, some men in the community studied, prepared fields and planted a total of approx. 25 acres of citrus trees. These tree crops have never been cultivated in the area before, but constitute a recently discovered means of using local resources productively. Moreover, it seems to be an ingenious way to cope with the changing gender-related division of labor within agriculture, since tree crops do not have to be maintained as extensively as traditional crops, and less input of labor may be sufficient to sustain cultivation.

This recent development may manifest a process of diversification along genderlines within the array of indigenous income-generating activities, which was started by the introduction of algae farming and its subsequent effects on various activities dominated by females (unpubl. data).

## CONCLUSION

The development of open-water algae farming in Zanzibar has led to manifest and visible results, not only at the corporate level and in Zanzibar's economy, but also at the local level. The encounter between the algae purchasing companies and the algae farming communities has changed important aspects of these communities' livelihood systems, which include a direct link to the world market and the global price fixing on commercial algae.

Algae farming today is perceived as an important activity that influences life in the algae-farming communities. The practice has increasingly become an integral part of a female occupational structure and, thus, created a marked effect on indigenous life-

styles. A traditional division of community members into two more or less equal halves; where one half of the population was mainly engaged in agriculture and other terrestrial activities, and the other half dealt mostly with aquatic activities, has changed since the establishment of algae cultivation. Today, a significantly larger share of the coastal population spends more productive time on sea-based activities.

This has not only led to a heavier reliance on lagoon activities, but also furthered a specialization by gender which has caused a decline in activities organized through joint efforts, e.g. in family-based agriculture.

So far, algae cultivation has had positive effects in regard to livelihood strategies and has also led to a decline in the risk of deprivation. Nevertheless, it is likely that the local economies will increasingly become tied to the future price of the algae and, consequently, the means for power and control over local livelihoods will be handed over to market forces.

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11. Approximate exchange rate: 1 US \$ 450 Tsh (November 1993).
12. The figures are built on the companies statistics on production.
13. For an account of different farming sites see (2).
- 14a. The calculation drawn from the 1988 population census with adjustments for the population growth up to 1991.
- 14b. From recent information, only days before printing this article, it appears that the price paid to farmers has been increased from 60 Tsh to 75 Tsh. This increase in price has led to a significantly raised productivity indicated by the 1994 export figures: 3652 tonnes as compared to 2042 in 1993. Shechambo F. and Ngazi Z. 1995. *Socio-Economic Impacts of Seaweed Farming in the East Coast of Zanzibar*, Paper presented at the Workshop on Socio-Economic and Environmental Impact of Seaweed Farming in Zanzibar, Zanzibar Reef Hotel, 3-5 October 1995.
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18. In fact a similar but opposite dispute evolved in early 1991, when the concession holding company of a village was unable to pay the farmers for their harvest, the farmers turned to the other company and that company adopted, after some strain, the village and later got the concession rights. See (2)
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24. An average monthly income from algae farming would lie in the interval of 2000-5000 Tsh. A ratio of 1:3 compared to agriculture. See also (15) for figures on income from agriculture.
25. I am greatly indebted to all my interviewees who so persistently helped me during both field studies. I must also express my gratitude to Mr. Staffan Eklund who co-authored the first publication in 1992.

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