



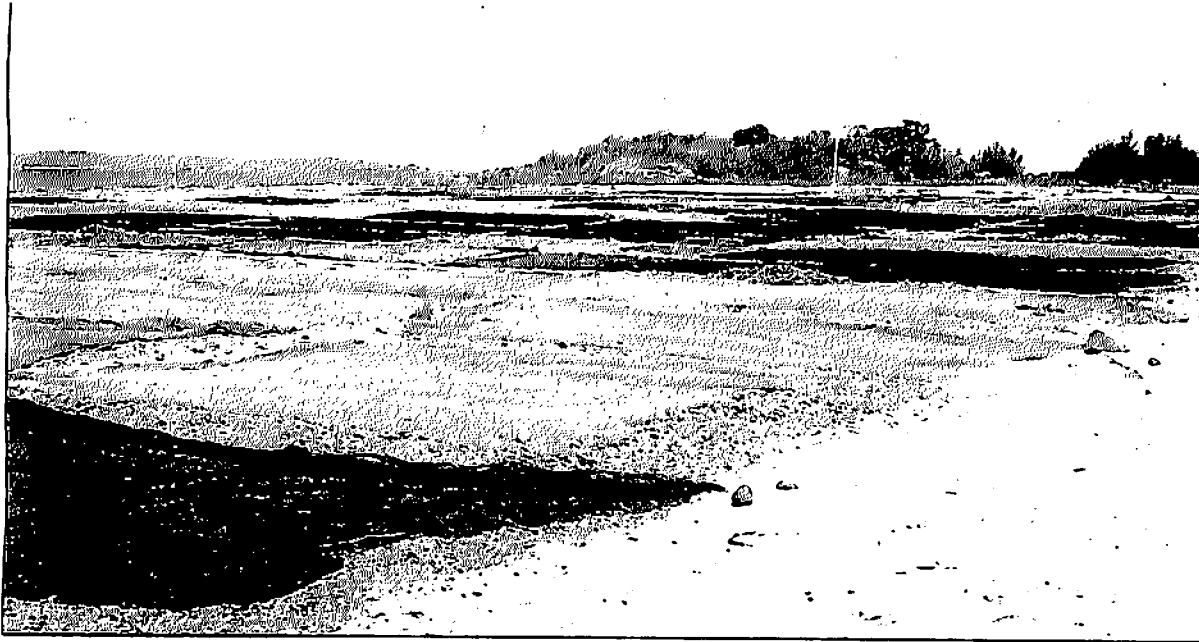
PHOTOS BY A.M. HATTA

A woman drives a canoe loaded with newly harvested seaweed in Jungut Batu, Bali.

# Seaweed-Based Economic Activities in Lombok and Bali, Indonesia

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*Seaweed production is an important, though secondary, activity for fishers in eastern Indonesia. In Lombok and Bali, however, it is a major enterprise involving whole village communities in a range of activities from trading to tourism.*



A typical drying platform belonging to a multinational company in Serewe, east Lombok, Indonesia.

## Introduction

Economic aspects of seaweed culture in Indonesia have rarely been examined. Any discussion has always emphasized macroeconomic terms, such as national demand, market and export potential. Seaweed-based economic activities in eastern Indonesia can be mainly divided into two 'traditional' patterns, gathering and culture. Seaweed gathering is a secondary activity for fishers, while culture is a major activity, together with fishing. Both gatherers and farmers are not motivated yet to diversify their economic activities, and so we like to define these two patterns as a narrow spectrum of economic activity.

Seaweed culture in east Lombok and Nusa Lembangan Bali differ from the above pattern. Seaweed has a very important value in these two regions. The trade in this commodity is able to accelerate the socioeconomic development and create a wide spectrum of related economic activities for whole villages.

There are two important species of seaweed cultured for economic purposes, i.e., *Kappaphycus alvarezii* and *Eucheuma denticulatum*. Both species are used in the carrageenan industry. Culture of these algae in Lombok and Bali is intensive and large scale. The cultured seaweed production in Bali in 1994 was 92 398 t, while average production of cultured seaweed in Lombok (1990-94) was 15 784 t. In Lombok, the fishers also gather wild seaweed, especially the agarophytes of *Gracilaria verrucosa* and *Gelidium latifolium*. The average production of wild seaweed (1990-94) in this region is 511 t. These agarophytes are consumed by regional agar industries and home industries in eastern Java.

Seaweed culture in protected areas of Lombok (Batunampar, Serewe and Gerupuk villages) is done using bamboo racks. The sizes of the racks are 8-10 m x 10 m supporting 38-50 ropes (lines) In Jungut Batu (Bali), which is more exposed, the farmers apply an off bottom net with average size about 10 x 13 m.

## Seaweed Culture Management

The seaweed based economic activities in Lombok and Bali are strongly influenced by the management of the culture. Based on our survey in these areas we classify the management of the culture into three types: (1) traditional dependent; (2) moderate semi-independent and (3) intensive independent. In the first type, all activities on the culture are regulated based on traditional paternalistic relationships, simple calculation and no capital involvement from outsiders (companies or regional traders). Further, the farmers or village collectors may sell their product to the company or trader who offers the best price. An example of this type is found in Batunampar, the oldest seaweed center in Lombok.

In the second type, the paternalistic relationship still dominates the management but the farmers begin to accept capital from the regional trader. The connection between trader (capital provider) and farmers is indirect; there is always a farmer-mediator. Usually this trader acts as the representative of a big company in Java. The farmer has an obligation to sell the majority of the product to the coordinator at the agreed price, although the farmer can still

sell the minority of the product to speculative traders who usually give a better price. Examples of the second type are found in Gerupuk (central Lombok) and Jungut Batu (Bali).

The third type, intensive independent management, means that the seaweed culture is based on industrial concepts: high efficiency, full capital and modern management. The farmers are totally subsidized by the company, so the dependency of the farmers on the company is very strong. In return, the farmers must sell all their products to the company at the agreed price. An example of this third type of management occurs in Serewe (east Lombok). In this village, a multinational company is operating a production unit and involving the whole village in the culture of seaweed. The company subsidizes the seeds, racks and ropes to the farmers and also provides facilities, such as harvesting boats, drying platforms and transportation of the dried seaweed from farmer's house to the company's warehouse. Consequently, the price in Serewe is lower by Rp50-75 (US\$1= Rp2 350) than the market price, because the company considers that the subsidies should be compensated by the lower price. However, the company assures a stable price and purchasing.

## The Activities Related to Seaweed Culture

During our socioeconomic survey of the centers of seaweed production in Lombok and Bali in August 1995, we noticed there were at least eight kinds of activities which were closely associated with seaweed culture.

## Seaweed cluster tying

The most important work in seaweed culture is the tying of the clusters onto the rope (line). This activity is labor- and time-consuming and must be done as quickly as possible. At the villages in Lombok (3 villages) and Jungut Batu (Bali) we found that the fishers were always lacking labor to help them tie the clusters (especially in the peak season of culture). However, this activity is a favorite job for women and for children after school. Non-professional labor (women and children) will earn Rp50 per rope (45-50 clusters) and professional labor will earn Rp60 per rope. In Bali the labor wage for tying clusters is higher, i.e., Rp75 per line and each consists of 50-55 clusters.

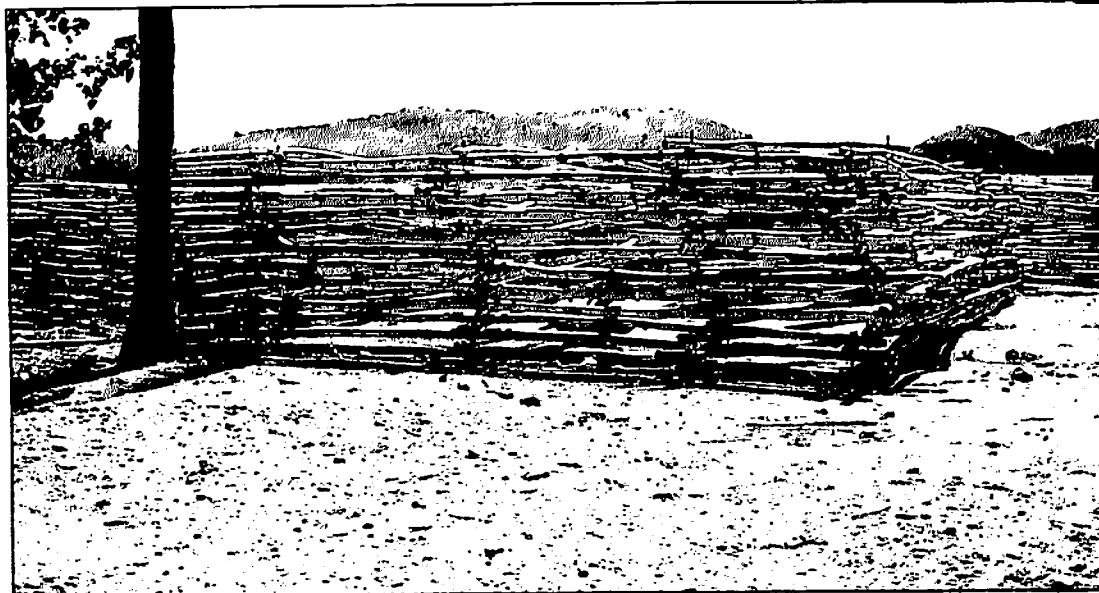
A woman can prepare 30-50 ropes in 3-4 hours (after her daily house work). Children can finish 20 ropes after school. In Lombok, a family with four members could earn Rp3 000-5 000 per day. This extra work is obviously very important to the villagers and contributes significant extra income. To reduce this operational cost, mostly fishers with large families will use their family effort to cover this activity. The other way is that most fishers will arrange the rhythm of harvesting and planting, so that a fisher of medium-sized family (with 4 children) can handle the whole task.

### Fixing rope (line) in the racks

Fixing ropes in the racks or squares is usually an activity for adults. This activity can be done either at low or high tide. At high tide they use wooden canoes to carry the ropes. A farmer who possesses a small number of racks will handle this activity with assistance from his wife or other adult family members, while a farmer with a large number of racks will hire laborers.

### Harvesting

The problem in harvesting seaweed is frequently faced by farmers who own a large number of culture racks. We found farmers with 12-20 racks or squares, whereas the average



Piles of bamboo racks ready for culture in Gerupuk, Central Lombok, Indonesia.

farmer possessed 4-6. In the good growth season from July to September, the seaweed grows very fast and in less than 35 days the racks are overgrown. In this situation the seaweed must be harvested as soon as possible, otherwise the clusters are easily detached by strong current and rough waves. To harvest a large number of racks, the farmers are helped by laborers. These laborers are usually the young or middle-aged men. In Lombok, laborers strand and transport the seaweed to the warehouse.

During a good harvest season, there is always a shortage of labor in the village. Therefore the wages become very expensive; in Batunampar a laborer can earn Rp8 000-10 000 per day. Sometimes the laborer is paid a percentage of the harvest.

### Gathering detached seaweed

Many detached seaweed thalli sink to the bottom or are stranded in the beach at low tide. These broken seaweeds belong to no one and the villagers are freely allowed to collect them.

In Batunampar, the gatherers of detached seaweed are mostly the children, who collect thalli in plastic bags at the low tide. In one operation, a teenager can collect 8-10 kg of wet detached seaweeds, while a younger child can get 3-6 kg. Mostly, the seaweeds are dried and sold to the village collector. The money is given to their parents to support their daily needs.

### Selling seaweed seed

The supply of seaweed seed is an important sub-activity. When the harvest is good or

there is no damage due to bacterial infection or any disastrous forces, seed price is cheap and vice versa. In Lombok, the price of 1 kg healthy seed is normally Rp250-300 but following the worst season the price can rise to Rp400/kg. In Bali, the price is higher, normally Rp600-700/kg and in the worst season it can go up to Rp900.

We found that each farmer used different quantities. The average quantity of seed needed for a 10 x 10 m<sup>2</sup> rack in Batunampar is 200 kg, in Serewe and Gerupuk about 150 kg. In Bali, a square of 13 x 10 m<sup>2</sup> needs about 770 kg.

### Cultured seaweed production (dry, tonnes per year) in Lombok and Bali.

Year	Lombok	Bali
1990	23 551.6	97 272.5
1991	11 134.5	81 810.3
1992	12 180.0	90 261.4
1993	14 465.9	n.a.
1994	17 280.6	92 398.2

n.a. = not available

Source: Fishery Directorate of Lombok and Bali Province.

### Seaweed trading in the village

Seaweed trading in Lombok and Bali creates unique networks and occupies a strategic position in the national and export markets. We found that there are at least three trading networks, i.e., (1) the frontier network,

in which producer and buyer are in the same village and have a social relationship; (2) the regional network which is less personal and operates within the province; and (3) regional-interregional network, which operates between provinces and become the national backbone of seaweed trading.

### The use of seaweed as food

A special case of seaweed consumption is found in Praya district of east Lombok. In this region, *Euचेuma denticulatum* is preferred as food and is consumed in many kinds of food, especially as side dishes. This condition is unusual, because it is not found elsewhere in Lombok and Bali, and creates a web of economic activity which consists of fishers, village traders, market merchants and consumers.

### Tourism

In Jungut Batu (Bali), seaweed culture and tourism can be run together and the first can support the second. In this seaweed center, culture is by the use of off-bottom nets arranged regularly. As a result, the white bare sand of the bottom is covered with a red-green-yellow carpet of seaweed. This unique underwater scenery is interesting to skin divers. Further, the land-based activities of the culture apparently have also been adjusted, so that every activity will be an interesting object to the tourist.

## The Role of Seaweed Culture to Economic Development

The price of seaweed in Indonesia is relatively unstable due to the international competition with other seaweed-producing countries, such as the Philippines, Malaysia and Tanzania. The seaweed price in Lombok differs greatly from that in Bali. In Lombok, the price of *Kappaphycus alvarezii* in 1991-92 was Rp 1 500/kg then decreased to Rp800/kg in 1993-1994. At this moment the price has risen slightly to Rp850/kg. The price of *Euचेuma denticulatum* is always much lower than *K. alvarezii*; it has fluctuated between Rp400 and Rp500/kg. In Bali the price is the highest in Indonesia. During the last few years the price for *K. alvarezii* and *E. denticulatum* has been



A family works together, here tying seaweed clusters in Gerupuk, Indonesia.

almost equal at Rp1 000-1 100/kg. Based on the recent price of *K. alvarezii*, seaweed culture in Bali has high economic return. The return on investment lies between 251 and 612% and the pay back period between 0.16 and 0.4 years.

When we visited Lombok and Bali in August 1995, there was very high market demand for seaweed. Two seaweed exporters in Lombok and Bali could fulfill only 50-60% of their quota. According to a representative of the biggest carrageenan producer in west Java, his ability to supply the raw material from Lombok to the company was far below the target. This market condition is certainly a good indicator for the near future of seaweed culture in eastern Indonesia.

To overcome the shortage in the seaweed supply, the company and community have two alternatives: they can intensify the culture or expand the area under culture. In Lombok, intensification means an increase in the number of racks and this solution matches well the available wide coastal area. In contrast, the available culture area in Bali is very limited, so intensification has been by: increased efficiency of area usage by applying the off-bottom method; a close rhythm of planting and harvesting; and planting the most valuable algal species.

The culture area can be expanded in two ways: firstly by initiating the new activity in surrounding villages and secondly by its introduction outside the region. In this way, villages can create a new activity for the whole community.

### Further Reading

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