SEAWEED RESOURCES IN THE DEVELOPING COUNTRIES OF ASIA: PRODUCTION AND SOCIO-ECONOMIC IMPLICATIONS

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ABSTRACT

The bulk of world seaweed production today comes from developed countries in the temperate region, including Japan, China, and Korea. The seaweed production potentials in the developing countries of Asia will have to be explored to meet the increasing world demand. Extensive shallow and farmable reef areas as well as cheap labor highly favor seaweed production. Harvesting from natural stocks, usually the practice in most developing countries, is unreliable. Efforts should thus be directed toward actual farming of seaweeds.

In the Philippines, development of the farming technology on *Eucheuma alvarezii* and *E. denticulatum* significantly increased production by the middle of the 70's. Harvests of *Eucheuma* from farms and other seaweeds from natural stocks now rank third among the fishery exports of the country.

The socioeconomic implications of the development of the seaweed resources in the developing countries of Asia are discussed. The Philippine experience is cited specifically to show the benefits derived from seaweed farming technology.

INTRODUCTION

Although no accurate data are available, world production of seaweeds at present seems quite sizeable. For instance, Naylor (1976) estimates a world production of 1 170 000 and 2 400 000 metric tons (mt) of wet weight for 1963 and 1973, respectively. The 1973 production was valued at approximately US$765 million at primary source. In 1974, production was estimated at 2 664 000 mt. An examination of the data, however, shows that the bulk of production was contributed by developed countries in the temperate

regions including Japan, China, and Korea which produced 697 800 mt (1974), 700 000 mt (1973), and 335 700 mt (1975), respectively. These countries are the major producers of seaweeds in Asia.

In contrast, developing countries contributed very little to the total seaweed production in the world. For instance, among the Asian countries, the Philippines produced only 7 000, Indonesia 15 000 and India 6 000 mt, or an aggregate of only 28 000 mt in 1974. Productions in the other countries of Asia were negligible. Hence the 1974 production of these countries represents a very small portion of the total world production. Naylor's (1976) estimate for the Philippines, however, is incorrect. The 7 000 mt produced in 1974 was on dry weight, not wet weight, basis.

Present estimates (Naylor 1976) show that seaweed production in developed countries cannot cope with the highly increasing demands for food, pharmaceutical, and industrial purposes. It is estimated that the annual increase in the demand for seaweeds and seaweed products is 8-10% (Naylor 1976). Hence, countries such as the United States, Canada, Denmark, Japan, France, Australia, and Germany are importing large amounts of dried seaweeds from developing countries in Southeast Asia.

STATUS OF SEAWEED PRODUCTION IN ASIA

Except for Japan, China, and Korea which have a well-established seaweed industry, most Asian countries are still dependent on the wild or natural seaweed crops, i.e., fishermen directly gather seaweeds from natural stocks. Actual farming of seaweeds in the Philippines is limited only to three commercial species, e.g., *Eucheuma alvarezii* (commercially known as the "cottonii type"), *E. denticulatum* (the "spinosum type") and *Caulerpa lentillifera.* The first two species are produced through mariculture while C. *lentillifera* is cultivated in ponds.

The harvesting of natural seaweed stocks is very unreliable. Production is highly dependent on the growth of the species which in turn is highly influenced by monsoons and other environmental stresses. In addition, the absence of a management program for the naturally produced species often results in the depletion and/or destruction of natural stocks due to overharvesting. In contrast, production through farming is not only reliable but is also a very efficient way of conserving local stocks. The principal seaweed genera, their uses, and present status of production in Asia are listed in Table 1.

The potentials of seaweed production in the developing countries of Asia are very high. Many Asian countries possess well developed coral reefs which could support high seaweed production. These shallow and farmable reef

areas, however, are presently utilized mainly for small-scale fishing. In the Philippines, the increased harvests of *Eucheuma* from farms reflect the development of such potentials and have made the country the major supplier of this species in the international market. Due to low production costs, seaweeds and seaweed products from developing countries in Asia can be highly competitive in the international market.

Table 1. Principal seaweed genera of economic potential in Asia

Country	Genera	Uses	Status of production
Philippines	*Caulerpa*	food	pond culture & wild crops
	Codium	food	wild crops
	Sargassum	alginate, feeds	wild crops
	Porphyra	food	wild crops
	Gelidiella	agar	wild crops
	Gracilaria	agar, food	wild crops
	Eucheuma	carrageenan, food	mariculture
Indonesia	*Gracilaria*	agar, food	wild crops
	Eucheuma	carrageenan	wild crops, mariculture
	Gelidiella	agar, food	wild crops
	Hypnea	carrageenan, food	wild crops
	Caulerpa	food	wild crops
	Acanthophora	food	wild crops
Singapore	*Eucheuma*	carrageenan	wild crops
	Gracilaria	agar	wild crops
	Sargassum	alginate	wild crops
Brunei	*Gracilaria*	agar	wild crops
East Malaysia	*Porphyra*	food	wild crops
	Sargassum	alginate	wild crops
	Eucheuma	carrageenan	wild crops
	Caulerpa	food	wild crops
	Gracilaria	agar	wild crops
West Malaysia	*Gracilaria*	agar	wild crops
Thailand	*Gracilaria*	agar	wild crops
	Porphyra	food	wild crops
Vietnam	*Gracilaria*	agar	wild crops
	Sargassum	alginate	wild crops
Hong Kong	*Sargassum*	alginate	wild crops
	Porphyra	food	wild crops

Table 1 *continued..*

Taiwan	*Gracilaria*	agar	pond culture
	Porphyra	food	wild crops; culture
Sri-Lanka	*Gracilaria*	agar	wild crops
	Porphyra	food	wild crops
India	*Gracilaria*	agar	wild crops; mariculture
	Gelidiella	agar	wild crops
	Sargassum	alginate	wild crops
	Hypnea	carrageenan	wild crops
Burma	*Gracilaria*	agar	wild crops
	Gelidium	agar	wild crops
	Sargassum	alginate	wild crops
Pakistan	*Gracilaria*	agar	wild crops
	Gelidium	agar	wild crops
	Hypnea	carrageenan	wild crops
	Porphyra	food	wild crops

SEAWEED PRODUCTION IN THE PHILIPPINES

The Philippine seaweed export profile is reflected in Table 2. No official records of local seaweed production are available before 1967 when the Philippines started exporting dried seaweeds to other countries. Production from 1967 to about 1972 was mostly harvests from natural stocks by fishermen. During this period, the unregulated harvests in response to the high demand of the dried produce in the world market led to the depletion of the natural stocks. Toward the end of the 1960's and during the early 1970's, production was maintained mainly by the discovery of new seaweed beds in very far and hardly accessible reef areas.

The development of farming technology in the early 70's made its full impact on production toward the middle 70's when production came mainly from the farming of two species of *Eucheuma,* namely, *E.alvarezii* and *E. denticulatum*. The farming of the second species contributed significantly to production during the latter half of the decade. A small portion of the total seaweed production was derived from natural stocks of other seaweeds such as *Gracilaria, Gelidiella, Caulerpa,* and *Sargassum*. Except for *Caulerpa,* their production is dependent up to now on natural stocks.

Pond culture of *Caulerpa* is presently done in Mactan, Cebu. Although the produce is locally sold in open markets of Metro Manila, Cebu City, Cagayan de Oro City, and Zamboanga City, recently a significant portion is being exported to Okinawa in a partially dehydrated (salted) state.

Table 2. Philippine seaweed export, 1967-1980

Year	Metric Ton	Value (Pesos)
1967	674.5	351 989
1968	263.9	221 056
1969	427.6	447 908
1970	318.1	527 321
1971	339.8	675 504
1972	483.9	1 414 051
1973	1 432.7	4 062 086
1974	5 039.6	14 973 151
1975	4 514.8	13 292 226
1976	3 950.1	12 366 568
1977	6 094.1	14 666 768
1978	13 575.3	42 480 674
1979	16 495.8	58 521 274
1980	13 191.3	55 667 616

Source: Exports of fish and fishery products cleared by the Bureau of Fisheries and Aquatic Resources, by kind, quantity, and value, Fisheries Statistics, 1967-1980.

All *Sargassum* productions in Central Visayas are being exported to Japan whereas those in Northern Mindanao are utilized in the local manufacture of feeds. A significant amount *of Gracilaria* and *Gelidiella* is exported while the rest is locally processed into crude agar bars. Production of other genera such as *Codium, Hypnea,* and *Porphyra* is dependent on natural stocks and the produce is only locally consumed (BFAR Statistics 1980).

The data on Philippine seaweed exports indicate an almost twenty-fold increase in production from 1967 to 1980 (BFAR Statistics 1980). From a minor product, seaweeds now rank third, behind tuna and shrimps, among Philippine fishery exports.

There are many other seaweed species which still remain to be tapped and/or developed. The rational development of these resources, however, is hampered by the lack of appreciation on the part of the policy makers of the importance and economic potentials of seaweeds as a fishery resource. This attitude is reflected in the priorities and the funding support allocated to seaweed research and development compared to other natural resources such as energy, forestry, minerals, etc. Notwithstanding the many reasons for this negative attitude, the developing countries of Asia should take a hard look at the history of the seaweed industry of Japan, China, and Korea where seaweeds as a resource touch on the everyday life of the people. Once this attitude is resolved, the solution to the other major problems such as lack of expertise, facilities, and funds will naturally follow. Solving these problems may take some time but surely time will be a minor constraint. And the resolution of the foremost problem of lack of appreciation for seaweeds may

be hastened through the influence of international agencies such as the UNESCO, FAO, UNDP, and others.

SOCIOECONOMIC IMPLICATIONS OF SEAWEED RESOURCE DEVELOPMENT

The socioeconomic impact of the development of the seaweed resources in the developing countries can be readily appreciated by first looking at the present status of the quality of life, resources, and livelihood of the people living in coastal areas in relation to the present emphasis on industrial development and urbanization.

A large portion of the Asian population lives along coastal areas and is intimately associated with the sea and its resources. Most of these coastal populations are located in far-flung areas which are hardly benefited by modern industrial development and urbanization. Being in the tropics, the coastal areas of Asian countries are characterized by well-developed coral reefs, shallow bays and coves which used to abound with fishery resources. Through intensive fishing, these coastal areas have been and will continue to be depleted of resources on which the very lives of the coastal population directly or indirectly depend. The grave concern for the consequences of the depletion of the fisheries in shallow coastal areas is best dramatized by the closure of traditional fishing grounds to big fishing operations. The Philippines, Indonesia and Thailand have enacted measures to prevent the overexploitation of the fishery stocks in some fishing grounds in consideration of the plight of the small-scale or artisanal fishermen who can hardly afford to have more sophisticated fishing crafts to fish in far areas which still support good fisheries. The decline in coastal productivity coupled with population increase consequently would lead to the lowering of living standards in the coastal areas. The development of seaweeds as a resource is an alternative activity which should rank high in government programs if the idea of a more equitable distribution of wealth and benefit is to accommodate the poor fishermen. In the Philippines, for instance, more than 600 000 of the fishing force are small-scale fishermen.

A Philippine experience, as exemplified by the development of the Danajon Reef in northern Bohol in Central Visayas, exquisitely demonstrates the socioeconomic benefits that can be derived from seaweed farming. The development of *Eucheuma* farming in this area is better documented than that in the Sulu Archipelago. During the peak production of *E. denticulatum* (Lim and Porse 1980) in nothern Bohol in 1979 there were: 200 farm houses and drying platforms constructed, 500 hectares of the reef planted with seaweeds, 2 000 people working daily on the farms, and 1 000 families or approximately 8 500 people fully or partially dependent on seaweed farming.

The above data do not include the people who were in some way benefited by the farming activities, e.g., the middlemen, the small store owners, and suppliers of farm materials, among others. The secondary impact of the farming activities is of course very hard to measure. However, favorable effect which the seaweeds brought to the people in terms of improvement of their life styles was best illustrated by their acquisition of simple luxury items such as radios, gas stoves, clothes, and motorized bancas. But the best proof that seaweed farming is a productive form of livelihood is the shift from fishing into seaweed farming. Results of interviews show that local fishermen were earning a net average of P12 per day. A hectare of seaweed farm netted a farmer an average of P1 200 per month excluding the capital investment.

The production in northern Bohol in 1979 was, however, small compared to that in Sulu in the southern Philippines which still accounts for the bulk of farmed seaweed.

As an entrepreneur, the seaweed farmer is subject to both favorable and adverse effects of the demand and price fluctuations in the international market.

Since seaweed farming is labor-intensive, the industry can employ the otherwise idle or underutilized labor force in the coastal areas.

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