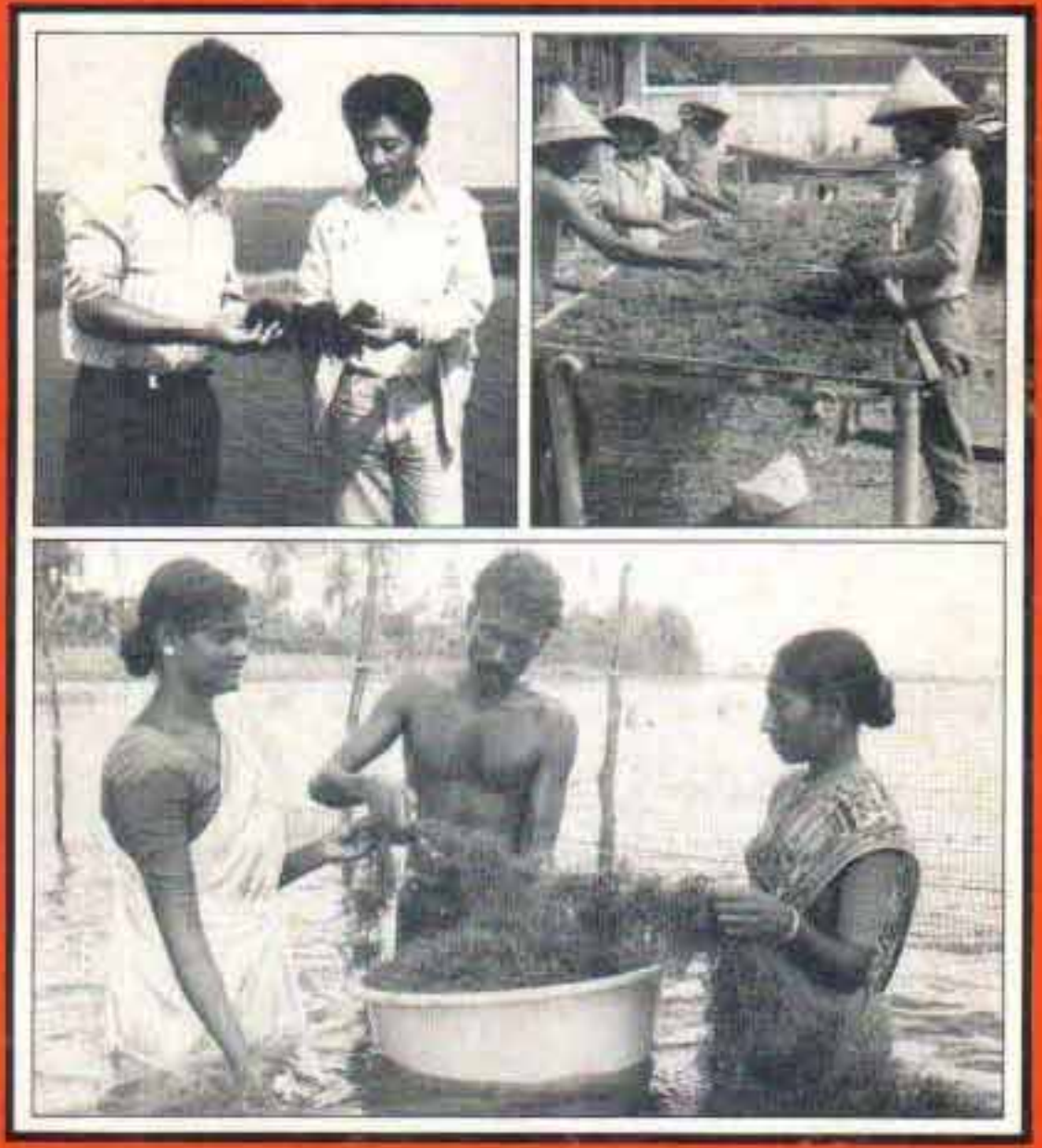
BOBP/REP/45

Report of the seminar on

GRACILARIA PRODUCTION AND UTILIZATION IN THE BAY OF BENGAL REGION

Songkhla, Thailand, 23-27 October 1989



BOBP
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BAY OF BENGAL PROGRAMME

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GRACILARIA PRODUCTION AND UTILIZATION IN THE BAY OF BENGAL

Report of a seminar held in
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Bay of Bengal Programme for Fisheries Development.
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This report summarizes the proceedings of an international seminar on Gracilaria production and utilization in the Bay of Bengal, held in Songkhla. Thailand. 23-27 October 1989. It also includes 23 papers presented at the seminar by participants from various countries. A bibliography on Gracilaria, which was prepared in connection with the seminar, is being published separately.

The seminar was held to review current status of knowledge on the subject worldwide and to help point future work directions.

The seminar and the report on it were jointly sponsored by two projects of the Bay of Bengal Programme (BOBP)-the Small-Scale Fisherfolk Communities Project and the Post-Harvest Fisheries Project.

The Small-Scale Fisherfolk Communities Project of the Bay of Bengal Programme began in 1987 for a duration of five years. It is funded by SIDA (Swedish International Development Authority) and DANIDA (Danish International Development Authority). Its main aim is to develop, demonstrate and promote technologies and methodologies to improve the conditions of fisherfolk in seven countries bordering the Bay of Bengal-Bangladesh, India, Indonesia, Malaysia, Maldives. Sri Lanka and Thailand. The Post-Harvest Fisheries Project is executed and funded by the ODA (Overseas Development Administration of the United Kingdom).

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INTRODUCTION

The Bay of Bengal Programme began its involvement with Gracilaria farming in 1983 when technical and financial support was provided to the Fisheries Research Institute of the Department of Fisheries, Malaysia. Technical trials based on spore setting and outplanting off Penang Island were promising.

Over the years there has been considerable interest in the agarophytic resources of India, particularly along the Ramanathapuram coast of Tamil Nadu. Research by various institutes' indicated culture potential and in consultation with the Department of Fisheries of the Government of Tamil Nadu, BOBP initiated a pilot project involving two villages in Ramnad district.

Concurrently, a similar project began in Sri Lanka together with the National Aquatic Resource Agency and Sarvodaya Shramadana Sangamaya ; a prominent NGO with wide experience in the country. Various technical problems arose during the implementation of the two pilot projects, but information on current experience with Gracilaria production and marketing in the BOBP region was not readily available. It appeared an opportune moment to gather together as much expertise as could be assembled in one place and assess the "state of the art" in agarophyte culture, processing and marketing, as well as the extent to which natural resources were being managed. Consequently, BOBP in collaboration with the Government of Thailand, convened a regional seminar in Songkhla, Thailand, October 23-27, 1989.

All the BOBP member states sent representatives and in addition, scientists, technicians and business people came from Vietnam, China, Hong Kong, the Philippines, Sweden, the United Kingdom, and the USA. International organizations interested in seaweed production were represented by ICLARM, INFOFISH, NACA and of course, BOBP. Development strategists, scientists, commercial processors and technicians were among the 82 participants.

The seminar was the first regional convocation of the seaweed industry. No international seminar had ever dealt earlier with a particular genus (although there has been some mention of the closely related Polycavernosa).

The topical organization of the seminar reflected an interest in applied aspects of Gracilaria, and included sessions on the status of culture, small-scale processing, marketing, and on the management of natural resources of agarophytes. Twenty-four papers covered these areas of interest, of which seventeen dealt with culture and processing.

This report contains a summary of **the** seminar proceedings and papers presented at the four sessions – 24 papers in all.

SUMMARY OF SEMINAR PROCEEDINGS

Pond culture of Gracilaria

Almost all cultured Gracilaria derives from ponds: open water systems are still quite experimental in tropical waters. However, open water culture is operating commercially in the temperate waters of China; such systems have also been developed in Chile's cool seas.

Tide level and pond design are particularly important to ensure good flow of seawater. Access to both fresh and seawater enable the farmer to maintain salinity at an optimal level for fast growth. Sites should have protection from strong winds, and muddy sand or sandy soil is preferable. Several issues arose during discussions: Paramount is the high cost of developing new ponds; the soil requirements for pond construction can restrict the spread of the technology. There may be conflicts with mangrove forest conservation if new areas are developed, since such tidal forests are widespread in tropical Asia. Soil acidity could be a very serious problem in ponds established in mangrove forest soils, but reclamation of acid sulphate soils is a lengthy and expensive process.

It is possible to involve small-scale brackishwater pond farmers in Gracilaria culture as demonstrated by private industry in South Sulawesi.

Polyculture of Gracilaria

Gruciluriu may be polycultured with other seaweeds or with fish and prawns. Polyculture of *Grucilaria* and Eucheuma has been experimented with in Bali, Indonesia. Trials have employed small-scale open water technology. However, in pond culture, protocols for fertilization regimes for specific soil water types and for maximizing seaweed growth and agar quality are still lacking. The best stocking densities for seaweed, fish and shrimp remain to be worked out, as does the amount of residual stock that should be left after harvesting in order to maximize production. All of the development has been done by trial and error and may be an area for applied research.

Open-water culture : the problem of grazing

Rabbit fish (Siganus spp) are the main grazers and they can literally wipe out large seaweed farms. It appears that juvenile rabbit fish are largely to blame; seaweed farms located in shallow seagrass beds are particularly vulnerable, since this is their natural habitat.

It may be that open-water culture is only possible where natural stocks of the desired species of Gracilaria are found. In practical terms, this may not always be possible. Turbid lagoons may be preferable to more exposed sites. Results of culture trials in Songkhla Lake itself and from earlier BOBP work in Penang seem to bear this out. Fouling by unwanted epiphytes and invertebrates may seriously affect product quality. Open-water culture of Gracilaria has been commercially successful in the Caribbean (St Lucia) but such success stories are rare.

In Malaysia, land based intensive systems have been tested. While of technical interest, there would be little likelihood of such systems being taken up by fisherfolk because of the high capital cost and the level of managerial expertise required.

Selection and seeding methods

Culture systems of whatever nature require seed stock, and a number of questions arose concerning selection and seeding methods. All commercial production in the tropics derive from vegetative propagation rather than spore-setting. Parent plants are used to seed substrates such as stone blocks planted in open temperate waters in China. Similar techniques were tested in Hawaii with limited results but further work with this approach might be warranted in the tropics. Hatchery spore setting in Sri Lanka has been successful on a small scale.

As agar yield and gel strength vary greatly with species and even possibly within species according to variety, strain selection becomes difficult. Until the confusion over the taxonomy of Gracilaria

is resolved, selection of strains will remain difficult. If there is a high degree of adaptation to micro-environments, how transferable will the results of strain selection be to new environments? Are the best species being cultured? Given the number of known species of *Gracilaria,* it was noted that only three (G. verrucosa, G. *tenuisripitata* and G. *edulis)* are cultured in Asia.

Seaweeds for human consumption

Seaweeds for direct human consumption are worth more than those destined for industrial use. The nutritional benefits of seaweed consumption were considered as a source of micro-nutrients (vitamins and trace elements). On the industrial side, problems are presented by variations in agar quality and composition as influenced by particular clones, light and nutrient conditions and the interactions of these factors.

The history of agar dates back to seventeenth century Japan. Consumption of seaweed as a fresh vegetable is probably an ancient practice; it is found today in places like Hawaii, Fiji, the Philippines, lndonesia and Malaysia. Home production of agar for puddings, soups and jellies can be found in Sri Lanka. Perhaps production for local consumption has scope for encouragement in some of the BOBP member countries.

World agar production

World agar production is estimated at 7,000 to 10,000 tonnes annually, and about half is from *Gruciluriu.* Japan is the top producer and consumer, but depends heavily upon imported *Gruciluriu* to meet national demand. In the BOBP region, Thailand, Malaysia and Indonesia are major importers of agar. In India, estimated annual production is 75 tonnes, but processing capacity may double if planned units come on line in the next few years.

Small-scale agar production

Small-scale, village level agar extraction has been tried in Thailand, Malaysia and India. In India, an attempt was made to adapt the Thai method to the village situation in Tamil Nadu, India. Inadequate dehydration before sun-drying has been difficult to overcome. In the village setting, the source of heat energy may also present difficulties. Wood is often the only fuel available and is costly.

Economic models can be used to set production targets, and demonstrate what technical problems influence profitability and how. However, there is a paucity of economic data and analysis for various agarophyte production systems now in use or being tested in the region.

Gel strength

International trade in dried *Gruciluriu* is based largely on gel strength; the higher the gel strength, the higher the price paid. Its measurement raised some questions: although the processing industry recognizes a standard method, it is not always used by investigators. Unlike other countries, the Indian industry does not use chemical treatments to upgrade gel strength. It is believed that Indian *Gracilaria* does not respond to such treatment. Local strains may be too high in sulfate or there could be some other environmental influences. Poor post-harvest handling could play a role.

There was disagreement on whether or not village industry could produce an agar of sufficient quality for the market. Several industrialists felt that it cannot and that villagers are better off concentrating on seaweed farming. Adaptive research could address the major problems in the village context — filtration, water removal and sanitation. Perhaps improved technology at this level is available from other countries. Japan has had a village industry for centuries. There are many small-scale agar plants in Taiwan, whose experience can be applied to local conditions in the BOBP countries.

All BOBP countries import agar, particularly the higher grades. The consensus is that world demand is increasing, but there is a lack of detailed information on the trade. A comprehensive study of world demand is needed in order to guide farmers, processors, investors and government policy makers.

Marketing

Although trade statistics are often questionable, world production is somewhere between 7,000 and 10,000 tonnes annually. Of this, about 3,700 tonnes enter international trade. Dried seaweed (Ceylon moss) has been exported from Sri Lanka since at least the mid-19th century, according to historical data. The present day trade is only a fraction of past production: 5 tonnes compared to 150 tonnes more than 100 years ago! The decline does not appear to be due to the resource base, but rather due to changes in the fishery. Seaweed collection is not competitive with shrimp fishing as a source of livelihood.

In Sri Lanka there is an interesting local market for dried Gracilaria sold in small packets for home production of agar. Porridge flavoured with coconut milk and lemon juice is popular among fishermen in the seaweed-producing areas. It is sold by the glass in small roadside stalls. Home-made jellies are also sold.

Malaysia is one of the region's major consumers of agar and agar products, amounting to M$ 6 million annually. The Malaysian market could have a strong impact on future developments in farming and processing in the region.

Management of *Gracilariu* resource

There is considerable potential for increased production from well managed natural stocks; experiences in Chile are an outstanding example. Production there increased from 80 to 600 tonnes after management measures were introduced.

However, an effective management program depends upon knowledge of the reproduction, growth cycle, growth rates, regeneration capacities, productivity and the influence of environmental factors on biomass production of the stock in question. Unfortunately, very little work has been done on natural stocks of agarophytes in the Bay of Bengal region. Stocks are reported to be over-exploited in the main producing area of India, though firm evidence is lacking because there have been no recent surveys of the resource. Agarophytes have been inventoried at 31 locations in Indonesia, mainly in Java, Sulawesi, and Bali. In Thailand there is a potential harvest of ***Polycavernosa*** (closely related to Gracilaria) from the large number of fish cages in southern Thailand. During the discussions, it was suggested that this might lead to new farming systems utilizing natural spore collection on discarded fish net.

The confused state of taxonomy was a recurring topic for resource management, species must be clearly known before individual stocks can be identified. Comparative studies of species could also be advantageous for culturists as well as resource managers.