# STATUS OF SEAWEED INDUSTRY IN INDIA

by

V.S. Krishnamurty Chennubholta[1]

[1] Scientist, Mandapam Regional Centre of Central Marine Fisheries, Research Institute, Marine Fisheries, P.O. Pin Code: 623520, Mandapan Camp, South India.

## 1. INTRODUCTION

Forty percent of the population in India is estimated to be vegetarian. Seaweeds with its high nutritive value constitute a potential resource of valuable supplementary food.

India has a coastline of 5 698 km. Rocky and coral formations are found in Tamil Nadu, Grujarat states, and in the vicinities of Bombay, Karawar, Batnagiri, Goa, Vizhinjam, Varkala, Vishakapatnam, and in few other places like Chilka and Pulicat lakes, Andaman and Nicobar Islands. The coastal areas of Tamil Nadu and Grujarat states are the important seaweed growing regions of the* country.

## 2. SEAWEED RESOURCES

Some surveys have been made to estimate the resources of the seaweeds in the country which are as follows:

### 2.1. Quantities, of alginophytes

The standing crop of seaweeds at the northwest end of Kathiawar has been estimated by Sreenivasarao, et al. (1964). On a 0.015 km$^2$ of reef area, they found 60 tons of fresh Sargassum or about 4 kg/m$^2$. Hornell (1918) estimated the amount of fresh Sargassum washed ashore along the Kathiawar coast to about 100 tons annually.

In the Gulf of Kutch north of Kathiawar peninsula, Desai (1967) gave a very high estimate of 1 000 000 tons of harvestable brown algae per year corresponding to 10 000 t dry weight. Chauhan and Krishnamurty (1968), however, harvested 19 000 tons fresh weight of alginophytes, 12 000 tons of which were Sargassum. while investigating a good 10 km$^2$ in the same area.

### 2,2 Quantities of agarophytes

Prasanna Varma and Krishnarao (1964) estimated the seaweed resources along the Pambian area in the Gulf of Mannar. In two areas covering 59 km$^2$, only 0.5 percent had coral or rocky reefs with economically harvestable seawee resources. An area of 0.294 km$^2$ has an estimated wet weight of harvestable Gracilaria at 334.9 tons, Gelidium at 18.9 tons and brown algae at 657.9 tons or agarophytes at 1.2 kg/m$^2$ and alginophytes at 2.2 kg/m$^2$.

In Palk-Bay, north of the Gulf of Mannar, Umamesheswararao (1968) estimated the standing crop of an area measuring 3.6 $km^2$. The mean values he got for two years of investigation were:

| | Fresh weight (in tons) | $ka/m^2$ |
|---|---|---|
| Agarophytes | 140 | 0.04 |
| Alginophytes | 148 | 0.04 |
| Edible algae | 217 | 0.06 |
| Other algae | 428 | 0.12 |
| | 953 | 0.26 |
| Seagrass | 2 000 | 2.6 |

From samplings in the Gulf of Kutch, Desai (1967) observed that 20 tons of dry Gracilaria can be harvested. A profuse growth of seaweeds has been observed in an area 800 m wide and 32 km long in the Gulf of Mannar between Mandapam and Tuticorin. The Gulf of Mannar is considered to be the richest ground for Gelidium in India.

Twenty thousand tons (wet weight) of Gracilaria and 2 000 tons of Gelidium or 3 000 tons and 300 tons dry weight respectively, can be collected annually from this area.

The total standing crops as revealed by discussions with seaweed collectors in the coastal villages of Ramnad and Tirunelveli districts and by the scientists of the Central Marine Research Institute are as follows:

| | Landings (fresh weight) | Probable resource (fresh weight) |
|---|---|---|
| Agarophytes | 5 000 t | 20 000 t |
| Alginophytes | 20 000 t | 80 000 t |

## 3. USES OF SEAWEEDS

Seaweeds are rich in protein, vitamins and mineral contents. Green and red algae are rich in protein ranging from 20.12 to 25.48 mg/100 g. They are also rich in Vitamins A, B, C and E. The Vitamin C content in Sargassum myriocysum exceeds that of lemon. Vitamins A, $B_{12}$ and B occurring in many seaweeds exceed in qualities than those occurring in other vegetable and animal matter. * Seaweeds are rich sources of colloidal carbohydrates such as agar-agar and algin which have a very wide industrial use. Agar-agar and algin are added to some food items, confectionary, dairy products, sweets, jellies, jams, desserts, ice cream, Pharmaceuticals, rubber making, in clarifying liquor, as a lubricant, laxative and in many other industries.- The most important use of agar is in bacteriology as a culture medium; while the algin is in textile industry.

In order to popularize seaweeds as substitutes for food and to maintain a continuous supply of raw materials to the ever-growing agar and algin industries, culture methods were developed as there is already depletion of these agarophytes and alginophytes in the natural environment by constant exploitation.

## 4. CULTURE WORK

In India, preliminary culture experiments were started by Thivy (1964) at Portander by tying small plants of Sargassum cinetum, S. vulgare, S. swartzii and Gelidiella acerosa to coir nets. In these experiments, plants of Sargassum cinctum with an initial height of 10 em had grown to a height of 37–52 cm within 40 days. Culture experiments on Ulva lactuca and U. rigida in the laboratory indicated that the apical and marginal portions show maximum increase (Kale and Krishnamurty, 1967) .

Experiments with Gracilaria corticata and G. edulis had shown that in former, the growth was slow during the first 45 days and a rapid increase from 1.8 to 5.5 cm was recorded during the next 45 days. In the latter, a growth of average 4.3 $kg/m^2$ in 80 days was observed in the coir nets used for culture work. Cultured Gelidiella acerosa in coir nets yielded a fresh weight of 3 $kg/m^2$ in 77 days from an initial seed material of 1 kg (Krishnamurty, C.G.S. et al. 1971).

At present, trials are underway to streamline a method by floating nets which could bring down the cost of production of seaweeds by culture practices. This also forms the future programme for the Institute.

## 5. THE WORK ON GRACILARIA AND OTHER SEAWEEDS

Gracilaria edulis and Gelidiella acerosa are the main agarophytes in India, and as such, they attract the attention of aquaculturists in the country.

### 5.1 Gracilaria edulis

Gracilaria edulis is being grown in coir ropes by longline rope method by seeding them in the twists and left in the inshore waters for further growth. An annual production rate of 3.5 kg/m of rope was obtained. Later, the ropes were fabricated in the form of nets and tied to wooden poles in the inshore waters. Here, the production rate was found to be three times the initial weight introduced in 60 days. The technology involved in the cultivation of Gracilaria edulis was transferred by the Central Marine Fisheries Research Institute, Cochin to interested fishermen in the coastal villages of Ramnad Diet in India under Land-to-Land Programme of Indian Council of Agricultural Research.

### 5.2 Gelidiella acerosa

Gelidiella acerosa has a very slow growth rate and the production rate obtained for this was three times in 77 days.

The method of cultivation is yet to be simplified to reduce the cost of production of seaweeds for which trials are underway.

### 5.3 Porphyra sp.

Cultivation of Porphyra in Japan by spores is a unique phenomenon in the world but full knowledge about spore germination of other seaweeds is lacking as the survival and viability of spores is very limited. In addition to this, it takes a lot of time for the spores to reach the plants of harvestable stage. Still, vegetative propagation (by fragments) is quicker and easier. In the Central Marine Fisheries Research Institute, Cochin, India treatments are underway to simplify the culture using the latter method, side by side with improving the techniques of spore culture.

## 6. POST-HARVEST TECHNOLOGY

The processing is done in the country itself as there are already nearly 10 factories manufacturing agar-agar in India. The leading one is M/S Cellulose Products of India. Grujarat is second with a branch at Tamil Nadu.

## 7. MARKETING

Agar in India sells at a rate of Rs 100 to 200 (i.e. US$12, $24) per kg depending upon the (quality) grade. The value of algin varies from Rs 60 to Rs 120 (US$7.5 to $15) depending upon the demand.

## 8. EXPORTS

The agar and algin industries have been established in the country in recent years. Some private firms in Grujarat and Tamil Nadu states have started production of agar and algin utilizing the raw materials collected along the Indian coasts. In order to ensure supplies to this industry, export of raw materials is now prohibited.

During 1966–1968, the exports of agarophytes were as follows:

| | Amount (dry weight) | Value (US Dollars) |
|---|---|---|
| 1966 | 163 t | 60 000 |
| 1967 | 198 t | 200 000 |
| 1968 | 92 t | 30 000 |

## 9. QUALITY CONTROL

The Government of India desires that agar and algin manufactured in India conforms to the standards required by various industries;! In this connection, the Indian Standards Institute in Calcutta has divided the agar into three categories based on moisture, nitrogen and ash contents:

a. Food grade agar,
b. Indian Pharmacophia grade agar, and
c. British Pharmacophia grade agar.

The quality of algin is determined by the viscosity in centipoise. Algin of very high viscosity is required for textile industry.

## 10. ECONOMICS

Culture of agarophytes should invariably be combined with agar production to make it economically feasible as cost of fresh or dry agarophytes fetches only low returns. Though the first year of staring may not bring profits, second year onwards profits may start accruing as the non-recurring expenditures would not be there from them.

## 11. PATENTS

Methods of cultivating Gracilaria edulis by rope method and the process of manufacture of sodium alginate were found to be economically feasible. The methods are patented and are available at the Central Salt and Chemicals Research Institute (CSMCRI), Bhavanagar and NRDC, New Delhi, respectively for the benefit of entrepreneurs.

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