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PRESENT STATUS OF SEAWEED EXPLOITATION AND SEAWEED INDUSTRY IN INDIA*

Seaweed resources

The seaweeds are the only source for the production of phytochemicals such as agar, carrageenan and algin which are widely used in several industries mostly as gelling, stabilizing and thickening agents. They are also used as human food, animal feed and manure. Seaweeds grow largely in shallow coastal waters wherever suitable substrata are available. Luxuriant growth of several species of green, brown and red seaweeds occur along the southeast coast of Tamil Nadu from Mandapam to Kanyakumari, Gujarat coast, Lakshadweep and Andaman-Nicobar Islands. Fairly rich seaweed beds are present in the vicinity of Bombay, Karwar, Ratnagiri, Goa, Varkala, Vizhinjam, Visakhapatnam and in coastal lakes like Chilka and Pulicat.

Natural standing crop of seaweeds

The seaweed resources survey conducted by various workers in different parts of Indian coast reveals that the total standing crop of seaweeds in the country is approximately 77,000 tonnes (wet). The Central Marine Fisheries Research Institute carried out the survey of marine algal resources along Tamil Nadu coast during 1971–'76 in collaboration with the Central Salt and Marine Chemicals Research Institute and Department of Tamil Nadu Fisheries. The area covered was from Athankarai to Rameswaram (45 km coastline) in Palk Bay and from Mandapam to Melamidalam (413 km coastline) and the adjoining 21 islands in Gulf of Mannar from high water mark to a depth of 6 m. The standing crop from the total area of 17,125 ha was estimated at 22,044 tonnes (wet wt.), consisting of 1,709 tonnes of agarophytes, 10,266 tonnes of alginophytes and 10,069 tonnes of other seaweeds. The resources of the commercially important species are 74 tonnes of *Gelidiella acerosa*, 974 tonnes of *Gracilaria* spp., 798 tonnes of *Hypnea* spp., 9,381 tonnes of *Sargassum* spp. and 714 tonnes of *Turbinaria* spp.

Seaweed resources of 12 islands of Lakshadweep namely Chetlat, Kiltan, Kadamat, Amini, Bitra, Bangaram, Agatti, Androth, Kavaratti, Kalpeni, Suheli and Minicoy were surveyed by the Central Marine Fisheries Research Institute during January to March, 1987. The total standing crop from these islands was estimated at 19,345 tonnes (wet wt.) consisting of 372 tonnes of *Gelidiella acerosa*, 798 tonnes of *Gracilaria edulis*, 98 tonnes of *Sargassum*, 3,300 tonnes of *Turbinaria* and 14,777 tonnes of other seaweeds.

During 1986–'89, the Central Marine Fisheries Research Institute conducted surveys for seaweed resources of deeper areas jointly with the Central Salt and Marine Chemicals Research Institute from Kilakkarai to Manapad. A total standing crop of 57,162 tonnes (wet wt.) of seaweeds was estimated (14,812 tonnes of green algae; 12,636 tonnes of brown algae and 29,761 tonnes of red algae) from 1,293 sq. km. area surveyed with depth ranging from 4 to 21.5 m. In this survey 288 tonnes of *Gracilaria*, 915 tonnes of *Sargassum* and 4,843 tonnes of *Hypnea* were estimated. The surveys carried out so far in the east and west coasts of India and Lakshadweep and Andaman-Nicobar Islands clearly show the diversity and abundance of seaweed resources in our country.

Commercial exploitation of seaweeds

In India, seaweeds are mainly used as raw material for the production of agar and sodium alginate. At present the red algae *Gelidiella acerosa, Gracilaria edulis* and *G. crassa* are used for extraction of agar-agar and species of *Sargassum (S. wightii, S. ilicifolium, S. plagiophyllum* and *S. myriocystum)* and *Turbinaria (T. conoides* and *T. ornata)* for sodium alginate. Now there are about 12 agar industries and 10 algin industries actively functioning at different places in the maritime states of Tamil Nadu, Andhra Pradesh, Kerala, Karnataka and Gujarat. All these seaweed based industries depend on the raw material being exploited from the natural seaweed beds occurring mainly in the southeast coast of Tamil Nadu from Mandapam to Kanyakumari. The commercial harvesting of seaweeds from this area has started in 1966. The seaweed landing centres along the southeast coast of Tamil Nadu are Rameswaram, Pamban, Vedalai, Seeniappa Darga, Periapatnam, Kilakkarai, Ervadi, Valinokkam, Mundal, Tharavaikulam and Kanyakumari area. The seaweeds harvested from these places are *Gelidiella acerosa, Gracilaria edulis, G. crassa* and species of *Sargassum* and *Turbinaria*. The data collected by the Central Marine Fisheries Research Institute on the landings of these plants in Tamil Nadu for a period of 11 years from 1978 to 1988 are given in Table 1. The year to year fluctuation in the quantity of alginophytes landed was due to the variation in the demand of the major algin producing industries based on their supply orders for sodium alginate. The resource position of alginophytes is adequate at present. The places, season of harvest and the cost of each seaweed are given below.

Gelidiella acerosa

It is a perennial plant growing on rocks and coral reefs and is being harvested from 1966 onwards. The

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Table 1. *Seaweed landings in Tamil Nadu coast (dry wt. in tonnes)*

Seaweed	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Sargassum spp.	3,636	4,256	3,090	2,522	3,176	2,070	780	2,096	491	868	2,605
Turbinaria spp.	1,021	1,281	438	222	704	375	235	385	160	250	523
Gelidiella acerosa	288	541	247	131	102	293	210	189	261	217	366
Gracilaria edulis	395	342	213	117	225	291	320	269	233	317	330
Gracilaria crassa	—	—	—	—	—	85	96	45	28	34	15
Total	5,340	6,420	3,988	2,992	4,207	3,114	1,641	2,984	1,173	1,686	3,839

landing centres for this agarophyte are Rameswaram, Pamban, Vedalai, Seeniappa Darga, Kilakkarai and Ervadi. The collection is mainly done around the islands in Gulf of Mannar using country boats. Shore collection is done at Kilakkarai and Ervadi throughout the year whenever the tide conditions are favourable. Invariably the harvested material of *Gelidiella acerosa* will get mixed up with other species of seaweeds and basal coral pieces and hence the dried material may only be 50% pure. The ratio between fresh and dry weight of *G. acerosa* is 3:1 and the rate for dried plant is from Rs. 5,500 to 8,000/- per tonne depending on the purity of material.

Gracilaria crassa

This red alga is being harvested since 1966 from five centres namely Rameswaram, Pamban, Vedalai, Seeniappa Darga and Kilakkarai. *G. edulis* grows on pebbles, small stones and seagrasses. It is collected throughout the year mainly around the Gulf of Mannar islands using country crafts while shore collection in Palk Bay and Gulf of Mannar areas is very meagre. Generally many other algae also get mixed up with the harvested *G. edulis* and the cost ranges from Rs. 2,500 to 3,000/- per tonne dry weight.

Gracilaria crassa

This agar yielding seaweed is being exploited since 1983 from 3 centres namely Pamban, Vedalai and Kilakkarai. *G. crassa* grows as a mat on rocks and stones. Since this plant is prostrate and cushion like, lot of sediments settle over the plants and the standing crop of this species is less when compared to *Gelidiella acerosa* and *Gracilaria edulis*. Therefore, only small quantity of this seaweed is harvested especially whenever *G. edulis* is not available. The cost of *G. crassa* is Rs. 2,500/- to 3,000/- per tonne dry weight.

Sargassum

This brown seaweed thrives on rocks and coral reefs. It forms the major constituent of the total commercial landings of seaweeds and it constitutes about 70% of the total seaweed harvested. It is exploited since 1966. *Sargassum wightii* is the main species and the rest are *S. myriocystum, S. ilicifolium, S. plagiophyllum* and *S. tenerrium*. The major portion harvested is from the Gulf of Mannar islands. Shore collection is done only at Pudumadam and Kanyakumari area (Kooduthalai to Leepuram). Some algin industries stock the raw material required for one year by procuring the formalin treated *Sargassum* during peak growth period of this alga *i.e.* August/September to December/January. Other algin industries procure ordinary dried *Sargassum* plants. The ratio between fresh and dry weight is 5:1. The cost of ordinary dried *Sargassum* is Rs. 600/- per tonne and that of formalin treated *Sargassum* is Rs. 850/-.

Turbinaria

There are three species of *Turbinaria viz. T. conoides, T. decurrens* and *T. ornata* in Mandapam area and they grow mostly on coral reefs. Since 1975, *Turbinaria* is landed at 6 centres namely Rameswaram, Pamban, Vedalai, Seeniappa Darga, Periapattanam and Kilakkarai. The season for collection of *Turbinaria* varies from one area to another depending on the peak growth period of the seaweed. At Kilakkarai January to March is the peak season whereas at Periapattanam it is between August and December and at Seeniappa Darga, Vedalai, Pamban and Rameswaram April to July is the season. The ratio between fresh and dry weight is 7:1 and the cost is Rs. 700/- per tonne of dry weed.

The seaweed industries sell the I.P. grade and food grade of agar at the rate of Rs. 500/- and 200/- per kg respectively. The rate for sodium alginate varies from Rs. 90 to 120/- per kg based on its quality.

Present level of seaweed exploitation

Since 1980 many agar and algin manufacturing seaweed industries have come up in India. As the demand for raw material of agar yielding seaweeds from agar industries is more and the natural resource is less, the agarophytes *Gelidiella acerosa* and *Gracilaria edulis* are being over exploited. The standing crop of algin yielding seaweeds *Sargassum* and *Turbinaria* is abundant. At present only about 50% of the standing crop of alginophytes is harvested and hence the requirement of raw material for algin production is met with easily. For years together the commercial exploitation of seaweeds is concentrated only along Tamil Nadu coast. Attempts must be made by the seaweed based industries to exploit the seaweeds, particularly agar yielding seaweeds, from other areas of Indian coasts and Lakshadweep and Andaman-Nicobar islands in order to meet their demands so that there will be regular supply without any paucity of raw material to the industries.