# OCCURRENCE AND GROWTH OF THE COMMERCIALLY IMPORTANT RED ALGAE IN A FISH CULTURE POND AT MANDAPAM

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**Abstract**

The red algae Gracilaria edulis, Hypnea valentiae, Acanthophora spicifera and Sarconema indica have been observed to occur and grow in a culture pond. Over a period of eight months, the algae grew to 104 kg in the pond of 800 sq m. The hydrological conditions in the pond are compared to those in the sea containing natural beds of these algae during the period of observations. This occurrence and growth may open up the possibility of growing these algae in culture ponds providing the requisite hydrological and nutrient conditions.

**Introduction**

A few species of the commercially important agar yielding red algae of the genus Gracilaria are cultured in ponds in Taiwan, as reported by Chen (1976). In India, Gracilaria verrucosa (Hudson) Papenfuss has been known to occur in fish culture ponds at Muttukadu near Madras (Chennubhotla and Kaliaperumal, 1987). But there has been no record on the occurrence and growth of the more important species Gracilaria edulis (Gmelin) Silva in culture ponds, although it is abundantly present in the sea along the southeast coast of India (Kaliaperumal et al 1987). Since this species is not reported to occur so far in any environment other than the sea, the observations made at Mandapam during 1987-1988 on the occurrence and growth of this species in a culture pond may be of interest

**Observations**

The pond in which G. edulis and other algae were observed to occur and grow is situated at about 200 m away from the sea, along the Palk Bay side of Mandapam (Figure 1, denoted by the numeral '18'). The pond was excavated during 1980, its embankments were constructed and it was subjected to engineering experiments along with ten other ponds during 1980-83 (Bensam, 1985). It is 40 m long, 20 m wide and 1 m deep. Sea water supply to the pond has been effected through a diesel engine pump with a

**Table 1 - Estimated fresh weight of red algae in Pond No.18 of the Fish Farm at Mandapam during 1987-88.**

| Name of the species | Standing crop of algae (wet weight in kg) in the months of sampling | | | | | |
|---|---|---|---|---|---|---|
| | Aug. '87 | Oct. '87 | Dec. '87 | March '88 | | May '88 |
| | | | | Removed during harvest of fish | Left over in pond | |
| Gracilaria edulis | 0.5 | 2.0 | 5.0 | 8.0 | 1.0 | 2.0 |
| Sarconema indica | Trace | 2.0 | 4.0 | 5.0 | 2.0 | 5.0 |
| Acanthophora spicifera | 2.0 | 10.0 | 40.0 | 50.0 | 20.0 | 30.0 |
| Hypnea valentiae | 1.5 | 4.0 | 10.0 | 14.0 | 4.0 | 10.0 |
| Total | 4.0 | 18.0 | 59.0 | 77.0 | 27.0 | 47.0 |

**Table 2 – Monthly mean values of some hydrological parameters in culture Pond No. 18 at the Fish Farm (CP), in the Gulf of Mannar (GM) and the Palk Bay (PB) adjoining the Fish Farm**

| Month | Water temp. (°C) | | | pH | | | Salinity (‰) | | | Dissolved oxygen (ml/l) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CP | GM | PB | CP | GM | PB | CP | GM | PB | CP | GM | PB |
| October '87 | 28.8 | 28.9 | 28.3 | 7.8 | 8.3 | 7.7 | 31.5 | 32.9 | 33.0 | 3.3 | 5.9 | 5.2 |
| November | 31.4 | 27.8 | 29.9 | 7.8 | 8.3 | 8.1 | 21.0 | 32.6 | 31.0 | 4.1 | 4.6 | 4.1 |
| December | 27.1 | 26.4 | 28.0 | 7.0 | 8.2 | 7.9 | 21.0 | 27.9 | 28.0 | 3.6 | 3.8 | 4.1 |
| January '88 | 25.3 | 25.3 | 25.3 | 8.1 | 8.2 | 7.6 | 24.0 | 29.3 | 25.5 | 3.7 | 4.4 | 4.4 |
| February | 30.6 | 25.9 | 30.2 | 8.0 | 8.3 | 8.0 | 33.5 | 31.8 | 25.0 | 1.5 | 4.6 | 5.1 |
| March | 30.1 | 29.2 | 29.8 | 7.8 | 8.3 | 7.8 | 34.0 | 33.1 | 29.0 | 1.8 | 4.5 | 5.4 |
| April | 32.4 | 30.1 | 31.5 | 7.7 | 8.3 | 8.0 | 34.0 | 33.0 | 28.5 | 1.5 | 3.9 | 4.4 |

suction line having a diameter of 7.5 cm and delivery line with a diameter of 5.0 cm. Experimental culture of Milkfish, Chanos chanos was taken up in the pond from the month of April 1983. From 1983 to July 1987, there was no growth of any macroalgae in the pond. In the other ponds also there has been no occurrence of such algae.

The occurrence of macroalgae in pond 18 was first noticed in August 1987, after stocking the pond with Milkfish during June 1987. In addition to G. edulis, the other commercially valuable algae found to occur and grow in the pond are Sarconema indica, Acanthophora spicifera and Hypnea valentiae. Apart from these red algae, a green alga, Chaetomorpha aerea, a blue-green alga, Lyngbya majuscula and a seagrass Halophila ovalis were also found to occur and grow in the pond. Since these algae served as the food of the fish stocked in the pond, these were left undisturbed except on the days of monthly sampling of the fish and at the time of fish harvest. The gross growth of algae was monitored periodically by random sampling from 1 sq m area at ten locations in the pond by calculating the wet weight of each species in the samples and by estimating the weight of each species for the total pond area. The height of the plants for G. edulis was also estimated. In March 1988, the Milkfish stocked in the pond were harvested and along with the fish a quantity of 77 kg of algae was removed from the pond. The estimated periodical standing crop of the algae for four species during 1987-88 is presented in Table 1.

As may be seen from Table 1, G. edulis has registered a growth increment from 0.5 kg in August to 9 kg in March in the pond of 800 sq m over a period of 8 months, at a growth rate of 0.05 g/day/sq m. The mean length of G. edulis plants was 3.4, 6.5, 9.8, 16.7 and 14.3 cm when the sampling was made during August, October, December, March and May respectively. The increase in weight of G. edulis is without taking into account the browsing of algae by fish stocked in the pond, numbering 320 in June, 1987. Milkfish is known to feed upon red algae such as Gracilaria in the Philippines (Bardach et al 1972). Among the other algae, the highest growth was recorded by Acanthophora spicifera amounting to 70 kg fresh weight followed by Hypnea valentiae (18 kg) and Sarconema indica (7 kg) over eight months, without taking into account the browsing by the fish stocked.

Obviously these algae have entered the pond through the water being pumped in for the culture of Milkfish. It may be noted in this connection that sea water was pumped into the other ponds also situated near pond No. 18 (Fig. 1); but in none of the other ponds these algae have established and grown. Physical examination of G. edulis growing in the pond has shown that the texture of plants was rough when compared with the specimens collected from the adjoining seas.

The hydrological parameters and nutrients in the pond under observation are presented in Table 2 and 3. These parameters were determined for both Palk Bay and Gulf of Mannar for comparison. There was no marked variation in the values obtained for water temperature and pH. The salinity values in the pond have gone down during November

Table 3 - Monthly mean values of nutrients in culture Pond No. 18 at the Fish Farm (CP), in the Gulf of Manner (GM) and the Palk Bay (PB) adjoining the Fish Farm.

| Month | Phosphate ( g at/l) | | | Silicate ( g at/l) | | | Nitrite ( g at/l) | | | Nitrate ( g at/L) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CP | GM | PB | CP | GM | PB | CP | GM | PB | CP | GM | PB |
| October '87 | 0.11 | 0.07 | 0.12 | 16.50 | 9.30 | 19.50 | 0.48 | 0.50 | 0.15 | 4.75 | 1.00 | 1.75 |
| November | 0.60 | 0.05 | 0.15 | 17.50 | 5.50 | 15.30 | 0.03 | 0.19 | 0.20 | 0.44 | 1.53 | 2.38 |
| December | 0.09 | 0.05 | 0.18 | 12.00 | 3.66 | 8.50 | 0.07 | 0.12 | 0.07 | 3.25 | 1.75 | 1.13 |
| January '88 | 0.12 | 0.08 | 0.15 | 14.00 | 7.30 | 10.50 | 0.02 | 0.02 | 0.04 | 1.88 | 0.92 | 4.00 |
| February | 0.55 | 0.04 | 0.13 | 8.25 | 5.70 | 9.00 | 0.15 | 0.04 | 0.08 | 3.00 | 2.16 | 3.88 |
| March | 0.09 | 0.14 | 0.04 | 16.00 | 6.70 | 16.00 | 0.20 | 0.15 | 0.13 | 1.13 | 1.30 | 1.38 |
| April | 0.15 | 0.10 | 0.10 | 29.00 | 9.50 | 10.50 | 0.11 | 0.17 | 0.06 | 1.00 | 1.00 | 0.75 |

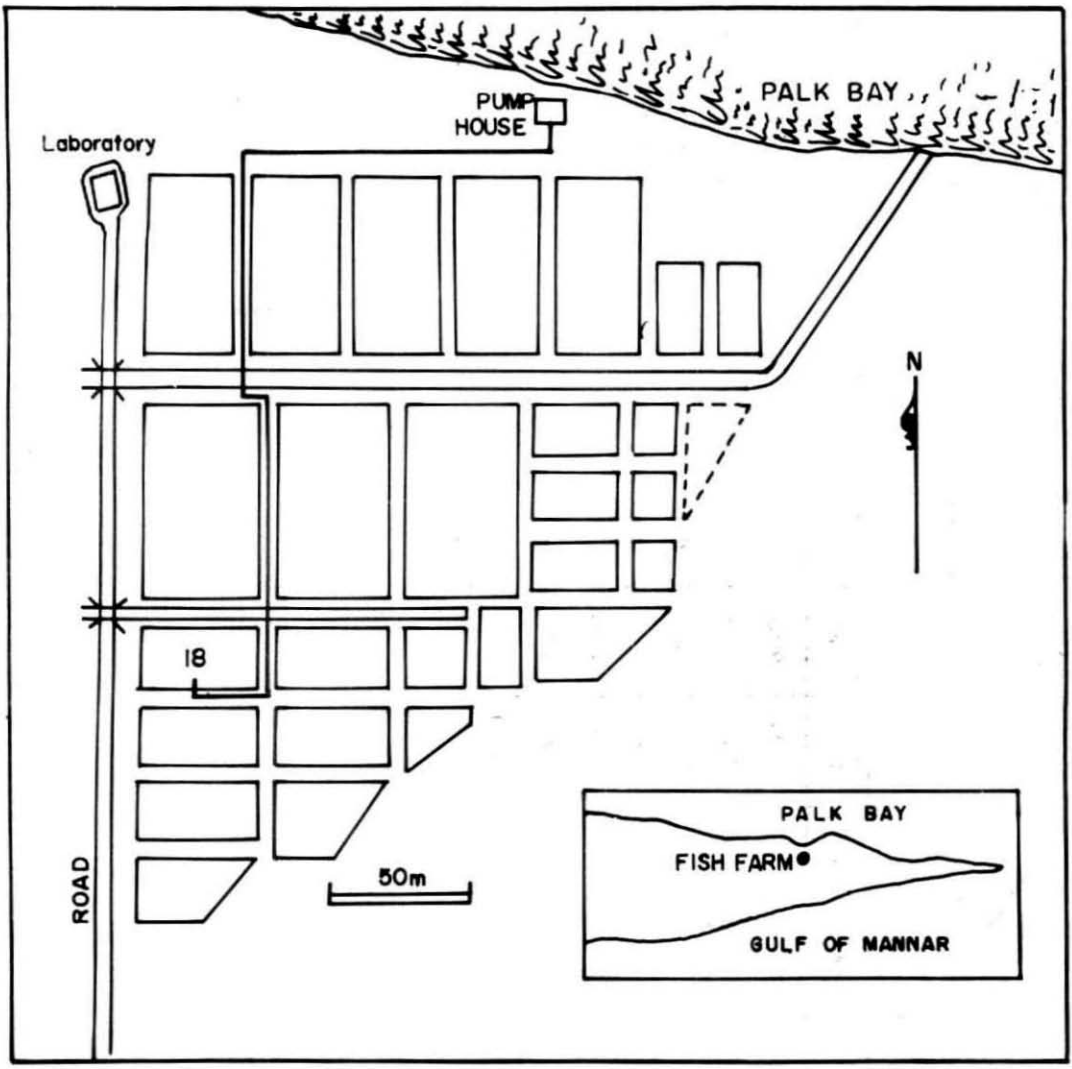


Fig. 1. Plan of the pond site; the pond studied is marked '18'.

and December, '87 recording values less than in both the seas obviously due to northeast monsoon rains during the period. During February-April, '88 the salinity was high because of evaporation of pond water under summer condition. The values obtained for dissolved oxygen in the pond were lower particularly from February to April than those obtained from the adjoining seas. In general, the nutrient values were comparatively high in the pond when compared with the seas, probably due to rice bran and oil cake supplied to the Milkfish stocked and due to exogenous products of the organisms growing in the pond.

**Discussion**

Apart from the off-bottom culture of Gracilaria undertaken in some countries, including experimental culture in India (Chennubhotla et al 1987), bottom culture of certain species is carried out in Taiwan (Chen, 1976). The principal species cultured are Gracilaria gigas, G. compressa, G. edulis and G. verrucosa of which the last one is the most common. Cuttings of the algae are planted at the bottom uniformly by fixing them to bamboo sticks or covered with used fishing nets to prevent them from drifting. Organic or inorganic fertilizers are used in the pond to accelerate the growth of Gracilaria. 3000 to 5000 kg of the fragmented plants are planted in a pond of one hectare size. Generally 70000 to 84000 kg of wet Gracilaria are produced from one hectare pond annually. The growth rate of G. edulis in the present study can be compared with the results obtained with the plants of G. edulis occurred in the natural environment and cultivated on coir rope nets in the near shore areas of Mandapam (Umamaheswara Rao, 1973 and 1974 and Chennubhotla et al 1978) and also species of Gracilaria cultured in the ponds at Taiwan (Chen, 1976). From the occurrence, survival and growth of G. edulis in the culture pond at Mandapam there appears to be a possibility for culturing this alga in culture ponds in India.

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