

Restoration of *Gracilaria edulis* by artificial propagation in Puttalam Lagoon; Sri Lanka

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Abstract

The red algae, *Gracilaris edulis* is a principle source of agar which disappeared from the Puttalam lagoon after 1998. The real cause for the disappearance remains unknown. A culture trail of *Gracilaria edulis* was undertaken using a floating raft system and designed to investigate the possibility of culturing the species in the Puttalam lagoon, Kalpitiya area after the depletion of natural stock. Propagules were taken from emerged natural stock in Sinna-Arichchal area. The aim of the study was to restore the *Gracilaria edulis* natural stock and determine whether artificial culture is possible. Two locations were selected namely “Near shore” (L1) and “Distance away from the shore” (L2). Growth and physio-chemical parameters was tested biweekly. The highest daily growth rate (DGR) (7.15 ± 0.23 %/ day) was recorded at L1 than (5.63 ± 0.107) L2. Maximum average fresh weight gained by propagules at L1 was 1.552 ± 1.361 kg after 60 days of culture. Though high nutrient content is available in south west monsoon period, fragmentation of plants due to heavy wave action coinciding with the high wind speeds was noted. The growth rate in L1 was lower than the growth rate recorded in a previous study in Kalpitiya by Jayasuriya (1993). Maximum surface water temperature recorded in present study (33° C) was higher than the previous study (31° C). The results reveled that growth rates were significantly influenced by temperature and nutrients ($P < 0.05$). The disturbance in the area was higher due to fisheries and eco-tourism activities. Therefore the community in the area should be informed to regulate the disturbances without affecting their fisheries activities. Restoration should be accompanied with the community around the area.

Keywords: *Gracilaria edulis*, Restoration, Culture, depletion, Floating raft

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Introduction

Historically, Sri Lanka has been engaged in exporting of *Gracilaria* species in large quantities harvested from natural stocks. It is fast gaining worldwide importance as a cheap source of dietary protein and minerals that is used as a feed in abalone aquaculture. Also it is one of principle sources of agar (Chiang, 1981). High demand for *Gracilaria* species has lead for the overexploitation of the natural stocks. According to the observed data of National Aquatic Resources Research and Development

Agency, the natural stock of *Gracilaria edulis* in the Puttalam lagoon has disappeared from the 1998 and although the real cause is not known, according to the fishers' information *G. edulis* natural stock has emerged in the Puttalam lagoon in area with small quantities. This study was designed to investigate the feasibility of culturing of *G. edulis* in Puttalam lagoon after the depletion and to restore the natural stocks in the area.

Materials and Methods

The study was carried out at Kalpitiya area (8°15' 0" N 79°46' 14.52" E) in Puttalam lagoon, Sri Lanka. Two locations named L1 (near shore) and L2 (distance away from the shore) were selected to establish the floating rafts (1.6 m × 1.6 m) as the cultivation structures. Propagules for the cultivation were collected from the Sinna-Arichchal area. Fifty gram bunches were made and hung along poly propylene lines (6 lines per each raft), spaced at a distance of 25 cm. Collectively 36 propagules were suspended on each raft. Thereby 72 propagules were prepared as replicates for one site. When measuring of fresh weights maximum possible numbers of replicates were used at a time. Daily growth rates were calculated according to the formula developed by Dawes *et al.* (1993) measuring fresh weight biweekly. Simultaneously, water samples were collected and selected water quality parameters analyzed, these comprised alkalinity and pH. They were analyzed at the National Aquatic Resources Research and Development Agency. Salinity and temperature was tested onsite. All the collected data were analyzed using one way analysis of variance (ANOVA).

Results and Discussion

According to the statistical analysis, there was a significant difference between the growths recorded at the two locations. Site L1 recorded a higher growth rate (7.15 % per day) than L2 (5.63 % per day) throughout the study period. The variation in the daily growth rates of *Gracilaria edulis* throughout the study period at the two different locations may be due to differences in one or more environmental factors in the study sites. High daily growth rates were occurred on the month of June which coincided with the south-west monsoon. Even though the south- west monsoon does not directly affect the study area, there may have some indirect impacts that could have accrued to fresh water fluctuation (Kala Oya and MiOya, 20th of July) which supply fresh water input to the lagoon from the catchment area. Therefore, this would promote the growth rate of the *Gracilaria* in the lagoon in the south west monsoon periods. Since the study was conducted for a short time period (3 months), exact effect of salinity on the growth

Proceedings of the National Aquatic Resources Research and Development Agency (NARA), Scientific Sessions 2015 of *Gracilaria edulis* could not be predicted. Salinity variation was 31 ppt to 34 ppt during the study period.

Figure 1: DGR variation at two locations throughout the study period with selected time intervals

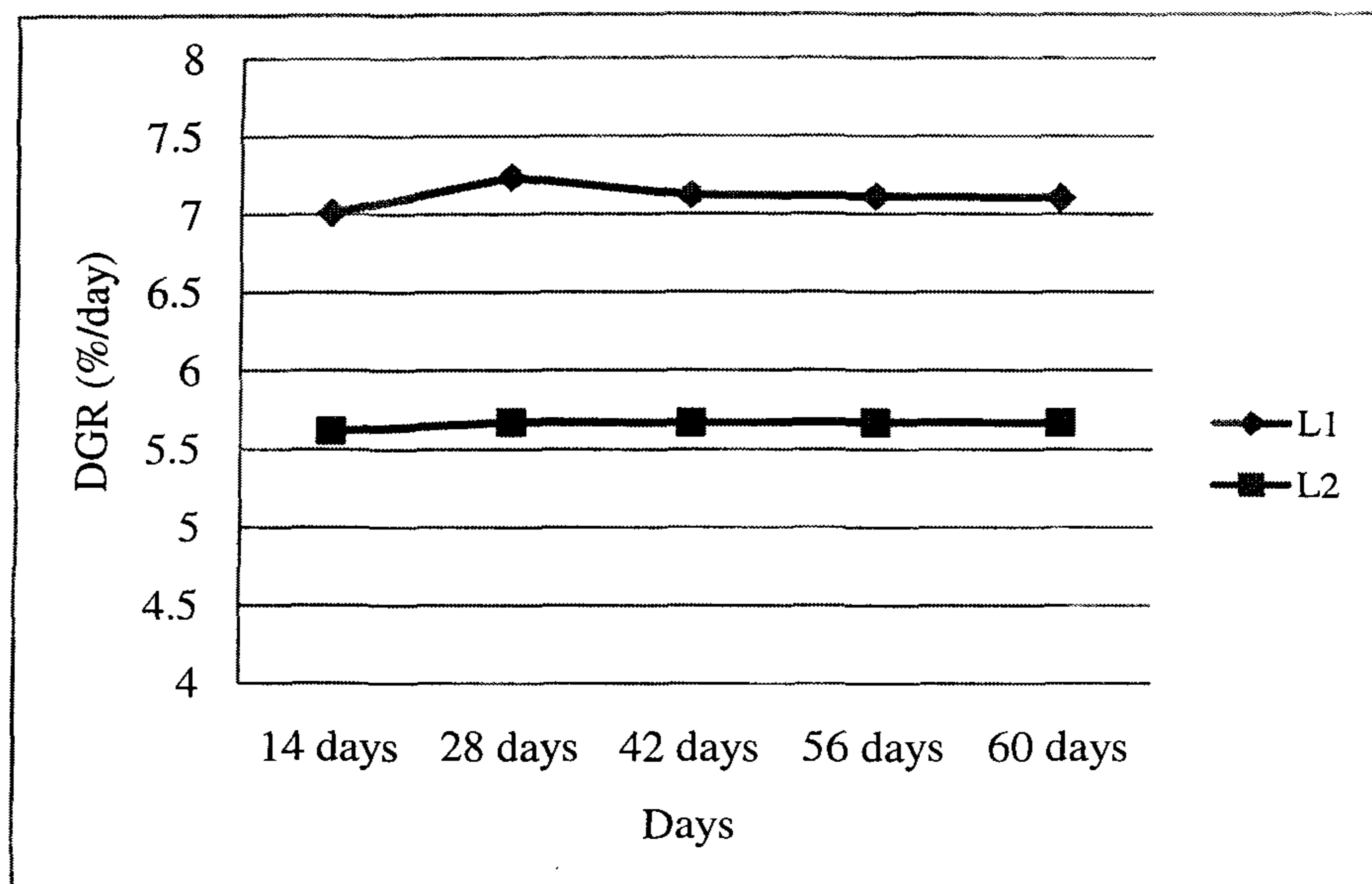


Table 1: Mean values of fresh weights, DGR, temperature, nitrate and ammonia concentrations

Location	Mean of Fresh weight	Mean of DGR	Mean of [NO ₃ ⁻]	Mean of [NH ₃ ⁺]	Mean of T0
L1	1552a	7.155a	0.301a	0.055a	31.05a
L2	718b	5.635b	0.139b	0.036b	31.5a

^{a,b} Different letters in the same row are significantly different (P < 0.05)

Among the analyzed water quality parameters, only nitrate and ammonium concentrations at the site were significantly different (Table 1) at two locations and shown a correlation with the growth. Mean concentration of NO₃⁻ and NH₃⁺ in L1 were higher. When compare two locations, L1 was richer with nutrients since it is located in a sea cucumber cultured pen and also L1 substrate was rich with the sea grasses (*Cymodocea serrulata* and *Enhalus acoroides*). Therefore nutrient gain and the nutrient circulation in the L1 could be considered high.

Conclusion

The results of the present study revealed that the artificial propagation of *Gracilaria edulis* in the Puttalam lagoon is possible after the depletion of the natural stock. But the growth rates are low when compared to previous studies that have conducted before the depletion.

References

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