



Monsoonal Variation and *Phragmatopoma* sp.-Driven Fragmentation in a *Thalassia hemprichii* Meadow in Sri Lanka

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Seagrass meadows provide critical ecosystem services, including carbon sequestration, coastal stabilization, and nursery habitats for marine organisms, but are increasingly susceptible to localized biotic and environmental stressors. This study investigated the temporal variation in percentage coverage and leaf morphology of *Thalassia hemprichii* at Pareiwella Beach, Sri Lanka, during three periods in 2025: January (pre-monsoonal phase), July (southwest monsoon onset), and September (late monsoon). Using random quadrat sampling ($n = 20$), seagrass cover and leaf length were assessed to evaluate the influence of monsoonal rainfall patterns and the activity of the tube-building polychaete *Phragmatopoma* sp. One-way analysis of variance (ANOVA) revealed a significant temporal variation in seagrass cover ($p = 0.0314$). Post hoc Tukey HSD testing identified a significant decline in mean seagrass cover from $65.0 \pm 8.20\%$ in July to $46.5 \pm 12.40\%$ in September, representing a mean decline of 18.5% ($p = 0.0321$). Importantly, no significant difference ($p > 0.05$) was observed in coverage between January and July. Notably, leaf length reached a maximum in July (10.0 ± 0.45 cm), coinciding with heavy rainfall and peak formation of sand tubes by *Phragmatopoma* sp. Furthermore, Pearson correlation analysis showed that the relationship between leaf length and coverage shifted from a weak positive correlation in January ($r = 0.27$) to a weak negative correlation in July ($r = -0.09$). The increased leaf elongation observed during July may represent a stress-induced compensatory response associated with monsoonal environmental conditions, including increased epiphyte accumulation and the presence of extensive sand tube structures formed by *Phragmatopoma* sp. These findings suggest that seasonal environmental changes and *Phragmatopoma* sp. activity may contribute to localized degradation of *T. hemprichii* meadows, highlighting the need for targeted coastal ecosystem management at Pareiwella Beach.

Keywords: Elongation, Epiphytes, Meadow fragmentation, Morphological plasticity, *Phragmatopoma* sp.