

**A STUDY ON SEAGRASS BIODIVERSITY, DISTRIBUTION AND
BIOMASS IN TUNKU ABDUL RAHMAN PARK,
SABAH, MALAYSIA**

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**A STUDY ON SEAGRASS BIODIVERSITY, DISTRIBUTION AND BIOMASS
IN TUNKU ABDUL RAHMAN PARK, SABAH, MALAYSIA**

By

JOSEPHINE GUMPIL

**This project report is submitted in partial fulfillment of the requirements for the
degree of Bachelor of Science (Marine Science).**

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ABSTRACT

A study on seagrass species composition, distribution, ecology, shoot density and biomass was conducted using transect and quadrat methods in April to June 1996 Tunku Abdul Rahman Park, Sabah.

Ten species belonging to five genera in five families of seagrasses were encountered: *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule pinifolia*, *Halodule uninervis* (wide and narrow leaf), *Enhalus acoroides*, *Halophila ovalis*, *Halophila minor*, *Halophila decipiens*, *Halophila spinulosa* and *Thalassia hemprichii*. *Halophila decipiens* and *Halophila spinulosa* represented new records for Sabah. This finding has brought to 11 total number of seagrass species presently known for Sabah. Descriptions of each species were also provided. Flowering and fruiting stages were observed in *Halodule pinifolia*, *Halophila spinulosa*, *Halophila decipiens* and *Enhalus acoroides*. *Halophila ovalis* is the most common with a wide distribution while *Halophila decipiens*, *Halophila spinulosa* and *Halophila minor* were relatively rare. *Halophila ovalis* was categorised into 3 types based on leaf morphology; i.e. spatulate-leaf, oval-leaf and small-leaf types.

The distribution of seagrass at the sites or between sites were related to substrate types, water depth, in relation of turbidity and competition among seagrass species. They were found growing in four types of substrates, i.e. loamy sand, sandy loam, fine sandy and coralline medium sand in meadow or patches. The species encountered varied in their depth distribution as in *Cymodocea* spp. (0.5 - 3.0 m), *Halodule* spp. (0.5 - 4.5 m), *Enhalus acoroides* (1.0 - 3.0 m), *Halophila* spp.

(0.5 - 18 m) and *Thalassia hemprichii* (1.0 - 3.0 m). All species inhabited shallow areas except for *Halophila decipiens* and *Halophila ovalis* which have a deep and wide range of depth distribution with maximum attainable depth of 7 to 18 m. There was no specific zonation in the distribution of the seagrasses.

The mean shoot density varied from 100 to 7733.33 shoots/m². The highest was exhibited by *Halodule pinifolia* (7733.33 ± 1020.79 shoots/m² at Kuari II, Pulau Gaya) and the lowest by *Halodule uninervis* (100 ± 100 shoots/m² at Kuari I, Pulau Gaya). Almost all sites showed similar shoot density trend with the shallow area (landwards) possessed higher shoot density and decreasingly lower towards deeper areas (seawards). Shoot density of *Halodule uninervis* at Tanjung Wokong, Pulau Gaya (1730 ± 493.52 shoots m⁻²) were significantly different higher than at Kuari I, Pulau Gaya (100 ± 100 shoots m⁻²).

The mean biomass of seagrasses varied from 1.03 to 144.05 g DW m⁻². *Cymodocea serrulata* at Kuari II, Pulau Gaya had the highest calculated mean biomass (AG: 45.54 to 66.16 g DW m⁻²; BG: 43.09 to 77.89 g DW m⁻²; TOTAL: 97.48 to 144.05 g DW m⁻²) while *Halophila ovalis* had the lowest biomass (AG: 0.69 g DW m⁻²; BG: 0.35 g DW m⁻²; TOTAL: 1.03 g DW m⁻²). The highest AG:BG ratio was found in *Halodule pinifolia* with a mean ratio of 1:1.99 (Kuari II, Pulau Gaya) while the lowest was observed in *Cymodocea serrulata* at Pulau Sulug I with a mean ratio of 1:0.79. A relatively higher biomass (e.g. *Halodule uninervis* and *Cymodocea serrulata*) occurred at shallow areas (landwards) and decreasingly lower

towards deeper areas (seawards). The biomass of seagrass in particular varied between sites.

Shoot density and biomass were highly correlated ($p < 0.05$) in *Halodule pinifolia* ($y = 0.046x - 1.1075$, $r^2 = 0.8458$ at Base Camp, Pulau Gaya and $y = 0.0118x - 23.2074$, $r^2 = 0.8121$ at Kuari II, Pulau Gaya); *Halodule uninervis* with wide leaf type ($y = 0.0421x + 2.5744$, $r^2 = 0.8268$ at Tanjung Wokong, Pulau Gaya); *Cymodocea serrulata* ($y = 0.1812x - 4.9066$, $r^2 = 0.9169$ at Kuari I, Pulau Gaya; $y = 0.1041x + 0.5426$, $r^2 = 0.9819$ at Kuari II, Pulau Gaya and $y = 0.0828x - 6.0274$, $r^2 = 0.9298$ at Pulau Sulug I) and *Cymodocea rotundata* ($y = 0.1053x + 8.4206$, $r^2 = 0.8439$ at Kuari II, Pulau Gaya).

Variations observed in linear regression equation (intercept, gradient) specifically for the same species but at different sites e.g. *Halodule pinifolia* and *Cymodocea serrulata* suggest that the biomass varied correspondingly with shoot density. In this case, this study cautioned that not all of the linear regression can be applied for the non destructive method for biomass study.

ABSTRAK

Kajian mengenai komposisi spesies, taburan, ekologi, kepadatan sulur dan biomas di perairan Taman Tunku Abdul Rahman, Sabah telah dijalankan dalam bulan April hingga June 1996. Kajian tersebut telah menggunakan kaedah penyampelan transek dan kuadrat.

Sepuluh spesies di bawah lima genera rumput laut telah didapati. Spesies - spesies tersebut daripada *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule pinifolia*, *Halodule uninervis* (daun lebar dan sempit), *Enhalus acoroides*, *Halophila ovalis*, *Halophila minor*, *Halophila decipiens*, *Halophila spinulosa* dan *Thalassia hemprichii*. *Halophila decipiens* dan *Halophila spinulosa* merupakan rekod baru bagi negeri Sabah. Deskripsi untuk setiap spesies juga dimasukkan dalam laporan ini. Peringkat pengeluaran bunga dan buah diperhatikan pada *Halodule pinifolia*, *Halophila spinulosa*, *Halophila decipiens* dan *Enhalus acoroides*. *Halophila ovalis* merupakan spesies yang paling tersebar manakala *Halophila decipiens*, *Halophila spinulosa* dan *Halophila minor* merupakan spesies nadir. *Halophila ovalis* boleh dikategorikan kepada 3 kumpulan berdasarkan kepada 3 morfologi daun iaitu berbentuk spatula, bujur dan kecil.

Taburan rumput laut di dalam atau di antara kawasan kajian ada kaitan dengan jenis substrat, kedalaman air, turbiditi dan juga persaingan di antara rumput laut. Rumput laut didapati tumbuh di atas pelbagai jenis substrat iaitu pasir berloam, loam berpasir, pasir halus dan pasir koral bersaiz sederhana kasar dalam bentuk bersatu (bergabung) atau berkelompok. Taburan spesies yang dijumpai berbeza dari segi

kedalaman seperti *Cymodocea* spp. (0.5 - 3.0 m), *Halodule* spp. (0.5 - 4.5 m), *Enhalus acoroides*. (1.0 - 3.0 m), *Halophila* spp. (0.5 - 18 m) dan *Thalassia hemprichii* (1.0 - 3.0 m). Kesemua spesies tumbuh di kawasan cetek kecuali *Halophila decipiens* dan *Halophila ovalis* yang mempunyai taburan kedalaman yang agak dalam dan berjulat luas yang boleh mencapai 7 hingga 18 m.

Min bilangan kepadatan sulur rumput laut berada dari julat 100 hingga 7733.33 sulur/m²; nilai tertinggi ditunjukkan oleh *Halodule pinifolia* (7733.33 ± 1020.79 sulur/m² di Kuari I, Pulau Gaya) dan yang paling rendah ditunjukkan oleh *Halodule uninervis* (100 ± 100 sulur/m² Kuari I, Pulau Gaya). Hampir kesemua kawasan kajian menunjukkan corak taburan kepadatan sulur yang sama di sepanjang transek. Kawasan yang cetek (mengarah ke darat) mempunyai nilai kepadatan sulur yang lebih tinggi dan nilainya semakin rendah ke arah kawasan yang lebih dalam (arah laut). Kepadatan sulur *Halodule uninervis* di Tanjung Wokong, Pulau Gaya (1730 ± 493.52 sulur m⁻²) adalah tinggi berbanding di Kuari I, Pulau Gaya (100 ± 100 sulur m⁻²).

Min biomas untuk rumput laut berjulat dari 1.03 hingga 144.05 g BK m⁻² (gram per berat kering per meter persegi). *Cymodocea serrulata* yang dijumpai di Kuari II, Pulau Gaya mempunyai nilai yang tertinggi iaitu; (AG: 45.54 hingga 66.16 g BK m⁻²; BG: 43.09 hingga 77.89 g BK m⁻²; TOTAL: 97.48 hingga 144.05 g BK m⁻²) manakala *Halophila ovalis* pula mempunyai nilai biomas yang terendah iaitu; (AG: 0.69 g BK m⁻²; BG: 0.35 g BK m⁻²; TOTAL: 1.03 g BK m⁻²). Nisbah AG:BG yang paling tinggi didapati pada *Halodule pinifolia* dengan nisbah min 1:1.99 (Kuari II,

Pulau Gaya) manakala jumlah AG:BG yang terendah adalah pada *Cymodocea serrulata* dengan nisbah min 1:0.79 (Pulau Sulug I). Corak taburan min biomas rumput laut di sepanjang transek memberi nilai biomas yang lebih tinggi di kawasan cetek (mengarah ke darat) dan semakin rendah ke arah kawasan yang lebih dalam (arah laut). Biomas untuk spesies terutamanya *Halodule uninervis* berbeza mengikut kawasan.

Kepadatan sulur dan biomas mempunyai korelasi yang tinggi ($p < 0.05$) untuk *Halodule pinifolia* ($y = 0.046 - 1.1075x$, $r^2 = 0.8458$) di Base Camp, Pulau Gaya dan $y = 0.0118x - 23.2074$, $r^2 = 0.8121$) di Kuari II, Pulau Gaya, *Halodule uninervis* berdaun lebar ($y = 0.0421x - 2.5744$, $r^2 = 0.8268$) di Tanjung Wokong, Pulau Gaya, *Cymodocea serrulata* ($y = 0.1812x - 4.9066$, $r^2 = 0.9169$ di Kuari I, Pulau Gaya; $y = 0.1041x + 0.5426$, $y = 0.1041x + 0.5426$, $r^2 = 0.9819$ di Kuari II, Pulau Gaya dan, $y = 0.0828x - 6.0274$, $r^2 = 0.9298$ di Pulau Sulug I) dan *Cymodocea rotundata* ($y = 0.1053x + 8.4206$, $r^2 = 0.8439$) di Kuari II, Pulau Gaya.

Terdapat adanya variasi di antara regresi linear (pintasan, kecerunan) yang wujud untuk spesies sama pada kawasan yang berbeza iaitu, *Halodule pinifolia* dan *Cymodocea serrulata* menunjukkan bahawa biomas berbeza mengikut kepadatan sulur. Dalam keadaan ini, kajian ini mengesyorkan perhatian harus diambil kerana bukan semua persamaan boleh digunakan untuk penentuan biomas dengan kaedah tanpa musnah.