Spatial dynamics of the seagrass beds of N'gouja

Guillaud Félix [1] , Miarana Razafimanantsoa [1], Julcot Aniciah Rabemanaja[1]
[1] University of La Réunion - Biodiversity and Tropical Aquatic, Coastal, and Island Ecosystems Department

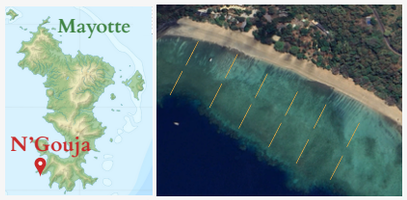
Introduction

Seagrass bed are among the most diverse coastal ecosystems and serve as nursery habitat for fishes, green turtle and invertebrates (Mann et al. 2024). However, N'Gouja seagrass was recently impacted by Chido cyclone in december 2024

Objective: Assessing the spatial dynamic of seagrass bed in N'Gouja.

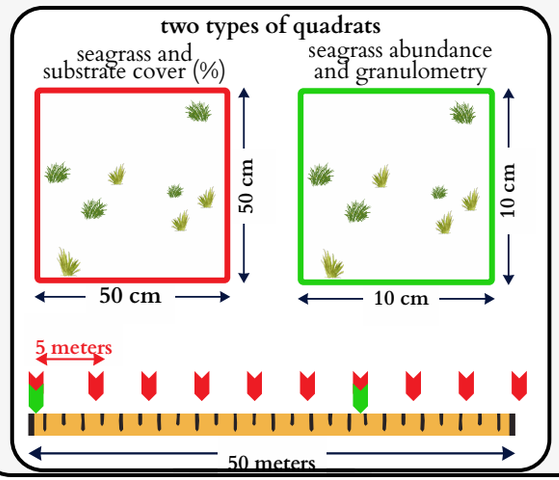
Hypothesis: Seagrass distribution and structure are governed by a gradient linked to substrate granulometry.

Materials and Methods



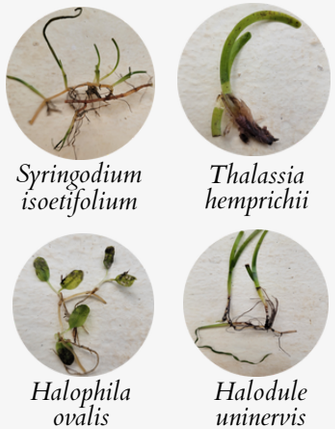
N'gouja bay study site

- Distribution mapped via **IDW** from shoot densities.
- **GAM** used to assess effects of species richness, algal cover, and granulometry on seagrass total density.
- **ANOVA** tested spatial differences among sites.



Results

Main seagrass species found



Syringodium isoetifolium — *Thalassia hemprichii* — *Halophila ovalis* — *Halodule uninervis*

1. Substrate Granulometry and Distance :

Absence of gradient: The LMM showed no significant effect of Cumulative Distance on granulometry (p=0.353).

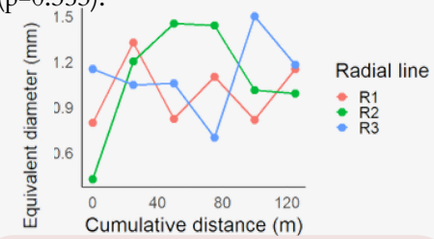


Figure 1 : Variation of equivalent substrate diameter vs. cumulative distance

2. Drivers of seagrass density

Species richness is the key driver: GAM revealed that species richness is the only significant predictor of seagrass density ($F = 16.1$, $p < 0.001$, $R^2 = 0.71$) (Fig.2)

Species contribution: Density varies significantly among species, highlighting the dominant role of certain species in overall meadow structure. (Fig.3)

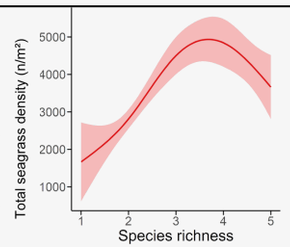


Figure 2 : Seagrass density predicted by species richness

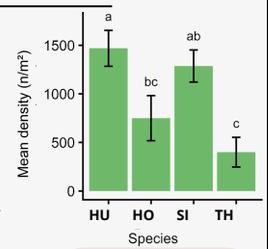


Figure 3 : Mean Density per species

3. Spatial distribution and density gradient

Mosaïc distribution: Density is highly heterogeneous, forming distinct patches (mosaics) of high and low density across the bay. (Fig 5)

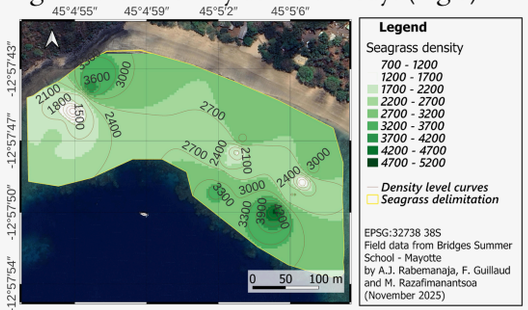


Figure 4 : Map of Seagrass density

Absence of shore gradient: The boxplots confirm that density does not show a clear trend (no significant decrease or increase) with increasing distance from the shore (ANOVA : $F = 1.06$, $p = 0.40$). (Fig.6)

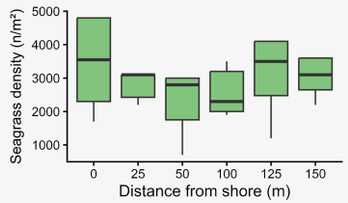


Figure 5: Seagrass density vs. Distance from shore

4. Categorical substrate type structures species composition

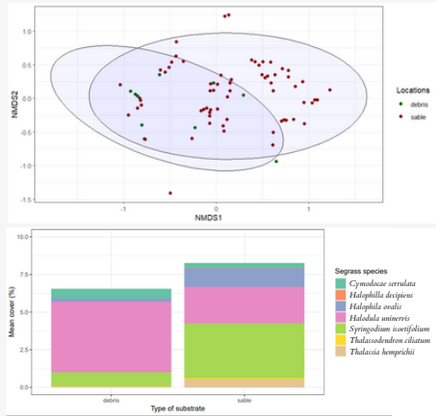


Figure 6 : NMDS of the effect of the type of substrate on the seagrass species composition and cover (PERMANOVA, method = bray, $F = 9.70$, $R^2 = 0.08$, $p < 0.001$)

Figure 7 : Composition of seagrass species and their mean cover depending of the type of substrate

Discussion

Species richness rather than granulometry

Only species richness influences density (indirect effect via species competition). The low granulometric range (0.4 -1.5 mm) insufficient to create contrasted gradient (Terrados et al., 1999).

Multi-factorial control

Unmeasured factors : hydrodynamism, turtle herbivory,, light availability, nutrient (Fonseca & Bell, 1998; Duarte, 1991).

Limitations

Image analysis alone (no sieving), photo quality issues, environmental factors unmeasured, incomplete leaf analysis, limited sampling.

Conclusion

This study demonstrates that the spatial structure of N'Gouja Bay seagrass bed is controlled by species richness rather than a simple granulometry gradient. The high heterogeneity of the substrate, potentially influenced by cyclone Chido, highlights the resilience challenge for seagrass bed.

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