Dynamics of seagrass recovery in the restoration site of Ranobe Bay, Southwest of Madagascar

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BACKGROUND

Seagrass meadows cover approximately 10 % of world's coasts.

They participate in nutrient cycling, oxygen production (14L/m²/day), and carbon storage (15% of the total carbon stored in the ocean).

Seagrass is a support of marine biodiversity and contribute to the income of local populations through fishing activities.

Unfortunately, seagrass meadows are declining globally due to climate change, sedimentation, and human activities (overfishing and pollution).

INTRODUCTION

The seagrass in Ranobe Bay, southwest Madagascar, is declining due to numerous factors.

Fig. 01: *Main factors of seagrass degradation in Ranobe Bay: A) Using destructive fishing gears, B) Trampling by fishing on foot, C) Abandonment of plastic float by seaweed farmers , D) Cyclone*

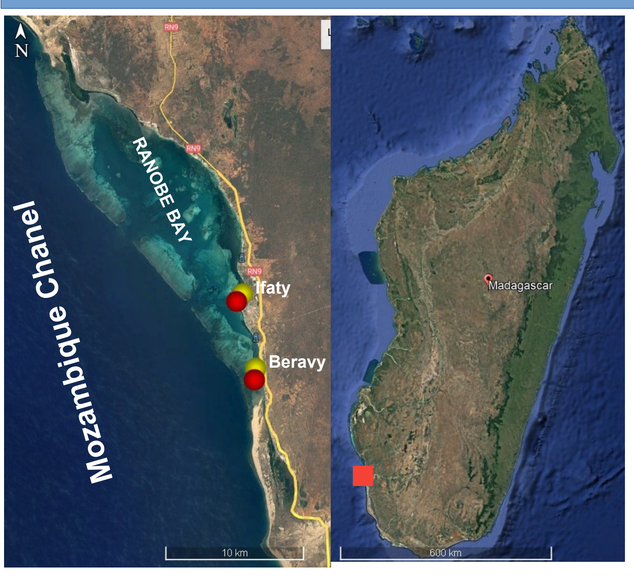
Trials on seagrass restoration was conducted in Beravy and Ifaty, villages of Ranobe Bay from April 2022 to April 2023.

Study objectives

-Assess the evolution of seagrass recovery in the restoration site by the technique of transplantation,

-Determine the relationship between survival rate and coverage based on the transplantation techniques.

MATERIALS AND METHODS



This study was conducted in the Ranobe Bay, in Toliara, located in the Southwest of Madagascar.

Transplantation was carried out at two sites: Beravy and Ifaty, located respectively 26 km and 30 km in the North of Toliara city.

Fig. 02: Localisation of the study site

1 Techniques for collecting shoots in the donor site

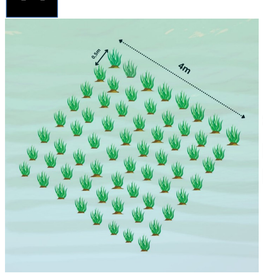
Fig. 03: Illustration of technique to collect seagrass : A/ Clod of seagrass, B/ Clods collected in the basin and C/ Clods putting in the restoration site

The clods of seagrass, including roots and sediment, were colleted using shovel within a 15cmx15cm quadrat to ensure uniformity.

The vegetatives shoots were collected by hands, using a shovel in some cases to ovoid the loss of roots and rhizomes.

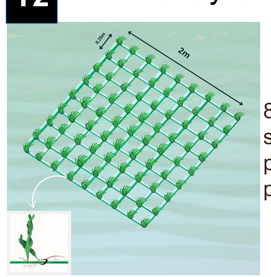
2 Techniques of transplantation

T1 Methods with sediment.



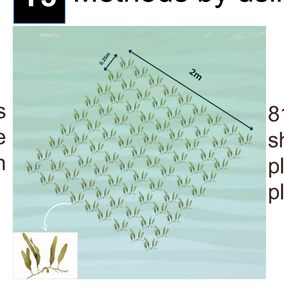
64 clods where planted in each plot/site

T2 Methods by using grid.



81 vegetatives shoots where planted in each plot/site

T3 Methods by using staple.



81 vegetatives shoots where planted in each plot/site

Fig. 04: Illustration of the three techniques of transplantation

3 Monitoring survey in situ (August 2022 – April 2023)

Survival rate: by counting all surviving transplants in each plot and at each site.

Seagrass recovery: by estimating the coverage rate within each quadrat.

RESULTS AND DISCUSSION

R1 Survival rate of the transplants

Tab. 01: Survival rate by techniques after 8 months of transplantation

Techniques	Beravy	Ifaty
T1	73.96 ± 7.38 %	65.63 ± 6.26 %
T2	23.87 ± 4.34 %	15.64 ± 5.83 %
T3	15.64 ± 2.57 %	16.05 ± 5.66 %

No significant difference between Beravy and Ifaty (Kruskal-Wallis: p=0.353).

Significant difference between T1, T2, and T3 (Kruskal-Wallis: p=0.002).

R2 Seagrass coverage in the restoration site

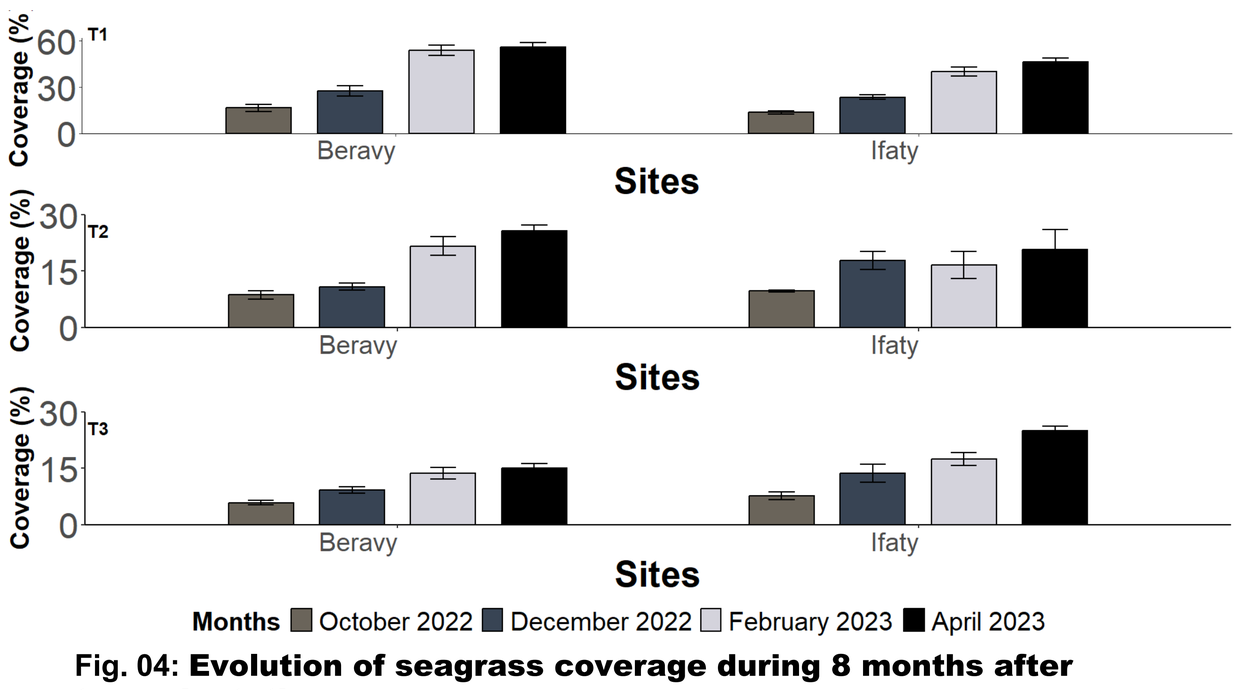
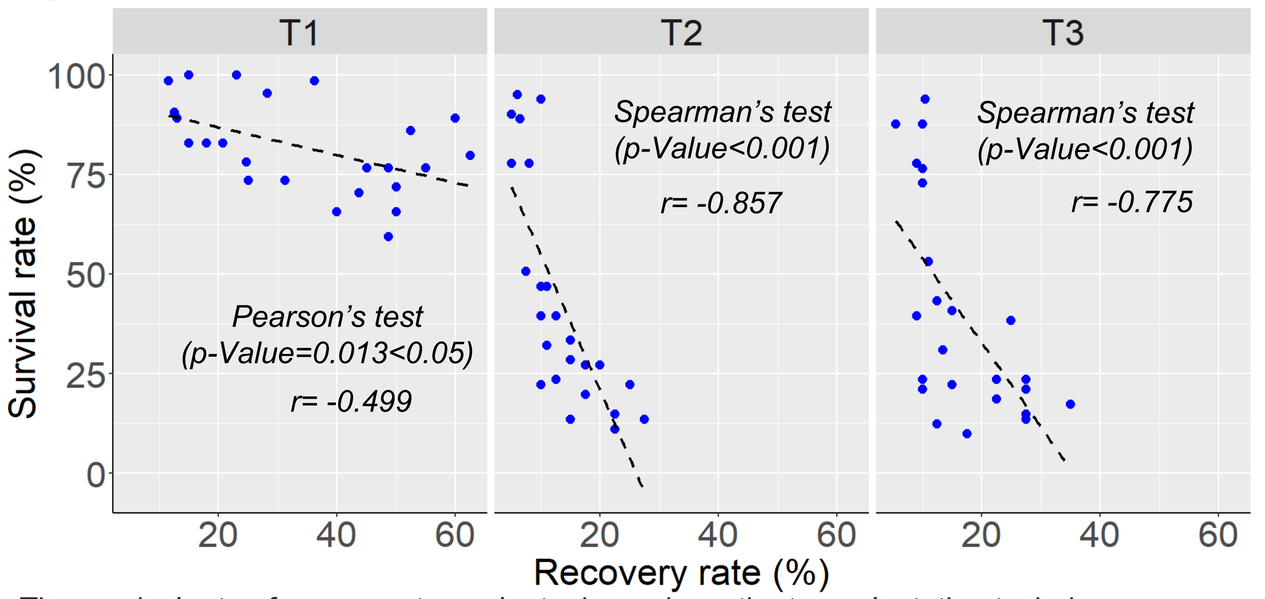


Fig. 04: Evolution of seagrass coverage during 8 months after transplantation

Tab. 01: Survival rate by techniques after 8 months of transplantation

Techniques	Significativity between sites	Significativity between techniques
T1	Significant (t.test, p=0.026)	Significant (ANOVA (p < 0.001)
T2	No significant (Welch t.test, p=0.395)	
T3	Significant (t.test, p< 0.001)	

R3 Correlation betwen survival and coverage rate by techniques



The survival rate of seagrass transplants depends on the transplantation techniques.

The T1 technique is the most effective method for restoring seagrass in Ranobe Bay (significant higher survival and recovery rate comparing to T2 and T3).

The survival rate decrease but the recovery in restoration sites increase.

CONCLUSION

The three tested restoration techniques differ significantly in term of survival and recovery rates.

The technique is one of the factors determining the dynamism of seagrass recovery in the restoration sites.

Understanding an other factors influencing success of tranplantation (biotics and abiotics factors) and testing new methods, such as seed planting, are crucial for improving restoration efforts in Ranobe Bay.

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