

Séminaire de lancement du project RenforC

Renforcement des puits de carbone en milieu marin

26 Avril 2021

Posidonia oceanica planting technique

used in the marine restoration project

El Bosque Marino de Red Eléctrica / Red Eléctrica Marine Forest

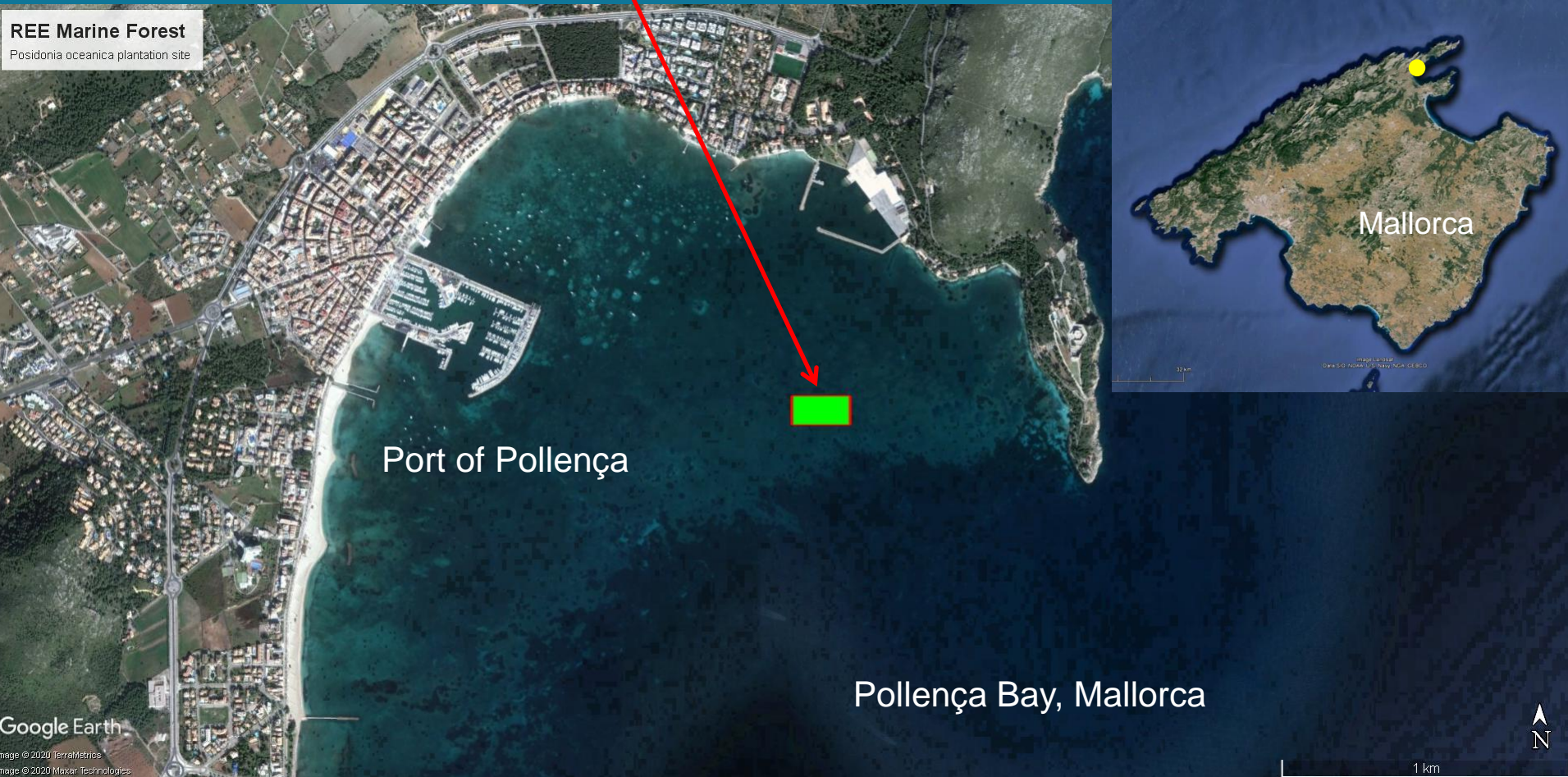
2017-2021(25)

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El Bosque Marino de Red Eléctrica / Red Eléctrica Marine Forest

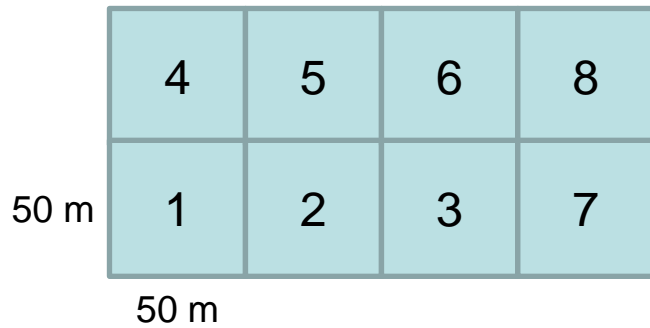
Goal: Planting of 2 hectares of *Posidonia oceanica* meadow



- Dead *Posidonia oceanica* fringe next to an extant living meadow
- Substratum is dead “matte” colonized by seagrass *Cymodocea nodosa* and other macroalgae
- Depth: 4 - 5 m

2-ha plot divided in 8 planting cells

12.800 rhizome fragments of *P. oceanica* produced by natural processes and collected near the planting site



50 m

50 m

5 m
5 m

Planting dates:

Planting cell 1, March 2018

Planting cells 2-3, Nov 2018

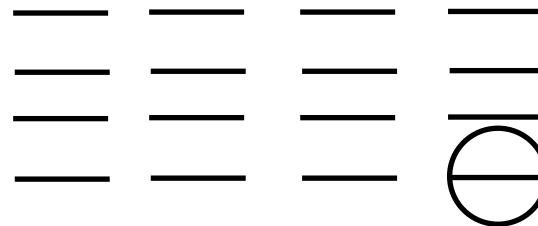
Planting cells 4-5, March-April 2019

Planting cells 6-8, Dec 2019-Feb 2020

**March 2020
100 %
planted!**

100 nodes per planting cell

20 nodes of each planting cell were randomly chosen for monitoring



16 rhizome fragments per node

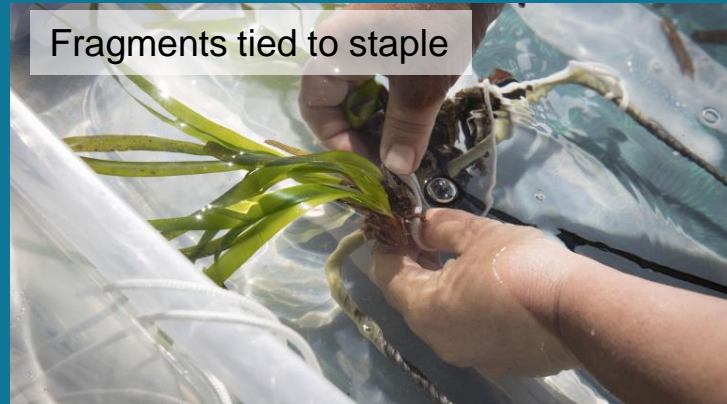
P. oceanica
rhizome
fragment



Manual collection of drifting rhizome fragments



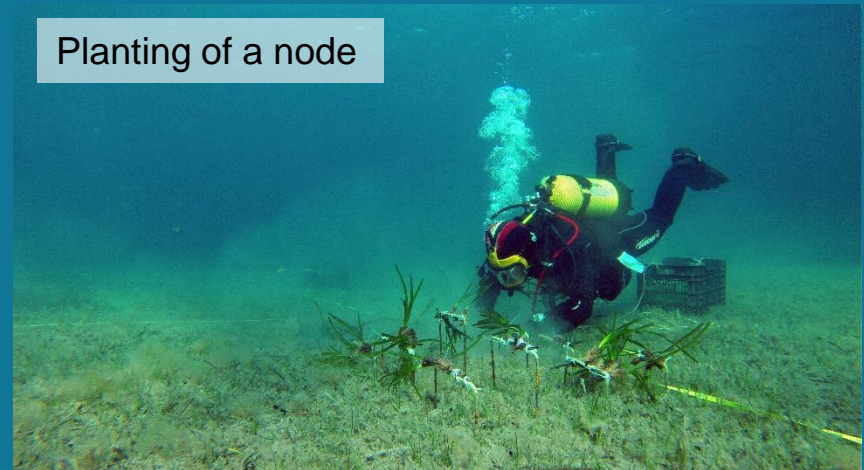
Fragments tied to staple



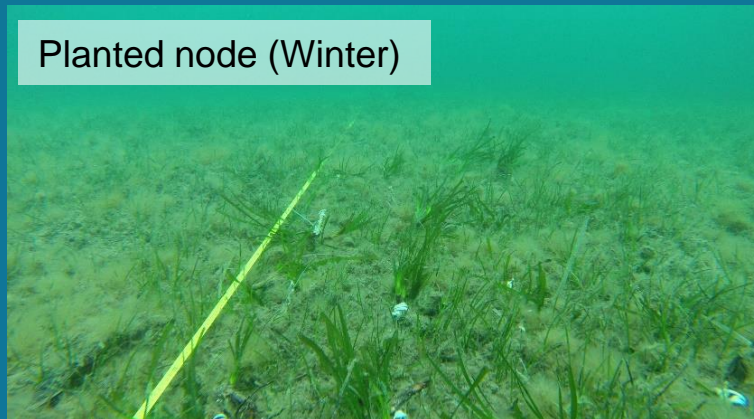
Individually anchored with staple



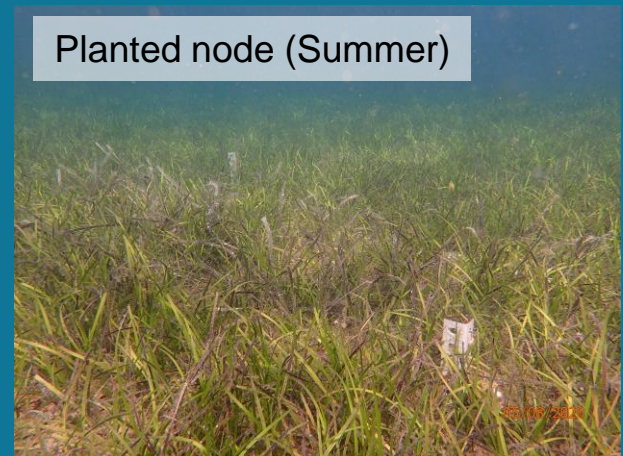
Planting of a node



Planted node (Winter)



Planted node (Summer)

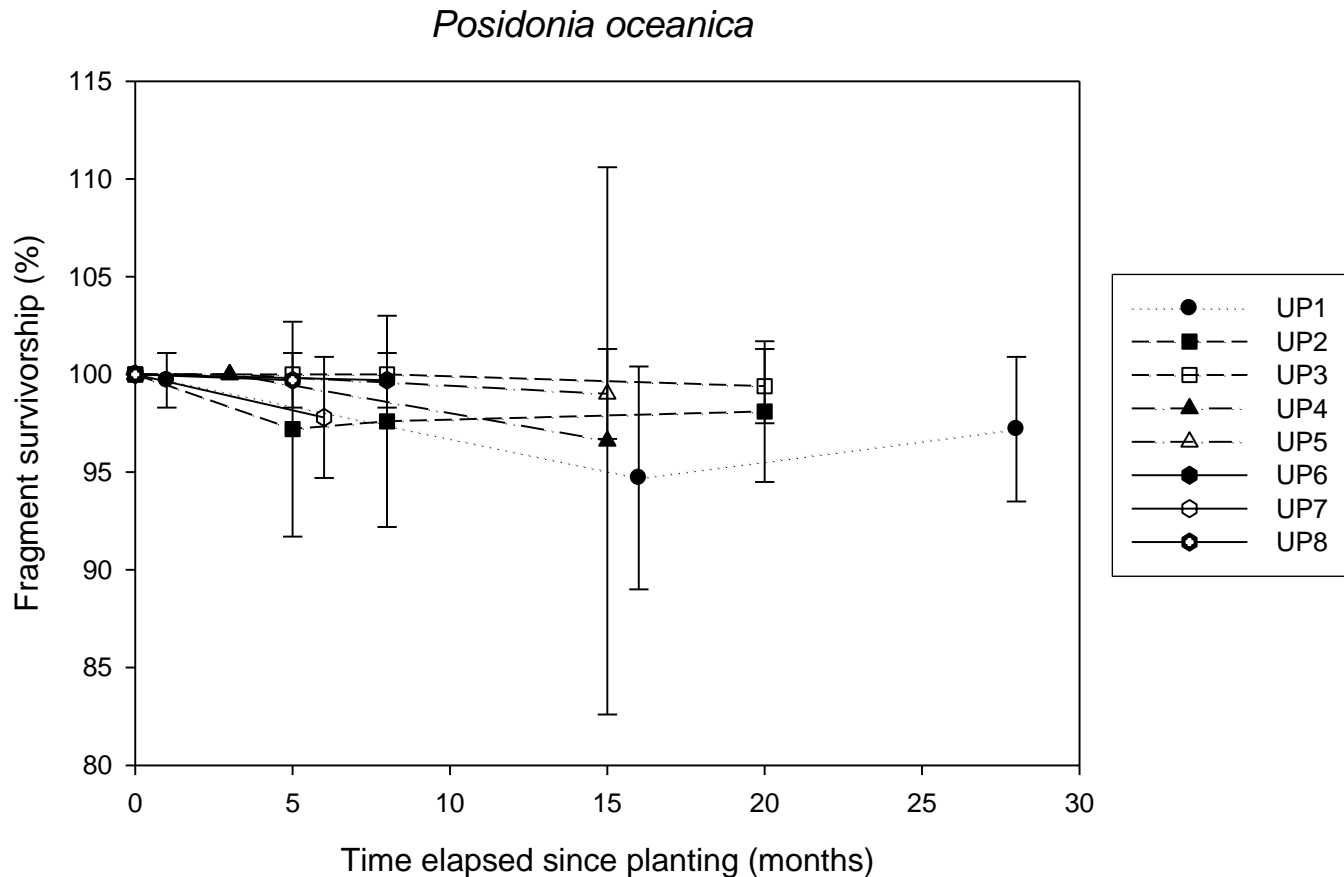


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Signalling buoys to prevent disturbance by anchor mooring



Survivorship of rhizome fragments higher than 90%



First survivorship check (months) is done on the total number of nodes planted, successive checks are done in 20 “monitoring nodes” randomly selected before planting in each planting cell

Results comparison with previous plantings of *P. oceanica* plagiotropic rhizomes

Survivorship	Time elapsed	Source
97 % - 99 %	1,5 - 2,5 years	Red Eléctrica Marine Forest
46 % - 55 %	1-3 years	Piazzzi et al 2021 <i>Water</i> 13, 661
~40 %, ~30 %	3 years, 6 years	Pirrota et al 2015 <i>Mediterranean Marine Science</i> 16 : 591-604
76 %	3 years	Piazzzi et al 1998 <i>Botanica Marina</i> 41: 593-601
85 %	3 years	Molenaar & Meinesz 1995 <i>Botanica Marina</i> 38: 313-322
100 %	1 year	Molenaar et al 1993 <i>Botanica Marina</i> 36: 481-488
20 % - 100 %	2-3 years	Meinesz et al 1993 <i>Botanica Marina</i> 36: 209-216

Survivorship of planted fragments in Red Eléctrica Marine Forest is similar or better than in previous plantings

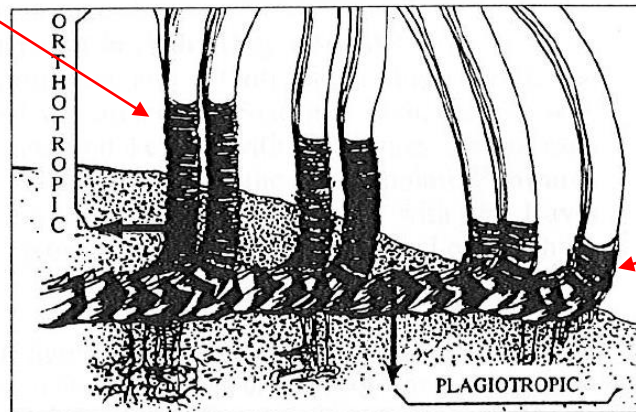
Vegetative development of rhizome fragments (July 2020)

10 nodes of each planting cohort are monitored (~ 160 rhizome fragments/cohort)

- Planting cell 1, 16 and 28 months after planting
- Planting cells 2-3, 8 and 20 months after planting
- Planting cells 4-5, 17 months after planting

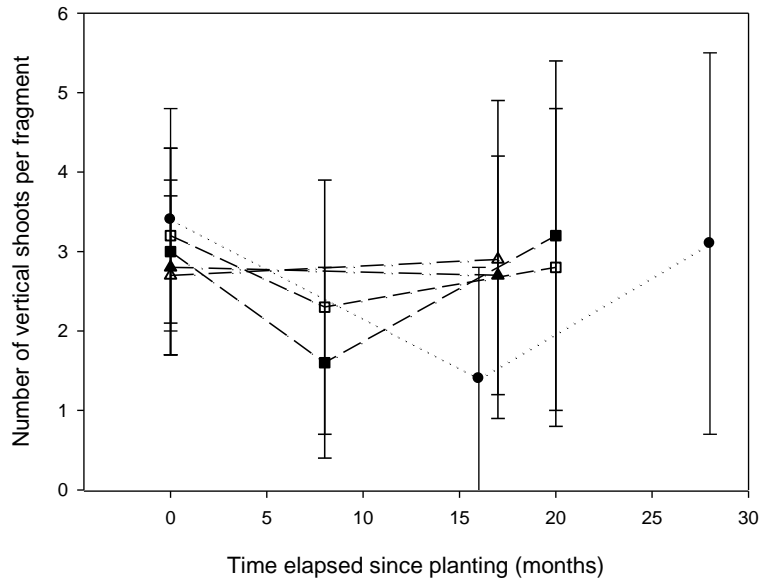
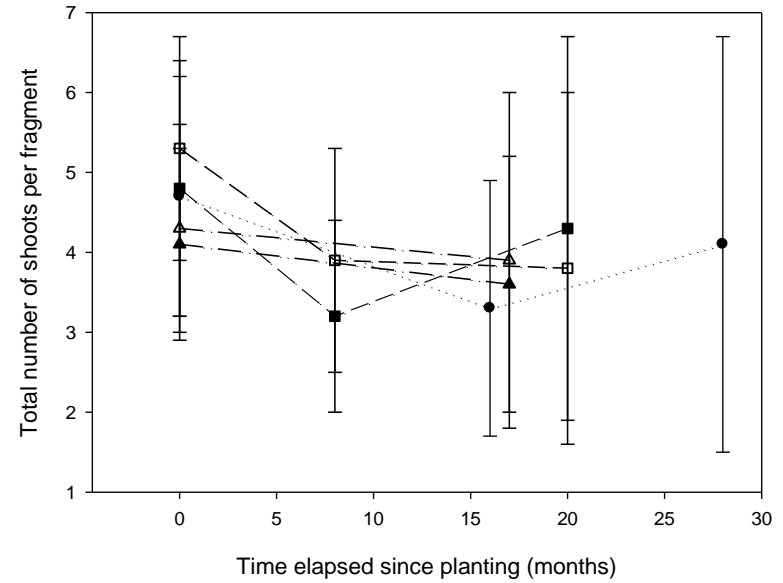
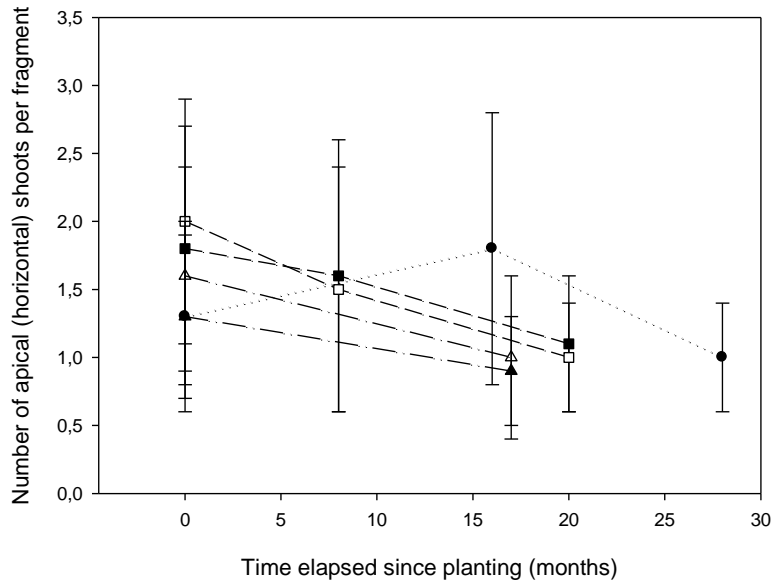
Number of shoots (vertical/horizontal) of each rhizome fragment

Vertical shoot



Horizontal/Apical shoot

Vegetative development of rhizome fragments (July 2020)



- Total number of shoots per fragment similar to initial
- Reduction of number of horizontal (apical) shoots
- “Simplification” of rhizome fragment: one apical only
- Two years of monitoring is not enough (see Pirrotta et al 2015)



06/08/2020

IMEDEA *P. oceanica* planting technique (1)

Target surface to plant:

250 m² of dead matte

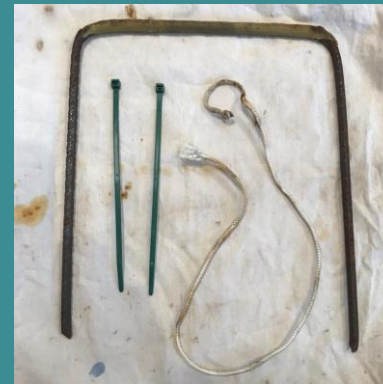
Plant material to be used as planting units:

Plagiotropic rhizome fragments containing a minimum of one apical and two vertical shoots

Collected in zones of natural accumulation in meadow gaps or edges

Planting unit:

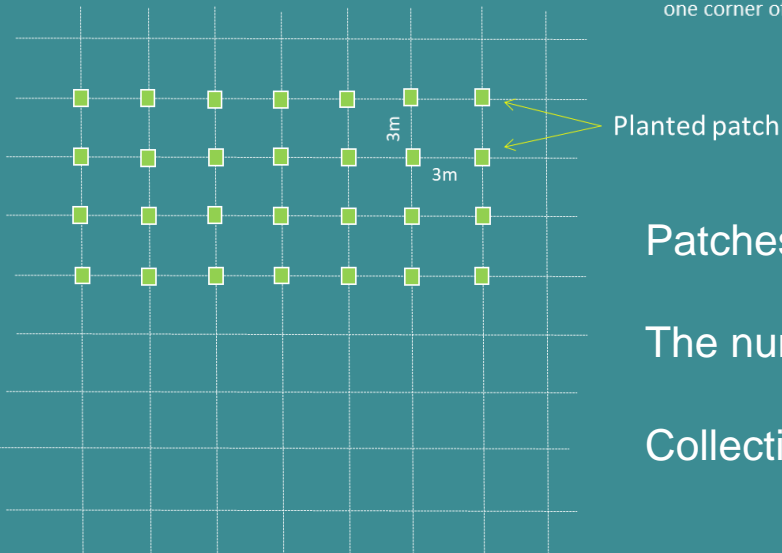
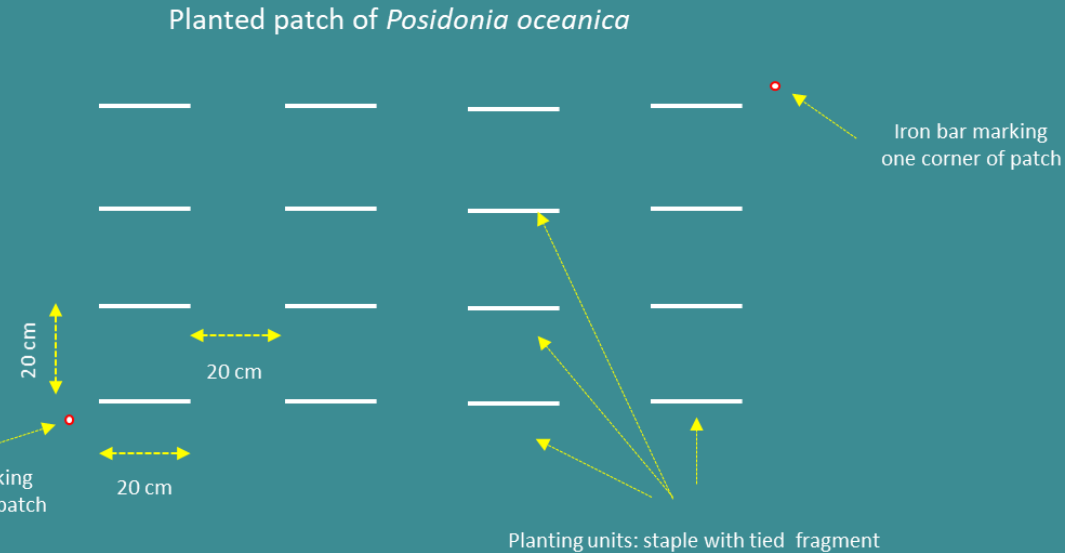
A single plagiotropic rhizome with an iron staple attached to it



IMEDEA *P. oceanica* planting technique (2)

Plantation design:

Planting units are planted in groups of 16 units forming a patch (~ 1 m²)
> 48 shoots per patch (64 shoots per patch is common)



Patches are established following a 3m x 3m grid pattern

The number of patches to be established is $250 \text{ m}^2 / 9 \text{ m}^2 = 28$

Collection of $28 \times 16 = 448$ plagiotropic rhizomes

IMEDEA *P. oceanica* planting technique (3)

Planting workplan:

Team: 5-6 persons

1 day for rhizome fragment collection

2 days for planting unit preparation:

fragment selection, *characterization and labeling*, stapling, patch-set grouping

2 days for actual planting

Planting between November and March

Ten patches are selected randomly and designated as “size-monitoring patches”:

All the fragments (n=160) are labeled (DYMO tag) and characterized when tied to the staple:

Number of apical and vertical shoots of each fragment is counted (initial fragment size)

Monitoring:

Annual (min of 5 years)

Number of living fragments in all patches:

fragment survivorship (% relative to initial number)

Number of apical and vertical shoots in all fragments of the 10 “size-monitoring patches”:

fragment size (number of shoots)



