

# ***Posidonia oceanica* Meadows Reforestation Project (Cartagena Port Authority). Offset CO2 emissions using *Posidonia oceanica* as carbon sink.**

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## **BACKGROUND**

The Bay of Pollença (Mallorca) hosts, with the participation of Laboratorios Munuera SL, a worldwide pioneering innovation project, which two degraded hectares of *Posidonia oceanica* meadows have been recovered. This is the Red Eléctrica Marine Forest, developed in collaboration with the Instituto Mediterráneo de Estudios Avanzados (IMEDEA) and the Govern de les Illes Balears.

The initiative was born in 2014 from the need to execute the underwater electrical interconnection between Talamanca (Ibiza) and the Bay of Santa Ponça (Mallorca) with the minimum environmental impact on the existing *Posidonia* meadows, protecting biodiversity and focusing on R+D+I.

Red Eléctrica commissioned the Marine Environmental Consulting of Laboratorios Munuera SL to develop the "Methodology for the use of *Posidonia oceanica* seeds and fragments for the recovery of *Posidonia oceanica* meadows".

After it had been carried out, and once the success of the methodology verified, Red Eléctrica went one step further in 2016 and started the Marine Forest project, which consisted of planting 12,800 fragments using an innovative technique that includes the phases of collecting fragments from natural fragmentation due to marine dynamics, the preparation of the specimens, the planting carried out by divers by anchoring each rhizome fragment on the seabed and, finally, the subsequent monitoring and follow-up. The survival of the planted fragments to date is over 90%.

Considering the successes obtained in previous Reforestation experiences with *Posidonia oceanica*, Laboratorios Munuera SL starts a new R+D+I Project, under the current contract of "Water Quality Control" of the Cartagena Port Authority after the good results obtained in the controls carried out in water and sediments, to determine the viability of Reforestation with *Posidonia oceanica* fragments, those potential areas for the growth of *Posidonia* meadows included in Zone 1 of the Cartagena Port Authority. This is the first time that this kind of project has been carried out in an industrial port

water with the characteristics of the port of Cartagena, the leading port in Spain in the movement of solid and liquid bulk.

## METHODOLOGY

The Reforestation project has the following phases:

### 1. Search for the Reforestation environment, potential capacity of the habitat for the *Posidonia meadows* growth.

Through a series of dives carried out by Commercial and Scientific Divers from Laboratorios Munuera SL, those locations where the seabed is consolidated, with the presence of gravel, have been selected, included in Zone 1 of the Port of Cartagena. The location selected by conditions of depth, sea and wind exposure and type of substrate is "*El Tajo de los Cuervos*" (11 meters).

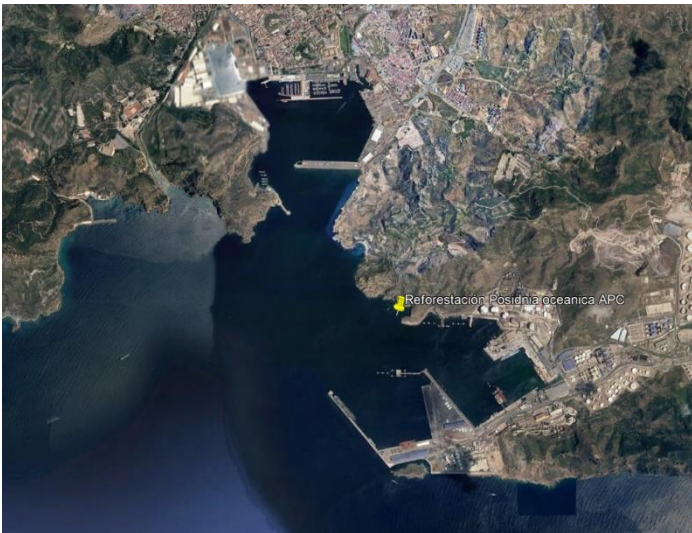


Figure 1. Reforestation environment. "*Tajo de los Cuervos*".



Figure 2. Seabed on "*Tajo de los Cuervos*". June 2021.

### 2. *Posidonia oceanica* fragments collection

The objective of the collection is to obtain the material used Reforestation work. Only that material that will not have a viable continuity in the natural environment is collected. The fragments gathered come from the anchorage in the "*Cabo Tiñoso - La Muela*" Marine Reserve and "*Isla de las Palomas ZEPA*" near the port of Cartagena.

The method of reforestation by fragments uprooted naturally by storms, has been chosen instead of other techniques such as making cuts in healthy meadows or seed germination for the following reasons:

- Cutting apical shoots of healthy meadows to replant in other areas does not provide benefits as a conservation technique. Thus, the growth areas of healthy meadows are destroyed to reforest already deteriorated areas.

- The sexual reproduction of *Posidonia oceanica* is not periodic and usually occurs as a response to stress. Sexual reproduction serves as a source of genetic variability, providing adaptive capacity to the species, allowing it to adapt to new conditions or colonize new environments
  - o The unpredictability of the phenomenon and the fact that the *Posidonia* seeds germinate at the moment the seed is detached from the fruit, makes reforestation with seeds extremely difficult.
  - o Also, the use of seeds requires technical and material resources that make the restoration of meadows more expensive and difficult: since tanks, rafts and specialized personnel in the maintenance of marine aquariums for the growth of the seeds (1 year minimum).

Thus, reforestation with fragments uprooted naturally by storms has been chosen, due to there are fragments to plant every year, it is one of the natural propagation ways of the plant and its maintenance does not require aquariums or other means. The fragment is collected and planted in a one-week interval.

In the stormy season between November and April, some fragments are naturally removed from the meadows. The marine dynamics generates natural areas of fragment accumulation, where, by Commercial/Scientific Divers from Laboratorios Munuera SL immersion, that material is selected and collected to replant.



**Figure 3.** Commercial/Scientific Diver from Laboratorios Munuera collecting fragments.



**Figure 4.** Fragments collection detail.



### 3. Maintenance of fragments of *Posidonia oceanica*. Anchoring system attaching.

During this phase, fragments are kept in the internal port waters of Cartagena, with the requirement of an optimum water quality, then fragments are attached to the anchoring system (brackets) and kept in the internal port waters of Cartagena awaiting to be planted.



Figure 5. Collected fragments keeping.



Figure 6. Keeping of fragments attached to brackets.



Figure 7. Laboratorios Munuera Marine Environmental Consulting team at the facilities of the Cartagena Port Authority.



Figure 8. *Posidonia oceanica* fragment attached to a bracket.

#### 4. *Posidonia oceanica* fragments planting.

Planting is carried out by hand directly in the substrate with the support of a bracket that serves as anchor, taking special care with the roots in the operation.



Figure 9. Fragments attached to brackets.



Figure 10. Fragments transport.



Figure 11. Fragment transport by a commercial/scientific diver of Laboratorios Munuera SL.



Figure 12. Commercial/scientific diver of Laboratorios Munuera SL during the planting.



Figure 13. *Posidonia oceanica* fragments.



Figure 14. Beacon pointing the plantation area "Tajo de los Cuervos".

## RESULTS

In 2022 65 fragments of *Posidonia oceanica* were planted in 4 patches with a gravel substrate ("Tajo de los Cuervos" Cartagena Port Authority Zone 1):

PATCH 1				PATCH 2			
22	22	22	22	22	22	22	22
22	22	22	22	22	22	22	22
22	22	22	22	22	22	22	22
22	22	22	22	22	22	22	22

A year after planting

Year	Total	Alive	Surv. Rate
2022	16	14	87.50%

A year after planting

Year	Total	Alive	Surv. Rate
2022	16	12	75.00%

PATCH 3				PATCH 4			
22	22	22	22	22	22	22	22
22	22	22	22	22	22	22	22
22	22	22	22	22	22	22	22
22	22	22	22	22	22	22	22

A year after planting

Year	Total	Alive	Surv. Rate
2022	16	15	93.75%

A year after planting

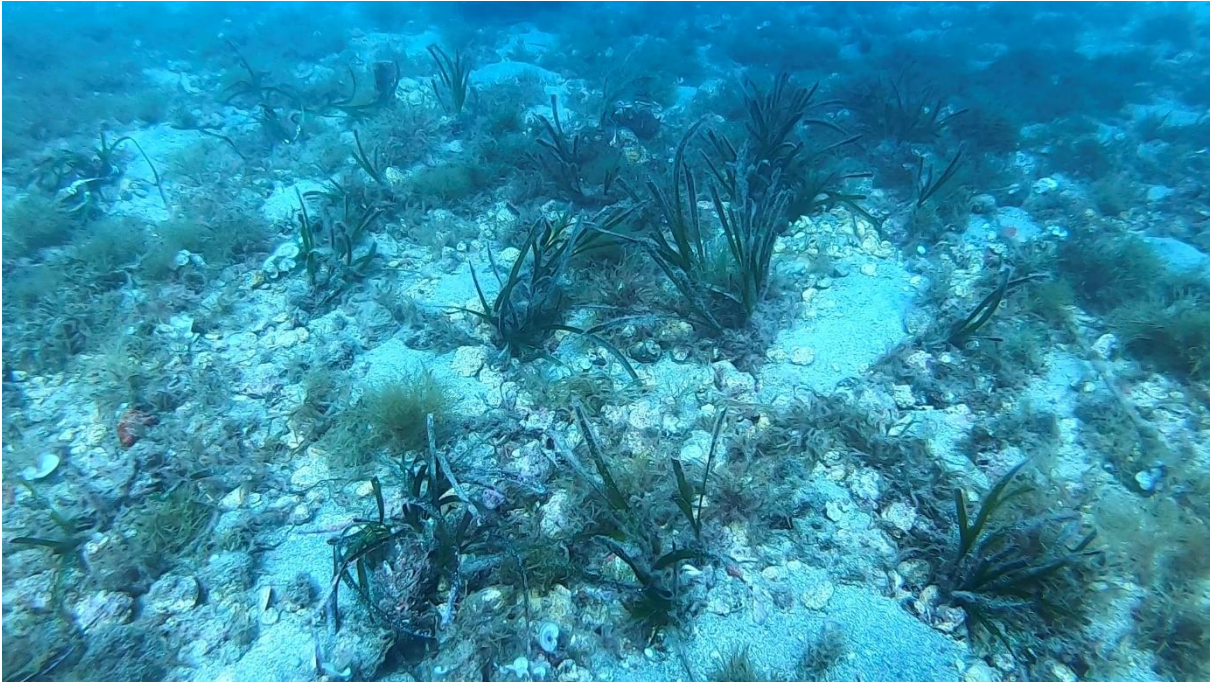
Year	Total	Alive	Surv. Rate
2022	17	9	52.94%

Global rate after one year

Year	Total	Alive	Surv. Rate
2022	65	50	76.92%

Project results after one year: the global survival rate is 76.92%





**Figure 15.** Planting patch after one year.

## **APPLICATIONS**

The methodology developed to reforest *Posidonia oceanica* meadows has applications in:

- Environmental Restoration Projects in degraded areas, once the anthropogenic factors, which caused the disappearance the *Posidonia oceanica* meadows associated to the affected ecosystem, have been removed, such as port environments where the water quality is optimal, as is the case of the port of Cartagena, which, after 10 years of monitoring water and sediment, it has been considered the environment is optimal for a project of these characteristics.
- The aim of this project is to restore *Posidonia oceanica* meadows, to preserve their capacity as a CO<sub>2</sub> sink and increase the offset CO<sub>2</sub> emissions, with the biodiversity improvement of the ecosystem, as well as increasing the number of existing plantations.

## **ACKNOWLEDEMENTS**

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## **BIBLIOGRAPHIC REFERENCES**

[https://www.ree.es/sites/default/files/downloadable/Guia-plantado-posidonia-oceanica-nov\\_0.pdf](https://www.ree.es/sites/default/files/downloadable/Guia-plantado-posidonia-oceanica-nov_0.pdf)