

# Highlight | restoration workshop

## *Ria de Aveiro living lab*

### *Restoration of primary dunes, seagrass meadows and salt marshes*

Ria de Aveiro is a shallow coastal lagoon, located in the Centro Region of Portugal. The lagoon, which covers around 11 000 ha, resulted from the retreat of the sea and the subsequent formation of coastal strands, becoming part of the estuary of the Rio Vouga, whose catchment area is around 3 363 km<sup>2</sup>. It is a complex socio-ecological region that is part of the Natura 2000 network and has a wide variety of biotopes with high biological diversity, namely the lagoon's water plane, beaches, sea grasslands "moliço", salt marshes, mudflats and sandbanks, riparian vegetation, dunes, natural lagoons such as Pateira de São Jacinto and Pateira de Fermentelos and small farms flanked by hedgerows («Bocage» landscape).

This workshop, on the restoration of coastal ecosystems is the result of collaboration between the Horizon Europe and LIFE projects: A-AAGORA, RESTORE4Cs, REWRITE, and LIFE SeagrassRiaWild, which, although they have different specific objectives, have the restoration of ecosystem such as primary dunes, sea grasslands and salt marshes as their common denominator. Thus, this workshop will therefore be the launch of the Living Lab around the issue of restoring coastal ecosystems. The Living Lab approach focuses on the active participation of stakeholders in the innovation process, allowing solutions to co-developed considering real needs and contributions.

To get to know the system in this specific context, the participants were invited to contribute their knowledge to clarify three questions regarding the most characteristic species of each of the coastal habitats to be considered in the restoration actions: primary dunes | European beachgrass; marine grasslands | Dwarf eelgrass and Common eelgrass; and salt marshes | Cordgrass, Sea purslane and Sea rush. Four maps were presented and in each one the participants, organized into subgroups, were asked to color-codes areas where the species occurred 20-50 years ago (yellow); the areas that currently threatened (red); and the areas that are most favourable for restoration in the near future (green). Each sub-group had the opportunity to analyse the four maps sequentially. The results reflect the cumulative contribution of the four subgroups.

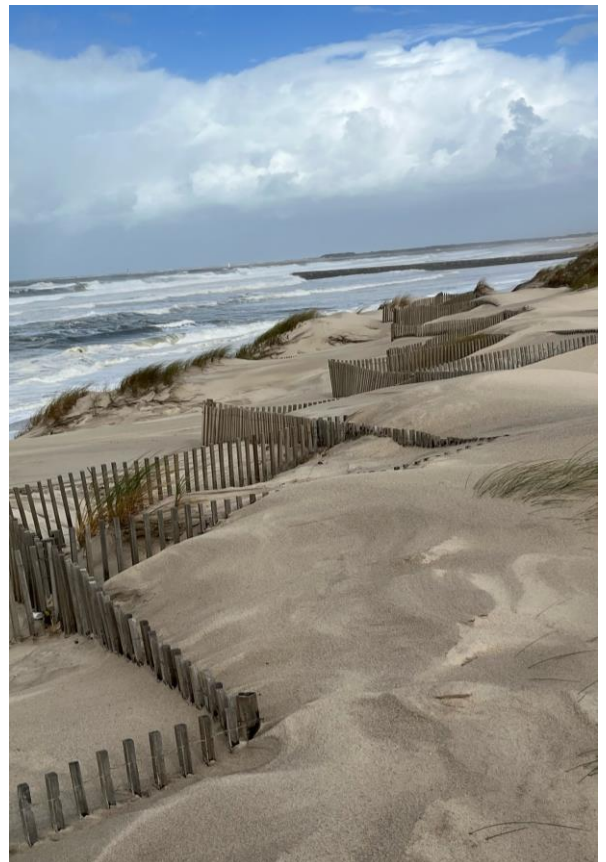
## Primary dune | embryonic dune

### *Ammophila arenaria* (European beachgrass)



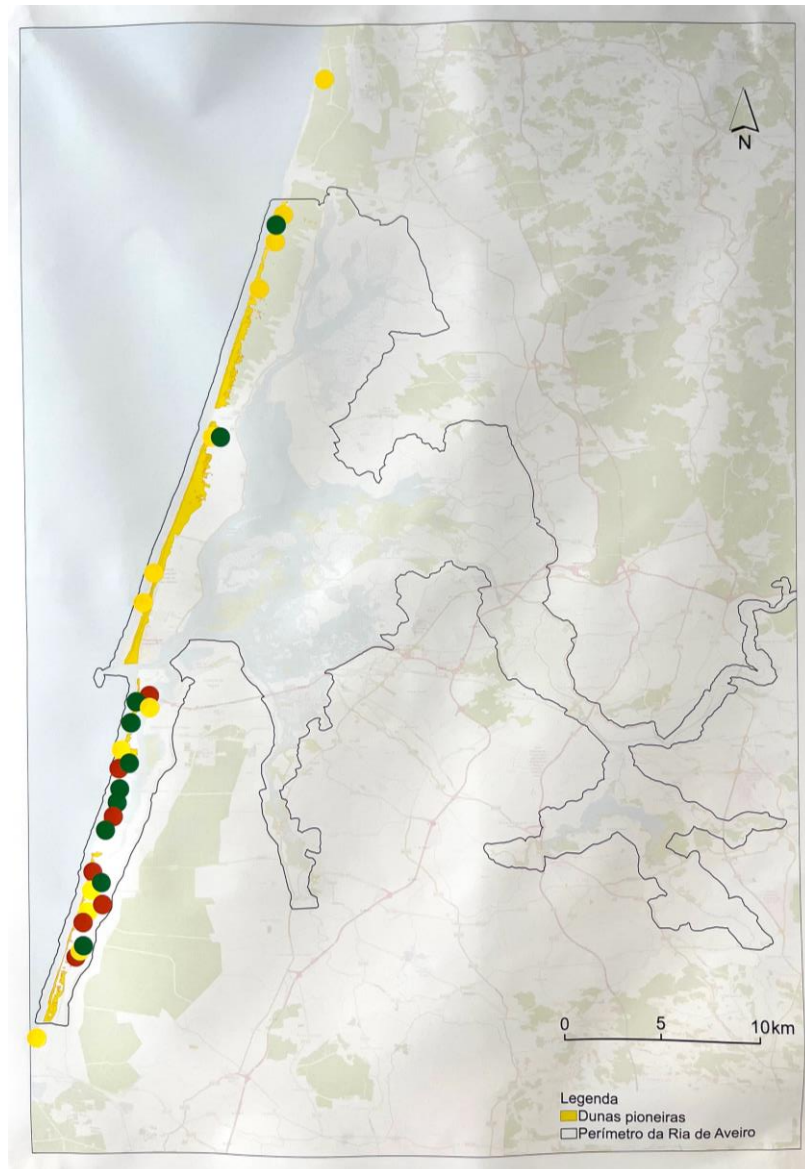
*Ammophila arenaria* L. is one of the plants that can be found in the primary dune systems of the Centro region's coastline. It belongs to the grass family and is known by the common name of European beachgrass. It has a wide geographical distribution and can be found in north of Europe and in the coastal areas of North Africa. The European beachgrass plays a fundamental role in the stabilization and development of the primary dune system, namely by fixing sands with its long roots that intertwine densely and intercepting sand in the leaves. The decrease in the amount of sediment that feeds the coastal drift, as a result of the regularisation of the hydrological regimes of the rivers, the construction of dams, human

occupation of sensitive areas, trampling of the dunes, and the erosive processes related to the rise in the average level of sea water and the increase in the frequency of extreme weather events, lead to decline and degradation of the dune systems. In the recent years, there has been an effort on the part of the Administration to implement actions to restore and protect primary dune areas.



## Primary dune | European beachgrass

*Ammophila arenaria*



As part of the Living Lab approach, a map depicting the primary dune system from Furadouro (Ovar) to Poço da Cruz (Mira) was presented. The areas where the species occurred around 20-50 years ago were identified in yellow, and the entire coastal strip from Ovar to Mira was generally marked. The currently threatened areas were marked in red, and the entire coastal stretch south of Aveiro bar was identified. The areas to be restored were marked in green, with the sections to the south of Furadouro and Torreira and the section to the south of the Aveiro bar having been identified. The participants pointed out that given the small size of the sandbank and the possibility of connecting the sea to the estuary, the restoration of the dune cordon south of Barra de Aveiro would be a priority, given its state of degradation. The participants also stressed that the construction of walkways parallel to the sea often leads to greater trampling of the dunes and that their layout should be rethought.



## Moliço | Dwarf eelgrass and Common eelgrass

*Zostera noltei* and *Zostera marina*

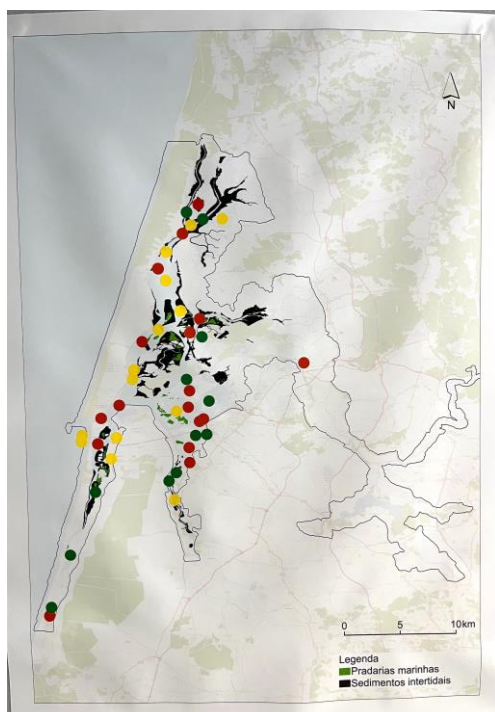


*Zostera noltei* is a seagrass with a wide Atlantic distribution. In the Ria de Aveiro, it covers more than 230 ha, providing habitat and protection for various biological communities, including bivalves, gastropods, crustaceans and juveniles of various fish species. It plays an important role in sediment retention and is a species that appears in the intertidal areas of estuaries and coastal lagoons. The narrow leaves can grow up to 30 cm, and the root system allows the species to survive in highly hydrodynamic conditions. It can carry out the photosynthetic process during periods of emersion at low tide, allowing it to grow in areas with high turbidity in the water column.

*Zostera marina* differs from *Z. noltei* in that it usually occupies subtidal (submerged) areas and has leaves that can grow up to 1 metre. It offers protection to important species such as eels and seahorses, acts as a particle filter and stabilises the seabed. It also plays an important role in retaining blue carbon. Having almost disappeared from the Ria de Aveiro during the 20th century, in line with the decline of the species worldwide, it has recently reappeared in small areas along the Mira channel.

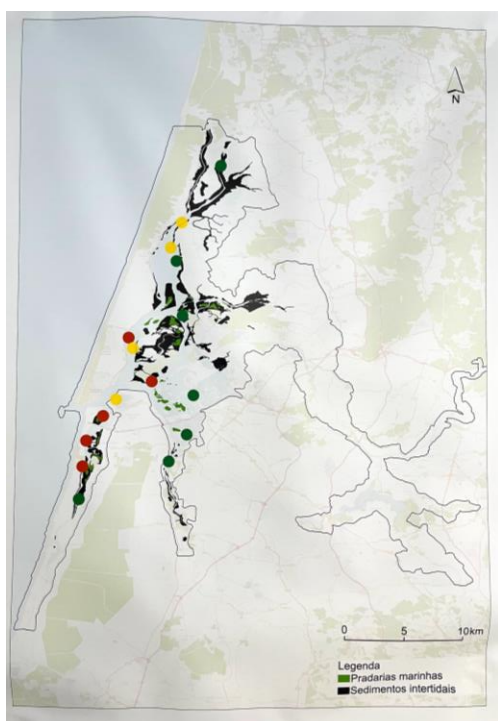
## Moliço | Dwarf eelgrass and Common eelgrass

### *Zostera noltei* and *Zostera marina*



*Zostera noltei* – Areas where the species occurred around 40-50 years ago were identified in yellow and existed as recently as 30 years ago along the coast from Murtosa to Ovar. Fifty years ago, it was found in front of São Jacinto; in the Ílhavo channel near Vista Alegre company; and in the Mira channel where Docapesca company is now located. It was still common to find Moliço leaves on Farol beach, brought in by the tide (today the tide brings in the water hyacinth). Areas where threats to the lagoon have been identified, even if not directly related to the restoration actions, are marked in red. These include the project to expand the Port of Aveiro, the deposition of aggregates on the banks, the artificialization of some channels, the loss of marine life due to the speed of the current, the erosion of the lagoon's coastal strip due to changes in hydrology and the works on the Lower Vouga Lagoon. Areas where the Dwarf eelgrass has

reappeared or areas where the low speed of the current could be favourable to its restoration are marked in green. The Mira channel was pointed out as the most promising for restoration actions due to its lower exposure to predicted changes.



*Zostera marina* – Areas where the species may have previously existed were identified in yellow. The participants agreed that it was difficult to identify the species because it is subtidal or rarely exposed, and because of its absence from the system. The historical presence of the species was mentioned, in the second half of the 1980s, in the current location of the Port of Aveiro, in the São Jacinto area and in the Ovar channel. Areas where conflicts could arise were marked in red. The hypotheses put forward to justify the degradation of the populations were: hydrological changes in the system; conflicts over the use of space with shellfish catchers; plant-specific pathogens; trawling gear; expansion of the polychaete *Arenicola spp.* The areas where restoration actions could have the greatest potential for success are marked in green, namely the areas upstream of the Mira and Ílhavo channels or in front of Torreira.



## Salt marsh | Cordgrass, Sea purslane and Sea rush

*Sporobolus maritimus*, *Atriplex portulacoides* and *Juncus maritimus*



*Sporobolus maritimus* (Curtis) P.M.Peterson & Saarela is a halophytic vascular plant (salinity-tolerant) from the Gramineae family, with the common name Cordgrass. It is a pioneer species, growing up to 70 cm, and plays a fundamental role in stabilising sediments, forming small islands of pioneer vegetation and helping to slow down the speed of the water. It colonises marine or river marine sediments, forming temporally submerged meadows subject to the daily influence of the tides. Typical of low marshes, and very common in the Ria de Aveiro, the Cordgrass is native to the west and south coasts of Europe and west Africa, along the Atlantic coast.



*Atriplex portulacoides* L., whose common name is Sea purslane, is a perennial shrub that can reach a height of 1.5 m. It occurs in the coastal areas of the Mediterranean region, North America, southern Africa and the European Atlantic. In Portugal, it occurs in intermediate marshes, cisterns, salt march slopes and estuary margins, and in soils that periodically flooded by the tides. It is a very common plant in the Ria de Aveiro.

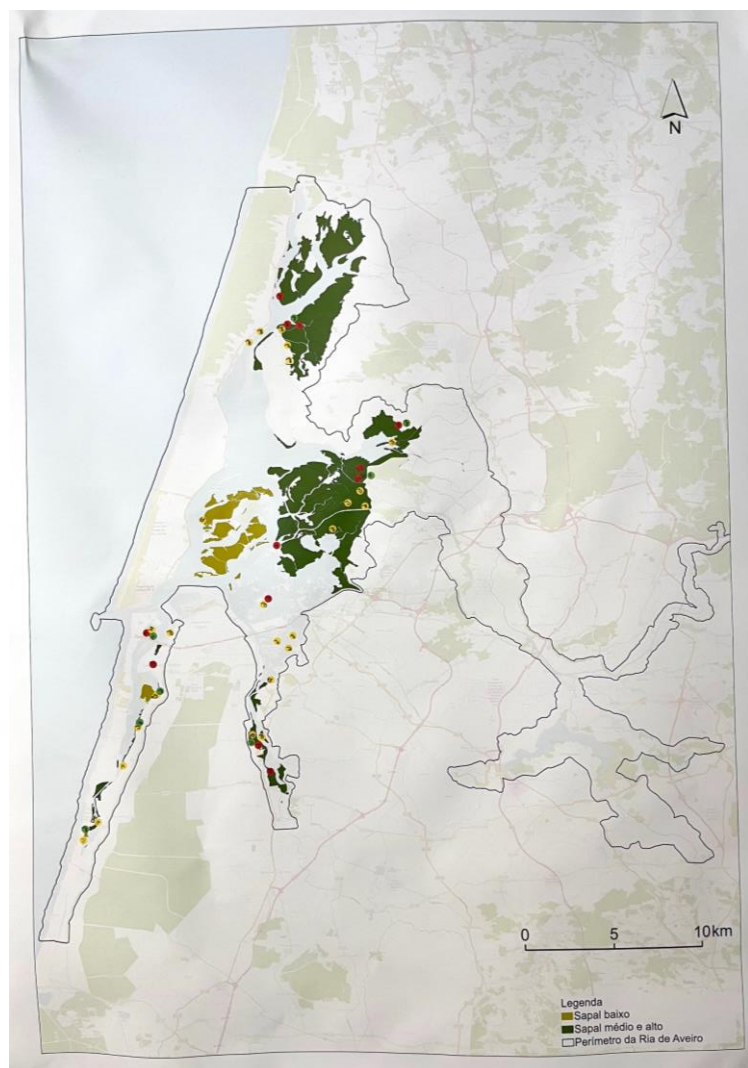


*Juncus maritimus*, commonly known as Sea rush, is a herbaceous plant that can reach a height of 1 m and is very common in the marshes of the Ria de Aveiro and all along the Atlantic coast of Europe. Characteristic of high marshes, it is traditionally used by farmers in the Aveiro region to make bedding for cattle.

The marsh plays a crucial role in stabilising sediments, contributing to erosion reduction and flood mitigation; it contributes to blue carbon storage and climate change mitigation, and serves as a habitat and shelter for various birds, bivalves, crabs, among others.

## Salt marsh | Cordgrass, Sea purslane and Sea rush

*Sporobolus maritimus*, *Atriplex portulacoides* and *Juncus maritimus*



For each species (distinguished on the map with the letters M, G and J, respectively), the areas of occurrence around 20-50 years ago and at present, when not yet marked on the map, were identified in yellow, the threatened areas in red and the areas for potential restoration in green.

*Sporobolus maritimus* – has been marked in yellow in the Mira Channel in the Gafanha da Vagueira area and north of the Barra bridge ("boca da Barra"). The area north of the Barra bridge was also marked in red as threatened, but also in green as a potential restoration site.

*Atriplex portulacoides* – has been marked in yellow in the Ílhavo Canal, in the Juncal-Ancho Bridge area; in the São Jacinto area and downstream of the Baixo Vouga Lagunar (BVL) dyke. In the area downstream of the BVL dyke, it was marked as endangered in red.

*Juncus maritimus* – has been marked, in yellow, as existing in the past in the area of the Ship of Santo André and the expansion area of the Port of Aveiro and in the present in the Mira channel (Areão, Gafanha do Carmo/emissário); in the central area of the Ria, in the old marinas, in São Jacinto and Rio Novo do Príncipe where it was abundant and is now degraded and fragmented (red), the cause being siltation. Other areas marked in red include Vista Alegre (due to dredging) and Esteiro da Medela, the Esgueira walkways, Pardilhó (on the quay behind the shipyard, due to the lack of hydrodynamics), Areão (reduction in the area of distribution), as well as the expansion area of the Port of Aveiro. In the Murtosa and Torreira area, many areas where reed beaches once existed are now submerged and degraded. In the Ilha Nova area, the Rushes, Sea purslane and *Salicornia sp.* areas were extensive, with the Rushes having reduced its area due to the destruction of the embankment/dyke (2001), and the consequent inability of the plants to tolerate submersion, as well as the increase in the tidal prism. The potential areas indicated for marsh restoration actions, in green, include the Praia do Areão area, Gafanha do Carmo, the area where the outfall is located, the area to the east of the BVL dyke and Murtosa/Torreira.

## *The participants*

*14<sup>th</sup> June 2024*

The workshop was attended by 25 representatives of stakeholders in the region (e.g. sectoral public administration, municipalities, non-governmental organisations, companies, education and vocational training institutions). Participants were mostly invited by email, telephone and in person.



During the workshop, participants had the opportunity to share their knowledge of the target species, while learning about the various restoration actions proposed under the projects involved in the workshop. The participants were divided into 4 groups, who rotated clockwise through each of the panels in 20-minute sessions. In addition to placing coloured stickers to mark the events on the maps, post-it notes were added to the maps, thus complementing the information shared. Coffee, drinks, cakes and savoury snacks were available in this relaxed and participatory atmosphere.



Once the different areas had been signposted, each moderator presented the cumulative results of each of the maps and a summary of the complementary information for joint validation by the participants. The participants were also invited to take part in marine grassland restoration actions already scheduled for June and July 2024.



## ***Final considerations at system level***

### ***Ria de Aveiro Living laboratory | constraints | challenges***

- Changes in the configuration of the Port of Aveiro and the implications for the Ria's hydrology
- Siltation and submergence time as a cause of Rushes' disappearance
- Dredging and deposition of inert on the banks of the Ria
- Degradation of the sea walls
- Cost versus return on investment for restoring degraded marinas
- Effect of increased current speed on restored habitats
- Potential conflict between restoration in subtidal areas and human activities
- Restoration of species and sites must be analysed "case by case"
- Impact of the construction of the bridge-weir of the Rio Novo do Príncipe (Baixo Vouga Lagunar)
- Impact of the planned building in the Lota area (Aveiro city)
- Impact of the water hyacinth on fresh, transitional and marine watercourses

### ***Ria de Aveiro Living lab | opportunities***

- The Mira channel will be less exposed to the impact of the Port of Aveiro expansion works and therefore has the best conditions for habitat restoration
- Reappearance of Dwarf eelgrass (*Zostera noltei*) in the Pardilhó and Brunheiro area
- Growth of salt marsh in Torreira in an area where rubble was deposited after dredging



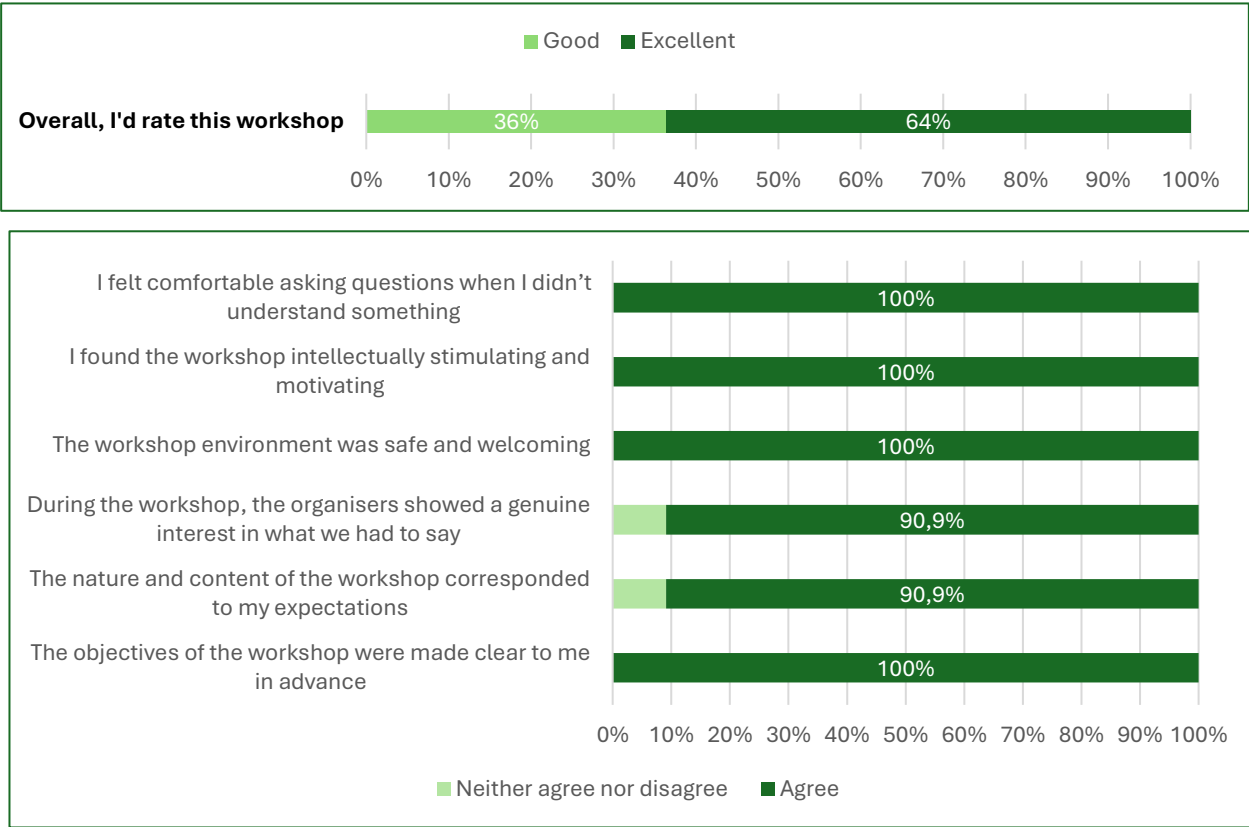
### ***Additional notes | moderators***

In the case of the dunes, it was explained that the working group has applied for and obtained complementary sources of funding, such as the Belmiro de Azevedo Foundation Award (2023.10050.PRIZE), for the installation and preservation of ecological corridors. In the case of *Zostera marina*, it was explained that the implementation of new restoration areas will have to take care of possible conflicts related to the exploitation of shellfish beds; deeper channels will also be avoided, as the low light levels prevent the species from developing. In the case of fragmented salt marsh areas, particularly downstream of the Baixo Vouga Lagoon dyke, they could be repopulated with marine grasslands as they are more tolerant of changes in the tidal prism.

# The participants

## Evaluation

At the end of the event, they were asked to evaluate the first participatory workshop on restoration. The results are show in the following figures:



How to cite:  
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