


Vegetation of the coastal dunes and wetland of Schinias National Park (NE Attica, Sterea Ellas, Greece)

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Key words: flora, salt-marsh communities, coastal habitats, Marathon Plain, diagnostic species, cluster analysis.

Ključne besede: lora, združbe slanišč, obalni habitati, nižina Maraton, diagnostične vrste, klastrska analiza.

Abstract

The vegetation developing on the coastal sand dunes and wetland of Schinias National Park, a Natura 2000 Site, was studied following the Braun-Blanquet method. Vegetation units were delimited using cluster analysis and by applying the fidelity measure; the phi-coefficient was used for the definition of diagnostic species. The vegetation types distinguished (twenty associations, two sub-associations and thirteen communities not assigned formal rank), which belong to 18 alliances, 16 orders and 12 classes, are discussed and presented in phytosociological tables. Among them *Mathiolo tricuspidatae-Anthemidetum tomentosae*, *Pistacio lentisci-Pinetum halepensis pinetosum pineae*, *Puccinellio festuciformis-Aeluropetum litoralis cressetosum creticae* and *Tamaricetum tetrandrae* are described for the first time. The vegetation types recognized in the study area are linked to twelve EUNIS habitat types, nine of which are related to 13 Annex I habitat types (Directive 92/43/EEC), and one to a habitat type of national interest (72A0). One Annex I habitat type occurring in the study area has scattered presence in the Natura 2000 network in Greece (1420), two are infrequent (2190, 2260), two are rare (2230, 2270) and three are priority habitat types (1150, 2250, 2270).

Izveček

Z Braun-Blanquetovo metodo smo proučili vegetacijo, ki se razvija na obalnih sipinih in mokriščih v Narodnem parku Schinias, ki je tudi Natura 2000 območje. Vegetacijske enote smo ločili s klastersko analizo in mero navezanosti; fi koeficient smo uporabili za opredelitev diagnostičnih vrst. Vegetacijske tipe (dvajset asociacij, dve subasociaciji in trinajst združb), ki smo jih uvrstili v 18 zvez, 16 redov in 12 razredov, predstavljamo s fitocenološkimi tabelami. Med njimi so *Mathiolo tricuspidatae-Anthemidetum tomentosae*, *Pistacio lentisci-Pinetum halepensis pinetosum pineae*, *Puccinellio festuciformis-Aeluropetum litoralis cressetosum creticae* in *Tamaricetum tetrandrae* novo opisane. Vegetacijske tipe v obravnavanem območju lahko uvrstimo v dvanajst EUNIS habitatnih tipov, devet izmed njih pa lahko povežemo s trinajstimi habitatni tipi s Priloge I Habitatne direktive (Directive 92/43/EEC) in enega kot habitatni tip državnega pomena (72A0). En habitatni tip s Priloge 1, ki se pojavlja v proučevanem območju je raztreseno razširjen v omrežju Natura 2000 območij v Grčiji (1420), dva nista pogosta (2190, 2260), dva sta redka (2230, 2270) in trije so prednostni habitatni tipi (1150, 2250, 2270).

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Introduction

Dunes and salt-marshes are essential components of coastal plains. By performing a variety of ecological services these intertidal, highly dynamic ecosystems ensure the stability and maintenance of diverse coastal habitats (Boorman, 2003; Miller, 2015). Their origin, viability and functionality depend on the coupled balance of many abiotic and biotic factors, among which vegetation dynamics seem to be of high importance. Pioneer vegetation colonizing coastal marshes and dunes contributes to the trapping and vertical accretion of sediment. This process leads to the creation of suitable habitats for the arrival of more and more plants which also promote the stabilization, maturation and maintenance of these systems (Silvestri & Marani, 2004; Acosta et al., 2007; Day et al., 2011; Prisco, 2012). While the existence of a stable vegetated platform prevents erosion and reduces coastal retreat (Sigren et al., 2014; Shepard et al., 2011), coastal wetlands and dunes around the Mediterranean Basin, but also worldwide, face the risk of extinction as they are subjected to geomorphologic and hydrologic disturbances causing substrate destabilization. Substrate quality degradation leads to the weakening of vegetation vitality and therefore to further deterioration of coastal habitats (Day et al., 2011; Pirone, 2014). Climate change and sea level rise are currently considered to be the main causes of these threats. It is now certain that the ability of coastal systems to cope successfully with them is adversely affected by human activities that can aggravate erosion (e.g. inhibiting sediment inflow, building on dunes, land use changes, degradation of estuarine systems, hydrological modifications etc.) (Scapini, 2010).

The plant communities colonizing coastal dunes are important indicators of the environmental quality of these fragile ecosystems (Pirone, 2014). In well-preserved sandy Mediterranean coastlines where human impact is low, vegetation development patterns follow the gradual change in environmental stressors (salt spray, sand burial, substrate mobility, drought, high temperature, nutrient deficiency, erosion) along the ecological gradient from the coastline inland. This pattern begins with the unstructured pioneer communities (annual vegetation of drift lines) close to sea and continues inland to the more complex vegetation types of the back dunes (evergreen sclerophyllous shrubs and woods), creating a characteristic vegetation zonation (Prisco, 2012; Miller, 2015). However, erosion and anthropogenic disturbances have profoundly affected the natural zonation patterns of coastal dune vegetation, which remain unaltered in only a few localities around the Mediterranean Basin (Prisco et al., 2012; Veronico et al., 2017).

In Mediterranean coastal marshes the spatial arrangement of plant species is mainly regulated by soil salinity and summer drought (Dítě et al., 2019). A sequence of vegetation zones usually develops parallel to the coast based on the individualized response of each plant species to various environmental factors, such as waterlogging regime and soil properties, along the elevation gradient. This means that different plant species dominate at different elevation levels of the marsh. According to the zonation pattern generated, the marsh can roughly be divided into low, middle and high elevation sectors (Bertness & Pennings, 2002; Cutini et al., 2010). What is more, plant assemblages within each zone develop in mosaic formations. This is because characteristics such as micro-relief, temporal and spatial variability of water regime, soil properties and biotic interactions give rise to a variety of micro-habitats (Moreno et al., 2018).

The aim of the present study is the inventory of vegetation units developing on the coastal dunes and the salt marsh of Schinias National Park (NE Attica, Greece). To this end, the dominant plant communities were identified, described and classified into habitat types, according to the Council Directive 92/43/EEC (Habitats Directive henceforth). In spite of intense human pressures, the vegetation of the abovementioned coastal systems is diverse and species rich. Nonetheless, with a few exceptions, it has not been thoroughly studied to date. Apart from a few phytosociological data concerning the herbaceous halophyte salt-marsh communities of Schinias National Park (Economidou, 1975), some additional information on the vegetation of the area is summarized in Brofas & Karetos (1992) and Spanou et al. (2007). Floristic data for the study area are available by Brofas & Karetos (1992), Koumpli-Sovantzi & Vallianatou (1994) and Strid (2016).

Materials and methods

Study area

The study area lies at the eastern part of the Marathon Plain (NE Attica) and is included in Schinias National Park (Figure 1). At a distance of forty kilometers from Athens, Schinias National Park hosts a wide range of terrestrial and marine ecosystems in a relatively small surface area (1384 hectares) and has been integrated into the Natura 2000 network both as a Site of Community Importance (SCI) and as a Special Protection Area (SPA) with the name “Ethniko Parko Schinia-Marathona” and the code GR3000003. The study area is low-lying and only the sandy coastal zone slopes towards the sea. It comprises the sandy beach, the coastal shifting and stabilized

dunes that run along the shoreline and the marsh extending north of the coastal dunes. The low swampy area of the marsh is closed to the sea and not directly exposed to wave action due to the natural barrier created by the sand dune system along its southern seaward end. The north and eastern side of the marsh are bordered by a series of karstic hills from which the springs of Makaria and Drakonera are discharged. Past alluvial deposits from the Oinoi (Haradros) river define its western boundaries. There is evidence that the natural environment of the marsh of Schinias went through 5 evolutionary stages. According to Margoni et al. (2002), a shallow sea gulf was originally formed in the area (approximately 5000 years ago), which was gradually isolated from the sea by a sandy barrier and became a lagoon. During its sequential evolutionary stages, this lagoon received inflows of water and sediments from both the sea (saline water) and the land (fresh water). Over time it turned into an extended brackish marsh. Today, the marsh retains its brackish

character, as it still receives fresh water from the discharge of the karst springs at its northern and eastern boundaries but also periodic inflows of seawater from the side of the sand dune barrier (Margoni et al., 2002). Like most Mediterranean coastal marshes, its flooding regime is not regulated by astronomic tidal action but by the seasonal fluctuations of the weather (Ibañez et al., 2002). Hence, it is only seasonally inundated by water and is completely dry in the summer.

Until the beginning of the 20th century the geomorphologic evolution of the study area was directly correlated to the action of Oinoi river (which, since the construction of the Marathon dam, is no longer active). The alluvial plain that formed around the river estuary is called the Marathon plain. Morphologically, it resembles the typical coastal plains of Greece “alluvial plains with a terminal swamp area separated from the sea by a sand barrier” (Pavlopoulos et al., 2006; Mertzanis & Mertzanis, 2013). Geotectonic units of NE Attica, which are actually

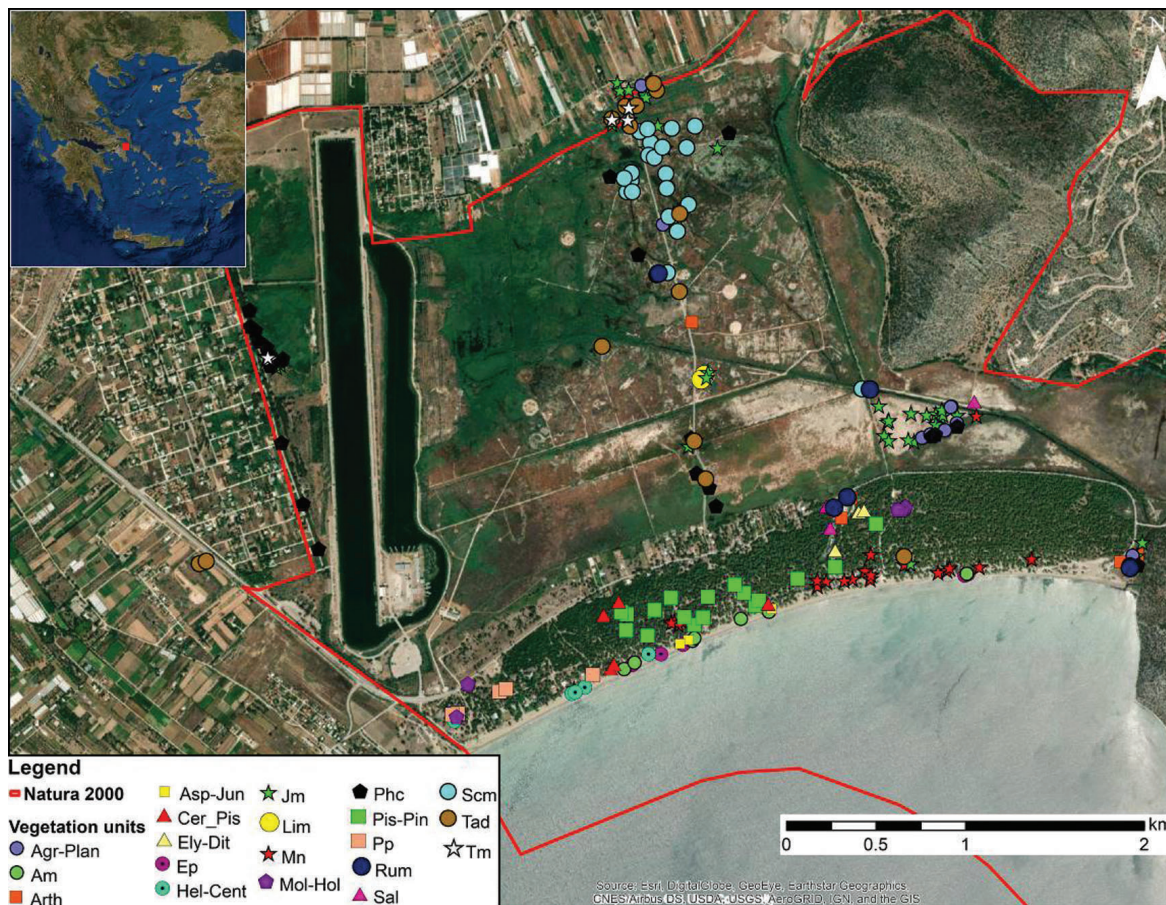


Figure 1: Schinias National Park included in the Natura 2000 Network under the name “Ethniko Parko Schinia-Marathona” (GR3000003), and the distribution of performed relevés per vegetation unit within the study area. For vegetation units abbreviations see Figure 2.

Slika 1: Narodni park Schinias je vključen v omrežje Natura 2000 kot “Ethniko Parko Schinia-Marathona” (GR3000003) in razširjenost popisov v različnih vegetacijskih tipih v preučevanem območju. Za oznake vegetacijskih tipov glej Sliko 2.

a “relatively autochthonous” metamorphic sequence constitutes the geological background of the broader area surrounding the Marathon plain. Various types of alluvium derived mainly from the former action of the Oinois river represent Quaternary deposits. Both the steep sides of the plain and the fault zones are covered by Pleistocene and Holocene talus cones and scree. Two fault systems are present in the area, an older having a NE-SW direction and a younger having a NW-SE direction. Numerous springs exist in the broader area, including the aforementioned Draconera and Makaria whose waters spring up at the east and the north of the plain respectively. The coastline is almost flat and not affected by tides (tide amplitude is less than 20 cm). Significant changes had been observed on the coastline limit between 1950s and 1960s (about 2 m/year), slowing (1 m/year) in the last decades (Pavlopoulos et al., 2006). The geology, geomorphology, paleoenvironment and contemporary status of the area are discussed in detail by several authors (e.g. Baeteman 1985; Maroukian et al., 1993; Pavlopoulos et al., 2006). Climactically speaking, the Marathon plain belongs to the semi-arid bioclimatic zone (Emberger’s pluviometric coefficient $Q = 61.45$) related to the *Oleo-Ceratonion* formations and its climate has an intense thermo-Mediterranean character (xerothermic index: 142.73). Further information on the climate and bioclimatic classification of the study area as well as the vegetation zone to which it belongs can be found in Spanou et al. (2007) and Gaitanis et al. (2015).

Data collection and analysis

A vegetation study was carried out following the Braun-Blanquet floristic-sociological approach (Westhoff & van der Maarel, 1980; Kent & Coker, 1992). Field data were collected from 222 vegetation sample plots (relevés), most of which (184 rels.) were conducted from April 2017 to July 2019, while the rest (38 rels.) in June and September 2012. Wherever possible, at least five (5) relevés were performed for each vegetation type. In the few cases where the size of the vegetation types did not allow as many as five (5) relevés, their number was determined by the availability of each vegetation type within the study area. The size of the plots was relatively constant for each vegetation type and harmonized with those suggested by Dimopoulos et al. (2018) for the monitoring and assessment of habitat types of national conservation status. In each sample plot, all vascular plants were recorded and their coverage was estimated using the transformed (9-point) Braun-Blanquet scale (Van der Maarel, 1979). Data were used not only for vegetation classification but also for the identification of habitat types since the latest proposed revisions of the EUNIS habitat classification system are

mainly based on the combined assessment of species occurrence and coverage (Schaminée et al., 2019a). In addition, for each sample plot, data regarding the sampling locality was recorded as proposed by Tsiripidis et al. (2018).

Plant specimens collected during the field work were identified mainly according to Davis (1965–85), Tutin et al. (1968–1993) and Strid (2016). The nomenclature of taxa follows Dimopoulos et al. (2013, 2016) and Flora of Greece Web (2022).

The delimitation of vegetation types was first made by the means of cluster analysis. Hierarchical clustering of the 222 phytosociological relevés was performed by using the “vegan” package (Oksanen et al., 2020) in R statistical environment (R Development Core Team, 2021), after transforming the Braun-Blanquet cover abundance values into a proper rank scale as suggested by Van der Maarel (1979). Single, complete and average linkage clustering methods were performed and the cophenetic correlation was used to measure the likeness between original dissimilarities and dissimilarities estimated from the tree produced by each clustering method. Average linkage (UPGMA) method maximized the cophenetic correlation. Subsequently, diagnostic species (species concentrated to particular relevés clusters or species delimiting differentiated subtypes within a cluster of closely related relevés) were defined by applying the fidelity measure and the phi-coefficient, as described in Chytrý et al. (2002). Given the unequal number of relevés per cluster, fidelity values were equalized following Tichý & Chytrý (2006), to mitigate the effect of unequal size of relevé clusters on calculation of fidelity. Fisher’s exact test ($p < 0.001$) was applied to exclude species whose occurrence concentration on the target relevé clusters was not significant. Selection of diagnostic species given in the synoptic table (Table 1) was based on two criteria: (1) fidelity higher than 0.30 and (2) species frequency equal or higher than 40%. The threshold values of these criteria were subjectively chosen to be low enough for the identification of a sufficient number of diagnostic species, and high enough so that many generalist species and species that are not exclusively present on a single vegetation type would not be considered as diagnostic. Reliability of the results is further enhanced by the combined application of the above criteria (Šilc et al., 2016; Dítě et al. 2019). The threshold frequency value for the constant species was set to 40%, following Chytrý & Tichý (2003). Finally, to exclude species rarely or never attaining high cover, species having a percentage cover higher than 25% in at least 10% of the relevés (Landucci et al., 2013, Marcenò et al., 2018) were defined as dominant.

As many of the species on which the cluster separation was based (diagnostic, constant, dominant) are con-

sidered characteristic of high-rank syntaxa listed in the EuroVegChecklist (Mucina et al., 2016), the relevés clusters were syntaxonomically interpreted and assigned to phytosociological classes, orders and alliances according to their floristic composition. The clusters whose floristic structure resembles that of communities already described and named according to the formal syntaxonomic code (Theurillat et al., 2021) were assigned to association level and named accordingly. Clusters not resembling accepted associations are described as new vegetation types (associations, sub-associations) but only when the relevés number per cluster was sufficient (higher than 5). Where they were less than 5, they are referred to as communities. Characteristic class species and high-rank syntaxa are presented throughout according to Mucina et al. (2016).

Habitat types were interpreted using the concept of indicator species (diagnostic, constant, dominant). This was achieved by following the phytosociological approach or by a crosswalk between the EUNIS habitat types (Davies et al., 2004; Schaminée et al., 2019a,b) and the alliances of the EuroVegChecklist hierarchical syntaxonomic system (Mucina et al. 2016). Many of the diagnostic or constant species recognized in the study area, are considered *indicator species* of particular habitat types included in the EUNIS classification system (Schaminée et al., 2013; 2014; 2019a,b; 2020). Furthermore, the latest changes and revisions in the EUNIS and EuroVegChecklist systems permit a valid crosswalk between alliances and habitat types. Habitat coding follows Davies et al. (2004), Schaminée et al. (2019 a,b) and the Interpretation Manual of EU Habitat types (Anonymous, 2013), whereas habitat types of national interest follow Dafis et al. (2001).

Results

From the total of 222 relevés, 143 were carried out in the marsh of Schinias and concern salt meadows (43 relevés), reed beds (48 relevés), halophilous scrubs (16 relevés), tamarisk scrubs (14 relevés), saline swards (11 relevés), temporarily flooded grasslands on subsaline soils (6 relevés) and submerged vegetation of brackish waters (5 relevés). Most of the remaining 79 relevés were derived from the coastal sand dunes, while a few originated from the strandline zone (5 relevés). All relevés were processed as described above for the construction of the dendrogram (Figure 2). The 222 relevés used in the analysis were grouped into 5 large clusters, each one of them illustrated by an alphabetic letter. The groups of relevés (corresponding to the alliances or orders recognized in the study area) are indicated with numbers (Figure 2). The cophenetic coefficient associated on the dendrogram, has a value of 0.954. Clusters A, B and C represent the

halo-nitrophilous vegetation of drift line and the vegetation of mobile, embryonic and back coastal dunes. These clusters were assigned to the alliances *Euphorbion peplidis*, *Ammophilion*, *Maresion nanae*, *Helichryso barrelieri-Centaureion spinosae* (cluster A), *Asparago orientalis-Juniperion macrocarpae*, *Pistacio lentisci-Pinion halepensis*, *Pinion pineae*, *Ceratonio-Pistacion lentisci* (cluster B) and *Molinio-Holoschoenion* (cluster C). Cluster C also includes four relevés congregated in group 10, for which no precise syntaxonomical assignment to the alliance level was determined. These were classified to the order *Elytrigio repentis-Dittrichietalia viscosae*. Vegetation colonizing the marsh area is grouped in clusters D and E. Relevés included in cluster D consist mostly of species-poor, mono-dominant stands preferring or tolerating high soil salinity (average number of species per relevé rarely more than 5). They were classified to the alliances *Salicornion fruticosae*, *Arthrocnemion glauci*, *Juncion maritimi*, *Scirpion maritimi* and *Tamaricion dalmaticae*. Cluster E assort vegetation types usually related to brackish habitats of middle and upper marshes. These relevés groups are ascribed to the alliances *Agropyro-Plantaginion maritimi*, *Phragmition communis*, *Ruppion maritimae* and *Trifolion maritimi*. Two more relevés classified to the order *Limonietalia* (group 13) are also placed within cluster E.

The classification analysis revealed thirty-five vegetation types (twenty associations, two sub-associations and thirteen communities, not assigned formal rank) that belong to eighteen alliances, sixteen orders and twelve phytosociological classes. The recognized alliances and orders were associated with twelve EUNIS habitat types (Davies et al., 2004; Schaminée et al. 2019a,b), nine of which are related to thirteen habitats of Annex I of the Habitats Directive (Anonymous, 2013) and one with a habitat type of national interest for Greece (Dafis et al., 2001). (See Table 2 for the complete syntaxonomic scheme.) Of the identified habitat types included in Annex I, one has a scattered presence in the Natura 2000 network in Greece (1420), two are infrequent (2190, 2260), two are rare (2230, 2270) and three (1150, 2250, 2270) are priority habitat types (Dimopoulos et al., 2006). In the text and Table 2, priority habitat types and the one of Greek interest are indicated by one or two asterisks respectively.

Discussion

A description of plant communities is provided below according to the main ecosystem types and highest syntaxonomic units (classes) encountered in the study area. In the classes mentioned in the following paragraphs the recognized vegetation types are assigned to alliances. However, in some cases it was not possible to classify them beyond

order level, due to limited number of diagnostic species or because relevant alliances are listed in EuroVegChecklist only from the western Mediterranean region. From the total of diagnostic species identified only these with $\phi > 0.40$ (dark shaded in Table 1) are presented in each alliance or order outlined, with the exception of *Juncion maritimi*. A detailed list of the taxa found in each vegetation unit is given in Tables 3–14, which includes 218 taxa recorded in 222 relevés. The main pressures and threats recorded for different vegetation types and related habitat types are also discussed.

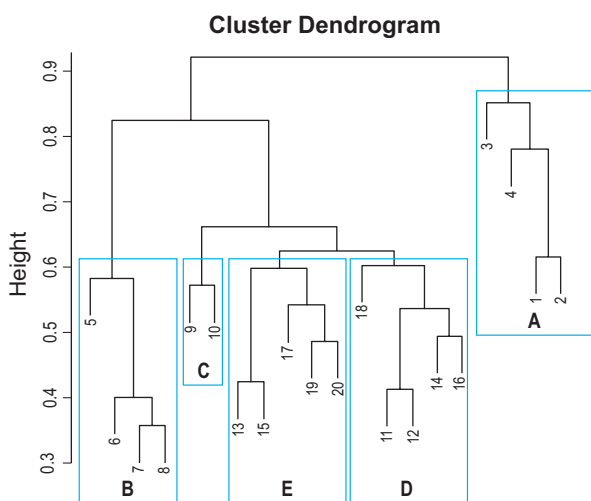


Figure 2: Cluster dendrogram of performed relevés, using the Average linkage (UPGMA) method. **Cluster A** refers to the alliances *Euphorbion peplidis* (Ep, 1), *Ammophilion* (Am, 2), *Maresion nanae* (Mn, 3), *Helichryso barrelieri-Centaureion spinosae* (Hel-Cent, 4). **Cluster B** refers to the alliances *Asparago orientalis-Juniperion macrocarpae* (Asp-Jun, 5), *Pistacio lentisci-Pinion halepensis* (Pis-Pin, 6), *Pinion pineae* (Pp, 7), *Cerantonio-Pistacion lentisci* (Cer-Pis, 8). **Cluster C** refers to the alliance *Molinio-Holoschoenion* (Mol-Hol, 9) and the order *Elytrigio repentis-Dittrichietalia viscosae* (Ely-Dit, 10). **Cluster D** refers to the alliances *Salicornion fruticosae* (Sal, 11), *Arthrocnemion glauci* (Arth, 12), *Juncion maritimi* (Jm, 14), *Scirpion maritimi* (Scm, 16) and *Tamaricion dalmaticae* (Tad, 18). **Cluster E** refers to the alliances *Agropyro-Plantaginion maritimi* (Agr-Plan, 15), *Phragmition communis* (Phc, 17), *Ruppion maritimae* (Rum, 19), *Trifolion maritimi* (Tm, 20) and the order *Limnietalia* (Lim, 13).

Slika 2: Dendrogram vegetacijskih popisov z povprečno metodo (UPGMA). **Klaster A** predstavlja zveze *Euphorbion peplidis* (Ep, 1), *Ammophilion* (Am, 2), *Maresion nanae* (Mn, 3), *Helichryso barrelieri-Centaureion spinosae* (Hel-Cent, 4). **Klaster B** predstavlja zveze *Asparago orientalis-Juniperion macrocarpae* (Asp-Jun, 5), *Pistacio lentisci-Pinion halepensis* (Pis-Pin, 6), *Pinion pineae* (Pp, 7), *Cerantonio-Pistacion lentisci* (Cer-Pis, 8). **Klaster C** predstavlja zvezo *Molinio-Holoschoenion* (Mol-Hol, 9) in red *Elytrigio repentis-Dittrichietalia viscosae* (Ely-Dit, 10). **Klaster D** predstavlja zveze *Salicornion fruticosae* (Sal, 11), *Arthrocnemion glauci* (Arth, 12), *Juncion maritimi* (Jm, 14), *Scirpion maritimi* (Scm, 16) in *Tamaricion dalmaticae* (Tad, 18). **Klaster E** predstavlja zveze *Agropyro-Plantaginion maritimi* (Agr-Plan, 15), *Phragmition communis* (Phc, 17), *Ruppion maritimae* (Rum, 19), *Trifolion maritimi* (Tm, 20) in red *Limnietalia* (Lim, 13).

Vegetation classification system

Coastal dune vegetation

Although the sand beach and sand dunes of Schinias are exposed to intense anthropogenic pressure, the patterns of vegetation organization along the gradient of environmental factors converge to a satisfactory degree with those expected for a Mediterranean coastal dune ecosystem (Acosta et al., 2007). From the seashore up to the end of the dune alignment various phytosociological units develop, ranging from the coastal pioneer halo-nitrophilous (*Cakiletea maritimae*) and halo-psammophyte communities (*Ammophiletea*) to the more complex vegetation types of back dunes (*Helichryso-Crucianelletea maritimae*, *Quercetea ilicis*). Moreover, throughout the outer belt of the dunes, discontinuous development of low-growing sabulicolous communities (*Helianthemetea guttati*) is observed. A rush meadow community (*Molinio-Arrhenatheretea*) is also encountered in small, humid depressions scattered mainly at the terrestrial edges of the pine forest, extending parallel to the coast, across the range of stabilized dunes.

Cakiletea maritimae

Natura 2000 habitat type: 1210 “Annual vegetation of drift lines”

Alliance (Ep) *Euphorbion peplidis* Tx. ex Oberd. 1952

Diagnostic species: *Salsola kali* (ϕ value 1, species frequency 100%), *Cakile maritima* (0.82, 100%), *Matthiola tricuspidata* (0.41, 80%), *Eryngium maritimum* (0.43, 40%)

Constant species: *Anthemis tomentosa* (species frequency 60%), *Elytrigia juncea* (60%)

Dominant species: none

A thick layer of organic matter deposited on the shoreline during storms favors the development of the association *Salsola kali-Cakiletum maritimae* (Table 3, rels. 1–5) which, like all pioneer halo-nitrophilous communities, has high nutritional demands and thrives in localities that are exposed to wave inundation and anthropogenic pressure. The limited number of species (with very low cover-abundance indices) is a common feature of this patchy and fragmented vegetation type throughout the Mediterranean region. This is because few plants can tolerate stormy wind, sand mobility and salt spray (Molina et al., 2003; Sýkora et al., 2003; Alegro et al., 2004; Šilc et al., 2016; Sarika et al., 2018; Stešević et al., 2019).

Ammophiletea

Natura 2000 habitat type: 2110 “Embryonic shifting dunes”

Alliance (Am) *Ammophilion* Br.-Bl. 1921

Diagnostic species: *Elytrigia juncea* (0.72, 100%), *Medicago marina* (0.72, 63%), *Allium stacticiforme* (0.64, 75%), *Hedypnois rhagadioloides* (0.63, 88%), *Pseudorhiza pumila* (0.61, 63%), *Eryngium maritimum* (0.59, 50%), *Bromus rubens* subsp. *rubens* (0.58, 63%), *Anthemis tomentosa* (0.42, 88%), *Lagurus ovatus* (0.42, 100%), *Erodium laciniatum* (0.41, 63%),

Constant species: *Matthiola tricuspidata* (75%)

Dominant species: *Elytrigia juncea*, *Medicago marina*, *Sporobolus pungens*

The associations *Eryngio-Sporobolium virginici* and *Cypero mucronati-Agropyretum juncei* are discontinuously distributed on loose, shifting dunes (Table 3, rels. 6–13). Rhizomatous geophytes and hemicryptophytes such as *Elytrigia juncea*, *Sporobolus pungens* and *Medicago marina* dominate this vegetation type as they are adapted to the harsh physical factors of the coastline and favor the dynamics of sand dune formation, evolution and stabilization (Sýkora et al., 2003). When the beach is broad enough, secondary, less mobile, yellow dunes with *Ammophila arenaria* may exist inland (Sýkora et al., 2003; Alegro et al., 2004). However, in the case of Schinias, the sandy belt is relatively narrow with an average width of ~300m and a direct transition from the embryonic dunes to the wooded area is observable, similarly to the transition reported from the Croatian coasts (Alegro et al., 2004).

Helianthemetea guttati

Natura 2000 habitat type: 2230 “*Malcolmietalia* dune grasslands”.

Alliance (Mn) *Maresion nanae* Géhu et al. 1987

Diagnostic species: *Medicago littoralis* (0.67, 68%), *Anthemis tomentosa* (0.51, 86%), *Silene colorata* (0.47, 45%), *Erodium laciniatum* (0.41, 50%),

Constant species: *Lagurus ovatus* (77%), *Matthiola tricuspidata* (63%)

Dominant species: *Medicago littoralis*, *Anthemis tomentosa*, *Silene colorata*, *Plantago bellardii*

In late winter the species *Silene colorata* (Table 4, rels. 15–18) dominates openings existing along the coastal front of the pine forest, but as spring progresses it is gradually replaced by a vegetation type dominated by *Anthemis tomentosa* and *Matthiola tricuspidata* (Table 4, rels. 1–10). This type of vegetation occurs frequently on Greek coasts but has not yet been described at the association level, possibly due to its’ ephemeral nature. Here, it is treated as the new association *Matthiola tricuspidatae-Anthemidetum tomentosae* ass. nov. hoc loco (Table 4, rel. 1–10, holotypus: rel. 2; characteristic taxa: *Anthemis tomentosa* and *Matthiola tricuspidata*). At the same time of year, just a few meters farther toward the interior of the forest, two more ephemeral communities emerge on sandy soils

less exposed to salt spray. The first is characterized by the dominance of *Medicago littoralis* and *Matthiola tricuspidata* (Table 4, rels. 11–14) and seems to represent the association *Medicagini littoralis-Anthemidetum tomentosae* (first reported from Rhodes Island by Géhu et al. 1989). The second is characterized by the dominance of *Plantago bellardii* (Table 4, rels. 19–22). Díez-Garretas et al. (2003) report that although *Anthemis tomentosa* and *Matthiola tricuspidata* do occasionally appear in phytosociological tables referring to the *Ammophiletea* or *Helichryso-Crucianelletea* (*Crucianelion maritimae*) classes, they actually belong to the order *Vulpietalia* and represent a therophytic element between the perennial vegetation of *Ammophiletea*. Tomaselli et al. (2011) and Minissale & Sciandrello (2015) also consider *Anthemis tomentosa* to be a character species of the order *Vulpietalia*, stating similarly that the communities of this order develop among the perennial vegetation of the classes *Ammophiletea*, *Helichryso-Crucianelletea* or even of *Quercetea ilicis*. We have adopted these assumptions and accept that the therophytic vegetation discussed above belongs to the *Vulpietalia* order (*Helianthemetea guttati* class), into which the ephemeral sabulicolous communities of coastal semi-fixed dunes of the Mediterranean region are grouped (Díez-Garretas et al., 2003; Costa et al., 2011).

Helichryso-Crucianelletea maritimae

Natura 2000 habitat type: 2260 “*Cisto-Lavenduletalia* dune sclerophyllous scrubs”

Alliance (Hel-Cent) *Helichryso barrelieri-Centaureion spinosae* Mucina et Dimopoulos in Mucina et al. 2016

Diagnostic species: *Centaurea spinosa* (1, 100%), *Cyperus capitatus* (0.70, 60%), *Elytrigia juncea* (0.54, 80%), *Malcolmia flexuosa* (0.47, 40%)

Constant species: *Lagurus ovatus* (60%)

Dominant species: *Centaurea spinosa*

Vegetation stands dominated by *Centaurea spinosa* develop sporadically on the sea facing slopes of semi fixed dunes. The community formed (Table 5, rels. 1–5) belongs to the *Helichryso barrelieri-Centaureion spinosae* alliance. This includes the coastal hemispherical phrygana of south-eastern Aegean and eastern Anatolia (Marcenò et al., 2018). Mucina et al. (2016) emphasize that *Centaurea spinosa* is a floristic element not only of *Helichryso-Crucianelletea maritimae* class but also of classes such as *Ammophiletea*, *Crithmo-Staticetea* and *Cisto-Micromerietea*. However, when the floristic composition of *Centaurea spinosa* dominated stands refers to the alliance *Helichryso barrelieri-Centaureion spinosae* then they represent a distinguishable habitat type, as mentioned here, that differs clearly from any of those linked to the rest of abovementioned classes.

Quercetea ilicis

Natura 2000 habitat type: 2250 “Coastal dunes with *Juniperus* spp.”

Alliance (Asp-Jun) *Asparago orientalis-Juniperion macrocarpae* (Díez-Garretas et Asensi 2014) Mucina in Mucina et al. 2016

Diagnostic species: *Juniperus macrocarpa* (0.79, 100%), *Bromus rigidus* (0.75, 100%), *Prasium majus* (0.59, 100%), *Matthiola tricuspidata* (0.52, 100%),

Constant species: *Anthemis tomentosa* (67%), *Pistacia lentiscus* (67%), *Piptatherum miliaceum* (67%)

Dominant species: *Juniperus macrocarpa*, *Pistacia lentiscus*

Juniperus macrocarpa dominated stands occur sporadically on semi fixed dune fields close to the sea. They are fragmented and frequently mixed with phytocoenoses belonging to the *Vulpietalia* and *Ammophiletalia* orders. Constant presence of the species *Pistacia lentiscus* and *Prasium majus* in the relevés (Table 6, rels. 1–3) reinforces the view that they represent the association *Prasio majoris-Juniperetum macrocarpae* of the alliance *Asparago orientalis-Juniperion macrocarpae*, known also from the islands of central southern Aegean area. The maritime juniper is a threatened plant species of the Mediterranean region, and its communities are considered priority habitats for conservation in the framework of the Habitats Directive (Díez-Garretas & Asensi, 2014).

Natura 2000 habitat type: 9540 “Mediterranean pine forests with endemic Mesogean Pines” and 2270 “Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*”

Alliance (Pis-Pin) *Pistacio lentisci-Pinion halepensis* Biondi et al. in Biondi et al. 2014

Diagnostic species: *Pinus halepensis* (0.91, 100%), *Rhamnus alaternus* (0.71, 88%), *Asparagus acutifolius* (0.69, 71%), *Pistacia lentiscus* (0.65, 94%), *Prasium majus* (0.65, 82%), *Quercus coccifera* (0.61, 59%), *Juniperus phoenicea* (0.52, 47%), *Pinus pinea* (0.48, 59%), *Piptatherum miliaceum* (0.47, 82%), *Smilax aspera* (0.46, 59%)

Constant species: *Lagurus ovatus* (53%)

Dominant species: *Pinus halepensis*, *Pinus pinea*, *Pistacia lentiscus*

The pine forest of Schinias develops on stabilized dunes, occupying an area of 3 kilometers long and 450 meters wide, bordering the marsh to the north and north-east. *Pinus halepensis* prevails in the eastern part of the forest (Table 6, rels. 4–10). Approximately halfway to the west *P. halepensis* start to mix with *P. pinea* individuals (Table 6, rels. 11–20). The latter species gradually dominates at the western end of the forest area, giving rise to pure *P. pinea* stands (Table 6, rels. 21–25). Several

sclerophyllous evergreen shrubs thrive in the under-storey, among which *Pistacia lentiscus* plays an important role in the structure of almost all the studied relevés. All *P. halepensis* stands (Table 6, rels. 4–10 & 11–20) can be attributed to the alliance *Pistacio lentisci-Pinion halepensis*. We consider that pure *P. halepensis* stands refer to the association *Pistacio lentisci-Pinetum halepensis* (Konstantinidis et al., 2012). Stands of *P. halepensis* mixed with *P. pinea* represent a subtype of the aforementioned association and are described here for the first time. Rel. 13 of Table 6 is considered the type for the initial description of this vegetation type as the new subassociation *Pistacio lentisci-Pinetum halepensis pinetosum pineae* subass. nov. hoc loco (Table 6, rel. 11–20, holotypus: rel. 13; characteristic taxa: *Pinus halepensis* and *P. pinea*).

Alliance (Pp) *Pinion pineae* Feinbrun 1959

Diagnostic species: *Pinus pinea* (0.66, 100%), *Clematis cirrhosa* (0.58, 40%), *Leontodon tuberosus* (0.55, 40%), *Helichrysum stoechas* subsp. *barrelieri* (0.49, 60%), *Pistacia lentiscus* (0.43, 80%), *Carlina corymbosa* (0.41, 40%),

Constant species: *Smilax aspera* (60%), *Piptatherum miliaceum* (60%)

Dominant species: *Pinus pinea*, *Pistacia lentiscus*

The stands with *P. pinea* as dominant (Table 6, rels. 21–25) represent the alliance *Pinion pineae*.

Natura 2000 habitat type: 9320 “*Olea* and *Ceratonia* forests”

Alliance (Cer-Pis) *Ceratonio-Pistacion lentisci* Zohary et Orshan 1959

Diagnostic species: *Pistacia lentiscus* (0.55, 100%), *Smilax aspera* (0.64, 100%), *Juniperus phoenicea* (0.49, 60%), *Anthyllis hermaniae* (0.43, 40%), *Scirpoides holoschoenus* (0.41, 40%).

Constant species: *Piptatherum miliaceum* (60%), *Rhamnus alaternus* (60%),

Dominant species: *Pistacia lentiscus*

Monospecific *Pistacia lentiscus* assemblages or mixed with *Quercus coccifera* (Table 7, rels. 1–5) develop at the edges or in the openings of the pine forest. They belong to the order *Pistacio lentisci-Rhamnetalia alaterni*, alliance *Ceratonio-Pistacion lentisci*. Tsiourlis et al. (2009) classified *Quercus coccifera-Pistacia lentiscus* shrublands of continental and insular Greece (apart from Crete), into the association *Quercus cocciferae-Pistacietum lentisci*. They note that this vegetation type is widespread in the Mediterranean Basin and that due to its wide distribution it has been described by many researchers, while in some cases, it was attributed to different associations.

Molinio-Arrhenatheretea

Natura 2000 habitat type: 2190 “Humid dune slacks”
Alliance (Mol-Hol) *Molinio-Holoschoenion* Br.-Bl. ex
Tchou 1948

Diagnostic species: *Scirpoides holoschoenus* (0.91, 100%),
Bromus hordeaceus (0.62, 40%), *Sinapis arvensis* (0.55,
40%), *Ditrichia viscosa* (0.50, 40%),

Dominant species: *Scirpoides holoschoenus*

Scirpoides holoschoenus stands (Table 7, rels. 6–10) develop in small, wet depressions scattered in the dune system, mostly along the land borders of the pine forest. Vegetation of this type is traditionally classified to the alliance *Molinio-Holoschoenion* as the association *Holoschoenetum vulgaris*, which grows on soils subjected to seasonal fluctuation of water table. It tolerates summer drought sufficiently and is usually rich in species characteristic of the *Molinio-Arrhenatheretea* class (Lastrucci et al., 2012; 2017a). However, the relevés analyzed in the present study do not share species with this class, with the exception of the dominant *Scirpoides holoschoenus*. Instead, species related to anthropogenic impacts such as overgrazing or disturbed nitrified soils (Schaminée et al. (2020) were constantly present, but with low cover-abundance degree (e.g. *Sinapis arvensis*, *Bromus hordeaceus*, *Ditrichia viscosa*). This situation is rather common in Mediterranean humid dune slacks (Schaminée et al., 2019b). García-Madrid et al. (2016) report that *Molinio-Holoschoenion* communities are widespread throughout the entire Mediterranean Basin (Macaronesian Islands up to the Black Sea), though with different floristic composition depending on groundwater regime, moisture gradient, soil properties and anthropogenic pressures, whereas Mucina et al. (2016) treat them as western Mediterranean syntaxa.

Artemisietea vulgaris

Order (Ely-Dit) *Elytrigio repentis-Dittrichietalia viscosae*
Mucina ined.

Diagnostic species: *Elytrigia obtusiflora* (1, 100%)

Constant species: *Juncus acutus* (50%), *Juncus maritimus*
(50%)

Dominant species: *Elytrigia obtusiflora*

In the study area *Elytrigia obtusiflora* occupies areas with human impact, especially the edges of forest roads along which it forms narrow strips (Table 7, rels. 11–14). *E. obtusiflora* is among the characteristic species of the *Artemisietea vulgaris* class (Mucina et al., 2016) used for formal definition of the EUNIS habitat type E5.1 “Anthropogenic herb stands” (Davies et al., 2004; Schaminée et al., 2019b). This is further divided into sub-types corresponding to different phytosociological classes including *Artemisietea vulgaris* (Schaminée et al., 2020). The

community of *E. obtusiflora* growing in Schinias could be assigned to the order *Elytrigio repentis-Dittrichietalia viscosae* which frames the anthropogenic sub-ruderal and ruderal grasslands and herblands of submediterranean and Mediterranean Southern Europe. However, the absence of additional diagnostic species in the stands of this vegetation type makes it impossible to classify them in any of the known alliances of this order.

Coastal wetland vegetation

At the lower Schinias marsh there is no clear predominance of *Salicornietea fruticosae* shrubs as the halophytic succulents of this class are combined with tall rush communities of *Juncetalia maritimi* or common reed beds of *Phragmito-Magnocaricetea*. However, as the marsh surface gradually raises, salt meadows of *Juncetalia maritimi* become dominant (middle marsh), while at even higher elevation levels (upper marsh) more competitive plant species prevail up to the outermost boundaries of the wetland (e.g. *Schoenoplectus litoralis*, *Bolboschoenus maritimus*, *Phragmites australis*). Thus, sequential dominance of different species along the elevation gradient creates two well-diversified vegetation zones that correspond to the middle marsh and the upper marsh. Stands of *Tamarix* spp. appear sporadically throughout the marsh, but only towards the uppermost edge do they form small woodland. Finally, dense beds of the submerged angiosperm *Ruppia maritima* occupy seasonally flooded openings.

Salicornietea fruticosae

Natura 2000 habitat type: 1420 “Mediterranean and thermo-Atlantic halophilous scrub (*Salicornietea fruticosae*)”.

Alliance (Sal) *Salicornion fruticosae* Br.-Bl. 1933

Diagnostic species: *Sarcocornia perennis* (0.82, 100%)

Constant species: *Juncus subulatus* (50%)

Dominant species: *Sarcocornia perennis*

Well-developed stands of the association *Puccinellio festuciformis-Sarcocornietum perennis* (Table 8, rels. 1–6) occur in the low and low-middle area of the marsh. *Sarcocornia perennis* dominates these stands that are generally poor in species. Low species richness is a typical feature of the highly stressful environments present along the whole elevation gradient of coastal marshes and *Salicornietea fruticosae* communities all over the Mediterranean region (Silvestri et al., 2005). According to Cutini et al. (2010), salinity and limited soil oxygen act as ecological filters, reducing species richness in coastal marshes.

Alliance (Arth) *Arthrocnemion glauci* Rivas-Mart. et Costa
M. 1984

Diagnostic species: *Arthrocnemum macrostachyum* (0.69, 100%)

Constant species: *Juncus subulatus* (88%)

Dominant species: *Arthrocnemum macrostachyum*

The association *Arthrocnemo-Juncetum subulati* (Table 8, rels. 7–14), which has not, to the best of our knowledge, been reported from Greece to date, was mostly found in localities of the mid-upper and upper marsh. This vegetation is usually associated with the better aerated, highly saline soils of upper salt marshes that remain moist even during the summer (Tomaselli et al., 2011; Sciandrello & Tomaselli, 2014).

Order (Lim) *Limonietalia* Br.-Bl. et O. de Bolòs 1958

Diagnostic species: *Psilurus incurvus* (0.91, 100%), *Limonium compactum* (0.82, 100%), *Schoenus nigricans* (0.75, 100%), *Elytrigia elongata* (0.68, 100%), *Arthrocnemum macrostachyum* (0.61, 100%), *Puccinellia festuciformis* (0.46, 50%)

Constant species: *Aeluropus littoralis* (50%), *Plantago crassifolia* (50%)

Dominant species: *Limonium compactum*

Limonium compactum forms a community scattered throughout the elevated, less humid parts of the middle-upper marsh (Table 8, rels. 15–16). Although this community is differentiated by a number of diagnostic species, it cannot be assigned to any of the known alliances of the order *Limonietalia* included in Mucina et al. (2016), as these refer to Iberian or Tyrrhenian-Central Mediterranean vegetation units. Communities dominated by *Limonium* species are often described as transitional between the hypersaline vegetation of the order *Salicornietalia fruticosae* and the drier and less saline places preferred by vegetation of the order *Juncetalia maritimi* (Golub et al., 2001; Tomaselli et al., 2011). Viciani et al. (2012) report that remnants of this vegetation type are also often recorded when habitats favouring its occurrence are under intensive human pressure.

Juncetea maritimi

Natura 2000 habitat type: 1410 “Mediterranean salt meadows”

Alliance (Jm) *Juncion maritimi* Br.-Bl. ex Horvatić 1934

Diagnostic species: *Aeluropus littoralis* (0.36, 58%), *Juncus maritimus* (0.31, 51%)

Constant species: *Juncus subulatus* (47%)

Dominant species: *Aeluropus littoralis*, *Juncus maritimus*, *Juncus subulatus*, *Elytrigia elongata* subsp. *elongata*

Juncus maritimus has a significant presence in the lower part of the mid marsh but it becomes predominant towards the upper borders of this zone. Here it forms dense, almost monospecific meadows (Table 9, rels. 1–10),

alternating and creating a mosaic with extended stands of *Juncus subulatus*. Communities of *J. maritimus* thriving in warm, arid southern Mediterranean areas are traditionally treated as representatives of the associations *Puccinellio festuciformis-Juncetum maritimi* or *Inulo-Juncetum maritimi* (synonym of the *Puccinellio festuciformis-Juncetum maritimi inuletosum crithmoidis*), and not of the northern Adriatic *Juncetum maritimi* (Veronico et al., 2017; Dítě et al., 2019). This view is adopted in the present study.

Juncus subulatus forms monospecific stands (Table 9, rels. 11–17) in the upper fringes of the middle marsh, occupying places in a slightly lower elevation than the surrounding adjacent ones, which are flooded for a long time. A different morphotype of this species, with thinner and lower in height individuals prevails in vegetation patches in the lower part of the middle marsh. These communities however have a different structure from that of *J. subulatus* in the upper limits of the same zone. We consider that the constant presence of the species *Juncus maritimus*, *Aeluropus littoralis* and *Cressa cretica* within the patches dominated by *J. subulatus* in the lower area of the mid marsh (Table 9, rels. 18–24) differentiates a community resembling the association *Aeluropo littoralis-Juncetum subulati* (Salazar et al., 2002; Alonso, 2011). It is worth mentioning that in the Mediterranean region *J. subulatus* combined with species such as *J. maritimus* and *A. littoralis* often replaces communities of genus *Salicornia* and that in salt marshes morphologic diversification of a species can be observed even at short distances, because halophytes often differentiate genetically, in response to environmental gradient (Willis & Davies, 1960; Penning & Bertness, 2001).

Aeluropus littoralis dominates a community discontinuously distributed in the lower area of the middle marsh. In many sources, it is supported that in the Mediterranean region this species is mostly related to the vegetation of the class *Juncetea maritimi* (Merloni & Piccoli 2007; Tzonev et al., 2008; Cazzin et al., 2009; Fanelli et al., 2015). Constant participation of the species of this class in the structure of *Aeluropus littoralis* communities (Table 9, rels. 25–35) indicates their close relationship with the particular class. We attribute the *Aeluropus littoralis* vegetation patches in the salt marsh of Schinias to the association *Puccinellio festuciformis-Aeluropetum littoralis*, mentioned from Italy and Albania with a similar structure (Poldini et al., 1999; Sciandrello & Tomaselli, 2014; Fanelli et al., 2015). Based on data collected, a subassociation differentiated by *Cressa cretica* is distinguished, which is described here for the first time as the *Puccinellio festuciformis-Aeluropetum littoralis cressetosum creticae* subass. nov. hoc loco (Table 9, rel. 25–30, holo-

typus: rel. 27; differential taxa: *Cressa cretica*). According to Jasprica et al. (2015) the communities of *Cressa cretica* in the Mediterranean region are correlated to the most haline and dry soils of salt marshes. Authors note that the appearance of salty efflorescences is frequent on these soils, as it was also observed in our study area. *Cressa cretica* occurs in various halophytic habitats throughout Greece, but data concerning vegetation units of this species are not available thus far.

Elytrigia elongata forms scattered patches along the upper margins of *Juncetalia maritimi* meadows and, rarely, on wet sandy depressions within the pinewood (Table 9, relevés 36–43). This species is usually found on the outer border of the upper salt marshes and is related to soils with moderate salt concentration that inundate occasionally and for short periods (Sciandrello & Tomaselli, 2014; Veronico et al., 2017). The community formed by *Elytrigia elongata* of the study area could be allocated to the association *Agropyro elongati-Inuletum crithmoidis* (Viciani & Lombardi, 2001; Tomaselli & Sciandrello, 2017; Veronico et al., 2017), widespread in Italy. However, due to very limited occurrence of *Limbarda crithmoides* in the Schinias stands, this vegetation type is significantly differentiated from the abovementioned association and is here treated as the community of *Elytrigia elongata*.

Alliance (Agr-Plan) *Agropyro-Plantaginion maritimi* Horvatić 1934

Diagnostic species: *Plantago crassifolia* (0.68, 82%), *Schoenus nigricans* (0.65, 64%)

Dominant species: *Plantago crassifolia*, *Schoenus nigricans*

Stands dominated by the species *Schoenus nigricans* and/or *Plantago crassifolia* (Table 10, rels. 1–11) develop on more elevated localities of the middle marsh. *Schoenus nigricans* is a common species in Mediterranean wet meadows, but the floristic composition of the communities formed differs depending on soil salinity. Communities occurring in saline habitats (rich in species of *Juncetalia maritimi*) differ floristically from those thriving in meadows fed by freshwater (lacking in species of *Juncetalia maritimi*, rich in *Molinio-Arrhenatheretea* species), and are thereby assigned to different syntaxa. In *Schoenus nigricans* communities of Mediterranean salt meadows, *Plantago crassifolia* frequently participates, even as a co-dominant species (Tomaselli et al., 2011; Veronico et al., 2017). The relevés recorded in the present study could be classified to the association *Schoeno nigricantis-Plantaginietum crassifoliae* and regarded as transitional between the halophilous vegetation of *Salicornietea fruticosae* and that of the *Juncetalia maritimi*, which prefers soils with lower salt concentration (Molina et al., 2003; Stančić et al., 2008; Tomaselli et al., 2011).

Phragmito-Magnocaricetea

Natura 2000 habitat type: 72A0 “Reed thickets”

Alliance (Scm) *Scirpion maritimi* Dahl et Hadac 1941

Diagnostic species: *Bolboschoenus maritimus* (0.71, 74%)

Constant species: *Juncus subulatus* (52%)

Dominant species: *Bolboschoenus maritimus*, *Schoenoplectus littoralis*, *Juncus subulatus*

More competitive but less salt tolerant plant species are widely distributed in the upper marsh, occupying the entire high elevation zone up to the land border of the wetland. The communities they form belong to the alliance *Scirpion maritimi*, which according to Mucina et al. (2016) could be alternatively assigned to *Juncetalia maritimi* class. This is supported by our results, as *Juncus subulatus*, a typical species of this class, enters the sub-halophilous reed beds of *Scirpion maritimi* and plays an important role in shaping their structure. A mosaic of stands corresponding to the associations *Scirpetum littoralis* (Table 11, rels. 1–7), *Scirpetum maritimi* (Table 11, rels. 8–15) and *Scirpo compacti-Juncetum subulati* (Table 11, rels. 16–23), grows in shallow depressions of the upper marsh that flood only in winter. According to Tomaselli & Sciandrello (2017) *Scirpo compacti-Juncetum subulati* can withstand short periods of drought, whereas communities of *Bolboschoenus maritimus* and *Schoenoplectus littoralis* only grow in locations that remain wet through the summer. This is in agreement with the findings of the current study. These and other associations of this alliance, mentioned from the Mediterranean Basin and continental Europe, are all floristically poor and their classification is mainly based on dominant species (Landucci et al., 2020).

Alliance (Phc) *Phragmition communis* Koch 1926

Diagnostic species: *Phragmites australis* (0.51, 76%)

Dominant species: *Phragmites australis*, *Typha domingensis*

The study area also hosts the alliance *Phragmition communis*, represented by stands dominated by *Phragmites australis* or *Typha domingensis*. These occur not only in the upper marsh but also in lower elevation localities, where it is possible that local conditions reduce salt concentration in the aquifer. It is well documented that biomass, density and height of reed culms are adversely affected by increasing salinity and flooding (Hellings & Gallagher, 1992; Batriu et al., 2015). Although hydrology is considered as the most decisive factor for their dispersal, their ability of clonal growth and aggressive rhizomatous spread encourage invasion along the whole elevation gradient of the marsh (Sebastián-González et al., 2012). Two variants of the association *Phragmitetum communis* are distinguished in Schinias. The first is rich in halophytes (*Juncus subulatus*, *J. heldreichianus*, *J. maritimus*) and colonizes temporarily

inundated sites, (Table 12, rels. 1–10). The second is rather poorer in species and is characterized by the absence of halophytes and the presence of taxa preferring less saline habitats (*Cynanchum acutum*, *Oenanthe pimpinelloides*, *Ranunculus sardous*, *Alopecurus myosuroides*, *Piptatherum miliaceum*) on permanently flooded soils or on elevated rarely flooded ridges (Table 12, rels. 11–19). *Phragmites australis* usually forms mono-dominant or species-poor stands (Landucci et al., 2013; Batriu et al., 2015), but it has been demonstrated that species richness of its stands tends to decrease in permanently flooded soils or in soils that are never flooded, and to increase in areas with periodic water level fluctuation (Lastrucci et al., 2017b). The association *Typhetum domingensis* occurs fragmentary between the common reed beds (Table 12, rels. 20–26). It seems to prefer slightly saline coastal habitats that periodically dry out, although it can develop equally well in freshwater habitats. The presence of this thermophilous vicariant of *Typhetum angustifoliae* is rather overlooked in the Mediterranean region probably due to morphologic similarities between *Typha domingensis* and *T. angustifolia* (Landucci et al., 2013; Sarika et al., 2018).

Nerio-Tamaricetea

Natura 2000 habitat type: 92D0 “Southern riparian galleries and thickets”

Alliance (Tad) *Tamaricion dalmaticae* Jasprica in Jasprica et al. 2016

Diagnostic species: *Tamarix tetrandra* (0.64, 43%)

Constant species: *Juncus subulatus* (79%)

Dominant species: *Tamarix tetrandra*, *T. hampeana*, *T. parviflora*, *Juncus subulatus*

Vegetation dominated by the dwarf-woody species *Tamarix parviflora*, *T. hampeana* or *T. tetrandra* grows fragmentally throughout the marsh. However, these species exhibit optimum development toward the terrestrial ends of the wetland, where mixed stands create small tamarisk woodlands. Among the stands of these species, those of *T. tetrandra* were the most prevalent and a sufficient number of relevés were carried out within them. Based on these data, the ascription of *T. tetrandra* stands to the association level was approached through the original diagnosis of a new (according to what is known so far) vegetation type which is first described in the present study as the *Tamaricetum tetrandrae* ass. nov. hoc loco (Table 13, rel. 9–14, holotypus: rel. 13; characteristic taxa: *Tamarix tetrandra*, *T. hampeana* x *tetrandra*, *Juncus subulatus*, *J. maritimus*, *J. acutus*). To date two alliances of *Nerio-Tamaricetea* class are known from the eastern Mediterranean. Among them, *Tamaricion dalmaticae* is the only one related to saline or sub-saline environments (Mucina et al., 2016). These communities known form the Balkan Adriatic

coasts, probably spread also into Greece (Jasprica, 2016). The presence of halophytes in all the relevés (Table 13, rels. 1–14) analyzed emphasizes their correlation to the aforementioned syntaxon. Furthermore, ruderal species from neighboring disturbed habitats enter these *Tamarix* stands, as they do in *Tamaricion dalmaticae* communities of the eastern Adriatic coasts (Jasprica, 2016). *Tamarix minoa* J.L. Villar, Turland, Juan, Gaskin, M.A. Alonso & M.B. Crespo (found in rel. 10, see Table 13) is recorded for the first time in continental Greece. Up until now, the species was considered endemic to the island of Crete (Flora of Greece Web, 2022; Strid, 2016). It was identified, for our study, by J. Zieliński (Kórnik) and N. Turland (Berlin) based on the voucher Zikos 2091, deposited at the ATHU Herbarium.

Ruppiaetea maritima

Natura 2000 habitat type: 1150 “Coastal lagoons”

Alliance (Rum) *Ruppion maritima* Br.-Bl. ex Westhoff in Bennema et al. 1943

Diagnostic species: *Ruppia maritima* (1, 100%), *Chara* sp. (0.76, 60%)

Dominant species: *Ruppia maritima*

Almost monophytic stands of *Ruppia maritima* are interspersed throughout the marsh in seasonally flooded openings (Table 13, rels. 15–19). This species, which is common in the littoral wetlands of Greece (Sarika et al., 2015), decomposes during summer after the water level drops, providing an important source of organic matter. It is a species with a rather narrow ecological niche but tolerates a wide range of salinity better than any other submerged angiosperm (Kantrud, 1991).

Molinio-Arrhenatheretea

EUNIS habitat type: R32-[E32a] “Mediterranean short moist grassland of lowlands”

Alliance (Tm) *Trifolion maritimi* Br.-Bl. ex Br.-Bl. et al. 1952

Diagnostic species: *Ranunculus sardous* (0.82, 83%), *Potentilla reptans* (0.69, 50%), *Carex divisa* (0.63, 50%), *Anagallis arvensis* (0.63, 50%), *Carex distans* (0.49, 50%), *Tragopogon longifolius* (0.44, 50%)

Dominant species: *Carex distans*, *C. divisa*

Vegetation dominated by the species *Carex distans* or *Carex divisa* forms distinct communities in temporarily flooded soils on the outer borders of the upper marsh (along the outer fringes of reed-beds or in openings between the tamarisk thickets) affected by heavy grazing and/or human activities. The communities of *C. distans* and *C. divisa* in Mediterranean coastal marshes are mostly ascribed to the *Juncion maritimi* alliance (Braun-Blanquet et al., 1952; Lavrentiades, 1964; Rivas-Martínez et al.,

2001; Biondi & Bagella, 2005; Sarika, 2012; Dítě et al. 2019). However, the lack of *Juncetea maritimi* species and the presence of *Molinio-Arrhenatheretea* species in the stands growing in Schinias marsh (Table 14, rels. 1–6) suggest their transitional character between the strictly halophytic communities of *Juncetalia maritimi* and the halo-sub-nitrophilous ones of the order *Potentillo-Polygonetalia avicularis* (*Molinio-Arrhenatheretea*) (Donker & Stevelink, 1961; Brullo et al., 2020). Based on this, we consider that they are framed into this order most likely as members of the alliance *Trifolion maritimi*, which is attributed to the EUNIS habitat type “Mediterranean short moist grassland of lowlands” and includes communities dominated either by species of *Juncetea maritimi* or *Molinio-Arrhenatheretea*, depending on habitat salinity (Schaminée et al., 2019a; Mercadal, 2021). Dítě et al. (2019) describe similar vegetation stands related to sub-saline soils. They state that due to their physiology, the sedge species *C. divisa* and *C. distans* seem to be stronger competitors than *Juncetea maritimi* elements, which do not manage to thrive although conditions are favorable for their growth.

Human pressures threatening the coastal dune and wetland vegetation of Schinias National Park

The coastal dune and wetland systems of Schinias National Park are constantly exposed to human-induced disturbances. This affects their functionality and integrity. Over the last decades, erosion, drainage, residential development and seaside recreation seem to be the main factors causing habitat degradation/fragmentation, while changes in land use, have been recognized as major drivers of biodiversity loss (Mertzanis & Merzanis, 2013; Gaitanis et al., 2015).

Erosion, one of the most important factors of biodiversity loss in coastal dune habitats (Veronico et al., 2017), is still active in the coastal zone of the Marathon plain (Mertzanis & Merzanis, 2013). A significant retreat of the shoreline has been recorded near the Haradros river estuary which coincides with the construction of the Marathonas dam in 1929. This is mainly because the reduction of sediment discharge enhances coastal erosion and degradation of dune habitats (Mertzanis & Merzanis, 2013; Scapini, 2010; Tomaselli et al., 2011; Veronico et al., 2017). In addition, residential development and intense seaside tourism have altered the morphology of the coastal dunes and it is well documented that such interventions have negative impact both on the growth of herbaceous plants and the regeneration of coastal forests (Stešević et al., 2017). It is also known that any alteration of dune

morphology leads to fragmentation of vegetation zonation and frequently causes the replacement or even the disappearance of the most common or sensitive plant communities (Fenu et al., 2012). However, spatial arrangements of dune vegetation in Schinias follow a rather sequential order but not the precise natural pattern expected in an undisturbed system as described by Acosta et al. (2007).

The psammophitic vegetation throughout the sand beach up to the first pine trees is fragmented and mixed, while regeneration of *Pinus halepensis* is almost exclusively observed in the openings of the under-storey shrubs. In places suffering intense anthropogenic pressure, such as the easily accessible eastern side of pine forest which receives many visitors, especially during the summer season, both under-storey vegetation and pine regeneration are absent. An inverse relationship is also observed between human presence and under-storey shrub density, which decreases from the western towards the eastern side of the study area and from the interior of the forest towards the beach. The *Pinus pinea* forest, one of the largest in Greece (Spanou et al., 2007), has been fragmented over the last decades. About half of this forest has been urbanized and its regeneration has been limited due to the felling of tree and soil compaction. Nevertheless, today, the regeneration of *Pinus pinea* in and around the Schinias National Park seems to be recovering as several new seedlings are observed in the older stand, but also in open habitats, expanding the forest towards NW.

The distribution of plants in wetlands corresponds to soil properties and water regime. Several studies verify that vegetation can be used as a bioindicator of human disturbances on the balanced feedback of soil-water-plant system (González-Alcaraz et al., 2014). Drainage projects conducted about a hundred years ago in the Marathonas plain resulted in the partial drying up of the Schinias marsh (Hadjibiros & Sifakaki, 2009). Part of the dried area was cultivated or built upon, while military infrastructure, long abandoned, was established on the rest of it. Nowadays, the marsh is fragmented by a network of roads and canals ending at the sea via two artificial ditches that run along both sides of the pine forest. A rowing center constructed in the core of the wetland for the 2004 Olympic Games significantly disrupts the integrity and functioning of this sensitive ecosystem. This project has aggravated the conservation status of the shrinking wetland, since a series of interventions such as construction of new canals, roads, parking spaces and sports facilities, profoundly altered the landscape and hydrology (Hadjibiros & Sifakaki, 2009; Gaitanis et al., 2015). Under the influence of these intensified and long-lasting anthropogenic interventions, vegetation zonation in many places (eg. near the sea, residences and rowing center) is disturbed or fragmented due

to unsustainable management. For example, the halophyte distribution pattern at the lower Schinias marsh is not reminiscent of that commonly found at the marine edges of coastal Mediterranean marshes, as there is no clear predominance of *Salicornietea fruticosae* shrubs (Ibañez et al., 2002). Instead, the pattern of development of halophytic succulents of this class is fragmented and mixed with tall rush communities of *Juncetalia maritimi* or stands of common reed. This is probably due to the wetland isolation from the sea and various anthropogenic interventions that disturb the water regime. González-Alcaraz et al. (2014) point out that habitat fragmentation is one of the major threats to wetlands exposed to human pressure. It is generally accepted that alteration or disappearance of vegetation zonation patterns in coastal wetlands is a consequence of their deterioration (Cutini et al., 2010). Relevant research confirms that anything that changes the gradient of physical stress or affects plant species competitiveness in marshes, may alter vegetation zonation patterns (Bertness & Pennings, 2002). This, then, reflects the environmental quality and the conservation status of the related habitats (Prisco et al., 2015). Although it is certain that many habitats have been lost or qualitatively degraded during the last decades, the degree of biodiversity reduction in the wetland cannot be accurately estimated due to the absence of previous studies.

Conclusions


The dunes and the salt marsh of Schinias National Park are among the most important coastal ecosystems in the region of Attica and, despite having been severely shrunk and fragmented, still host numerous vegetation types, which enhance their ability to provide crucial ecosystem services. It is widely known that vegetation characteristics (e.g. density, biomass production, canopy architecture, zonation), are directly related to the vital benefits that coastal dunes and wetlands offer to society. Furthermore, rich vegetation development significantly improves fundamental ecosystem functions such as protecting and stabilizing the shoreline (erosion control, accretion) and mitigating the effects of sea level rise. There is also evidence that vegetation establishment ensures the development and survival of coastal dunes and marshes. It is argued that the development of the coastal dunes and salt marshes is directly linked to the coupled balance between vegetation dynamics and geomorphology (rate of sand transport and trapping, sediment accretion), and that this equilibrium can be disturbed if vegetation growth, sediment accretion and sand trapping are hindered or degraded (Ruocco et al., 2014; Sigren et al., 2014; McInnes 2016; Sarika & Zikos 2020, Salimi et al., 2021). Thus, the conservation and

proper management of these unique natural landscapes is of paramount importance to their equilibrium and maintenance, as well as to the protection of local biodiversity. What is more, it could also ensure a critical legacy for future generations, given the regulating role coastal sand dunes and wetlands have on the effects of climate change.

Our results are in agreement with those of previous studies carried out in similar systems (Scapini, 2010; Fenu et al., 2012; Ruocco et al., 2014), confirming that coastal dunes and wetlands, despite suffering intense anthropogenic pressure all over Europe, still host a great variety of vegetation and habitat types. In the study area, vegetation development both in the dunes and the wetland area follows the ecological gradient of the main environmental factors from the coastline inland, generating zonation patterns. Within each zone, plant communities are distributed as mosaics, as a variety of habitats are created by the micro-relief, temporal and spatial variability of environmental factors (salt spray, sand burial, substrate mobility, drought, high temperature, nutrient deficiency, erosion, water regime, soil properties) and biotic interactions. The thirty-five vegetation types identified are typical of Mediterranean coastal ecosystems, four of them are first described in the present study (*Mathiolo tricuspidatae-Anthemidetum tomentosae*, *Pistacio lentisci-Pinetum halepensis pinetosum pineae*, *Puccinellio festuciformis-Aeluropetum litoralis cressetosum creticae*, *Tamaricetum tetrandrae*), while three (*Ruppium maritima*, *Juniperus macrocarpa* and *Pinus pinea* communities) are considered as priority habitat types within the framework of the Habitats Directive. The majority of EUNIS habitat types recorded in study area (nine of the twelve interpreted in total) are of high conservation value, as they are related to thirteen habitats of Annex I of the Habitats Directive (92/43/EEC). As far as the flora of the study area is concerned, it could be considered sufficiently rich, as 218 taxa were recorded in 222 relevés. Among the taxa colonizing the dune and marsh habitats of Schinias the species *Tamarix minoa* has special interest since it is recorded for the first time in continental Greece.

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Table 1. Synoptic table of the percentage occurrence frequency of the diagnostic species in the alliances or orders classified. Diagnostic species (with the phi value > 0,30 and frequency $\geq 40\%$) are marked by shading. Highly diagnostic species (with phi > 0,40) are dark shaded. Values with frame but without shading indicate additional diagnostic species with phi > 0,30 and frequency $\leq 40\%$. A thorough presentation of this table is given in Tables 3–14. Abbreviations of the vegetation units (alliances and orders) are explained in the text and in Figure 2.

Table 1: Sinoptična tabela s frekvenco pojavljanja diagnostičnih vrst v odstotkih za posamezno zvezo ali red. Diagnostične vrste (z fi vrednostjo večjo od 0,30 in frekvenco večjo ali enako 40%) so označene zasenčeno. Močno diagnostične vrste (fi večji od 0,40) so temno zasenčene. Vrednosti v okvirčkih brez zasenčenosti nakazujejo dodatne diagnostične vrste s fi vrednostjo manjšo od 0,30 in frekvenco manjšo od 40%. Narančen prikaz te table je v tabelah 3–14. Označe vegetacijskih enot (zvez in redov) so pojasnjene v tekstu in Sliki 2.

Vegetation units number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Vegetation units abbreviation	Ep	Am	Mn	Hel-Cent	Asp-Jun	Pis-Pin	Pp	Cer-Pis	Mol-Hol	Ely-Dit	Sal	Arth	Lim	Jm	Agr-Plan	Sem	Phc	Tad	Rum	Im	
<i>Euphorbia peplidis</i>	100	25	9	20																	
<i>Cakile maritima</i>	20																				
<i>Euphorbia pepus</i>	100																				
<i>Salsola kali</i>	20																				
<i>Xanthium orientale</i> subsp. <i>italicum</i>	20																				
<i>Annemophilon</i>																					
<i>Bromus rubens</i> subsp. <i>rubens</i>	63	18	20																		
<i>Hechypnois rhagadioloides</i>	40	88	32	20																	
<i>Medicago marina</i>	20	63																			
<i>Panicratium maritimum</i>		13																			
<i>Sporobolus pungens</i>	20	25	5	20																	
<i>Maresion nanae</i>																					
<i>Anchusa undulata</i> subsp. <i>hybrida</i>			14																		
<i>Brassica tournefortii</i>			32	20																	
<i>Cerastium brachypetalum</i> subsp. <i>roemeri</i>			18																		
<i>Hordeum murinum</i> subsp. <i>leporinum</i>			36		33	6											4	7			17
<i>Hypochoeris achyrophorus</i>			27																		17
<i>Medicago litoralis</i>	40		68			6															
<i>Parapholis incurva</i>			27																		
<i>Petrorhagia dubia</i>			14																		
<i>Plantago bellardii</i>			23																		
<i>Plantago lagopus</i>			36																		
<i>Plantago weldenii</i>			18																		
<i>Rumex bucephalophorus</i>			32																		
<i>Silene colorata</i>			45		33	12		20													
<i>Sisymbrium irio</i>			14																		

Vegetation units number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Vegetation units abbreviation	Ep	Am	Mn	Hel-Cent	Asp-Jun	Pis-Pin	Pp	Cer-Pis	Mol-Hol	Ely-Dit	Sal	Arth	Lim	Jm	Agr-Plan	Scm	Phc	Tad	Rum	Im	
<i>Trifolium scabrum</i>	.	.	27	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Valantia hispida</i>	.	.	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helichryso barrelieri-Centaureion spinosae</i>																					
<i>Centaurea spinosa</i>	.	.	.	100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cyperus capitatus</i>	.	.	.	60	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Erigeron sumatrensis</i>	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Heliotropium europaeum</i>	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Malcolmia flexuosa</i>	.	13	9	40	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Verbascum pinnatifidum</i>	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Asparago orientalis-Juniperion macrocarpae</i>																					
<i>Bromus rigidus</i>	.	.	27	.	100	6	.	.	.	.	.	.	.	.	.	.	.	.	.	7
<i>Cutandia maritima</i>	20	.	14	.	33	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Reichardia picroides</i>	.	13	.	.	33	12	20	.	.	.	.	.	.	.	.	.	.	4	.	.
<i>Pistacio lentisci-Pinion halepensis</i>																					
<i>Asparagus acutifolius</i>	71	20	40	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carthamus lanatus</i>	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cistus creticus</i>	29	.	20	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cistus monspeliensis</i>	24	.	20	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cymosurus echinatus</i>	24	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Myrtus communis</i>	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pinus halepensis</i>	33	100	.	20	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scaligeria napiformis</i>	18	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium angustifolium</i>	29	.	.	.	.	.	.	.	.	.	.	.	.	7	.	
<i>Vulpia fasciculata</i>	.	.	14	.	.	24	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pinion pineae</i>																					
<i>Arisarum vulgare</i>	20	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Brachypodium distachyon</i>	.	.	9	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ephedra foeminea</i>	20	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Leontodon tuberosus</i>	40	.	.	.	.	.	.	.	.	.	.	.	.	17	
<i>Oxalis pes-caprae</i>	20	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ceratonia-Pistacion lentisci</i>	
<i>Aetheorhiza bulbosa</i>	.	.	5	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	7	.
<i>Molinio-Holoschoenion</i>	
<i>Bromus hordeaceus</i>	40	.	.	.	.	.	.	.	.	.	.	.

Vegetation units number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Vegetation units abbreviation	Ep	Am	Mn	Hel-Cent	Asp-Jun	Pis-Pin	Pp	Cer-Pis	Mol-Hol	Ely-Dit	Sal	Arth	Lim	Jm	Agri-Plan	Scm	Phc	Tad	Rum	Tim
<i>Ditrichia viscosa</i>	40	.	.	.	.	.	.	.	4	7	.	.
<i>Sinapis arvensis</i>	6	.	.	40	.	.	.	.	.	.	.	.	.	.	.
<i>Elytrigia repentis-Ditrichietalia viscosae</i>
<i>Elytrigia obusiflora</i>	100	.	.	.	.	.	.	.	.	.	.	.
<i>Juncus acutus</i>	50	.	13	.	9	9	.	.	20	29	.	.
<i>Arthrocnemion glauci</i>
<i>Juncus subulatus</i>	50	88	.	47	.	52	24	79	.	.
<i>Limnietalia</i>
<i>Elytrigia elongata</i> subsp. <i>elongata</i>	100	19	.	.	8	14	.	.
<i>Limonium compactum</i>	17	.	100	7	.	.	.	7	.	.
<i>Psilaris incurvus</i>	100	5	.	.	.	.	.	.
<i>Juncus maritimi</i>
<i>Aeluropus litoralis</i>	17	.	50	58	36	4	20	14	.	.
<i>Cressa cretica</i>	30	.	.	.	.	.	.
<i>Juncus maritimus</i>	50	.	.	.	51	27	.	28	14	.	.
<i>Scirpion maritimi</i>
<i>Bolboschoenus maritimus</i>	2	.	74	8	.	.	.
<i>Schoenoplectus litoralis</i>	39	12	.	.	.
<i>Phragmites communis</i>
<i>Juncus gerardii</i>	12	.	.	.
<i>Phragmites australis</i>	25	.	5	18	.	76	36	.	17
<i>Typha domingensis</i>	9	28	.	.
<i>Tamaricion dalmaticae</i>
<i>Bromus madritensis</i> subsp. <i>haussknechtii</i>	14	.	.
<i>Galium aparine</i>	14	.	.
<i>Stellaria media</i>	14	.	.
<i>Tamarix hampeana</i>	36	.	.
<i>Tamarix hampeana</i> x <i>tetrandra</i>	29	.	.
<i>Tamarix parviflora</i>	36	.	.
<i>Tamarix tetrandra</i>	43	.	.
<i>Ruppion maritimae</i>
<i>Chara</i> sp.	60
<i>Ruppia maritima</i>	100
<i>Trifolium maritimi</i>

Vegetation units number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Vegetation units abbreviation	Ep	Am	Mn	Hel-Cent	Asp-Jun	Pis-Pin	Pp	Cer-Pis	Mol-Hol	Ely-Dit	Sal	Arth	Lim	Jm	Agr-Plan	Scm	Phc	Tad	Rum	Tm	
<i>Anacamptis palustris</i>	17
<i>Anagalis arvensis</i>	7	.	50
<i>Bellis annua</i>	17
<i>Bromus scoparius</i>	17
<i>Carex distans</i>	20	.	.	.	.	50
<i>Carex divisa</i>	4	.	.	.	.	50
<i>Festuca arundinacea</i> subsp. <i>interrupia</i>	4	.	.	.	.	17
<i>Galium debile</i>	33
<i>Geranium dissectum</i>	14	.	.	33
<i>Hordeum geniculatum</i>	17
<i>Medicago orbicularis</i>	17
<i>Oenanthe silaifolia</i>	7	.	.	16	.	.	.	33
<i>Potentilla reptans</i>	50
<i>Ranunculus sardous</i>	8	.	.	.	83
<i>Trigopogon longifolius</i>	20	14	.	.	50
<i>Trifolium nigrescens</i>	17

Diagnostic species for more than one vegetation units

<i>Allium sticticiforme</i>	40	75	14	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Elytrigia juncea</i>	60	100	.	80	33	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Eryngium maritimum</i>	40	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Matthiola tricuspidata</i>	80	75	64	.	100	6	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pseudorhiza pumila</i>	40	63	5	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anthemis tomentosa</i>	60	88	86	40	67	12	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Erodium laciniatum</i>	20	63	50	40	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lagurus ovatus</i>	.	100	77	60	33	53	40	40	.	.	.	.	.	.	.	.	12	7	.	.	17
<i>Anthyllis hermanniae</i>	.	.	.	.	33	12	20	40	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Juniperus macrocarpa</i>	.	.	.	.	100	24	40	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phagnalon graecum</i>	.	.	.	.	33	6	.	.	.	25	.	.	.	.	.	.	.	.	.	.	.
<i>Piptatherum miliaceum</i>	.	.	5	.	67	82	60	80	40	.	.	.	2	.	.	4	8	21	.	.	.
<i>Pistacia lentiscus</i>	.	.	.	.	67	94	80	100	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Prasium majus</i>	.	.	.	.	100	82	40	40	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carlina corymbosa</i>	.	.	.	.	.	29	40	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Juniperus phoenicea</i>	.	.	.	.	.	47	.	60	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Pinus pinea</i>	.	.	.	.	.	59	100	20	40	.	.	.	.	.	.	.	.	.	.	.	.

Vegetation units number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Vegetation units abbreviation	Ep	Am	Mn	Hel-Cent	Asp-Jun	Pis-Pin	Pp	Cer-Pis	Mol-Hol	Ely-Dit	Sal	Arth	Lim	Jm	Agr-Plan	Scm	Phc	Tad	Rum	Im	
<i>Quercus coccifera</i>	59	20	40	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rhamnus alaternus</i>	33	88	40	60	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Smilax aspera</i>	33	59	60	100	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Clematis chirrosa</i>	40	20	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helicbrysum stoechas</i> subsp. <i>barrelieri</i>	33	29	60	40	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scirpoides holoschoenus</i>	40	100	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Halimione portulacoides</i>	25	.	.	25	.	.	.	.	.	.	.	.	.
<i>Puccinellia festuiciformis</i>	33	.	50	2	.	9	.	.	.	14	.	.
<i>Sarcocornia perennis</i>	100	38	.	.	.	.	.	.	.	14	.	.
<i>Arrhcnemum macrostachyum</i>	100	100	12	9	4	8	.	.	.	.	.
<i>Plantago crassifolia</i>	25	.	50	.	.	82	12	7	.	.	.	.
<i>Schoenus nigricans</i>	100	2	.	64	.	.	.	.	.	.
Other species																					
<i>Aira elegantissima</i>	4	.	.
<i>Alopecurus myosuroides</i>	8	.	.	17
<i>Althaea officinalis</i>	4	.	.	.
<i>Arenaria leptoclados</i>	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Arum</i> sp.	7	.	.
<i>Asparagus aphyllus</i>	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Asphodelus ramosus</i> subsp. <i>ramosus</i>	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aster squamatus</i>	13	.	.	.	.	.	.	.	7	.	.
<i>Atriplex</i> sp.	7	.	.
<i>Avena barbata</i>	16	7	.	.
<i>Biscutella dichyma</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Bituminaria bituminosa</i>	7	.	.
<i>Briza maxima</i>	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Bromus alopecurus</i>	.	.	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.
<i>Bromus diandrus</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.
<i>Bromus sterilis</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.
<i>Capparis spinosa</i>	4	.	.	.
<i>Cardopatum corymbosum</i>	2	.	.	.	.	.	.	.	.
<i>Catapodium marinum</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Centaureum spicatum</i>	9	.	.	.	.	.	.	.
<i>Chenopodium murale</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Vegetation units number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Vegetation units abbreviation	Ep	Am	Mn	Hel-Cent	Asp-Jun	Pis-Pin	Pp	Cer-Pis	Mol-Hol	Ely-Dit	Sal	Arth	Lim	Jm	Agr-Plan	Sem	Phc	Tad	Rum	Im
<i>Cichorium intibus</i>	4	4	.	.	.
<i>Cirsium vulgare</i>	7	.	.
<i>Cynanchum acutum</i>	20	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	20	7	.	.
<i>Cynodon dactylon</i>	12	27	.	8	.	.	.
<i>Daucus carota</i>	20	.	.	.	.	.	.	.	.	12	14	.	.
<i>Dysbania ambrosioides</i>	4	.	.	.
<i>Echium arenarium</i>	20	13	18	.	.	.	.	.	.	.	.	.	.	2	.	4	12	.	.	.
<i>Elytrigia scirpea</i>	4	.	.	.
<i>Eruca vesicaria</i>	2	.	.	4	.	.	.
<i>Foeniculum vulgare</i>	4	.	.	.
<i>Geranium molle</i>	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helianthemum salicifolium</i>	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helminthotheca echioides</i>	4	8	.	.	.
<i>Hordeum vulgare</i> subsp. <i>spontanum</i>	7	.	.
<i>Isolepis cernua</i>	4	4	.	.	.
<i>Juncus beldreichianus</i>	2	18	.	16	7	.	.
<i>Lagocchia cuminoides</i>	7	.	.
<i>Lepidium draba</i>	4	.	.	.
<i>Limbarda crithmoides</i>	25	.	25	.	5	9	.	.	.	.	.
<i>Limonium narbonense</i>	4	.	.	.
<i>Limonium virgatum</i>	9	.	.	.	.	.
<i>Linum bienne</i>	.	.	9	.	.	24	.	20	.	.	.	.	.	.	9	.	.	.	.	17
<i>Lolium rigidum</i> subsp. <i>lepturoides</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lotus halophilus</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lotus peregrinus</i>	20	13	5	.	.	18	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Medicago sativa</i> subsp. <i>falcata</i>	7	.	.
<i>Melilotus indicus</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.	17
<i>Notobasis syriaca</i>	7	.	.
<i>Oenanthe pimpinelloides</i>	20	7	.
<i>Ononis diffusa</i>	6	.	.	.	.	.	.	.	.	.	.	.	.	.	33
<i>Parentucellia latifolia</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Plantago altissima</i>	4	.	.	.
<i>Plantago indica</i>	.	.	14	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Poa trivialis</i>	7

Vegetation units number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Vegetation units abbreviation	Ep	Am	Mn	Hel-Cent	Asp-Jun	Pis-Pin	Pp	Cer-Pis	Mol-Hol	Ely-Dit	Sal	Arth	Lim	Jm	Agr-Plan	Scm	Phc	Tad	Rum	Im	
<i>Polycarpon tetraphyllum</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polygonum maritimum</i>	7	.	.
<i>Polygonum monspeltensis</i>	5	.	.	4	7	.	.	.
<i>Polygonum viridis</i>	9	.	.	8	.	.	.	.
<i>Rumex pulcher</i>	8	.	.	.	.
<i>Salsola soda</i>	5	.	.	.	.	.	.	.
<i>Scorzonera crocifolia</i>	5	.	.	12	.	.	.	.
<i>Silene gallica</i>	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Silene sartorii</i>	.	13	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Silybum marianum</i>
<i>Sisymbrium officinale</i>	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sisymbrium orientale</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Solanum dulcamara</i>	4	.	.	.	.
<i>Sonchus oleraceus</i>	.	25	.	.	.	6	.	.	.	.	.	.	.	.	.	.	4	14	.	.	.
<i>Suaeda vera</i>	5	.	.	.	.	.	.	.
<i>Tamarix hampeana</i> x <i>parviflora</i>	7	.	.	.
<i>Tamarix minor</i>	7	.	.	.
<i>Tenacrium scordium</i> subsp. <i>scordioides</i>	7	.	.	24	.	.	.	17
<i>Thymbra capitata</i>	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Torilis nodosa</i>	7	.	.	.
<i>Trifolium campestre</i>	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium fragiferum</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium grandiflorum</i>	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium infamia-ponertii</i>	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium spumosum</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trigonella balansae</i>	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tripolium pannonicum</i> subsp. <i>pannonicum</i>	13	.	2	.	.	.	.	.	.	.
<i>Urtica pilulifera</i>	7	.	.
<i>Valerianella turgida</i>	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Vicia sativa</i>	7	.	.

Table 2: A crosswalk between syntaxa and various habitat typologies. EUNIS: EUNIS Habitat Classification (Davies et al., 2004; Schaminée et al., 2019); Annex: Habitat types of Annex I of the Council Directive 92/43/EEC; NI: Habitat types of national interest.

Tabela 2: Prevod med sintaksami in različnimi habitatnimi tipologijami. EUNIS: Eunis habitatna klasifikacija (Davies et al., 2004; Schaminée et al., 2019); Annex: habitatni tipi s Priloge 1 Habitatne direktive 92/43/EEC; NI: habitatni tipi nacionalnega pomena.

	EUNIS	Annex	NI
<i>CAKILETEA MARITIMAE</i> Tx. et Preisig in Tx. ex Br.-Bl. et Tx. 1952 <i>Thero-Atriplicetalia</i> Pignatti 1953			
<i>Euphorbion peplidis</i> Tx. ex Oberd. 1952 <i>Salsolo kali-Cakiletum maritimae</i> Costa et Mansanet 1981 corr. Rivas-Martinez, Costa et Loidi 1992	N12	Annual vegetation of drift lines (1210)	
<i>AMMOPHILETEA</i> Br.-Bl. et Tx. ex Westhoff et al. 1946 <i>Amnophiletalia</i> Br.-Bl. et Tx. ex Westhoff et al. 1946 <i>Ammophilion</i> Br.-Bl. 1921 <i>Eryngio-Sporobolium virginici</i> Géhu et Uslu 1989 <i>Cypero mucronati-Agropyretum juncei</i> (Kühnholtz-Lordat 1923) Br.-Bl. 1933	N14	Embryonic shifting dunes (2110)	
<i>HELLANTHEMITEA GUTTATI</i> Rivas Goday et Rivas-Mart. 1963 <i>Vulpietalia</i> Pignatti 1953 <i>Maresion nanae</i> Géhu et al. 1987 <i>Mathiolo tricuspidatae-Anthemidetum tomentosae</i> ass. nova <i>Medicagini littoralis-Anthemidetum tomentosae</i> Géhu et al. 1989 <i>Silene colorata</i> community <i>Plantago bellardii</i> community	N16	Malcolmietalia dune grasslands (2230)	
<i>HELICHRYSO-CRUCIANELETEA MARITIMAE</i> Géhu et al. in Sissingh 1974 <i>Crucianelletalia maritimae</i> Sissingh 1974 <i>Helichryso barvelieri-Centaureion spinosae</i> Mucina et Dimopoulos in Mucina et al. 2016 <i>Centaurea spinosa</i> community	N1B	Cisto-Lavenduletalia dune sclerophyllous scrubs (2260)	
<i>QUERCETEAE ILICIS</i> Br.-Bl. ex A. Bolòs et O. de Bolòs in A. Bolòs y Vayreda 1950 <i>Pinetalia halepensis</i> Biondi, Blasi, Galdenzi, Pesaresi et Vagge in Biondi et al. 2014 <i>Pistacio lentisci-Pinon halepensis</i> Biondi, et al. in Biondi et al. 2014 <i>Pistacio lentisci-Pinetum halepensis</i> De Marco, Veri & Caneva 1984 <i>Pistacio lentisci-Pinetum halepensis pinetosum pineae</i> subass. nova <i>Pinion pineae</i> Feinbrun 1959 <i>Pinus pinea</i> community <i>Pistacio lentisci-Rhamnetalia alaterni</i> Rivas-Mart. 1975	N1G	Mediterranean pine forests with endemic Mesogean pines (9540)	
	N1G	Wooded dunes with <i>Pinus pinea</i> and/or <i>Pinus pinaster</i> (2270*)	

<i>Asparagus orientalis-Juniperion macrocarpae</i> (Díez Garretas et Asensi 2014) Mucina in Mucina et al. 2016	N1B	Coastal dunes with Juniperus spp. (2250*)
<i>Juniperus macrocarpa</i> community		
Cerantonio-Pistacion lentisci Zohary et Orshan 1959	N1B	Olea and Ceratonia forests (9320)
<i>Quercus cocciferae-Pistacietum lentisci</i> Tsiourlis, Konstantinidis, Xofis 2009		
MOLINIO-ARRHENATHERETEAE Tx. 1937		
<i>Holoschoenalia</i> Br.-Bl. ex Tchou 1948		
Molinio-Holoschoenion Br.-Bl. ex Tchou 1948	N1J	Humid dune slacks (2190)
<i>Scirpoides holoschoenus</i> community		
<i>Potentillo-Polygonetalia avicularis</i> Tx. 1947	R32- [E32a]	
Trifolion maritimi Br.-Bl. ex Br.-Bl. et al. 1952		
<i>Carex distans</i> community		
<i>Carex divisa</i> community		
SALICORNIEAE FRUTICOSAE Br.-Bl. et Tx. ex A. Bolòs y Vayreda et O. de Bolòs in A. Bolòs y Vayreda 1950	A2.5	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) (1420)
<i>Salicornietalia fruticosae</i> Br.-Bl. 1933		
Salicornion fruticosae Br.-Bl. 1933	A2.5	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) (1420)
<i>Puccinellio festuciformis-Sarcocornietum perennis</i> (Br.-Bl. 1931) Géhu 1976		
Arthrocnemion glauci Rivas-Mart. et Costa M. 1984		
<i>Junco subulati-Arthrocnemietum glauci</i> Brullo & Furnari 1976		
<i>Limnietalia</i> Br.-Bl. et O. de Bolòs 1958		
<i>Limnietum compactum</i> community		
JUNCETEAE MARITIMI Br.-Bl. in Br.-Bl. et al. 1952		
<i>Juncetalia maritimi</i> Br.-Bl. ex Horvatić 1934		
Juncion maritimi Br.-Bl. ex Horvatić 1934	A2.5	Mediterranean salt meadows (Juncetalia maritimi) (1410)
<i>Puccinellio festuciformis-Juncetum maritimi</i> (Pignatti 1953) Géhu in Géhu et al. 1984		
<i>Juncetum subulati</i> Caniglia et al. 1984		
<i>Aeluropo litoralis-Juncetum subulati</i> Cirujano 1981		
<i>Puccinellio festuciformis-Aeluropetum litoralis</i> (Corb. 1968) Géhu et Costa 1984 in Géhu et al. 1984		
<i>Puccinellio festuciformis-Aeluropetum litoralis cressetosum creticae</i> subass. nova		

EUNIS	Annex	NI
<i>Elytrigia elongata</i> community	Agropyro-Plantaginon maritimi Horvatić 1934	A2.5
<i>Schoeno nigricantis-Plantagnetum crassifoliae</i> Br.-Bl. in Br.-Bl., Roussine & Nègre	PHRAGMITO-MAGNOCARICETEAE Klika in Klika et Novák 1941	Mediterranean salt meadows (<i>Juncetalia maritimi</i>) (1410)
<i>Phragmitetalia</i> W. Koch 1926	Phragmition communis Koch 1926	Q54
<i>Phragmitetum communis</i> Schmale 1939	<i>Bolboschoenetalia maritimi</i> Hejny in Holub et al. 1967	Reed thickets (72A0**)
Scirpion maritimi Dahl et Hadac 1941	<i>Scirpetum maritimi</i> van Langendonck 1931	Q54
<i>Scirpetum lionalis</i> Pignatti 1953	<i>Scirpo compacti-Juncetum subulati</i> Géhu, Biondi, Géhu-Franck et Costa 1992	Reed thickets (72A0**)
NERIO-TAMARICETEAE Br.-Bl. et O. de Bolos 1958	<i>Tamaricetalia africanae</i> Br.-Bl. et O. de Bolo 1958	S93- [F93]
Tamaricion dalmaticae Jasprica in Jasprica et al. 2016	<i>Tamarix parviflora</i> community	Southern riparian galleries and thickets (Nerio- Tamaricetea and Securinegion tinctoriae) (92D0)
<i>Tamarix hampeana</i> community	<i>Tamaricetum tetrandrae</i> ass. nov. hoc loco	S93- [F93]
RUPPIETEAE MARITIMAE J. Tx. ex Den Hartog et Segal 1964	<i>Ruppia</i> community	A5.5
<i>Ruppia</i> community	Ruppion maritima Iversen 1934	Coastal lagoons (1150*)
ARTEMISIETEAE VULGARIS Lohmeyer et al. in Tx. Ex von Rochow 1951	<i>Elytrigio repentis-Dittrichietalia viscosae</i> Mucina ined.	E5.1
<i>Elytrigia obtusiflora</i> community		

Table 3 (Tabela 3): *Salsola kali-Cakiletum maritimae* (rels. 1–5), *Eryngio-Sporobolietum virginici* (rels. 6–7), *Cypero mucronati-Agropyretum juncei* (rels. 8–13).

Relevé №	1	2	3	4	5	6	7	8	9	10	11	12	13
Abbreviations of vegetation units (alliances and orders)	Ep	Ep	Ep	Ep	Ep	Am	Am	Am	Am	Am	Am	Am	Am
Plot size (m ²)	16	16	15	16	16	16	16	16	16	16	16	15	15
Total cover (%)	4	5	5	4	5	60	40	60	60	40	40	30	70
Latitude	38° 08.587'	38° 08.590'	38° 08.423'	38° 08.400'	38° 08.374'	38° 08.500'	38° 08.431'	38° 08.364'	38° 08.500'	38° 08.590'	38° 08.483'	38° 08.437'	38° 08.379'
Longitude	24° 02.641'	24° 02.650'	24° 01.792'	24° 01.725'	24° 01.638'	24° 02.051'	24° 01.820'	24° 01.614'	24° 02.051'	24° 02.647'	24° 01.966'	24° 01.826'	24° 01.646'
Species №	4	10	8	3	14	9	10	12	16	8	9	10	5
<i>Cakile maritima</i>	1	1	1	1	r	.	.	.	.	+	.	r	.
<i>Salsola kali</i>	1	+	+	+	r	.	.	.	.	.	.	.	.
<i>Sporobolus pungens</i>	r	.	.	.	.	4	3	.	.	.	.	.	.
<i>Elytrigia juncea</i>	.	1	+	.	+	1	3	4	4	3	3	1	2b
<i>Medicago marina</i>	.	.	.	.	1	.	.	1	r	.	2b	3	4
Characteristics of <i>Helianthemetea guttati</i>													
<i>Anthemis tomentosa</i>	.	r	r	.	+	2a	+	+	+	1	1	2a	.
<i>Matthiola tricuspidata</i>	r	.	1	+	r	+	+	r	+	.	+	+	.
<i>Hedypnois rhagadioloides</i>	.	r	.	.	r	1	1	+	1	1	1	1	.
<i>Lagurus ovatus</i>	.	.	.	.	.	+	+	+	+	r	+	+	+
<i>Erodium laciniatum</i>	.	r	.	.	.	+	1	r	1	+	.	.	.
<i>Pseudorhiza pumila</i>	.	r	.	.	1	.	2m	+	r	.	.	1	2m
<i>Medicago littoralis</i>	.	.	r	.	r	.	.	.	.	.	.	.	.
Characteristics of <i>Stipo-rachynietea distachyae</i>													
<i>Bromus rubens</i> subsp. <i>rubens</i>	.	.	.	.	.	r	.	1	2m	.	.	+	2m
<i>Echium arenarium</i>	.	+	.	.	.	.	.	.	.	.	r	.	.
<i>Lotus peregrinus</i>	.	1	.	.	.	.	.	.	+	.	.	.	.
<i>Cutandia maritima</i>	.	.	r	.	.	.	.	.	.	.	.	.	.
<i>Malcolmia flexuosa</i>	.	.	.	.	.	r	.	.	.	.	.	.	.
Characteristics of <i>Ammophiletea</i>													
<i>Eryngium maritimum</i>	.	.	r	.	r	.	r	+	+	+	.	.	.
<i>Pancreatum maritimum</i>	.	.	.	.	.	.	.	+	.	.	.	.	.
Companions													
<i>Allium staticiforme</i>	.	+	.	.	r	.	+	r	1	r	r	+	.
<i>Xanthium strumarium</i>	.	.	.	.	r	.	.	.	r	.	.	.	.
<i>Sonchus oleraceus</i>	.	.	.	.	.	.	.	.	r	.	r	.	.
<i>Reichardia picroides</i>	.	.	.	.	.	.	.	.	+	.	.	.	.
Other taxa													
<i>Euphorbia peplus</i>	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Cynanchum acutum</i>	.	.	.	.	r	.	.	.	.	.	.	.	.
<i>Silene sartorii</i>	.	.	.	.	.	.	.	.	r	.	.	.	.

Table 4 (Tabela 4): *Mathiolo tricuspidatae-Anthemidetum tomentosae* (rels.1–10), *Medicagini littoralis-Anthemidetum tomentosae* (rels. 11–14), *Silene colorata* comm. (rels. 15–18), *Plantago bellardii* comm. (rels. 19–22).

Relevé №	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Abbreviations of vegetation units (alliances and orders)	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn	Mn
Plot size (m ²)	16	16	15	16	15	16	15	16	16	15	16	16	15	16	10	5	10	10	10	15	10	5	
Total cover (%)	40	70	70	80	60	75	70	40	60	60	70	40	20	40	85	60	70	70	80	80	80	80	
Latitude	38° 08.599'	38° 08.605'	38° 08.317'	38° 08.594'	38° 08.607'	38° 08.579'	38° 08.575'	38° 08.573'	38° 08.562'	38° 08.579'	38° 08.626'	38° 08.966'	38° 08.626'	38° 08.479'	38° 08.576'	38° 08.598'	38° 08.613'	38° 08.588'	38° 08.470'	38° 08.478'	38° 08.475'	38° 08.637'	
Longitude	24° 02.587'	24° 02.595'	24° 01.463'	24° 02.560'	24° 02.685'	24° 02.303'	24° 02.278'	24° 02.223'	24° 02.197'	24° 02.356'	24° 02.842'	24° 02.676'	24° 02.842'	24° 01.789'	24° 02.196'	24° 02.340'	24° 02.459'	24° 02.358'	24° 01.778'	24° 01.766'	24° 01.756'	24° 02.357'	
Species №	8	10	8	12	16	13	10	4	14	7	13	11	11	6	12	15	11	11	10	12	12	12	
<i>Anthemis tomentosae</i>	4	3	3	4	3	3	3	3	3	1	2a	2a	1	1	2a	1	1	.	+	.	r	.	
<i>Medicago littoralis</i>	.	1	.	.	1	1	1	1	r	.	3	3	2a	3	1	+	1	.	.	1	.	1	
<i>Silene colorata</i>	.	.	.	.	.	.	.	.	.	.	1	.	.	2m	4	2b	2b	3	2m	1	1	1
<i>Plantago bellardii</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	5	5	5	3
Characteristics of <i>Helianthemetea guttati</i>																							
<i>Matthiola tricuspidata</i>	2a	2a	2a	1	+	2a	2m	2m	2m	2b	1	2a	.	.	.	+	.	+	.	.	.	.
<i>Erodium laciniatum</i>	.	.	.	.	.	.	r	.	r	.	.	r	1	1	2a	+	1	+	r	.	.	+
<i>Lagurus ovatus</i>	1	2a	1	2m	+	.	+	.	1	r	.	1	.	.	+	+	1	1	+	+	+	2m	
<i>Rumex bucephalophorus</i>	.	.	.	+	+	+	.	.	r	.	.	.	+	.	.	.	+	r	.	.	.	.
<i>Hedypnois rhagadioloides</i>	.	+	.	+	+	.	r	.	.	.	2a	2a	+	.	.	.	.	.	.	.	.	.
<i>Pseudorhiza pumila</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anchusa undulata</i> subsp. <i>hybrida</i>	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	r	r	.	.
<i>Vulpia fasciculata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	+	.
<i>Helianthemum salicifolium</i>	+	1
Characteristics of <i>Saginetea maritima</i>																							
<i>Plantago lagopus</i>	.	.	.	.	.	r	+	.	.	r	+	2a	.	.	+	r	.	r	.	.	.	.
<i>Parapholis incurva</i>	2b	2b	.	+	+	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.
<i>Plantago weldenii</i>	+	.	.	.	1	r	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Catapodium maritimum</i>	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Characteristics of <i>Stipo-Trachynietea distachyae</i>																							
<i>Echium arenarium</i>	+	+	.	.	r	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Malcolmia flexuosa</i>	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cerastium brachypetalum</i> subsp. <i>roemeri</i>	.	.	.	.	.	.	.	.	.	.	r	.	.	.	+	2m	.	.	.	r	.	.
<i>Valantia hispida</i>	.	.	.	1	.	.	.	.	.	.	.	.	r	.	.	.	r	.	.	.	.	.
<i>Cutandia maritima</i>	.	2a	.	.	r	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium spumosum</i>	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Silene gallica</i>	.	.	.	.	.	1	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
<i>Anisantha rubens</i> subsp. <i>rubens</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	+	.
<i>Lotus peregrinus</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Arenaria leptoclados</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2m	1	.	.
<i>Petrorhagia dubia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	r	.
<i>Trachynia distachya</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.

Relevé №	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Companions																							
<i>Hordeum murinum</i> subsp. <i>leporinum</i>	.	.	.	r	.	+	+	.	.	1	.	2b	.	.	+	+	.	2a	.	.	.	.
<i>Bromus rigidus</i>	.	+	2a	.	.	.	.	.	+	+	.	.	.	.	.	.	2b	+	.	.	.	.
<i>Brassica tournefortii</i>	.	.	.	+	r	r	+	.	+	.	r	.	.	.	.	.	.	+	.	.	.	.
<i>Hypochoeris achyrophorus</i>	2a	.	.	.	r	.	.	.	.	.	r	r	+	.	.	.	.	+
<i>Sisymbrium irio</i>	r	.	.	r	.	.	.	.	.	.	.	.	r	.	.	.	.
<i>Bromus alopecurus</i>	+	+	+	
<i>Plantago indica</i>	1	+	.	.	+	.	.	.	.	.
<i>Allium staticiforme</i>	r	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.
<i>Sisymbrium officinale</i>	+	+	
<i>Valerianella turgida</i>	r	+	.	.	.	.	.
<i>Cakile maritima</i>	+	.	+	
<i>Silene sartorii</i>	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium scabrum</i>	.	.	.	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2a	1	1
<i>Trifolium imfamia-ponertii</i>	+	.
<i>Bromus diandrus</i>	+
<i>Linum bienne</i>	r	.	.	.	.	+	.	.
<i>Sisymbrium orientale</i>	+
<i>Geranium molle</i>	+	.	+
Other taxa																							
<i>Trigonella balansae</i>	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aetheorhiza bulbosa</i>	.	.	.	+
<i>Lolium rigidum</i> subsp. <i>lepturoides</i>	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polycarpon tetraphyllum</i>	2m	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Piptatherum miliaceum</i>	+
<i>Chenopodium murale</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Bromus sterilis</i>	+
<i>Sporobolus pungens</i>	+
<i>Melilotus indicus</i>	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium imfamia-ponertii</i>	r	.	.	.	.	.	.	.	.	.	.
<i>Lotus halophilous</i>	1	.	.	.	.	.	.	.	.	.	.	.
<i>Parentucellia latifolia</i>	r
<i>Trifolium fragiferum</i>	1
<i>Biscutella didyma</i>	r
<i>Petroraghia dubia</i>	+

Table 5 (Tabela 5): *Centaurea spinosa* comm. (rels. 1–5).

Relevé №	1	2	3	4	5
Abbreviations of vegetation units (alliances and orders)	Hel-Cent	Hel-Cent	Hel-Cent	Hel-Cent	Hel-Cent
Plot size (m ²)	16	16	15	16	16
Total cover (%)	80	100	80	70	70
Latitude	38° 08.306'	38° 08.400'	38° 08.321'	38° 08.309'	38° 08.241'
Longitude	24° 01.457'	24° 01.688'	24° 01.496'	24° 01.467'	24° 01.103'
Species №	8	3	5	10	5
<i>Centaurea spinosa</i>	5	5	5	4	4
Characteristics of <i>Helichryso-Crucianelletea maritimae</i>					
<i>Verbascum pinnatifidum</i>	.	.	.	.	+
Characteristics of <i>Ammophiletea</i>					
<i>Elytrigia juncea</i>	+	+	1	2a	.
<i>Cyperus capitatus</i>	+	.	r	+	.
<i>Sporobolus pungens</i>	+	.	.	.	.
Characteristics of <i>Helianthemetea guttati</i>					
<i>Anthemis tomentosa</i>	r	.	.	+	.
<i>Lagurus ovatus</i>	+	+	.	+	.
<i>Erodium laciniatum</i>	+	.	.	.	.
<i>Hedypnois rhagadioloides</i>	.	.	.	+	.
<i>Pseudorhiza pumila</i>	.	.	+	.	.
Characteristics of <i>Stipo-Trachynietea distachyae</i>					
<i>Anisantha rubens</i> subsp. <i>rubens</i>	.	.	.	+	.
<i>Malcolmia flexuosa</i>	.	.	+	+	.
<i>Brassica tournefortii</i>	.	.	.	.	+
Other taxa					
<i>Plantago indica</i>	+	.	.	.	.
<i>Cakile maritima</i>	.	.	.	r	.
<i>Erodium</i> sp.	.	.	.	1	.
<i>Erigeron sumatrensis</i>	.	.	.	.	1
<i>Heliotropium europaeum</i>	.	.	.	.	+

Table 6 (Tabela 6): *Juniperus macrocarpa* comm. (rels. 1–3), *Pistacio lentisci-Pinetum halepensis* (rels. 4–20), *Pinus pinica* comm. (rels. 21–25).

Relevé No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Abbreviations of vegetation units (alliances and orders)	Asp- Jun	Asp- Jun	Asp- Jun	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pis- Pin	Pp	Pp	Pp	Pp	Pp	
Plot size (m ²)	16	16	16	250	200	200	200	250	200	200	200	200	250	250	200	200	250	200	200	220	250	16	16	16	16	16
Tree layer cover (%)	40	100	100	40	40	40	25	40	10	30	30	40	50	50	70	50	45	50	70	60	50	25	55	50	40	
Shrub layer cover (%)	100	100	100	100	100	100	100	100	90	100	100	100	100	100	70	100	15	70	70	70	80	100	50	10	10	
Latitude	38° 08' 43.3"	38° 08' 50.7"	38° 08' 42.4"	38° 08' 50.5"	38° 08' 70.9"	38° 08' 49.5"	38° 08' 50.0"	38° 08' 60.7"	38° 08' 51.5"	38° 08' 44.4"	38° 08' 47.0"	38° 08' 48.7"	38° 08' 45.7"	38° 08' 53.4"	38° 08' 53.6"	38° 08' 48.8"	38° 08' 57.9"	38° 08' 52.8"	38° 08' 54.5"	38° 08' 56.5"	38° 08' 31.1"	38° 08' 35.1"	38° 08' 31.7"	38° 08' 25.9"	38° 08' 25.6"	
Longitude	24° 01' 80.8"	24° 02' 05.9"	24° 01' 78.3"	24° 01' 70.6"	24° 02' 37.4"	24° 01' 62.2"	24° 01' 60.5"	24° 02' 25.0"	24° 02' 01.0"	24° 01' 68.5"	24° 01' 82.6"	24° 01' 85.2"	24° 01' 62.0"	24° 01' 75.5"	24° 01' 86.7"	24° 01' 79.6"	24° 02' 13.7"	24° 02' 02.0"	24° 01' 97.5"	24° 01' 94.8"	24° 01' 23.8"	24° 01' 52.0"	24° 01' 25.8"	24° 01' 11.3"	24° 01' 09.6"	
Species No	12	13	5	11	7	11	7	8	18	9	9	9	13	15	21	10	16	13	15	17	11	8	10	6	6	
<i>Juniperus macrocarpa</i>	3	4	5																							
<i>Pinus halepensis</i>	2b			3	4	3	2b	3	2a	3	2a	2b	3	3	3	3	3	2b	3	3						
<i>Pinus pinica</i>											2b	2b	2a	2a	2b	2b	2a	3	3	2b	3	2b	3	3	4	
Characteristics of <i>Querceteta ilicis</i>																										
<i>Pistacia lentiscus</i>	3	2b			5	4	5	5	5	5	5	5	4	4	4	5	2a	4	4	4	4	4	5	4	+	
<i>Rhamnus alaternus</i>	1			2b	+	1	2a	+	1	1	1	2a	2b	2a	2a	2a	r	.	+	.	+	2a	.	.	.	
<i>Smilax aspera</i>	+			2a	.	1	1	+	2a	.	2m	2a	2a	2a	+	.	.	.	.	.	.	1	+	.	.
<i>Prasium majus</i>	2a	1	1	.	+	2a	.	1	+	+	1	1	1	2a	+	1	+	+	+	+	+	.	1	.	.	
<i>Quercus coccifera</i>	.			2a	.	2a	.	+	.	.	.	.	.	3	r	1	+	.	.	.	2a	.	.	.	.
<i>Juniperus phoenicea</i>	.			.	+	.	.	+	.	.	.	1	2a	r	+	1	.	.	.	.	.	.	.	.	.
<i>Piptatherum miliaceum</i>	+	1	1	1	1	1	+	1	+	1	1	1	1	1	1	1	1	1	1	1	1	+	1	+	.	
<i>Asparagus acutifolius</i>	.			+	.	r	+	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.
<i>Juniperus macrocarpa</i>	.			.	.	.	.	.	.	.	.	1	1	+	.	.	.	.	.	.	.	.	.	.	1
<i>Myrtus communis</i>	.			2a	.	.	.	.	.	.	.	.	.	2b	.	.	.	.	.	.	.	.	.	.	.
<i>Clematis chirrosa</i>	.			.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Asparagus acutifolius</i>	.			.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.
<i>Arisarum vulgare</i>	.			.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Characteristics of <i>Ononido-Rosmarinetea</i>																										
<i>Helichrysum stoechas</i> subsp. <i>barrleri</i>	r	.	.	+	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	r
<i>Cistus creticus</i>	.	.	.	.	+	.	.	.	.	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.
<i>Carlina corymbosa</i>	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	r

Relevé No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
<i>Cistus monspeliensis</i>	.	.	.	r	.	.	l	.	.	r	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anthyllis hermanniae</i>	.	2a	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Corydolithus capitatus</i>	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Characteristics of <i>Helianthemetea guttati</i>																											
<i>Lagurus ovatus</i>	.	+	l	r	.	.	.	r	2m	r	2m	2m	l	l	+	.	.	.	.	.	+
<i>Mathiola tricuspidata</i>	r	+	r	.	.	.	.	.	2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anthemis tomentosa</i>	r	+	.	.	.	.	.	.	l	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Reichardia picroides</i>	.	+	l	+	.	.	.	.	.	.	.
<i>Silene colovata</i>	.	+	r	.	r	.	.	.	.	.	.	.
<i>Medicago littoralis</i>	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Vulpia fasciculata</i>	+	2a	.	+	.	.	.	.	.	.	.
Companions																											
<i>Trifolium angustifolium</i>	r	r	.	r	r	.	.	.	.	.	.	.	.	.
<i>Bromus rigidus</i>	+	+	+	+
<i>Linum bienne</i>
<i>Cynosurus echinatus</i>
<i>Lotus peregrinus</i>
<i>Scaligeria napiformis</i>
<i>Elytrigia juncea</i>	r	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phagnalon graecum</i>	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Hordeum murinum</i> subsp. <i>leporinum</i>	.	.	+
<i>Cardamus lanatus</i>	r	.	.	.	.	.	.	.	.	.	.	.	.
Other taxa																											
<i>Cutandia maritima</i>	.	+
<i>Sonchus oleraceus</i>	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sinapis arvensis</i>	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Asphodelus ramosus</i> subsp. <i>ramosus</i>	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Brachypodium distachyon</i>
<i>Ephedra phoenicea</i>
<i>Oxalis pes-caprae</i>
<i>Leontodon tuberosus</i>
<i>Cynanchum acutum</i>
<i>Allium stactiiforme</i>	r	.	.	.	.	.	.	.	.
<i>Ononis diffusa</i>
<i>Briza maxima</i>
<i>Trifolium scabrum</i>
<i>Trifolium campestre</i>
<i>Trifolium grandiflorum</i>

Table 7 (Tabela 7): *Quercus coccifera*-*Pistacietum lentisci* (rels. 1–5), *Scirpoides holoschoenus* comm. (rels. 6–10), *Elytrigia obrusiflora* comm. (rels. 11–14).

Relevé No	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Abbreviations of vegetation units (alliances and orders)	Cer_Pis	Cer_Pis	Cer_Pis	Cer_Pis	Cer_Pis	Mol-Hol	Mol-Hol	Mol-Hol	Mol-Hol	Mol-Hol	Ely-Dit	Ely-Dit	Ely-Dit	Ely-Dit
Plot size (m ²)	200	200	200	200	200	16	16	16	16	16	16	16	16	16
Shrub layer cover (%)	100	100	100	100	100	70	75	75	80	100	80	100	100	100
Latitude	38° 08.523'	38° 08.365'	38° 08.518'	38° 08.375'	38° 08.492'	38° 08.750'	38° 08.743'	38° 08.744'	38° 08.251'	38° 08.329'	38° 08.644'	38° 08.646'	38° 08.737'	38° 08.741'
Longitude	24° 01.598'	24° 01.573'	24° 02.048'	24° 01.583'	24° 01.552'	24° 02.461'	24° 02.451'	24° 02.439'	24° 01.109'	24° 01.143'	24° 02.250'	24° 02.25'	24° 02.321'	24° 02.337'
Species No	6	4	12	10	13	5	5	3	1	1	3	4	2	4
<i>Pistacia lentiscus</i>														
<i>Scirpoides holoschoenus</i>						4	4	4	4	4				
<i>Elytrigia obrusiflora</i>											5	5	5	5
Characteristics of <i>Quercetea ilicis</i>														
<i>Smilax aspera</i>	1	2a	2a	2a	1									
<i>Rhamnus alaternus</i>	1			+	2a									
<i>Prasium majus</i>				+	1									
<i>Quercus coccifera</i>	1				4									
<i>Juniperus phoenicea</i>			1	1	+									
<i>Asparagus acutifolius</i>			+		+									
<i>Pinus halepensis</i>			+											
<i>Pinus pinea</i>					r	r	r							
Characteristics of <i>Ononido-Rosmarinetea</i>														
<i>Helichrysum stoechas</i> subsp. <i>barrelieri</i>		r		+										
<i>Anthyllis hermanniae</i>			+											
<i>Cistus creticus</i>	+													
<i>Cistus monspeliensis</i>					+									
Characteristics of <i>Helianthemetea guttati</i>														
<i>Lagurus ovatus</i>			r	+										
<i>Mathiola tricuspidata</i>		r												

Relevé №	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Anthemis tomentosa</i>	.	.	r	.	.	.	.	.	.	.	.	.	.	.
<i>Silene colorata</i>	.	.	+
<i>Linum bienne</i>	+
Characteristics of <i>Juncetea maritimi</i>														
<i>Juncus acutus</i>	+	.	.	.
<i>Juncus maritimus</i>	+	+
<i>Limbarda crithmoides</i>	2a	.	.
<i>Plantago crassifolia</i>	1
Companions														
<i>Piptatherum miliaceum</i>	+	.	+	1	1	+	.	+	.	.	.	.	.	.
<i>Sinapis arvensis</i>	r	r	.	.	.	.	.	.	.
<i>Ditrichia viscosa</i>	r	r	.	.	.	.	.	.	.
<i>Bromus hordeaceus</i>	+	+
Other species														
<i>Daucus carota</i>	r	.	.	.	.	.	.	.	.	.
<i>Clematis chirrosa</i>	+
<i>Sonchus oleraceus</i>
<i>Aetheorhiza bulbosa</i>	.	.	+
<i>Hordeum murinum</i>
<i>Elytrigia juncea</i>
<i>Phagnalon graecum</i>	r	.	.	.
<i>Halimione portulacoides</i>	1	.	.
<i>Limonium</i> sp.	+

Table 8 (Tabela 8): *Puccinellia festuciformis*-*Sarcocornietum perennis* (rels. 1–6), *Arthrocnemo-Juncetum subulati* (rels. 7–14), *Limonium compactum* comm. (rels. 15–16).

Relevé №	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Abbreviations of vegetation units (alliances and orders)	Sal	Sal	Sal	Sal	Sal	Sal	Arth	Arth	Arth	Arth	Arth	Arth	Arth	Arth	Lim	Lim
Plot size (m ²)	16	16	16	16	16	16	16	16	16	16	16	16	15	16	16	15
Total cover (%)	100	100	80	100	100	70	100	100	100	100	100	100	100	100	70	70
Longitude	38° 08.750'	38° 08.747'	38° 08.729'	38° 08.699'	38° 09.760'	38° 08.999'	38° 08.600'	38° 08.637'	38° 09.645'	38° 08.739'	38° 08.619'	38° 08.770'	38° 09.188'	38° 08.723'	38° 09.063'	38° 09.052'
Latitude	24° 02.223'	24° 02.247'	24° 02.267'	24° 02.235'	24° 01.702'	24° 02.669'	24° 03.133'	24° 03.161'	24° 01.658'	24° 02.250'	24° 03.110'	24° 02.298'	24° 01.818'	24° 02.269'	24° 01.856'	24° 01.846'
Species №	2	2	1	1	5	2	4	5	3	3	4	4	2	2	7	6
<i>Sarcocornia perennis</i>	5	5	5	5	5	4	.	.	.	.	.	.	.	.	.	.
<i>Arthrocnemum macrostachyum</i>	.	.	.	.	.	.	5	5	5	5	5	5	5	5	+	r
<i>Limonium compactum</i>	.	.	.	.	r	.	.	.	.	.	.	.	.	.	4	3
Characteristics of <i>Juncetea maritimi</i>																
<i>Aeluropus littoralis</i>	.	.	.	.	1	.	.	.	.	.	.	.	.	.	+	.
<i>Juncus maritimus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Juncus subulatus</i>	2m	2a	.	.	1	.	1	1	1	2a	+	+	+	.	.	.
<i>Puccinellia festuciformis</i>	.	.	.	.	r	+	.	.	.	.	.	.	.	.	+	.
<i>Limbarda crithmoides</i>	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
<i>Juncus acutus</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
<i>Elytrigia elongata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2a	+
<i>Scoenus nigricans</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r
<i>Plantago crassifolia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2b
<i>Tripolium pannonicum</i> subsp. <i>pannonicum</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Characteristics of <i>Salicornietea fruticosae</i>																
<i>Halimione portulacoides</i>	.	.	.	.	.	.	1	.	.	.	2a	.	.	.	.	.
<i>Sarcocornia perennis</i>	.	.	.	.	.	.	.	.	.	1	.	+	.	1	.	.
Other taxa																
<i>Phragmites australis</i>	.	.	.	.	.	.	.	+	.	.	r	.	.	.	.	.
<i>Aster squamatus</i>	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
<i>Psilurus incurvus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1

Table 9 (Tabela 9): *Puccinellio festuciformis-Juncetum maritimi* (rels. 1–10), *Juncetum subulati* (rels. 11–17), *Aeluropo littoralis-Juncetum subulati* (rels. 18–24), *Puccinellio festuciformis-Aeluropetum littoralis* (rels. 25–35), *Elytrigia elongata* comm. (rels. 36–43).

Relevé №	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Abbreviations of vegetation units (alliances and orders)	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm	Jm
Plot size (m ²)	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Total cover (%)	100	80	90	100	100	80	70	100	100	100	100	100	100	100	100	100	90	80
Longitude	38° 09.111'	38° 09.081'	38° 09.092'	38° 08.894'	38° 08.665'	38° 08.946'	38° 08.905'	38° 08.919'	38° 08.908'	38° 08.634'	38° 09.601'	38° 09.728'	38° 09.722'	38° 09.600'	38° 08.616'	38° 09.602'	38° 09.655'	38° 09.451'
Latitude	24° 00.545'	24° 00.567'	24° 00.555'	24° 01.808'	24° 03.176'	24° 02.554'	24° 02.488'	24° 02.398'	24° 01.830'	24° 03.159'	24° 01.738'	24° 01.677'	24° 01.680'	24° 01.684'	24° 03.145'	24° 01.896'	24° 01.716'	24° 01.777'
Species №	8	3	5	1	2	4	4	2	1	3	1	4	1	1	1	3	3	3
<i>Juncus maritimus</i>	4	4	5	5	5	5	4	5	5	5	.	.	.	.	.	.	.	.
<i>Juncus subulatus</i>	.	.	.	.	.	.	.	.	.	.	5	5	5	5	5	5	4	4
<i>Aeluropus littoralis</i>	1	.	.	.	.	2a	2a	2a	.	.	.	.	.	.	.	+	+	2m
<i>Elytrigia elongata</i> subsp. <i>elongata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Characteristics of <i>Therosalicornietea</i>																		
<i>Cressa cretica</i>	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
<i>Salsola soda</i>	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	2m	.	.
Characteristics of <i>Juncetea maritimi</i>																		
<i>Juncus acutus</i>	.	2m	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Elytrigia scirpea</i>	2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Tipolium pannonicum</i>	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
<i>Schoenus nigricans</i>	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.
<i>Limbarda crithmoides</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Puccinellia festuciformis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Centaurium spicatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Juncus heldreichianus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Companions																		
<i>Arthrocnemum macrostachyum</i>	.	.	.	.	+	.	.	.	.	2a	.	+	.	.	.	.	+	.
<i>Limonium compactum</i>	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
<i>Cynodon dactylon</i>	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polypogon viridis</i>	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Oenanthe silaifolia</i>	r	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Scorzonera crocifolia</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Psilurus incurvus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polypogon monspeliensis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
<i>Teucrium scordium</i> subsp. <i>scordioides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Oenanthe pimpinelloides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Suaeda vera</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other taxa																		
<i>Phragmites australis</i>	2m	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Teucrium scordium</i> subsp. <i>scordioides</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Bolboschoenus maritimus</i>	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.
<i>Piptatherum miliaceum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Foeniculum vulgare</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cardopatum corymbosum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phragmites australis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 10 (Table 10): *Schoeno nigricans-Plantagininetum crassifoliae* (rels. 1–11).

Relevé N°	1	2	3	4	5	6	7	8	9	10	11
Abbreviations of vegetation units (alliances and orders)	Agr-Plan	Agr-Plan	Agr-Plan	Agr-Plan	Agr-Plan	Agr-Plan	Agr-Plan	Agr-Plan	Agr-Plan	Agr-Plan	Agr-Plan
Plot size (m ²)	16	16	16	15	16	16	16	16	15	15	15
Total cover (%)	100	100	90	90	100	100	100	90	100	80	100
Latitude	38° 08.913'	38° 08.921'	38° 08.633'	38° 08.987'	38° 08.931'	38° 08.948'	38° 09.419'	38° 08.986'	38° 09.758'	38° 09.758'	38° 09.749'
Longitude	24° 02.512'	24° 02.537'	24° 03.147'	24° 02.601'	24° 02.581'	24° 02.617'	24° 01.731'	24° 02.599'	24° 01.695'	24° 01.695'	24° 01.666'
Species N°	6	2	7	2	4	4	3	1	2	2	3
<i>Schoenus nigricans</i>	5	5	4	4	5	5	+	.	.	.	.
<i>Plantago crassifolia</i>	.	.	3	2a	1	+	5	5	4	5	5
Characteristics of <i>Juncetea maritimi</i>											
<i>Aeluropus litoralis</i>	1	.	.	.	+	1	.	.	.	.	.
<i>Juncus heldreichianus</i>	+	.	+	.	.	.	.	.	.	.	.
<i>Juncus maritimus</i>	2a	.	.	.	1	2a	.	.	.	.	.
<i>Limbarda crithmoides</i>	r	.	.	.	.	.	.	.	.	.	.
<i>Juncus acutus</i>	.	.	1	.	.	.	.	.	.	.	.
<i>Puccinellia festuciformis</i>	.	.	.	.	.	.	.	.	.	.	r
Companions											
<i>Cynodon dactylon</i>	.	.	.	.	.	.	.	.	2b	1	+
<i>Phragmites australis</i>	r	+	.	.	.	.	.	.	.	.	.
Other taxa											
<i>Linum bienne</i>	.	.	+	.	.	.	.	.	.	.	.
<i>Arthrocnemum macrostachyum</i>	.	.	.	.	.	.	r	.	.	.	.
<i>Limonium virgatum</i>	.	.	+	.	.	.	.	.	.	.	.

Table 11 (Tabela 11): *Scirpetum littoralis* (rels. 1–7), *Scirpetum maritimi* (rels. 8–16), *Scirpo compacti-Juncetum subulati* (rels. 17–23).

Relevé №	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Abbreviations of vegetation units (alliances and orders)	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm	Scm
Plot size (m ²)	16	16	16	16	16	16	16	16	15	16	16	16	16	16	16	16	16	16	16	15	16	16	16
Total cover (%)	80	100	90	100	90	80	80	75	100	90	80	80	90	80	90	80	90	70	100	100	100	100	100
Latitude	38° 09.403'	38° 08.609'	38° 09.029'	38° 09.300'	38° 09.614'	38° 09.648'	38° 09.653'	38° 09.640'	38° 09.523'	38° 09.497'	38° 09.584'	38° 9.602'	38° 9.467'	38° 09.578'	38° 09.540'	38° 09.305'	38° 09.603'	38° 09.505'	38° 09.646'	38° 09.542'	38° 09.529'	38° 09.497'	38° 09.438'
Longitude	24° 01.775'	24° 03.139'	24° 02.331'	24° 01.713'	24° 01.694'	24° 01.758'	24° 01.828'	24° 01.662'	24° 01.635'	24° 01.623'	24° 01.688'	24° 1.803'	24° 1.808'	24° 01.705'	24° 01.740'	24° 01.745'	24° 01.730'	24° 01.743'	24° 01.685'	24° 01.636'	24° 01.614'	24° 01.639'	24° 01.749'
Species №	1	1	1	1	1	3	3	2	3	1	1	1	1	4	2	2	6	2	2	3	2	2	2
<i>Schoenoplectus littoralis</i>	4	5	5	5	5	5	4	2a	2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Bolboschoenus maritimus</i>	.	.	.	.	.	.	+	4	4	5	5	5	5	4	5	5	4	4	3	4	3	4	3
<i>Juncus subulatus</i>	.	.	.	.	.	+	+	.	1	.	.	.	.	.	r	2a	2	2m	4	3	4	3	4
Companions																	+			+			
<i>Typha domingensis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other taxa																							
<i>Elytrogia scirpea</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aeluropus littoralis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.
<i>Scirpus cernuus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ariboenemum macrostachyum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
<i>Cichorium intibis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helminthotheca echioides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Piptatherum miliaceum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 12 (Table 12): *Phragmitetum communis* (rels. 1–19), *Typbetum domingensis* (rels. 20–26).

Relévé No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Abbreviations of vegetation units (alliances and orders)	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	Phc	
Plot size (m ²)	16	16	16	6	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	
Total cover (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	90	
Latitude	24° 01.870'	24° 01.870'	24° 01.833'	24° 01.891'	24° 01.855'	24° 00.548'	24° 00.547'	24° 00.577'	24° 00.514'	24° 00.485'	24° 00.503'	24° 00.693'	24° 00.537'	24° 00.585'	24° 00.646'	24° 00.581'	24° 00.488'	24° 00.321'	24° 02.552'	24° 02.618'	24° 03.162'	24° 02.542'	24° 01.817'	24° 01.657'	24° 01.572'	24° 01.930'
Longitude	38° 08.796'	38° 08.830'	38° 08.819'	38° 08.752'	38° 08.819'	38° 09.106'	38° 09.085'	38° 09.096'	38° 09.143'	38° 09.217'	38° 09.168'	38° 08.650'	38° 09.128'	38° 09.101'	38° 08.757'	38° 08.902'	38° 09.178'	38° 09.370'	38° 08.922'	38° 08.941'	38° 08.611'	38° 08.918'	38° 08.913'	38° 09.349'	38° 09.534'	38° 09.638'
Species No	11	9	10	5	5	8	11	9	8	7	6	8	7	7	5	7	8	9	1	2	3	2	2	2	1	2
<i>Phragmites australis</i>																										
<i>Typha domingensis</i>																										
Characteristics of <i>Juncetea maritimi</i>																										
<i>Juncus subulatus</i>	2a	r	2m	2m																						
<i>Juncus acutus</i>			r	+	r	1			+																	
<i>Juncus heldreichianus</i>					2b	2m	2b			1																
<i>Juncus maritimus</i>			+	+					2m	2m	2m	+														
<i>Aeluropus litoralis</i>		+	+	+					1	1																
<i>Plantago crassifolia</i>	1	r																+								
<i>Elytrigia scirpea</i>	+	r							r																	
<i>Juncus gerardii</i>										1	2m															
<i>Elytrigia elongata</i> subsp. <i>elongata</i>																										
Characteristics of <i>Phragmito-Magnocaricetea</i>																										
<i>Teucrium scordium</i> subsp. <i>scordoides</i>									1	1	r		+													
<i>Bolboschoenus maritimus</i>												+														
<i>Schoenoplectus litoralis</i>																										
Characteristics of <i>Molinio-Arrhenatheretea</i>																										
<i>Carex distans</i>	1		r		1	r	+																			
<i>Oenanthe silatifolia</i>			1				+	r																		
<i>Oenanthe pimpinelloides</i>	r			1		+							2a	1												
<i>Ranunculus sardous</i>																										
Companions																										
<i>Tragopogon longifolius</i>	+		r				+						1													
<i>Cynanchum acutum</i>													+													

Relevé No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
<i>Avena barbata</i>	+	1	.	.	.	r	.	1	.	.	.	.	.	.	.	.
<i>Scorzonera crocifolia</i>	+	.	.	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lagurus ovatus</i>	.	r	.	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Melilotus indicus</i>	r	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Daucus carota</i>	+	.	.	.	+
<i>Alopecurus myosuroides</i>	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Piptatherum miliaceum</i>	2m	2a	.	.	.	.	.	.	.	.
<i>Arrhenemum macrostachyum</i>	.	2m	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2a	.	.	.	.	.
<i>Cynodon dactylon</i>	.	.	+	2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polygonum viridis</i>	.	.	.	2m	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Helminthotheca ebioides</i>	1	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.
<i>Rumex pulcher</i>	r	r	.	.	.	.	.	.	.	.	.	.
Other taxa																									
<i>Scirpus cernuus</i>	+
<i>Sonchus oleraceus</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polygonum monspeliensis</i>	2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Aira elegantissima</i>	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Limnium nar-bonense</i>	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex divisa</i>	.	.	+
<i>Hordeum marinum</i>	2m	.	.	.	.	.	.	.	.	.
<i>Festuca arundinacea</i> subsp. <i>interrupta</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Dirichia viscosa</i>	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cichorium intibus</i>	+
<i>Solanum dulcamara</i>	1	.	.	.	.	.	.	.	.	.	.	.
<i>Reichardia picroides</i>	r	.	.	.	.	.	.	.	.	.	.
<i>Plantago altissima</i>	+
<i>Capparis spinosa</i>	r	.	.	.	.	.	.	.	.	.
<i>Althaea officinalis</i>	+
<i>Dysbania ambrosioides</i>	+
<i>Foeniculum vulgare</i>	r	.	.	.	.	.	.	.	.	.
<i>Bromus sterilis</i>	2m	.	.	.	.	.	.	.	.
<i>Bromus alopecurus</i>	1	.	.	.	.	.	.	.	.
<i>ErUCA vesicaria</i>	+
<i>Lepidium draba</i>	r	.	.	.	.	.	.	.	.

Table 13 (Tabela 13): *Tamarix parviflora* comm. (rels. 1–3), *Tamarix hampeana* comm. (rels. 4–8), *Tamaricetum tetrandrae* (rels. 9–14), *Ruppia maritima* (rels. 15–19).

Relevé №	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Abbreviations of vegetation units (alliances and orders)	Tad	Tad	Tad	Tad	Tad	Tad	Tad	Tad	Tad	Tad	Tad	Tad	Tad	Tad	Rum	Rum	Rum	Rum	Rum
Plot size (m ²)	50	50	100	50	50	50	50	50	50	50	50	50	50	50	4	4	4	4	4
Total cover (%)	90	100	100	80	80	100	80	90	80	80	80	100	100	100	100	100	100	100	100
Latitude	38° 09.700'	38° 09.260'	38° 09.653'	38° 09.670'	38° 09.130'	38° 08.631'	38° 09.445'	38° 09.738'	38° 09.754'	38° 08.905'	38° 09.702'	38° 08.815'	38° 08.614'	38° 08.620'	38° 08.772'	38° 09.028'	38° 08.604'	38° 08.747'	38° 09.303'
Longitude	24° 01.619'	24° 01.781'	24° 01.632'	24° 01.577'	24° 01.548'	24° 02.458'	24° 01.782'	24° 01.712'	24° 01.703'	24° 01.826'	24° 01.651'	24° 01.860'	24° 00.334'	24° 00.355'	24° 02.287'	24° 02.355'	24° 03.139'	24° 02.247'	24° 01.718'
Species №	4	9	9	3	5	13	2	7	6	5	7	5	15	11	1	1	2	2	2
<i>Tamarix parviflora</i>	5	5	5	3	2														
<i>Tamarix hampeana</i>				4	5	4	5	5											
<i>Tamarix tetrandra</i>																			
<i>Ruppia maritima</i>															5	5	5	5	5
Characteristics of Nerio-Tamaricetea																			
<i>Tamarix hampeana</i> x <i>tetrandra</i>								1				1	2a	2a					
<i>Tamarix hampeana</i> x <i>parviflora</i>					1														
<i>Tamarix</i> cf. <i>minoa</i>										1									
Characteristics of Juncetea maritimi																			
<i>Juncus subulatus</i>	3	2b		2b	1	2b	3	3	2a	2m	3		2a						
<i>Elytrigia elongata</i>			1						1										
<i>Juncus acutus</i>	+										+		1	1					
<i>Aeluropus litoralis</i>								1	+										
<i>Juncus maritimus</i>						2b							+						
<i>Puccinellia festuciformis</i>								+			+								
<i>Plantago crassifolia</i>										+									
<i>Juncus heldreichianus</i>												+							
Characteristics of Artemisietea vulgaris																			
<i>Daucus carota</i>						+							+						
<i>Piptatherum miliaceum</i>												1	1	2b					
<i>Urtica pilulifera</i>												3							
<i>Ditrichia viscosa</i>													1						
<i>Cirsium vulgare</i>																			

Relevé No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
<i>Notobasis syriaca</i>
<i>Silybum marianum</i>
Companions																				
<i>Phragmites australis</i>	3	1	.	.	.	.	1	.	1	1	.	.	.	.	.	.
<i>Chara</i> sp.	1	1	1	+
<i>Galium aparine</i>	.	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Geranium dissectum</i>
<i>Sonchus oleraceus</i>	+	1	.	.	.	.	.	.	.
<i>Sarcocornia perennis</i>	2b	.	.	.	.	.	.	.	.	.	.	.	.
<i>Stellaria media</i>	.	+
<i>Arum</i> sp.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Medicago sativa</i> subsp. <i>falcata</i>
<i>Bromus madritensis</i> subsp. <i>haussknechtii</i>	.	+
<i>Tragopogon longifolius</i>	.	.	1	2m	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	+
Other taxa																				
<i>Bromus intermedius</i>
<i>Lagoecia cuminoidea</i>	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anagalis arvensis</i>
<i>Bromus rigidus</i>	+
<i>Trifolium angustifolium</i>	+
<i>Aetheorhiza bulbosa</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Polygogon maritimus</i>	2m	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lagurus ovatus</i>
<i>Lagurus ovatus</i>	+
<i>Hordeum murinum</i> subsp. <i>leporinum</i>	+
<i>Polygogon monspeltensis</i>
<i>Limonium compactum</i>	r	.	.	.	.	.	.	.	.	.	.	.	.
<i>Oenanthe pimpinelloides</i>	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Atriplex</i> sp.
<i>Aster squamatus</i>
<i>Avena barbata</i>	+
<i>Torilis nodosa</i>	1	.	.	.	.	.	.	.
<i>Torilis nodosa</i>	2m	.	.	.	.	.	.	.	.
<i>Cynanchum acutum</i>	1	.	.	.	.	.	.	.
<i>Bituminaria bituminosa</i>	1	.	.	.	.	.	.	.
<i>Hordeum vulgare</i> subsp. <i>spontanum</i>
<i>Poa trivialis</i>
<i>Vicia sativa</i>
<i>Vicia sativa</i>

Table 14 (Tabela 14): *Carex distans* comm. (rels. 1–3), *Carex divisa* comm. (rels. 4–6).

Relevé №	1	2	3	4	5	6
Abbreviations of vegetation units (alliances and orders)	Tm	Tm	Tm	Tm	Tm	Tm
Plot size (m ²)	16	16	16	15	16	15
Total cover (%)	100	90	80	80	80	80
Latitude	38° 09.107'	38° 09.102'	38° 09.105'	38° 09.670'	38° 09.669'	38° 09.698'
Longitude	24° 00.538'	24° 00.546'	24° 00.540'	24° 01.577'	24° 01.625'	24° 01.628'
Species №	6	5	14	5	9	5
<i>Carex distans</i>	4	4	2a	.	.	.
<i>Carex divisa</i>	.	.	.	4	4	4
Characteristics of <i>Molinio-Arrhenatheretea</i>						
<i>Ranunculus sardous</i>	2m	r	1	1	r	.
<i>Potentilla reptans</i>	+	+	1	.	.	.
<i>Galium debile</i>	1	.	+	.	.	.
<i>Oenanthe pimpinelloides</i>	.	2a	1	.	.	.
<i>Oenanthe silaifolia</i>	.	.	.	1	r	.
<i>Anacamptis palustris</i>	.	.	r	.	.	.
Companions						
<i>Tragopogon longifolius</i>	r	.	+	+	.	.
<i>Anagallis arvensis</i>	.	.	+	.	+	r
<i>Geranium dissectum</i>	.	.	.	1	r	.
Other taxa						
<i>Teucrium scordium</i> subsp. <i>scordioides</i>	+	.	.	.	.	.
<i>Phragmites australis</i>	.	+	.	.	.	.
<i>Hordeum hystrix</i>	.	.	1	.	.	.
<i>Alopecurus myosuroides</i>	.	.	2m	.	.	.
<i>Lagurus ovatus</i>	.	.	1	.	.	.
<i>Melilotus indicus</i>	.	.	+	.	.	.
<i>Festuca arundinacea</i> subsp. <i>interrupta</i>	.	.	+	.	.	.
<i>Trifolium nigrescens</i>	.	.	+	.	.	.
<i>Linum bienne</i>	.	.	.	.	r	.
<i>Bellis annua</i>	.	.	.	.	r	.
<i>Hordeum murinum</i> subsp. <i>leporinum</i>	.	.	.	.	+	.
<i>Hypochoeris achyrophorus</i>	.	.	.	.	+	.
<i>Leontodon tuberosus</i>	.	.	.	.	.	1
<i>Medicago orbicularis</i>	.	.	.	.	.	r
<i>Bromus scoparius</i>	.	.	.	.	.	r