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Flora and vegetation of some coastal ecosystems of Sterea Ellas and eastern continental Greece

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Abstract: Sarika, M. *Notes on the flora and vegetation of some coastal ecosystems of Sterea Ellas and eastern continental Greece (Greece). Lazaroa 33: 65-99 (2012).*

Vegetation of four coastal ecosystems of eastern continental Greece and of Sterea Ellas, including dune, marshland, wet meadow, reed bed and aquatic habitats, was studied in several years. The flora of the investigated regions consists of 217 taxa belonging to 42 families and 135 genera, most of which are reported for the first time. The majority of taxa are Therophytes (101 taxa, 46%); Hemicryptophytes and Geophytes are also well represented in the life form spectrum. From a chorological point of view the Mediterranean element (123 taxa, 57%) outweight the rest while the most diverse group of widespread taxa occupies the second place (83 taxa, 38%). The macrophytic vegetation was analysed following the Braun-Blanquet method. Twenty one plant communities were found belonging to twelve alliances, ten orders and eight phytosociological classes. The vegetation units distinguished are described, documented in form of phytosociological tables, and compared with similar communities from other Mediterranean countries. According to directive 92/43/EU, nine habitat types were delimited through the assessment of the dominant vegetation types.

Keywords: flora, vegetation, coastal ecosystems, habitat types, Greece.

Resumen: Sarika, M. *Flora y vegetación de los ecosistemas costeros de Sterea Ellas y del este de la Grecia continental. Lazaroa 33: 65-99 (2012).*

La vegetación de cuatro áreas de costa del este de Grecia continental y de Sterea Ellas ha sido estudiada en distintas campañas. Estos estudios incluyen dunas, marjales, prados húmedos, cañaverales y comunidades acuáticas. La flora de los territorios estudiados se compone de 217 taxones, pertenecientes a 42 familias y 135 géneros, la mayor parte de los cuales están citados por primera vez. La mayoría de ellos son terófitos (46%, 101 especies), mientras que los hemicriptófitos y los geófitos también están bien representados. Desde el punto de vista corológico los elementos mediterráneos (57%, 123 especies) suponen el mayor contingente, mientras que lase species ampliamente distribuidos suponen el 38% (83 especies). La vegetación macrofítica fue analizada por el método sigmatista de Braun-Blanquet. Veintidos comunidades fueron detectadas y agrupadas en doce alianzas, diez órdenes y ocho clases fitosociológicas. De todas ellas, aportamos documentación y tablas fitosociológicas y se han comparado con otros tipos de vegetación similar de otros países mediterráneos. De acuerdo a la Directiva 92/43/EU, se han reconocido nueve tipos de hábitats a través del estudio de los tipos de vegetación dominantes.

Palabras clave: flora, vegetación, ecosistemas costeros, habitats, Grecia.

INTRODUCTION

Coastal ecosystems are among the most productive and the most heavily used and threatened natural systems globally. Their deterioration due to human activities is intense and increasing. Nevertheless, they support a broad range of habitat types that contain a wealth of species and genetic diversity, they store and cycle nutrients, filter pollutants from inland freshwater systems, and help to protect shorelines from erosion and storms. Coastal regions include a wide array of near shore-terrestrial (dunes and sandy shores), and intertidal (estuaries, deltas, lagoons) environments, each of which provides its own distinct bundle of goods and services and faces somewhat different pressures.

In these ecosystems, the distribution pattern of plant communities is related to substrate proper-

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ties such as soil salinity and moisture - both widely recognised as the most important factors that are controlled by temporary salt-water flooding. These properties determine the occurrence of two main types of coastal vegetation: plant communities in dune and sandy shore environments, and plant communities in maritime wetlands which are essentially able to grow on flooded and saline soils (RIVAS-MARTÍNEZ & *al*., 1980). The latter are arranged along a hygro-halophilous gradient. The muddy zones that are flooded or are directly influenced by seawater (mudflats, salt marshes), are vegetated by annual or perennial species with fleshy leaves or stems, able to withstand inundation and intense evaporation. The influence of tides on coastal vegetation depends on the relative duration of submergence and exposure, and the duration of this period is critical to the establishment of plant from seed, especially for annual plants such as *Salicornia* (CUTINI & *al*., 2010). Further inland, the vegetation of salt meadows and brackish reed beds is usually more diverse and composed of various communities characterised by rushes and tall helophytes (MOLINA, 1994, 1996; CURCÓ, 2001; MOLINA & *al*., 2003). Coastal wetlands are regarded as transitional ecosystems regulating fluxes of materials and energy between the land and the sea. They are increasingly becoming the last remaining coastal biodiversity hot spots worldwide, as refuges for wildlife faced with the human squeeze (DE LAS HERAS & *al*., 2009; PERILLO & *al*., 2009).

The Greek coastal ecosystems have attracted the interest of botanists during past decades, and several publications concerning their vascular flora and vegetation are available. The most recent related research projects were carried out in Macedonia (BABALONAS & PAPASTERGIADOU, 1993; KARAGIANNAKIDOU & *al*., 2000; VASILIOU & *al*., 2000), Thrace (DROSSOS, 1992), Thessaly (DROSSOS & *al*., 1996; ELEFTHERIADOU & *al*., 1995), western Greece (GEORGIADIS & *al*., 1990, 1997; KOUMPLI-SOVANTZI, 1991, 2005; RAABE & KOUMPLI-SOVANTZI, 2000; SARIKA & *al*., 2005; CHRISTIA & PAPASTERGIADOU, 2007; KARAGIANNI & *al*., 2008; CHRISTIA & *al*., 2011) and Peloponnese (KORAKIS & GERASIMIDIS, 2006). Data on Northern Aegean coastal habitats (PAPASTERGIADOU & BABALONAS, 1996) as well as some reviews of the Greek coastal flora and vegetation have also been published (LAVRENTIADES, 1993; BABALONAS & *al*., 1995; SÝKORA & *al*., 2003).

The flora and vegetation of near shore-terrestrial and wetland environments encountered in four coastal ecosystems in the eastern part of central Greece and of Sterea Ellas are the subject of this study. The investigated regions involve (1) a coastal ecosystem near the village of Sourpi (Pagasitikos Gulf, Magnissia Prefecture) called Elos Sourpis, (2) the Spercheios River Delta near the city of Lamia (Maliakos Gulf, Phthiotida Prefecture), (3) coastal area near the village of Scala Atalantis (Northern Evoikos Gulf, Phthiotida Prefecture) called Vourlias wetland, and (4) coastal area in the northern part of the Attiki Prefecture between Chalkutsi and Oropos villages (Southern Evoikos Gulf). Apart from some species reported from the coastal wetlands of Oropos (KOUMPLI-SOVANTZI & VALLIANATOU, 1994; KOUMPLI-SOVANTZI, 1995), there are no floristic or phytosociological reports from these regions.

This paper aims to provide the first inventory of the flora, vegetation and habitat types encountered in the abovementioned natural ecosystems and regions.

STUDY AREA

LOCATIONS AND GEOLOGY

The wetland Elos Sourpis is a coastal ecosystem (28 ha) of eastern continental Greece located between Platanos and Sourpi villages in the Pagasitikos Gulf (E 22º50'0'' N 39º10'0'') (Figure 1). It mainly consists of seasonally inundated mudflats, salt meadows, reed beds and *Tamarix sp*. A stream with intermittent flow crossing the area and a spring close to its upland border supply the wetland with fresh water. Seawater flows into the marsh, making the water brackish to saline. Middle Triassic to Jurassic marble forms the alpine geological substratum, outcropping on the southern part of the Sourpi Bay. Eastward of these formations appears the late Cretaceous flysch, namely phyllites and sandstones, with grey limes-

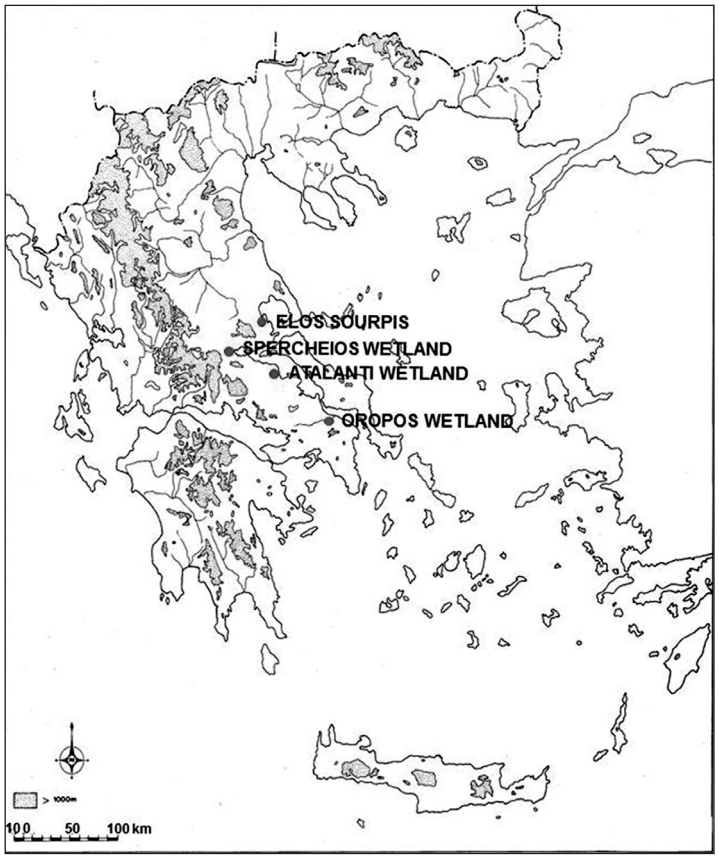

Figure 1. – Map of Greece showing the location of the four studied coastal regions.

tone intercalations. Quaternary alluvial clastic sediments, derived from the continental erosion and re-deposition of the above deposits, cover the alpine formations on the north-northwestern part of Sourpi, and are also found in coastal marine deposition of silts, sands and conglomerates (Marinos & *al*., 1962).

The Spercheios River meets the sea at the eastern part of central Greece, in the southwest corner of the Maliakos Gulf (E 22º34'32" N 38º50'26") (Figure 1), where it forms an extensive outfall area that comprises floodplains, mudflats, salt marshes, reed beds and inlets of particular importance for many birds. This coastal estuarine system is included in the Special Protection Areas for avifauna and the Sites of Community Importance, as defined in directives 79/409/EEC and 92/43/EEC respectively. The core of the estuary covers 3966,38 ha while the wider area is close to 10000 ha. Most of the area outside the core is intensively cultivated—mainly as rice fields. The land around the estuary is occupied mainly by dry cropland and grasslands, while a small portion is covered by olive trees. Quaternary fluvial deposits cover the entire area of the Spercheios River Delta, in addition to coastal marine conglomerates. Erosion material (marls, silts, sandstones, conglomerates) originating from Neogene deposits lies to the west and southwest of the area. The Neogene deposits, with lignite horizons, contain lake invertebrate fossils, such as *Limnaea, Pianorbis, Melanopsis*, and *Vivapara*. Coastal marine Neogene sediments also outcrop in the area and contain fossil bivalves, such as *Ostrea* and *Cardium* (Marinos & *al*., 1963).

The Atalanti or Vourlias wetland is located near to the village of Scala Atalantis in the Northern Evoikos Gulf (E 23º5'0" N 38º35'0") (Figure 1). It comprises a narrow coastal zone with mudflats, salt marshes, degraded wetland vegeta-

tion, agricultural land, and shallow inlets. The geological setting of the area consists of Quaternary clastic deposits (clays, sands, gravel, talus). These are mainly continental deposits originating from erosion and deposition of the substratum, which is exposed on the topographic highs further to west. Coastal conglomerate deposits have developed occasionally. Limestone formations appear mainly to the south (MARATOS, 1965).

The wetland area lying in the northern part of the Attiki Prefecture between the villages of Chalkutsi and Scala of Oropos (E 23º44'0'' N 38º20'0'') (Figure 1) is delimited on its western side by the Asopos River estuary and covers 420 ha. Its eastern boundaries are designated by a complex system of sand and mudflats seasonally inundated by seawater, forming lagoons and changing the landscape of sea-inlets. Its central part was a salt marsh formation that has recently been departmentalised by buildings and roads. The deltaic geological deposits that cover the wetland area of Oropos consist of alluvial sands and silts, with a few conglomerates and red silts. These were deposited in old-river valleys, across a lowland area open to the sea. The coasts of the area expose sand and silty lacustrine and riverine deposits, and beach rocks. During the most recent geological times, these Holocene deposits represent the evolution of the Asopos Delta, as the river transported and deposited sedimentary material further seawards, extending the coastal area towards the sea (KATSIKATSOS, 2000; PARGINOS & *al*., 2007).

The ecosystems we investigated are important sites for the maintenance of local and regional biodiversity. They hold various types of habitat and vegetation, offering ideal environments for many species of avifauna. They are intermediate resting stations for migrating and wintering birds and they also sustain endemic or protected species such as *Barbus cyclolepis choloremat*icus Stephanidis, a fish endemic to the Cholorema stream that flows near the upland border of the Elos Sourpis wetland. Likewise, the temporary or permanent shallow brackish waters encountered in many habitat types of these ecosystems represent natural parks for the reproduction of fish and the development of their juveniles.

CLIMATE

According to the xerothermic index (x) (BAGNOULS & GAUSSEN, 1953), and based on climatic data from the meteorological stations of Volos (alt. 14.62 m, period 1956-1997), Lamia (alt. 143.4 m, period 1970-1997) and Tanagra (139 m, period 1958-2010), the climate of the regions can be characterised as meso-Mediterranean, intensely so in Tanagra (late April to early September, 68.69 biologically dry days) and weakly in the districts of Volos (late April to August, 48.45 biologically dry days) and Lamia (May to August, 45.53 biologically dry days). The xerothermic index reflects the intensity of dry period in a given region and represents the total number of biologically dry days of the dry months which are defined by the ombrothermic diagram of this region. For calculation of biologically dry days of each dry month a mathematical formula is used taking into account 1) the total number of days per dry month 2) the total number of rainy days per dry monh 3) the total number with dew per dry month and 4) the relative humidity coefficient. Based on EMBERGER'S (1955, 1959) and SAUVAGE'S (1963) climatic classifications, the meteorological station of Lamia belongs to the sub-humid bioclimatic zone, the meteorological station of Volos to the semi-arid bioclimatic zone, and the meteorological station of Tanagra to the arid bioclimatic zone.

DATA AND METHODS

The floristic and habitat records are based on data collected by the author during the spring and summer of 1999-2001, partly within the framework of the Natura 2000 Vegetation and Habitat Identification and Mapping project. For the study of the flora, 476 plant specimens were collected and identified in the Laboratory of Systematic Botany, University of Athens (ATHU). The nomenclature of taxa follows mainly GREUTER & *al*. (1984, 1986, 1989, 2008), TUTIN & *al*. (1968-1980, 1993) and STRID & KIT TAN (1997, 2002). Life-form classification followed RAUNKIAER'S (1934) system improved by ELLENBERG and MÜE-

LLER-DOMBOIS (1967) and was based on the works of GARCKE & VON WEIHE (1972), PIGNATTI (1982) and OBERDORFER (1990). For the chorological types, PIGNATTI'S (1982) classification was used in combination with that of TUTIN & *al*. (1968-1980, 1993).

For the identification and description of the prevailing vegetation types, 141 relevés (vegetation sample plots) were analysed in the field according to the BRAUN-BLANQUET method (WESTHOFF & VAN DER MAAREL 1980; KENT & COKER, 1992). The cover-abundance degree was estimated using the extended (9-point) BRAUN-BLANQUET scale (BARKMAN & *al*., 1964). The collection of vegetation samples was followed by a synthetic phase, leading to the distinction of the community types and their final classification into higher syntaxonomic units. At this stage the relevés were clustered into a "primary" or "raw" table in which the species were listed after their degree of presence. The primary table was rearranged several times, according to the table technique elaboration proposed by Knapp (1958) and Ellenberg (1956), in order to establish groupings of relevés by rearrangment of columns as well as to group taxa with similar distributions in the table by rearrangement of rows. The result of the first rearrangement of the primary table was the "presence table" in which became apparent, whether the relevés vary irregularly, or certain combinations of species prefer some relevés. Such groups of species were more or less mutually exclusive and were used as groups of differential species (provisional sets of diagnostic species) for further rearrangement of the presence table (Tables 2-10). In a next stage the differentiating species were grouped on the left hand side of the paper, the rows were arranged in their corresponding groups and the relevés were rearranged to show a diagonal order of species from the left to the right of the table. After a complete elaboration this table is a "differentiated table" in which the groups of differentiating species that correspond to the phytocoena included in the table appear clearly. The next step comprises the replacement of each relevé group (phytocoenon) distinguished on the basis of a specific group of differential species, by a column in which for each participating species the presence degree is indicated as a constancy class value. The table derived from this step of elaboration is called "synoptic table' (Tables 11, 12) and after its comparison with tables from other types of vegetation of the same or adjacent regions an idea was formed about the local diagnostic species groups (character-species, differential species, constant companions). With those species the vegetation units (phytocoena) were then identified. Afterwards the synoptic tables were compared with literature and with tables with similar vegetation types from other regions. Character-taxa were found and a syntaxonomic interpretation was attempted. Vegetation units were delimited based on an assessment of species fidelity and are given in phytosociological tables (Tables 2-10). Syntaxonomic nomenclature is mainly based on PHILIPPI (1992), BALÁTOVÁ- OULÁČKOVĂ & *al*. (1993), MUCINA (1997), RIVAS-MARTÍNEZ & *al*. (2001), SÝKORA & *al*. (2003), and DÍEZ-GARRETAS & *al*. (2003).

The delimitation and classification of habitats were achieved through the assessment of the dominant vegetation types and their characteristic and diagnostic species, as described in LAVRENTIADES (1964, 1971), HORVAT & *al*. (1974), BABALONAS (1979), DIMOPOULOS & *al*. (1995), and SÝKORA & *al*. (2003). The coding of the discernible habitats follows DAFIS & *al*. (1999, 2001) and the INTERPRETATION MANUAL OF EU HABITAT TYPES (2003).

RESULTS AND DISCUSSION

FLORA

The vascular flora of the investigated coastal ecosystems includes 217 taxa (181 species, 36 subspecies) of 135 genera and 42 families. Apart from a few species already recorded from the Oropos coastal wetland area (KOUMPLI-SOVANTZI & VALLIANATOU, 1994; KOUMPLI-SOVANTZI, 1995) the remainder are new for the investigated habitats. Among the families identified Graminae were the most diverse in species (53 taxa), followed by Compositae (19 taxa), Leguminosae (17 taxa), Chenopodiaceae (13 taxa) and Cyperaceae (13

taxa). Of the plant species found in the areas of study only one is pteridophyte while the rest are all Spermatophytes (Dicotyledons 130 taxa, Monocotyledons 86 taxa). From all the plant taxa encountered we wish to emphasize the presence of *Althenia filiformis* and *Bolanthus thymifolius*.

Althenia filiformis is a Mediterranean element that prefers brackish water. It usually colonizes sites with direct or indirect contact with the sea, but is also encountered in inland salt lakes. It usually grows in water up to 50 cm deep, but in our case it was mostly found in <10 cm of water at the edge of a small lagoon that lies at the southern end of the Oropos wetland area. It was either the only phanerophyte in the water or shared the habitat with *Ruppia maritima*. KOUMPLI-SOVANTZI (1995) reported *A. filiformis* from a vernal pool in the neighbourhood of the village of Oropos and from coastal aquatic habitats of Naxos island. These are the only records of this species from Greece.

The Greek endemic species *Bolanthus thymifolius* was found on sandy soil at the mouth of Spercheios River. This species is scattered from Strerea Ellas and Evvia to NE Greece, in rocky places, usually on limestone (STRID & KIT TAN, 1997). According to TRIGAS (2003) it is mainly distributed in eastern Sterea Ellas and eastern Thessaly, sporadically occurring in Evvia and in northern Greece.

The life form spectrum in Figure 2 shows that in the investigated areas the proportion of Therophytes (101 taxa) is higher than that of other life forms. Hemicryptophytes (62 taxa) and Geophytes (23 taxa) are also quite well represented, whereas Chamaephytes (12 taxa), Phanerophytes (9 taxa) and Hydrophytes (11 taxa) occur in lower percentages. According to data in the literature Therophytes almost always predominate in Mediterranean coastal ecosystems (GARCÍA & *al*., 1993), while a significant percentage of hemicryptophytes is usually observed when maritime wetlands are present in these ecosystems, due to the humid conditions that prevail in such habitats (BABALONAS, 1979; GEORGIADIS & *al*. 1997; KORAKIS & GERASIMIDIS, 2006). The chorological spectrum (Fig. 2) reveals a definite predominance of the Mediterranean element (60%) that represent the largest group, including 132 taxa of which 74 (34%) are Mediterranean (Medit., Steno-Medit, Medit.-Atl., Medit.-Turan.) and 57 (26%) Euro-Mediterranean. The group of widespread taxa, although comprising a greater number of geoelements (Paleotemperate, Subcosmopolitan, Cosmopolitan, European, Eurasiatic, Circumboreal, Paleosubtropical, Subtropical, Eurosiberian and Thermo-cosmopolitan), is in second place and is represented by just 86 taxa (39%). Finally the Greek endemic element, makes up only a small percentage (0,45%, 1 taxon) of the chorological spectrum of the ecosystems studied.

The number of taxa found in the areas of study is rather low, if we take into account data concerning other coastal areas of Greece (GEORGIADIS & *al*., 1997; SARIKA & *al*., 2005), but it is widely accepted that in coastal wetlands a negative rela-

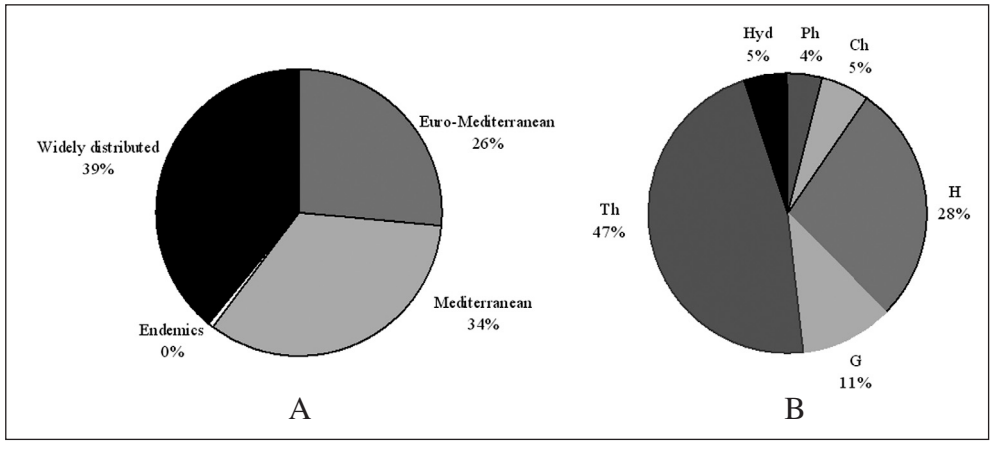

Figure 2. – Chorological spectrum (A) and life-form spectrum (B) of the investigated coastal flora.

tionship exists between plant species richness and salinity. In fact, there is evidence in the literature to confirm that only relatively few plant species are able to tolerate a high salt concentration in the soil solution (García & *al*., 1993; Medinski, 2007; Perelman & *al*., 2007). In the wetlands of Oropos we recorded 78 taxa; in the Atalanti wetland 71 taxa; in Elos Sourpis 80 taxa and in the Spercheios River Delta 111 taxa (see Appendix 1).

Vegetation and habitat types

From the elaboration of data collected during the vegetation analysis in the field, a total of 6 associations, 2 subassociations and 13 communities not assigned formal rank were recognised (see symtaxonomical scheme). Classification of the distinguished vegetation units into habitat types according to directive 92/43/EU revealed nine habitat types that are strictly related to the soil humidity, salinity and texture (Table 1). A mosaic of plant communities, alternately distributed, was observed in all the investigated ecosystems, but the dominant vegetation units varied substantially among them. Thus, in the Spercheios River Delta, the communities of sandy soils, mudflats, salt meadows and reed beds are dominating the vegetation physiognomy. In the Elos Sourpis and in Atalanti wetlands the salt meadow and reed bed communities outweight the rest, whereas communities of Mediterranean and thermo-Atlantic halophilous scrubs dominate in the Oropos wetland area (Table 1).

Table 1
Classification of the distinguished vegetation units into habitat types according to directive 92/443/EU. Abbreviations are: Sp (Spercheios River Delta), Sr (Elos Sourpis), At (Atalanti wetland), and Or (Oropos wetlands)

Habitat types and vegetation units	Sp	Sr	At	Or
Annual vegetation of drift lines (1210)				
Salsolo kali-Cakiletum maritimae	+		+	
Embryonic shifting dunes (2110)				
Eryngio-Sporoboletum virginici	+		+	
Malcolmietalia dune grasslands (2230)				
Aeluropus littoralis community	+	+		+
Matthiola tricuspidata-Anthemis tomentosa community	+			+
Salicornia and other annuals colonising mud and sand (*Thero-Salicornietea*, 1310)				
Spergularia salina-Salicornia europaea community	+	+	+	
Spergularia salina-Suaeda splendens community	+			
Mediterranean and thermo-Atlantic halophilous scrubs (*Salicornietea fruticosae*, 1420)				
Sarcocornia perennis-Halimione portulacoides community	+	+	+	+
Arthrocnemum macrostachyum community	+			+
Sarcocornia fruticosa-Halocnemum strobilaceum community				+
Limonium gmelinii community	+			
Limonium virgatum community	+	+		
Mediterranean salt meadows (1410)				
Juncetum maritimo-acuti	+	+	+	+
Juncus subulatus community	+	+	+	
Juncus heldreichianus community		+	+	
Carex divisa-Carex distans community			+	
Reed beds (72A0)				
Phragmitetum communis typicum	+	+	+	
Phragmitetum communis elymetosum elongati	+	+		+
Phragmitetum communis juncetosum subulati	+	+	+	
Bolboschoenetum maritimi	+	+	+	
Schoenoplectetum tabernaemontani				
Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation (3150)				
Potamogeton pectinatus-Myriophyllum spicatum community		+		
Thermo-Mediterranean riparian galleries (92D0)		+		

Annual vegetation of drift lines (habitat code: 1210)

The salt-resistant shout-lived communities of the drift line (a narrow habitat strip at the high tidal mark characterized by accumulation of debris) are grouped within the *Cakiletea maritimae*. The *Cakiletea* communities form an ecotone between the beach and the adjacent dune ecosystem. This habitat type of drift-line communities was encountered as a fragmented zone along the bay of Atalanti and in the coastal area of the Spercheios River Delta. The vegetation observed in this zone was exclusively represented by scattered stands of *Cakile maritima* and *Salsola kali*. The floristic composition of these stands allows their classification within the *Cakiletea maritimae* as the *Salsolo kali-Cakiletum maritimae* (Table 2).

Embryonic shifting dunes (habitat code: 2110)

Embryonic shifting dunes are the first stage of dune development and their vegetation colonises areas of incipient dune formation. The vegetation of this habitat type was represented by a discernible plant community composed of several psammophytes, all character and diagnostic species of the *Ammophiletea*. The pioneer species of the embryonic shifting dunes, *Elytrigia juncea*, along with *Eryngium maritimum* and *Sporobolus virginicus*, constitute a typical association of this habitat

Table 2
Salsolo kali-Cakiletum maritimae Costa et Mansanet 1981 corr. Rivas-Martinez, Costa & Loidi 1992 (1-5)
(*Euphorbion peplis, Euphorbietalia pepli, Cakiletea maritimae*)
Eryngio-Sporoboletum virginici Géhu & Uslu 1989 (6-14)
(*Agropyrion juncei, Ammophiletalia, Ammophiletea*)

Plot size (m^2)	10	5	10	10		20	20	15	18	20	20	18	15	
Species N.	7	5	6	5		5	7	9	9	9	7	6	8	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Characteristics														
Cakile maritima	2a	2a	1	.	IV	.	r	.	r	2m	.	.	.	II
Salsola kali	.	.	.	2m	II	.	.	.	.	.	.	.	.	
Elytrigia juncea	.	.	.	.		5	1	1	4	3	5	r	2a	V
Eryngium maritimum	.	.	.	.		.	.	2b	r	4	2b	2m	4	IV
Sporobolus virginicus	.	.	.	.		.	.	.	.	2b	2a	3	4	III
Euphorbia parallias	.	.	.	.		.	4	2m	4	r	.	.	.	III
Lotus cytisoides	2b	1	.	.	III	.	.	.	.	.	.	.	.	.
Medicago marina	.	.	.	.		.	.	.	.	3	.	.	.	I
Companions														
Matthiola tricuspidata	.	.	3	.	II	+	1	.	.	2m	2m	+	2m	IV
Parapholis incurva				r	II	.	+	2m	3		3		2b	IV
Anthemis tomentosa	.	.	.	.		.	.	.	.	+	1	5	1	III
Anisantha rubens	.	.	.	.		.	.	.	.	1	3	.	2a	II
Lagurus ovatus	.	.	2b	.	II	.	.	.	r	.	.	+	.	II
Halimione portulacoides	.	.	.	.		2m	.	.	2a	.	.	.	.	II
Xanthium strumarium	r	.	.	.	.	.	.	r	.	.	.	.	.	.
Polypogon monspeliensis	.	.	.	r	II	.	.	r	.	.	.	.	.	I
Limonium bellidifolium	4	.	.	.	II	.	.	r	.	.	.	.	.	I
Crithmum maritimum	2m	4	.	.	III	.	.	.	.	.	.	.	.	.
Reichardia picroides	+	1	.	.	.	.	.	.	.	.	.	.	.	.

Other species: *Capparis spinosa* 3, *Silene sedoides* r in 1; *Parietaria cretica* r in 2; *Brassica geniculata* and *Phragmites australis* 2a, *Avena barbata* + in 3; *Atriplex prostrata* and *Cynodon dactylon* 1 in 4; *Limonium graecum* r in 6; *Hordeum murinum* subsp. *leporinum* 2m, *Atriplex prostrata* + in 7; *Spergularia salina* and *Lolium rigidum* subsp. *rigidum* 2m, *Juncus acutus* r in 8, *Melilotus segetalis* 2, *Sarcocornia perennis* 1 in 9; *Medicago littoralis* 2m in 13.
Localities: 1-3, 7, 9-11, 13: Atalanti wetland; 4, 6, 8, 12: Spercheios River Delta.

type - the *Eryngio-Sporoboletum virginici*, which was encountered in the Spercheios River Delta and in the bay of Atalanti (Table 2). The *Eryngio-Sporoboletum virginici* usually grows in places that are temporarily inundated by the sea. It is the most halophytic of the dune communities and shows a greater resistance to inundation than the vegetation on other sand dunes (SÝKORA & *al*., 2003).

Malcolmietalia dune grasslands (habitat code: 2230)

Matthiola tricuspidata, Anthemis tomentosa, Medicago littoralis, and *Silene colorata* all diagnostic species of the class *Thero-Brachypodietea* (DÍEZ-GARRETAS & *al*., 2003), are the inhabitants of this habitat type which occurs in the Spercheios River Delta and in the coastal wetlands near the village of Oropos (Table 3). They have developed at extended patches in which were abundant and constantly present. The above-mentioned stands of the *Thero-Brachypodietea* belong to the *Cutandietalia maritimae* the *Alkanno tinctoriae-Maresion nanae*. These syntaxa, which have Mediterranean distribution comprise ephemeral plant communities found on coastal sands and dunes with salt spray.

The *Aeluropus littoralis* dominated stands observed in the wetlands of Oropos, in the Sper-

Table 3
Aeluropus littoralis comm. (1-11)
Mathiola tricuspidata-Anthemis tomentosa comm. (12-18)
(*Alkano tinctoriae-Maresion nanae, Cutandietalia maritimae, Thero-Brachypodietea*)

Plot size (m^2)	10	15	15	20	20	10	10	20	20	20		20	20	20	20	20	20	
Species N.	6	6	7	6	6	6	5	12	7	11		8	10	10	9	8	7	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Characteristics																		
Aeluropus littoralis	5	5	5	2b	4	5	5	4	5	2b	V	2m	1	.	.	.	.	II
Anthemis tomentosa	4	2b	2m	3	1	4	1		.		IV	3	3	2m	2a	+	1	V
Matthiola tricuspidata	1	r	+	+	1	.	.	2m	.	.	III	+	2b		2a	3	3	V
Medicago littoralis	.	.	.	.	.	.	.	.	.	.	.	2m	2m	4	2b	2b	2m	V
Silene colorata	2a	.	.	.	.	.	.	2a	.	.	I	2m	2a	1	3	4		V
Lagurus ovatus	2b	.	.	.	.	2b	2m	.	.	.	II	1	r	.	1	.	.	III
Plantago lagopus	.	.	.	.	.	.	.	.	.	.	.	.	2b	.	4	3	4	IV
Echium arenarium	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	2m	+	IV
Trifolium scabrum	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	II
Vulpia fasciculata	.	.	.	.	.	.	.	.	.	.	.	.	.	2b	.	.	.	I
Companions																		
Lotus cytisoides	+	+	.	.	.	.	.	.	.	.	I	.	2b	.	.	.	.	I
Melilotus indicus	.	.	r	.	.	2m	.	2m	.	.	II	.	.	.	.	.	.	.
Polycarpon tetraphyllum	.	.	.	.	.	.	.	2m	.	.	I	.	.	.	.	.	+	I
Hordeum murinum subsp. *leporinum*	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	+	.	I
Avena barbata	.	.	.	.	.	.	.	.	+	.	I	.	.	.	r	.	.	I
Plantago coronopus subsp. coronopus	.	.	.	.	.	.	.	.	.	2m	I	.	.	r	.	.	.	I
Parapholis incurva	.	.	4	.	.	.	.	.	.	.	I	.	.	2b	.	.	.	I
Hordeum marinum	.	.	.	.	.	.	.	.	2m	2m	I	.	.	.	.	.	.	.
Phalaris minor	.	.	.	.	.	.	.	.	r	1	I	.	.	.	.	.	.	.
Rostraria cristata	.	.	.	.	+	.	.	.	2a	.	I	.	.	.	.	.	.	.
Cakile maritima	.	+	.	.	.	.	.	1	.	.	I	.	.	.	.	.	.	.

Other species: *Limonium graecum* + in 2; *Medicago marina* + in 3, *Calystegia soldanella* 1 in 4; *Polygonum arenarium* 2a in 5; *Papaver rhoeas* 2a, *Limonium sp*. 2b and *Linaria micrantha* + in 8; *Lolium rigidum* 5, *Puccinellia sp*. and *Parapholis filiformis* 3, *Phalaris paradoxa* 2a in 10; *Eryngium maritimum* 2b in 12; *Anisantha matridensis* subsp. *delilei* + in 15.
Localities: 1-3, 8, 10, 13, 15-17: Oropos wetland area; 4-7, 9, 12, 14: Spercheios River Delta; 9: Elos Sourpis.

cheios River Delta and in the wetland Elos Sourpis were constantly associated with species of *Cutandietalia maritimae* such as *Anthemis tomentosa* and *Matthiola tricuspitada* (Table 3). *Aeluropus littoralis* is widespread mostly in the coastal territories of the Mediterranean and the Black Sea Coasts and according to MUCINA (1997) it is listed as a diagnostic species of the *Juncetea maritimi* (at least in the Mediterranean). There are several communities dominated by *A. littoralis* described from Spain and Italy (RIVAS-MARTÍNEZ & *al*., 2001; CAZZIN & *al*., 2009) as well as from the Black Sea coast of Romania (THEURILLAT & MORAVEC 1998; FĂGĂRAS & *al*., 2003) and of Göksu Delta-Turkey (KARAÖMERLIOGLOU, 2007) included in the *Juncetea maritimi*. In my opinion, the floristic composition of the *A. littoralis* stands found in the study areas does not allow their classification within the *Juncetea maritimi*. With the exception of *Triglochin bulbosa* subsp. *barrelieri* and *Elymus elongatus* subsp. *ponticus*, no *Juncetea maritimi* species have been recorded in these stands. On the contrary, character species of the *Thero-Brachypodietea, Saginetea maritimae* and *Stellarietea mediae* were generally frequent (Table 3). The *Aeluropetum littoralis*, reported from northern Greece (BABALONAS, 1979; VASILIOU & *al*., 2000), resembles several associations described from Bulgaria (TZONEV & *al*., 2008), Romania (KRAUSH, 1965; ŞERBĂNESCU, 1965; GÉHU & *al*., 1994; POP, 2002) and Ukraine (DUBYNA & NEUHÄUSLOVÁ, 2000). The stands of *A. littoralis* in the investigated areas differ floristically to a great extent from all these communities, in that they consist exclusively of character and diagnostic species belonging to the *Salicocornietea fruticosae* (BABALONAS, 1979; VASILIOU & *al*., 2000) or the *Festuco-Puccinellietea* (TZONEV & *al*., 2008).

Salicornia and other annuals colonising mud and sand (habitat code: *Thero-Salicornietea*, 1310)

The phanerogamic communities occuping the uppermost zones of the tidal mudflats are poor in species and are classified within the *Thero-Salicornietea*. These flood-dependent communities consist of annual succulent halophytes (*Chenopodiaceae*), and are confined to extreme habitats with low oxygen content in the soil. In the Mediterranean region this vegetation is mostly represented by *Salicornia* or *Suaeda* dominated phytocoenoses. These genera are taxonomically intricate encompassing many microspecies difficult to identify. According to STRID & KIT TAN (1997) the genus *Salicornia* in Greece is solely represented by the species S. EUROPAEA. In our study areas the zone of tidal mudflats was thinly vegetated either by *S. europaea-Spergularia salina* (Elos Sourpis and Atalanti wetland) or by *Spergularia salina- Suaeda splendens* co-dominated stands (Spercheios River Delta) (Table 4). *Spergularia salina* is an annual nitro-halophilous species of coastal and continental marshes that is usually reported as a character and diagnostic species of the *Juncetea maritimi* (MUCINA, 1997; COSTA & *al*., 2009) or of the *Saginetea maritimae* (CURCÓ, 2000). GONZĂLEZ (2009) reported from Spain a community dominated by *Salicornia europaea* and *Spergularia marina* as the *Spergulario marinae-Salicornietum europeae*. He classified this association within the *Thero-Salicornietea*, as suggested also by RIVAS-MARTÍNEZ & *al*. (2001). Likewise PEINADO & *al*. (1995) reported *S. marina* as a therophyte that thrives in gaps within the upper salt marsh associations of the *Salicornietea fruticosae*, (*Arthrocnemion glauci*) or in the associations of the *Thero-Salicornietea* dominated by *Suaeda* (*Thero-Suaedion*). We suggest that our relevés with *Salicornia europaea* and *Spergularia salina* resemble the association *Spergulario marinae-Salicornietum europeae*.

Mediterranean and thermo-Atlantic halophilous scrub (habitat code: *Salicornietea fruticosae*, 1420)

In the zonation, the pioneer vegetation of the *Thero-Salicornietea* is usually replaced by communities of semi-woody shrubs and perennial halophytes that occur on waterlogged saline and muddy substrates and are classified as the *Salicornietea fruticosae*. This vegetation is not limited to the Atlantic and Mediterranean coasts, but extends also to North Africa and Middle East

Table 4
Spergularia salina-Salicornia europaea comm. (1-7)
Spergularia salina-Suaeda spledens comm. (8-11)
(*Thero-Salicornietalia, Thero-Salicornietea*)

Plot size (m^2)	10	10	10	10	10	10		5	5	8	
Species N.	9	8	12	5	7	8		6	6	7	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11
Characteristics											
Salicornia europaea agg	2b	2b	3	1	2a	4	V	.	.	.	.
Spergularia salina	5	4	2a	5	4	r	V	3	2m	5	V
Suaeda splendens	.	.	.	.	.	2a	I	3	5	1	V
Companions											
Hordeum marinum	2m	1	3	2m	.	1	V	1	1	.	III
Parapholis incurva	1	.	2m	3	.	.	III	.	1	.	II
Plantago coronopus subsp. *coronopus*	.	2b	3	.	3	.	III	.	.	.	.
Polypogon monspeliensis	r	.	.	.	.	1	II	2b	+	2m	V
Puccinelia distans subsp. *distans*	3	2a	.	.	2m	.	III	2m	2m	.	III
Tripolium pannonicum subsp. *tripolium*	.	.	.	.	.	r	I	.	.	+	II
Juncus bufonius	4	.	4	.	4	.	III	.	.	2b	II
Halimione portulacoides	2a	.	+	2a	.	.	III	.	.	.	.
Melilotus indicus	1	+	.	.	.	.	II	.	.	.	.

Other species: *Juncus hybridus* 4, *Carex divisa* 1 in 2; *Aeluropous littoralis* 2a, *Centaurium tenuiflorum* 2b, *Bupleurum tenuissimum* and *Polypogon maritimus* 1, *Medicago polymorpha* + in 3; *Limonium narbonense* r in 5; *Bolboschoenus maritimus* 2m, *Phragmites australis* + in 6; *Euphorbia* sp.2b in 8; *Puccinellia festuciformis* 2m, *Atriplex prostrata* 1 in 10.
Localities: 1, 2: Atalanti wetland; 3-5: Elos Sourpis; 6-10: Spercheios River Delta.

(KALIGARIČ & ŠKORNIK, 2007). It is tolerant to long floods that occur during the winter, whereas in the summer it appears on dry, salt and crusty soils. In our study areas five fairly discernible communities of the halophilous scrub were encountered.

The *Arthrocnemum macrostachyum* stands were recorded in coastal marshy plains near the village of Oropos and in the Spercheios River Delta. *Sarcocornia fruticosa* and *Halimione portulacoides* were always present along with *A. macrostachyum* in the phytocoenoses of Oropos, and *Halocnemum strobilaceum* was found in the phytocoenoses of the Spercheios River Delta (Table 5). WOLFF (1968) reported from Mesolonghi a more diverse community with a similar structure as the *Arthrocnemo glauci-Halocnemetum strobilacei* association. *Arthrocnemetum glauci* and *Halimiono-Arthrocnemetum glauci*, reported from eastern Turkey (ISTANBULLUOGLU, 2004), have also similarities with the *Arthrocnemum macrostachyum*-dominated stands found in area.

Distinct patches of *Sarcocornia fruticosa* and *Halocnemum strobilaceum*, constantly associated with *Parapholis incurva*, were observed only in the marshy plains of Oropos (Table 5). They obviously represent a community that strongly resembles the *Arthrocnemo-Halocnemetum strobilacei* reported from the Göksu Delta-Turkey (KARAÖMERLIOGLU, 2007) and the *Halocnemetum strobilacei* reported from the Evros River Delta (BABALONAS, 1979).

In the study areas the most frequent and well represented phytocoenoses of this habitat type were *Sarcocornia perennis - Halimione portulacoides* stands, the majority of which were characterised by the constant and abundant presence of *Puccinellia festuciformis* (Table 6). WOLFF(1968) and BABALONAS (1979) reported similar but more diverse communities from Mesolonghi and Evros as the *Salicornietum radicantis*. A community dominated by *Sarcocornia perennis* and *Halimione portulacoides*, reported from the Yumortalik Lagoon, Turkey (ALTINÖZLÜ, 2004) seems most similar to our community.

Table 5
Arthrocnemum macrostachyum comm. (1-7)
(*Arthrocnemion glauci, Salicornietalia fruticosae, Salicornietea fruticosae*)
Sarcocornia fruticosa-Halocnemum strobilaceum comm. (8-13)
(*Salicornion fruticosae, Salicornietalia fruticosae, Salicornietea fruticosae*)
Limonium virgatum comm. (14-17) *Limonium gmelinii* comm. (18-20)
(*Limonietalia, Salicornietea fruticosae*)

Plot size (m^2)	20	20	20	20	15	15		20	20	20	20	20		20	20	20		20	20	
Species N.	4	4	4	2	16	8		9	5	4	5	8		4	10	6		7	4	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Characteristics																				
Arthrocnemum macrostachyum	5	5	4	2a	3	2a	V	.	.	.	.	.	.	.	.	.	.	.	.	.
Sarcocornia fruticosa	.	.	.	.	4	4	II	4	4	3	3	3	V	.	.	.	.	.	.	.
Halocnemum strobilaceum	.	.	.	5	.	.	I	2b	4	3	3	.	IV	.	.	.	.	.	.	.
Limonium virgatum	.	.	.	.	.	.	.	.	.	.	.	.		4	4	4	V	.	.	.
Limonium gmelinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	5	V
Companions							.													
Halimione portulacoides	1	1	2m	.	2a	4	V	.	.	.	.	5	I	2b	1	4	V	1	2m	V
Limonium bellidifolium	2b	3	+	.	.	.	III	.	.	.	.	.		.	.	.	.	.	.	
Puccinelia festuciformis	.	.	3	.	.	.	I	.	.	.	.	.		1	.	.	II	.	+	III
Parapholis incurva	.	.	.	.	.	.	.	2a	2a	2a	2m	.	IV	.	.	.	.	.	.	.
Plantago coronopus subsp. *coronopus*	.	.	.	.	.	3	1	2a	.	.	.	.	I	.	+	.	.	.	.	.
Melilotus indicus	.	.	.	.	+	r	II	.	.	.	.	2a	I	.	.	+	II	.	.	.
Limbarda crithmoides	.	.	.	.	.	.	.	.	.	.	.	.	.	2a	1	r	V	.	.	.
Sphenopus divaricatus	.	.	.	.	.	.	.	+	1	.	2a	.	III	.	.	.	.	.	.	.
Spergularia salina	.	.	.	.	.	.	.	+	1	2b	.	.	III	.	.	.	.	.	.	.
Sarcocornia perennis	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	2m	2b	V
Centaurium tenuiflorum	.	.	.	.	.	.	.	.	.	.	.	1	I	.	2b	.	II	.	.	.
Triglochin bulbosa subsp. *barrelieri*	.	1	.	.	.	.	I	2a	.	.	.		I	.	.	.	.	.	.	.
Elymus elongatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r		III	+	.	III
Avena sterilis subsp. *ludoviciana*	.	.	.	.	3	.	I	.	.	.	.	+	I	.	.	.	.	.	.	.
Lolium rigidum subsp. *rigidum*	.	.	.	.	.	3	I	.	.	.	.	2m	I	.	.	.	.	.	.	.
Sonchus oleraceus	.	.	.	.	+	1	II	.	.	.	.	.	.	.	.	.	.	.	.	.

Other species: *Juncus maritimus* 3 in 1; *Piptatherum miliaceum* 2a, *Medicago scutellata* 2b, *Phalaris minor Lolium multiflorum* 2m in 5; *Polypogon maritimus* + in 7; *Parapholis marginata* 2m in 8; *Limonium narbonense* 2b en 14.
Localities: 1, 2, 5, 6, 8, 9-12: Oropos wetland area; 3, 4, 14, 18, 19: Spercheios River Delta; 15, 16: Elos Sourpis.

Two relevés with *Limonium gmelinii* were recorded in the Spercheios River Delta and three with *L. virgatum*, on the marshy plains of the Sourpi bay (Table 5). These probably represent communities of the *Limonietalia*, rich in perennial, rosette-forming *Limonium* spp., which in Mediterranean coastal regions occupy soils temporarily permeated (though not inundated) by saline water and are subject to extreme summer drying by formations of salt inflorescences. Similar formations are known from several coastal areas of Greece (BABALONAS, 1979).

Mediterranean salt meadows (habitat code: 1410)

Communities dominated by tall rushes, such as *Juncus maritimus, J. acutus* and *J. subulatus*, create impressive dense grasslands on subsaline soils saturated with surface or underground water and have usually been assigned to the *Juncetea maritimi*. These communities form a more or less continuous fringe on the transitional zone between the upper salt marsh zone and the upland vegetation, growing on sites where salt and fresh

Table 6
Sarcocornia perennis-Halimione portulacoides comm.
(*Arthrocnemion perennis, Salicornietalia fruticosae, Salicornietea fruticosae*)

Plot size (m^2)	30	30	25	30	30	25	25	30	30	20	30	30	30	25	25	30	30	30	30	20	30	30	
Species N.	3	6	4	3	2	5	4	4	7	5	4	4	5	6	3	4	5	3	2	6	5	5	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Characteristics																							
Sarcocornia perennis	2a	2b	4	3	5	5	5	4	4	3	4	5	5	3	2b	2m	5	5	4	3	5	3	V
Halimione portulacoides	.	+	5	2a	2a	1	3	5	2b	4	2a	2b	2b	2b	+	3	.	.	.	.	.	.	IV
Puccinelia festuciformis	.	.	.	.	.	2m	2m	2a	+	2m	4	2m	2a	5	5	4	1	2m	4	5	+	2m	IV
Limonium narbonense	.	.	3	4	.	.	.	+	.	2a	+	1	3	.	.	.	r	.	.	.	.	.	II
Limonium bellidifolium	.	.	.	.	.	r	+	.	2m	.	.	.	.	.	.	.	.	.	.	.	.	4	I
Limonium gmelinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	r	I
Limonium virgatum	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Companions																							
Juncus heldreichianus	.	.	2b	.	.	.	.	.	.	.	.	.	3	.	.	.	2a	.	.	.	.	.	I
Juncus subulatus	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	2b	+	.	I
Phragmites australis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+		r	I
Juncus acutus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	.	I
Hordeum marinum	.	5	.	.	.	.	.	.	.	2m	.	.	.	.	.	.	.	.	.	.	.	.	I
Parapholis incurva	2a	2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I

Other species: *Triglochin bulbosa* ssp. *barrelieri* 4 in 1; *Plantago coronopus* subsp. *coronopus* 3, *Centaurium tenuiflorum* + in 2; *Polypogon monspeliensis* in 6; *Juncus maritimus* 4, *Limbarda crithmoides* 1 in 9; *Elymus elongatus* +, *Matthiola tricuspidata* r in 14; *Aeluropus littoralis* 1 in 16; *Bolboschoenus maritimus* 2m in 17; *Tripolium pannonicum* subsp. *tripolium* 2m in 20.
Localities: 1: Oropos wetland area; 2, 3, 6-11: Elos Sourpis; 4, 5, 13, 17: Atalanti wetland; 14-16, 18-22: Spercheios River Delta.

phreatic waters mix (Rivas-Martínez & *al*., 1980).

Stands dominated by *J. maritimus* or *J. acutus*, or both, are occasionally treated in the literature as representative segments of the *Juncetum maritimo-acuti* (Ganiatsas, 1936; Horvatić, 1934; Babalonas, 1979; Georgiadis & *al*., 1997; Frondoni & Iberite, 2002; Kaligarič & Škornik, 2006), whereas in some cases they have been considered either as the *Juncetum maritimi* or as the *Juncetum acuti* (Lavrentiades, 1963; Babalonas, 1979; Korakis & Gerasimidis, 2006; Karagianni & *al*., 2008). In our study areas seven relevés were dominated by *J. maritimus*, three by *J. maritimus* along with *J. acutus*, whereas in five relevés *J. acutus* was always combined with *Elymus elongatus* subsp. *ponticus* (Table 7). We propose that all these stands should be considered as belonging to Juncetum maritimo-acuti, which was represented by its typical form and a phase with *Elymus elongatus* subsp. *ponticus*.

Two more discernible plant communities, one dominated by *Juncus subulatus* and one by *Juncus heldreichianus*, were encountered in the salt meadows of the study area (Table 8). Phytocoenoses dominated by these species are reported less frequently in the literature. Karagianni & *al*. (2008) mentioned a *J. subulatus* community from several rivers of Western Greece, and pointed out several species, such as *J. acutus, Bolboschoenus maritimus, Aeluropus littoralis, Sarcocornia fruticosa, Tamarix parviflora*, as coexistent in its structure. Gradstein & Smittenberg (1977), who described the *Juncetum subulato-maritimi* noted that this vegetation was characterised by dense and floristically rather poor mats of *J. maritimus* and *J. subulatus* mixed with larger tufts of *J. heldreichianus*. Similar in structure, but without *J. heldreichianus*, is the *Scirpo-Juncetum subulati* reported from north-eastern Sardinia (Biondi & *al*., 2004) and from Lazio, Italy (Frondoni & Iberite, 2002). In our case *J. subulatus*

Table 7
Juncetum maritimo-acuti Horvatić 1934 (1-14)
Carex divisa-Carex distans comm. (15-18)
(*Juncion maritimi, Juncetalia maritimi, Juncetea maritimi*)

Plot size (m^2)	30	30	30	30	30	30	30	30	30	30	30	30	25		10	15	15	
Species N.	3	6	4	3	3	5	9	8	10	3	5	12	11		9	10	5	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Characteristics																		
Juncus maritimus	5	5	5	5	5	5	2b	5	.	.	.	.	.	IV	.	.	.	.
Juncus acutus	.	.	.	.	.	.	3	2b	3	2b	2a	2b	4	III	.	.	.	.
Elymus elongatus	.	.	.	.	.	1	.	.	4	4	5	4	.	II	.	.	.	.
Carex divisa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	4	5	V
Carex distans	.	.	.	.	.	.	.	.	.	.	.	.	r	I	4	2a	.	IV
Juncus subulatus	.	.	.	.	.	.	.	.	2b	3	.	.	.	I	.	.	.	.
Juncus heldreichianus	.	.	.	.	.	r	.	.	.	.	.	.	.	I	.	.	.	.
Elytrigia scirpea	.	.	.	.	.	.	4	.	.	.	.	.	.	I	.	.	.	.
Tripolium pannonicum subsp. *tripolium*	.	.	.	.	.	.	.	+	1	.	.	.	.	I	.	.	.	.
Triglochin bulbosa subsp. *barrelieri*	.	.	.	.	.	.	3	.	.	.	.	.	.	I	.	2m	.	II
Companions																		
Sarcocornia fruticosa	.	.	2b	.	.	.	1	.	.	.	.	.	.	I	.	.	.	.
Arthrocnemum macrostachyum	.	2b	3	4	.	.	1	.	.	.	.	.	.	II	.	.	.	.
Limonium bellidifolium	.	.	2a	.	.	+	.	.	.	.	.	.	.	I	.	.	.	.
Puccinellia festuciformis	.	.	.	.	.	.	.	.	1	.	.	.	r	I	.	.	.	.
Sarcocornia perennis	.	.	.	.	+	.	.	.	2m	.	1	1	.	II	+	.	.	II
Halimione portulacoides	+	.	.	.	.	2a	1	+	+	.	.	.	.	II	.	.	.	.
Phragmites australis	.	.	.	.	2m	.	+	+	1	.	1	.	.	II	.	.	.	.
Daucus carota	.	.	.	.	.	.	.	.	.	.	.	.	+	I	+	.	.	II
Lotus corniculatus	.	.	.	.	.	.	.	.	.	.	.	.	2a	I	1	2m	.	IV
Geranium dissectum	.	.	.	.	.	.	.	.	.	.	r	1	.	I	.	.	.	.
Limonium graecum	.	3	.	+	.	.	2a	.	.	.	.	.	.	II	.	.	.	.
Polypogon monspeliensis	1	.	.	.	.	.	.	+	.	.	.	.	.	I	2a	.	.	II
Melilotus indicus	.	.	.	.	.	.	.	.	.	.	.	.	1	I	.	.	2m	II
Hordeum murinum subsp. *leporinum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	3	IV
Marrubium peregrinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	IV
Oenanthe silaifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2m	2m	.	IV

Other species: *Parapholis filiformis* 4, *Juncus bufonius* 2a, *Centaurium tenuiflorum* 1 in 2; *Lotus palustris s.l.* 1, *Limonium gmelinii* + in 8; *Bolboschoenus maritimus* 1 in 9; *Anagallis arvensis, Galium aparine, Picris sp.* and *Taraxacum sp.* 1, *Torilis nodosa* and *Ornithogalum sp.* +, *Vicia sativa* subsp. *nigra* and *Ophrys fusca* r in 12; *Dittrichia viscosa* 3, *Elytrigia juncea* 2b, *Bromus hordeaceus* subsp. *hordeaceus* 2m, *Limonium sinuatum* +in 13; *Juncus inflexus* 1 in 15; *Hordeum geniculatum* 3, *Juncus hybridus* 1, *Monerma cylindrica* and *Pulicaria dysenterica* r in 16; *Juncus articulatus* 1 in 17.
Localities:1, 6: Elos Sourpis; 2-4, 7, 11-12: Oropos wetland area; 5, 8-10: Spercheios River Delta; 13, 15-17: Atalanti wetland.

formed monospecific stands, significantly resembling those of the *Scirpo-Juncetum subulati* from Lazio (Table 8).

Finally, three *Carex divisa-Carex distans* dominated relevés (Table 7) from subsaline grasslands of the Atalanti wetland should be probably assigned to the *Juncetea maritimi* (e. g ADAM, 1977). LAVRENTIADES (1964) reported similar but more diverse plant communities from the coasts of the western Peloponnese, stating that they resembled those described by BRAUN-BLANQUET & *al*. (1952) in the Mediterranean coasts of France under the *Caricetum divisae*. *Carex divisa* is typically found in damp brackish pastures near the sea (WATTS & VILAR, 1997).

Table 8
Juncus subulatus comm. (1-6) *Juncus heldrichianus* comm. (8-14)
(*Juncion maritimi, Juncetalia maritimi, Juncetea maritimi*)

Plot size (m^2):	20	20	15	25	20	20		30	30	30	25	25	30	30	
Species N.	6	3	4	3	5	6		14	6	5	5	1	3	9	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Characteristics															
Juncus subulatus	5	5	5	5	5	5	V	.	.	.	.	.	.	.	.
Juncus heldreichianus	.	.	.	.	.	.	.	4	5	4	5	5	5	4	V
Juncus maritimus	.	.	.	.	.	.	.	3	2m	3	.	.	.	.	III
Elymus elongatus	.	.	.	.	.	.	.	4	3	.	.	.	.	2a	III
Juncus acutus	.	.	.	.	.	+	I	2a	.	.	.	.	.	.	I
Puccinellia distans subsp. *distans*	4	.	.	.	.	.	I	1	.	.	.	.	.	.	I
Tripolium pannonicum subsp. *tripolium*	.	1	.	.	1	.	I	.	.	.	.	.	.	.	.
Juncus litoralis	.	.	.	+	.	.	I	.	.	.	.	.	.	.	.
Carex distans	.	.	.	.	.	.	.	.	.	.	.	.	.	r	I
Carex divisa	.	.	.	.	.	.	.	.	.	.	3	.	.	.	I
Carex extensa	.	.	.	.	.	.	.	.	2m	.	.	.	.	.	I
Juncus gerardi subsp. *gerardi*	.	.	.	.	.	.	.	2b	.	.	.	.	.	.	I
Plantago crassifolia	.	.	.	.	.	.	.	+	.	.	.	.	.	.	I
Companions															
Halimione portulacoides	2b	2b	.	.	.	.	II	1	.	.	.	.	.	.	I
Sarcocornia perennis	2m	.	.	.	2m	.	II	.	+	.	.	.	.	.	I
Phragmites australis	.	.	.	.	1	.	I	.	.	1	.	.	1	.	II
Limonium narbonense	2a	.	.	.	.	.	I	+	r	.	.	.	.	.	II
Limonium bellidifolium	+	.	.	.	.	.	I	2m	.	.	.	.	+	.	II
Puccinellia festuciformis	.	.	.	.	2b	2a	II	.	.	.	.	.	.	.	.
Bolboschoenus maritimus	.	.	.	2b	.	3	II	.	.	.	.	.	.	.	.
Melica ciliata subsp. *ciliata*	.	.	.	.	.	.	.	.	.	.	+	.	.	+	II
Torilis nodosa	.	.	.	.	.	.	.	1						r	I

Other species: *Oenanthe silaifolia* 2m, *Rumex conglomeratus* 1 and *Melilotus segetalis* + in 3; *Parapholis incurva* 2b, *Hordeum murinum* subsp. *leporinum* + in 6; *Lotus corniculatus, Cynanchum acutum* and *Centaurium tenuiflorum* + in 8; *Cyperus laevigatus* subsp. *distachyos* 2b in 10; *Elytrigia juncea* 2m, *Dittrichia viscosa* r in 11; *Daucus guttatus* and *Rostraria cristata* 1, *Hordeum bulbosum* in 14.
Localities: 1, 8-10, 13, 14: Elos Sourpis; 2 and 5: Spercheios River Delta; 3-4, 6, 11, 12: Atalanti wetland.

Reed beds (habitat code: 72A0)

Reed beds dominated by *Phragmites australis*, are an important type of vegetation in Mediterranean coastal wetlands. Communities of common reed (*Phragmites australis*) or of reed-like tall helophytes (*Typha* and *Scirpus*), classified within the *Phragmito-Magno-Caricetea*, were found in all the investigated areas. These communities show a vigorous development, expanding as continuous girdles along the Asopos River mouth and in the Spercheios River Delta. In the rest of the sites studied they were represented by spot-like stands occurring through the subsaline grasslands of the *Juncetea maritimi*, or in muddy brackish flats amongst the perennial halophytes of *Salicornietea fruticosae*. This type of vegetation, which is also developed at the edges of the subsaline habitats, towards to the uplands and along ditches, mainly consisted either of *Phragmites australis* or of *Bolboschoenus maritimus* dominated stands.

Bolboschoenus maritimus stands of the *Bolboschoenetum maritimi* were mainly found in sites directly connected with the sea (estuaries) or in sites flooded periodically by salt water (Table 9). According to literature data (Wolff 1968; Gradstein & Smittenberg 1977; Babalonas 1979; Lastrucci & *al*., 2010) they usually achieve their optimum in the vicinity of lagoons,

Table 9
Schoenoplectetum tabernaemontani Soó 1947 (1-3) *Bolboschoenetum maritimi* Eggler 1933 (5-12)
(*Cirsio brachycephali-Bolboschoenion, Bolboschoenetalia, Phragmito-Magno-Caricetea*)
Potamogeton pectinatus-Myriophyllum spicatum comm. (14-17)
(*Potamion, Potametalia, Potametea*)

Plot size (m^2):	30	30	30		30	30	30	30	30	30	30	30		30	30	30	30	
Species number:	4	5	10		1	4	10	5	7	5	7	4		3	3	3	5	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Characteristics																		
Scirpus lacustris subsp. *tabernaemontani*	2a	3	2a	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bolboschoenus maritimus	.	.	2a	II	5	3	5	4	3	5	5	4	V	.	.	.	.	.
Myriophyllum spicatum	.	.	.	.	.	.	.	.	.	.	.	.	.	4	3	5	1	V
Potamogeton pectinatus				.	.	.	.	.	.	.	.	.	.	3	4	2m	5	V
Phragmites australis	5	5	5	V	.	.	+	.	+	1	1	.	III	2a	2b	+	+	V
Typha domingensis	.	.	2a	II	.	.	3	3	.	.	.	.	II	.	.	.	.	.
Companions																		.
Juncus subulatus	.	.	.	.	.	.	3	.	.	3	.	.	II	.	.	.	.	.
Juncus heldreichianus	2b	.	.	II	.	.	.	.	.	4	.	.	I	.	.	.	.	.
Juncus maritimus	.	3	.	II	.	.	.	.	.	.	.	3	I	.	.	.	.	.
Polypogon monspeliensis	2m	2b	2a	V	.	.	.	.	.	.	2b	1	II	.	.	.	.	.
Spergularia salina	.	1	.	II	.	.	.	.	.	.	+	.	I	.	.	.	.	.
Samolus valerandi	.	.	+	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex conglomeratus	.	.	.	.	.	2a	2m	.	.	.	.	.	II	.	.	.	.	.
Atriplex prostrata	.	.	.	.	.	.	.	.	2b	.	r	.	II	.	.	.	.	.
Oenanthe silaifolia	.	.	.	.	.	1	4	.	.	.	.	.	II	.	.	.	.	.
Trifolium fragiferum	.	.	1	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Apium nodiflorum	.	.	1	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arthrocnemum macrostachyum	.	.	.	.	.	.	.	.	.	.	2m	.	I	.	.	.	+	I

Other species: *Cirsium creticum* 2a, *Calystegia sepium* 2m in 3; *Carex divisa* 5 in 6; *Hordeum murinum* subsp. *leporinum* and *Poa trivialis* subsp. *trivialis* 2a, *Alopecurus myosuroides* 2b, *Melica ciliata* subsp. *ciliata* 1 in 7; *Cyperus longus* 3, *Scirpoides holoschoenus* 2b, *Salix alba* 1 in 8; *Polypogon viridis* 4, *Lolium rigidum* subsp. *rigidum* 2m, *Rapistrum rugosum* and *Tamarix tetrandra* + in 9; *Matthiola tricuspidata* + in 10; *Suaeda splendens* 1 in 11; *Juncus acutus* 2a in 12; *Plantago crassifolia* + in 17.
Localities: 1-3, 8, 9,12, 14-17: Elos Sourpis; 5-7, 10: Atalanti wetland; 11; Spercheios River Delta.

where salt and fresh waters mix, but they can also grow successfully in shallow waters of lakesides, ditches and rivers.

Phragmites australis stands represent the *Phragmitetum communis* (Table 10). The stands of this association usually thrive in fresh water habitats, but its occurrence in coastal wetlands, (Babalonas 1979; Cassar & *al*., 2008; Făgăraş, 2008; Tinner & *al*., 2009), suggest that are well adapted to such environments as well. It is well known that *Phragmites australis*, the essential and many times the sole species of this community, develops equally well in costal salt marshes and in fresh water wetlands lying at higher elevation. In the wetlands of the study area the typical form of this community (Table 10, rels. 1-5) was detected in slightly brackish inland sites, where soil saturation or inundation was induced mainly by fresh water. At these sites, the community included pure and very species-poor stands in which *P. australis* was the sole constituent (Elos Sourpis, Atalanti wetland and Spercheios River Delta).

On plains closer to the sea and more or less affected by salt water, two rather more halophytic variants of the community were observed: one

Table 10
Phragmitetum communis Schmalle 1939 *typicum* (rels. 1-6), *elymetosum elongati* (rels. 7-17), *juncetosum subulati* (rels. 18-23)
(*Phragmition communis, Phragmitetalia, Phragmito-Magno-Caricetea*)

Plot size (m^2):	30	30	30	30	30		30	30	30	30	30	30	30	30	30	30		30	30	30	30	30	
Species number:	3	6	2	1	1		10	8	7	7	6	8	4	2	8	5		5	3	5	6	5	
Relevé N.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Characteristics																							
Phragmites australis	5	5	5	5	5	V	5	5	5	3	5	4	4	5	4	4	V	5	5	5	5	5	V
Lotus palustris s.l.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.
Bolboschoenus maritimus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	III
Differentials of subass.																							
Elymus elongatus	.	.	.	.	.	.	1	1	2m	5	3	3	5	4	5	5	V	.	.	.	.	.	.
Juncus subulatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2b	4	3	.	+	IV
Companions																							
Juncus acutus	.	.	.	.	.		+	.	1	.	.	.	.	.	.	1	I	.	.	.	.	.	.
Juncus heldreichianus	.	.	1	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex divisa	.	.	.	.	.	.	.	.	.	.	.	2a	1	.	.	.	I	.	.	.	.	.	.
Carex extensa	.	.	.	.	.	.	.	.	.	2b	.	2a	.	.	.	.	I	.	.	.	.	.	.
Tripolium pannonicum subsp. *tripolium*	.	.	.	.	.	.	2m	.	.	.	.	.	.	.	.	.	I	2m	.	.	.	.	I
Polypogon monspeliensis	.	.	.	.	.	.	+	.	.	2m	2b	1	.	.	.	.	II	.	.	.	.	.	.
Sarcocornia fruticosa	.	.	.	.	.	.	.	.	.	.	.	.	+	.	3	2b	II	.	.	.	.	.	.
Limonium gmelinii	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	I	1	.	.	.	.	I
Halimione portulacoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	I	.	.	.		.	.
Calystegia sepium	2b	2m	.	.	.	II	.	2m	.	.	1	.	.	.	.	.	I	.	.	.	2b	.	I
Rumex conglomeratus	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	I	.	1	.	.	1	II
Atriplex prostrata	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	I	1	.	.	.	.	I
Beta vulgaris subsp. *maritima*	.	1	.	.	.	I	.	1	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.
Cynanchum acutum	+	.	.	.	.	I	.	.	2m	.	.	.	.	.	.	.	I	.	.	.	.	.	.
Apium graveolens	.	.	.	.	.	.	.	.	.	1	2a	.	.	.	.	.	I	.	.	.	.	.	.
Lotus corniculatus	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	II	.	.	2m	.	.	I

Other species: *Cichorium intybus* 2m and *Daucus carota s.l.* + in 2; *Puccinellia festuciformis* + in 7; *Plantago lanceolata* 1, *Rumex patientia* + in 8; *Limbarda crithmoides* 1 in 9; *Puccinellia distans* subsp. *distans* + in 10; *Juncus gerardi* subsp. *gerardi* and *Carex hispida* 2b in 12; *Sonchus bulbosus* and *Limonium sp*. 2a, *Parapholis filiformis* 2b, *Centaurium tenuiflorum* r in 15; *Oenanthe silaifolia* + in 19; *Veronica anagalloides* 2m in 20; *Parentucellia viscosa* 2m, *Galium spurium, Vicia villosa* subsp. *villosa* 1 in 21; *Melilotus segetalis* 1 in 22.
Localities: 1, 12 and 20: Elos Sourpis; 2, 7-11 and 18: Spercheios River Delta; 3-5, 19 and 21-22: Atalanti wetland; 13-16: Oropos wetland area.

with *Elymus elongatus* subsp. *ponticus* (Table 10, rels. 7-16) and the other with *Juncus subulatus* (Table 10, rels.18-22). Each variant was characterised by the constant presence of the corresponding differential species, and we propose that both should be considered as sub-units within the *Phragmitetum communis*.

Schoenoplectetum tabernaemontani (Table 9) was the most restrict element of reed-bed vegetation found in the area as its stands of *Scirpus lacustris subsp. tabernaemontani* and some locally prominent dominant species (*Typha domingensis* and *Bolboschoenus maritimus*) were encountered in Elos Sourpis solely. Irimia & Danu (2010) reported similar plant community from Vaslui river basin, Romania. According to literature (Făgăraş, 2007; Lastrucci & *al*., 2010) communities dominated by *Scirpus lacustris subsp. tabernae-*

montani thrive both on brackish and freshwater habitats.

Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation (habitat code: 3150)

In the upland border of the wetland Elos Sourpis fresh water springs and shallow depressions fill up with standing water, providing ideal conditions to support a community consisting of *Potamogeton pectinatus* and *Myriophyllum spicatum* (Table 9). At the height of the growing season an increase in biomass induces a spectacular development of species that cover large areas. Communities of similar structure are reported in the literature either as the *Myriophyllo-Potametum* (POLIĆ & *al*., 2008) or more frequently as the *Po-*

Table 11
Synoptic table of species constancy of studied plant communities
Salsolo kali-Cakiletum maritimae (1)
Eryngio-Sporoboletum virginici (2)
Aeluropus littoralis comm. (3), *Matthiola tricuspidata-Anthemis tomentosa* comm. (4)
Spergularia salina-Salicornia europaea (5), *Spergularia salina-Suaeda splendens* comm. (6)
Arthrocnemum macrostachyum comm. (7), *Sarcocornia fruticosa-Halocnemum strobilaceum* comm. (8), *Limonium virgatum* comm. (9), *Limonium gmelinii* comm. (10), *Sarcocornia perennis-Halimione portulacoides* comm. (11).
Quotation used (combination of the constancy class value and cover-abundance degree -amplitude- of species) are according with WESTHOFF & VAN DER MAAREL (1980).

N. relevés:	4	8	10	6	6	3	6	5	3	2	22
Average N. species:	5	7	7	8	8	6	6	6	6	6	4
Association N.	1	2	3	4	5	6	7	8	9	10	11
Characteristics of *Salsolo kali-Cakiletum maritimae*											
Salsola kali	II^{2m}	.	.	.	.	.	.	.	.	.	.
Cakile maritima	IV^{1-2a}	II^{r-2m}	I^{+-1}	.	.	.	.	.	.	.	.
Characteristics of *Eryngio-Sporoboletum virginici*.											
Elytrigia juncea	.	V^{r-5}	.	.	.	.	.	.	.	.	.
Eryngium maritimum	.	IV^{r-4}	.	I^{2b}	.	.	.	.	.	.	.
Aeluropus littoralis comm.						.	.	.	.	.	
Aeluropus littoralis	.	.	V^{2b-5}	II^{1-2m}	I^{2a}	.	.	.	.	.	I^{1}
Characteristics of Matthiola *tricuspidata-Anthemis tomentosa* comm.											
Matthiola tricuspidata	II^{3}	IV^{+-2m}	$IIIr^{-2m}$	V^{+-3}	.	.	.	.	.	.	I^{r}
Anthemis tomentosa	.	III^{+-5}	IV^{1-4}	V^{+-3}	.	.	.	.	.	.	.
Characteristics of *Spergularia salina-Salicornia europaea* comm.											
Salicornia europaea agg.	.	.	Ir	.	V^{1-4}	.	.	.	.	.	.
Spergularia salina	.	I^{2m}	.	.	V^{r-5}	V^{2m-5}	.	III^{+-2b}	.	.	.
Characteristics of *Spergularia salina-Suaeda splendens* comm.											
Suaeda splendens	.	.	.	.	I^{2a}	V^{1-5}	.	.	.	.	.
Arthrocnemum macrostachyum comm.											
Arthrocnemum macrostachyum	.	.	.	.	.	.	V^{2a-5}	.	.	.	.
Characteristics of *Sarcocornia fruticosa-Halocnemum strobilaceum* comm.											
Sarcocornia fruticosa	.	.	.	.	.	.	II^{4}	V^{3-4}	.	.	.
Halocnemum strobilaceum	.	.	.	.	.	.	I^{5}	IV^{2b-4}	.	.	.
Limonium virgatum comm.											
Limonium virgatum	.	.	.	.	.	.	.	.	V^{4}	.	I^{1}
Limonium gmelinii comm.											
Limonium gmelinii	.	.	.	.	.	.	.	.	.	V^{5}	I^{r-1}
Characteristics of *Sarcocornia perennis-Halimione portulacoides* comm.											
Sarcocornia perennis	.	.	.	.	.	.	.	.	.	V^{2b-2m}	V^{2a-5}
Halimione portulacoides	.	II^{2a-2m}	.	.	III^{+-2a}	.	V^{1-4}	I^{5}	V^{1-4}	V^{1-2m}	IV^{+-5}

Association N.	1	2	3	4	5	6	7	8	9	10	11
Characteristics of *Phragmito-Magno-Caricetea*											
Phragmites australis	I^{2a}	.	.	.	I^{+}	.	.	.	.	.	I^{r}
Bolboschoenus maritimus	.	.	.	.	I^{2m}	.	.	.	.	.	I^{2m}
Characteristics of *Salicornietea fruticosae*											
Limonium bellidifolium	II^{4}	I^{r}	.	.	.	.	III^{+-3}	.	.	.	I^{r-4}
Puccinelia festuciformis	.	.	.	.	.	II^{2m}	I^{3}	.	II^{1}	III^{+}	IV^{+-5}
Limonium narbonense	.	.	.	.	I^{r}	.	.	.	II^{2b}	.	II^{r-4}
Limbarda crithmoides	.	.	.	.	.	.	.	.	V^{r-2a}	.	I^{1}
Characteristics of *Stellarietea mediae*											
Melilotus indicus	.	.	II^{r-2m}	.	II^{+-1}	.	II^{r-+}	II^{2a}	II^{+}	.	.
Avena barbata	II^{+}	.	I^{+}	I^{r}	.	.	.	.	.	.	.
Lolium rigidum	.	I^{2m}	I^{5}	.	.	.	I^{3}	I^{2m}	.	.	.
Anisantha matridensis subsp. *delilei*	.	.	.	I^{+}	.	.	.	.	.	.	.
Hordeum murinum subsp. *leporinum*	.	I^{2m}	.	I^{r-+}	.	.	.	.	.	.	.
Anisantha rubens	.	II^{1-2a}	.	.	.	.	.	.	.	.	.
Linaria micrantha	.	.	I^{+}	.	.	.	.	.	.	.	.
Phalaris minor	.	.	I^{r-1}	.	.	.	I^{2m}	.	.	.	.
Rostraria cristata	.	.	I^{+-2a}	.	.	.	.	.	.	.	.
Papaver rhoeas	.	.	I^{2a}	.	.	.	.	.	.	.	.
Characteristics of *Ammophiletea*											
Lotus cytisoides	III^{1-2b}	.	I^{+}	I^{2b}	.	.	.	.	.	.	.
Euphorbia parallias	.	III^{r-4}	.	.	.	.	.	.	.	.	.
Sporobolus virginicus	.	III^{2a-4}	.	.	.	.	.	.	.	.	.
Medicago marina	.	I^{3}	I^{+}	.	.	.	.	.	.	.	.
Calystegia soldanella	.	.	I^{1}	.	.	.	.	.	.	.	.
Characteristics of *Saginetea maritimae*											
Parapholis incurva	II^{r}	IV^{+-3}	I^{4}	I^{2b}	III^{1-3}	II^{1}	.	IV^{2a-2m}	.	.	I^{2a}
Plantago coronopus subsp. *coronopus*	.	.	I^{2m}	I^{r}	III^{2b-3}	.	I^{3}	I^{2a}	.	.	I^{3}
Polypogon monspeliensis	II^{r}	I^{r}	.	.	II^{r-1}	V^{+-2m}	.	.	.	.	I^{1}
Centaurium tenuiflorum	.	.	.	.	I^{2b}	.	.	I1	II^{2b}	.	I^{+}
Hordeum marinum	.	.	I^{2m}	.	V^{1-3}	III^{1}	.	.	.	.	.
Sphenopus divaricatus	.	.	.	.	.	.	.	III^{+-2a}	.	.	.
Parapholis filiformis	.	.	I^{3}	.	.	.	.	.	.	.	.
Parapholis marginata	.	.	.	.	.	.	.	.	II^{2m}	.	.
Polypogon maritimus	.	.	.	.	I^{1}	.	.	.	II^{+}	.	.
Characteristics of *Thero-Brachypodietea*											
Lagurus ovatus	II^{2b}	II^{r-+}	II^{2b-2m}	III^{r-1}	.	.	.	.	.	.	.
Medicago littoralis	.	I^{2m}	.	V^{2b-4}	.	.	.	.	.	.	.
Silene colorata	.	.	I^{2a}	V^{1-4}	.	.	.	.	.	.	.
Plantago lagopus	.	.	.	IV^{2b-4}	.	.	.	.	.	.	.
Echium arenarium	.	.	.	IV^{+-2m}	.	.	.	.	.	.	.
Trifolium scabrum	.	.	.	II^{1}	.	.	.	.	.	.	.
Vulpia fasciculata	.	.	.	I^{2b}	.	.	.	.	.	.	.
Characteristics of *Crithmo-Staticetea*											
Crithmum maritimum	III^{2m-4}	.	.	.	.	.	.	.	.	.	.
Capparis spinosa	II^{3}	.	.	.	.	.	.	.	.	.	.
Limonium graecum	.	I^{r}		.	.	.	.	.	.	.	.
Characteristics of *Juncetea maritimi*											
Elymus elongatus	.	.	.	.	.	.	.	.	III^{r}	III^{+}	.
Puccinelia distans subsp. *distans*	.	.	.	.	III^{2a-3}	III^{2m}	.	.	.	.	.
Tripolium pannonicum subsp. *tripolium*	.	.	.	.	I^{r}	II^{+}	.	.	.	.	I^{2m}
Triglochin bulbosa subsp. *barrelieri*	.	.	.	.	.	.	I^{1}	I^{2a}	.	.	I4
Juncus subulatus	.	.	.	.	.	.	.	.	.	.	I^{+-2b}
Juncus heldreichianus	.	.	.	.	.	.	.	.	.	.	I^{2a-3}

Association N.	1	2	3	4	5	6	7	8	9	10	11
Juncus maritimus	.	.	.	.	.	.	I^3	.	.	.	I^4
Juncus acutus	.	I^r	.	.		.		.	.	.	I^{r-+}
Carex divisa	.	.	.	.	I^1	.	.	.	.	.	.
Characteristics of *Isoeto-NanoJuncetea*											
Juncus bufonius	.	.	.	.	III^4	II^{2b}	.	.	.	.	.
Juncus hybridus	.	.	.	.	I^4	.	.	.	.	.	.
Companion species											
Atriplex prostrata	II^1	.	.	.	.	.	.	.	.	.	.
Cynodon dactylon	II^1	.	.	.	.	.	.	.	.	.	.
Melilotus segetalis	.	I^{2m}	.	.	.	.	.	.	.	.	.
Brassica geniculata	II^{2a}	.	.	.	.	.	.	.	.	.	.
Limonium sp.	.	.	I^{2b}	.	.	.	.	.	.	.	.
Polygonum arenarium	.	.	I^{2a}	.	.	.	.	.	.	.	.
Polycarpon tetraphyllum	.	.	I^{2m}	I^+	.	.	.	.	.	.	.
Phalaris paradoxa	.	.	I^{2a}	.	.	.	.	.	.	.	.
Puccinellia sp.	.	.	I^3	.	.	.	.	.	.	.	.
Euphorbia sp.	.	.	.	.	.	II^{2b}	.	.	.	.	.
Bupleurum tenuissimum	.	.	.	.	I^1	.	.	.	.	.	.
Medicago polymorpha	.	.	.	.	I^+	.	.	.	.	.	.
Medicago scutellata	.	.	.	.	.	.	I^{2b}	.	.	.	.
Avena sterilis subsp. *ludoviciana*	.	.	.	.	.	.	I^3	I^+	.	.	.
Galium spurium	.	.	.	.	.	.	.	.	.	.	.
Piptatherum miliaceum	.	.	.	.	.	.	I^{2a}	.	.	.	.
Lolium multiflorum	.	.	.	.	.	.	I^{2m}	.	.	.	.
Sonchus oleraceus	.	.	.	.	.	.	II^{+-1}	.	.	.	.

Other taxa: *Silene sedoides* and *Parietaria cretica* II^r and *Reichardia picroides* III^{+-1} in 1; *Atriplex prostrata* I^+ and *Xanthium strumarium* I^r in 2; *Cynodon dactylon, Cynanchum acutum* and *Atriplex tatarica* I^1, *Bromus scoparius* and *Limonium narbonense* I^r, *Cynosurus echinatus, Anisantha diandra, Arenaria leptoclados* and *Hymenolobus procumbens* I^+ in 3.

Procedence of releves: 1: Table 2, rels. 1-5; 2: Table 2, rels. 5-14; 3: Table 3, rels.1-10; 4: Table 3, rels. 12-17; 5: Table 4, rels. 1-6; 6: Table 4, rels. 8-10; 7: Table 5, rels. 1-6; 8: Table 5, rels. 8-12; 9: Table 5, rels. 14-16; 10: Table 5, rels. 18-19; 11: Table 6, rels. 1-22

tamo pectinati-Myriophylletum spicati (MOLINA & SARDINERO, 1998; NINOT & *al*., 2000; IMERI & *al*., 2010). Both species are very phenoplastic. They usually occur in inland freshwaters, but can grow equally well in slightly brackish water where the salinity does not exceed 6‰ (VAN WIJK & *al*., 1988; VAN WIJCK & *al*., 1994). The mechanisms by which supra-optimal salinity affects the distribution of higher plants that occur mainly in freshwater are not known, but as SCULTHORPE (1967) pointed out, they are probably varied and complex. As was demonstrated by VAN WIJK & *al*. (1988) species with a wide ecological range, such as *P. pectinatus* and *M. spicatum*, develop into genetically different populations that are adapted to local habitat characteristics.

Thermo-Mediterranean riparian galleries (habitat code:92D0)

Tamarix scrub was encountered in the wetland Elos Sourpis. During our visits to the area no flowering individuals of the dominant tamarisk shrubs were found and no precise identification into species was possible. Thus, the exact syntaxonomical position of this type of vegetation is difficult to define. However the general floristic composition of stands allows their classification within the *Nerio-Tamaricetea*. Many taxa such as *Bromus hordeaceus* subsp. *hordeaceus, Hordeum leporinum, Hordeum geniculatum, Torilis nodosa, Poa trivialis* subsp. *trivialis, Cynosurus echinatus* and *Halimione portulacoides* were constantly associated with these phytocoenoses,

which formed vigorous thickets in the southern part of the wetland towards its upland borders.

The halophytic vegetation found in the areas of study is highly diverse, as shown by the presence of 21 different vegetation types assigned to 12 alliances, 10 orders and 8 phytosociological classes (see syntaxonomomical scheme). The vegetation units are presented in two synoptic tables of species constancy, in which the number of relevés and the average number of species of each plant community are given (Tables 11, 12). Species diversity of the vegetation units identified is rather diminished, as their average numbers of species did not exceed 8.6 taxa. Species poorness is a common feature of many similar vegetation units, both within Greece (LAVRENTIADES, 1964; WOLFF, 1968; BABALONAS, 1979) and in geographically more distant areas (ALCARAZ & *al*., 1986; FILIGHEDDU & *al*., 2000; FRONDONI & IBERITE, 2002; BIONDI & *al*., 2004; KALIGARIČ & ŠKORNIK, 2007; MARTIS & SERRI, 2009).

The most diverse identified plant communities on the basis of their complexity (expressed as species diversity) were the following: *Matthiola tricuspidata-Anthemis tomentosa* community (average number of species 8.6), *Spergularia salina-Salicornia europaea* community (average number of species 8.1), *Carex divisa-Carex acuta* community (average number of species 8), *Eryngio-Sporoboletum virginici* (average number of species 7.5) and *Aeluropus littoralis* community (average number of species 7.2).

Table 12

Synoptic table of species constancy of studied plant communities
Juncus subulatus comm. (1), *Juncus heldreichianus* comm. (2), *Juncetum maritimo-acuti* (3), *Carex divisa-Carex distans* comm. (4), *Phragmitetum communis typicum* (5a), *elymetosum elongati* (5b), *juncetosum subulati* (5c), *Bolboschoenetum maritime* (6), *Schoenoplectetum tabernaemontani* (7) *Potamogeton pectinatus-Myriophyllum spicatum* comm. (8)
Quotation used (combination of the constancy class value and cover-abundance degree -amplitude- of species) are according with WESTHOFF & VAN DER MAAREL (1980).

N. relevés:	6	7	13	3	8	10	5	8	3	4
Average N. species:	4	6	6	8	4	6	5	5	6	3
Association N.	1	2	3	4	5a	5b	5c	6	7	8
Characteristics of *Juncus subulatus* comm.										
Juncus subulatus	V^{5}	.	I^{2b-3}	.	.	.	IV^{+-4}	II^{3}	.	.
Characteristics of *Juncus heldreichianus* comm.										
Juncus heldreichianus	.	V^{4-5}	I^{r}	.	I^{1}	.	.	I^{4}	II^{2b}	.
Juncetum maritimo-acuti										
Juncus maritimus	.	III^{2m-3}	IV^{2b-5}	.	.	.	.	I^{3}	II^{3}	.
Juncus acutus	I^{+}	I^{2a}	III^{2b-4}	.	.	I^{+-1}	.	I^{2a}	.	.
Characteristics of *Carex divisa-Carex distans* comm.										
Carex divisa	.	I^{3}	.	V^{3-5}	.	I^{1-2a}	.	I^{5}	.	.
Carex distans	.	I^{r}	I^{r}	IV^{2a-4}	.	.	.	.	.	.
Characteristics of *Phragmitetum communis*										
Phragmites australis	I^{1}	II^{1}	II^{+-2m}	.	V^{5}	V^{4-5}	V^{5}	III^{+-1}	V^{5}	.
Bolboschoenetum maritimi										
Bolboschoenus maritimus	II^{2b-3}	.	I^{1}	.		.	III^{1}	V^{3-5}	II^{2a}	.
Characteristics of *Schoenoplectetum tabernaemontani*										
Scirpus lacustris subsp. *tabernaemontani*	.	.	.	.		.	.	.	V^{2a-3}	.
Characteristics of *Potamogeton pectinatus-Myriophylleum spicatum* comm.										
Myriophyllum spicatum	.	.	.	.	.	.	.	.	.	V^{1-5} V^{2m-5}
Potamogeton pectinatus	.	.	.	.	.	.	.	.	.	
Characteristics of *Salicornietea fruticosae*										
Limonium bellidifolium	I^{+}	II^{+-2m}	I^{+-2a}	.	.	.	.	.	.	.
Puccinelia festuciformis	II^{2a-2b}	.	I^{r-1}	.	.	I^{+}	.	.	.	.

Association N.	1	2	3	4	5a	5b	5c	6	7	8
Limonium narbonense	I2[a]	I[r-+]	.	.	.	.	.	.	.	.
Limbarda crithmoides	.	.	.	.	.	I[1]	.	.	.	.
Arthrocnemum macrostachyum	.	.	I2b-4	.	.	.	.	I[2m]	.	I[+]
Sarcocornia fruticosa	.	.	I[1-2b]	.	.	II[+-3]	.	.	.	.
Limonium gmelinii	.	.	I[+]	.	.	I[+]	I[1]	.	.	.
Sarcocornia perennis	II[2m]	I[+]	II[+-2m]	II[+]	.	.	.	.	.	.
Halimione portulacoides	II[2b]	I[1]	II[+-2a]	.	.	I[1]	.	.	.	.
Characteristics of *Stellarietea mediae*										
Lolium rigidum	.	.	.	.	.	.	.	I[2m]	.	.
Torilis nodosa	.	I[r-1]	I[+]	.	.	.	.	.	.	.
Hordeum murinum subsp. *leporinum*	.	.	.	IV[3]	.	.	.	I[2a]	.	.
Rostraria cristata	.	I[1]	.	.	.	.	.	.	.	.
Geranium dissectum	.	.	I[r-1]	.	.	.	.	.	.	.
Vicia sativa subsp. *nigra*	.	.	I[r-1]	.	.	.	.	.	.	.
Characteristics of *Juncetea maritimi*										
Elymus elongatus	.	III[2a-4]	II[1-5]	.	.	V[1-5]	.	.	.	.
Puccinelia distans subsp. *distans*	I[4]	I[1]	.	.	.	I[+]	.	.	.	.
Tripolium pannonicum subsp. *tripolium*	I[1]	.	I[+-1]	.	.	I[2m]	I[2m]	.	.	.
Triglochin bulbosa subsp. *barrelieri*	.	.	I[3]	II[2m]	.	.	.	.	.	.
Juncus littoralis	I[+]	.	.	.	.	.	.	.	.	.
Elytrigia scirpea	.	.	I[4]	.	.	.	.	.	.	.
Juncus gerardi	.	I[2b]	.	.	.	I[2b]	.	.		.
Plantago crassifolia	.	I[+]	.	.	.	.	.	.	.	I[+]
Carex extensa	.	I[2m]	.	.	.	I[2a-2b]	.	.	.	.
Carex hispida	.	.	.	.	.	I[2b]	.	.	.	.
Characteristics of *Saginetea maritimae*										
Polypogon monspeliensis	.	.	I[+-1]	II[2a]		II[1-2m]	.	II[1-2b]	II[2m-2b]	.
Centaurium tenuiflorum	.	I[+]	I[1]	.	.	Ir	.	.	.	.
Hordeum marinum	I[+]	.	.	.	.	.	.	.	.	.
Parapholis incurva	I[2b]	.	.	.	.	.	.	.	.	.
Parapholis filiformis	.	.	I[4]	.	.	I[2a]	.	.	.	.
Spergularia salina	.	.	.	.		.	.	I[+]	II[1]	.
Parentucellia viscosa	.	.	.	.	.	.	I[2m]	.	.	.
Characteristics of *Molinio-Arrhenatheretea*										
Lotus corniculatus	.	I[+]	I[2a]	IV[1-2m]	.	I[+-1]	I[2m]	.	.	.
Oenanthe silaifolia	I[2m]	.	.	IV[2m]	.	.	I[+]	II[1-4]	.	.
Daucus carota	.	.	I[+]	II[+]	I[+]	.	.	.	.	.
Bromus hordeaceus subsp. *hordeaceus*	.	.	I[2m]	.	.	.	.	.	.	.
Juncus inflexus	.	.	.	II[1]	.	.	.	.	.	.
Pulicaria dysenterica	.	.	.	II[r]	.	.	.	.	.	.
Hordeum geniculatum	.	.	.	II[3]	.	.	.	.	.	.
Poa trivialis subsp. *trivialis*	.	.	.	.	.	.	.	I[2a]	.	.
Characteristics of *Isoeto-Nano-Juncetea*										
Juncus articulatus	.	.	.	II[1]	.	.	.	.	.	.
Juncus bufonius	.	.	I[2a]	.	.	.	.	.	.	.
Juncus hybridus	.	.	.	II[1]	.	.	.	.	.	.
Samolus valerandi	.	.	.	.		.	.	.	II[+]	.
Characteristics of *Phragmito-Magno-Caricetea*										
Calystegia sepium	.	.	.	.	II[2b-2m]	I[1-2m]	I[2b]	.	II[2m]	
Typha domingensis	.	.	.	.		.	.	II[3]	II[2a]	.
Lotus palustris s.l.	.	.	I[1]	.	.	I[+]	.	.	.	.
Companions									.	
Rumex conglomeratus	I[1]	.	.	.	.	I[1]	II[1]	II[2a-2m]	.	.
Atriplex prostrata	.	.	.	.	.	I[r]	I[1]	II[r-2b]	.	.

Association N.	1	2	3	4	5a	5b	5c	6	7	8
Melilotus segetalis	I^{+}	.	.	.	.	.	I^{1}	.	.	.
Elytrigia juncea	.	I^{2m}	I^{2b}	.	.	.	.	.	.	.
Melilotus indicus	.	.	I^{1}	II^{2m}	.	.	.	.	.	.
Cirsium creticum	.	.	.	.	I^{2b}	I^{2m}	.	.	II^{2a}	.
Limonium graecum	.	.	II^{+-3}	.	.	.	.	.	.	.
Limonium sinuatum	.	.	I^{+-1}	.	.	.	.	.	.	.
Anagallis arvensis	.	.	I^{1}	.	.	.	.	.	.	.
Ornithogalum sp.	.	.	I^{+}	.	.	.	.	.	.	.
Galium aparine	.	.	I^{1}	.	.	.	.	.	.	.
Picris sp.	.	.	I^{1}	.	.	.	.	.	.	.
Taraxacum sp.	.	.	I^{1}	.	.	.	.	.	.	.
Ophrys fusca	.	.	I^{r}	.	.	.	.	.	.	.
Dittrichia viscosa	.	I^{r}	I^{3}	.	.	.	.	.	.	.
Rumex patientia	.	.	.	.	.	I^{+}	.	.	.	.
Cyperus laevigatus subsp. *distachyos*	.	I^{2b}	.	.	.	.	.	.	.	.
Daucus guttatus	.	I^{1}	.	.	.	.	.	.	.	.
Melica ciliata subsp. *ciliata*	.	II^{+}	.	.	.	.	.	I^{1}	.	.
Hordeum bulbosum	.	I^{r}	.	.	.	.	.	.	.	.
Monerma cylindrica	.	.	.	II^{r}	.	.	.	.	.	.
Marrubium peregrinum	.	.	.	r^{-+}	.	.	.	.	.	.
Cynanchum acutum	.	I^{+}	.	.	I^{+}	I^{2m}	.	.	.	.

Other species: *Cichorium intybus* I^{2m} in 4; *Plantago lanceolata, Beta vulgaris* subsp. *maritima, Apium graveolens, Limonium* sp. and *Sonchus bulbosus* I^{1} in 6; *Vicia villosa* I^{1}, *Galium spurium* and *Veronica anagalloides* I^{2m} in 7; *Matthiola tricuspidata* and *Tamarix tetrandra* I^{+}, *Suaeda splendens* and *Salix alba* I^{1}, *Cyperus longus* I^{3}, *Polypogon viridis* and *Rapistrum rugosum* I^{4}, *Scirpoides holoschoenus* and *Alopecurus myosuroides* I^{2b} in 8; *Apium nodiflorum* and *Trifolium fragiferum* II^{1} in 9.

Procedence of releves: 1: Table 8, rels.1-6; 2: Table 8, rels. 8-14; 3: Table 7, rels. 1-13; 4; Table 7, 15-17; 5a: Table 10, rels. 1-5; 5b: Table 10, rels. 7-16; 5c: Table 10, rels. 18-22; 6: Table 9, rels. 5-12; 7: Table 9, rels. 1-3; 8: Table 9, rels. 14-17.

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SYNTAXONOMICAL SCHEME OF THE STUDIED VEGETATION UNITS

Cakiletea maritimae Tx. et Preising ex Br.-Bl. et Tx. 1952
Euphorbietalia peplis Tx. ex. Oberd. 1949
Euphorbion peplis Tx. ex. Oberd. 1952
Salsolo kali-Cakiletum maritimae Costa et Mansanet 1981 corr. Rivas-Martinez, Costa & Loidi 1992

Ammophiletea Br.-Bl. et Tx. ex Westhoff et al. 1946
Ammophiletalia Br.-Bl. 1933
Agropyrion juncei Pignatti 1953
Eryngio-Sporoboletum virginici Géhu et Uslu 1989

Thero-Brachypodietea Br.-Bl. ex A. de Bolòs y Vayreda 1950
Cutandietalia maritimae Rivas-Martinez, Díez-Garretas & Asensi in Rivas-Martinez et al. 2002
Alkanno tinctoriae-Maresion nanae Rivas Goday ex Rivas Goday & Rivas-Martinez 1963 corr. Díez-Garretas, Asensi & Rivas-Martinez 2001
Matthiola tricuspidata-Anthemis tomentosa community
Aeluropus littoralis community

Thero-Salicornietea (S. Pignatti 1953) R. Tx. in R. Tx. et Oberd. 1958
Thero-Salicornietalia Tüxen in Tüxen & Oberdorfer ex Géhu & Géhu-Franck 1984
Salicornion europaeo-ramosissimae Géhu & Géhu-Franck 1984
Spergularia salina-Salicornia europaea community
Thero-Suaedion Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
Suaeda splendens-Spergularia salina community

Salicornietea fructicosae Br.-Bl. et R. Tx. ex A. et O. de Bolòs 1950
Salicornietalia fruticosae Br.-Bl. 1933
Arthrocnemion perennis Rivas-Martínez in Rivas-Martinez & Costa 1984
Sarcocornia perennis-Halimione portulacoides community
Arthrocnemion glauci Rivas-Martínez & Costa 1984
Arthrocnemum macrostachyum community
Salicornion fruticosae Br.-Bl. 1933
Sarcocornia fruticosa-Halocnemum strobilaceum community
Limonietalia Br.-Bl. & O. de Bolòs 1958
Limonium gmelinii community
Limonium virgatum community

Juncetea maritimi R. Tx. et Oberd. 1958
Juncetalia maritimi Br.-Bl. ex Horvatić 1934
Juncion maritimi Br.-Bl. ex Horvatić 1934
Juncetum maritimo-acuti Horvatić 1934
Juncus subulatus community
Juncus heldreichianus community
Carex divisa-Carex distans community

Phragmito-magno-caricetea Klika in Klika et Novák 1941
Phragmitetalia W. Koch 1926
Phragmition communis W. Koch 1926
Phragmitetum communis Schmale 1939 typicum

Phragmitetum communis Schmale 1939 elymetosum elongati
Phragmitetum communis Schmale 1939 juncetosum subulati
Bolboschoenetalia maritimi Hejný in Holub et al. 1964
Cirsio brachycephali-Bolboschoenion (Passarge 1978) Mucina in Bal.-Tul. et al. 1993
Bolboschoenetum maritimi Eggler 1933
Schoenoplectetum tabernaemontani Soó 1947

Potametea Klika in Klika & Novák 1941
Potametalia Koch 1926
Potamion (Koch 1926) Libbert 1931
Potamogeton pectinatus-Myriophyllum spicatum community

Nerio-tamaricetea Br.-Bl. et O. de Bolós 1958

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APPENDIX 1

List of taxa found in the investigated coastal regions. Abbreviations are: Sp (Spercheios River Delta), Sr (Elos Sourpis), At (Atalanti wetland), and Or (Oropos wetlands).

	Life form	Chorological type	Distibution
Pteridophyta			
Equisetaceae			
Equisetum arvense L.	G rhiz	Circumbor	Sp
Angiospermae Dicotyledones			
Apocynaceae			
Nerium oleander L.	P caesp	S-Steno-Medit	Sp
Asclepiadaceae			
Cynanchum acutum L.	P lian	Paleosubtrop	Sp, Sr
Boraginaceae			
Echium arenarium Guss.	H bienn	Steno-Medit	Or
Capparaceae			
Capparis spinosa L. subsp. *spinosa*	NP	Eurasiat (Subtrop)	
Caryophyllaceae			
Arenaria leptoclados (Reichenb.) Guss.	T scap	Paleotemp	Sp, Or
Bolanthus thymifolius (Sm.) Phitos	Ch suffr	Endem	Sp
Petrorhagia dubia (Rafin.) G. López & Romo	T scap	S-Medit	Sp
Cerastium glomeratum Thuill	T scap	Euro-Medit	Or
Polycarpon tetraphyllum (L.) L.	T scap	Euro-Medit	Sp, Or
Silene colorata Poiret	T scap	Steno-Medit	Sp, Or
Silene fabaria (L.) Sm. subsp. fabaria	H scap	E-Medit	Sr
Silene sedoides Poiret	T scap	Steno-Medit	At
Spergularia salina J. Presl & C. Presl	T scap	Subcosmop	Sp, Sr, At, Or
Stellaria media (L.) Vill.	T rept	Cosmop	Or
Chenopodiaceae			
Arthrocnemum macrostachyum (Moric.) K. Koch	Ch succH	Medit.- Macar	Sp, Or
Atriplex prostrata Bouch. ex DC.	T scap	Circumbor	Sp, At
Atriplex tatarica L.	T scap	Centroas.-Euro-Medit	Sp
Beta vulgaris subsp. *maritima* (L.) Arcang.	H scap	Euro-Medit	Sp
Halimione portulacoides L.	Ch frut	Circumbor	Sp, Sr, At, Or
Halocnemum strobilaceum (Pallas) M. Bieb.	Ch succ	S-Medit	Sp, Or
Salicornia europaea L.	T scap	W-Europ.	Sp, Sr, At
Salsola kali L.	T scap	Paleotemp	Sp
Salsola soda L.	T scap	Paleotemp	Or
Sarcocornia fruticosa (L.) A. J. Scott	Ch succ	Euro-Medit	Or
Sarcocornia perennis (Miller) A. J. Scott	Ch succ	Euro-Medit	Sp, Sr, At, Or
Suaeda splendens (Pourret) Gren. & Gordon	T scap	Centroas.-N-Medit	Sp
Suaeda maritima (L) Dumort.	T scap	Cosmop	Sp, Sr, Or
Compositae			
Anacyclus clavatus (Desf.) Pers.	T scap	Steno-Medit	Or
Anthemis tomentosa L.	T scap	NE-Medit	Sp, Sr, At, Or
Artemisia sp.			Sr
Atractylis cancellata L.	T scap	S-Medit	Sp
Calendula arvensis (Vaill.) L.	T scap	Euro-Medit	Or
Cichorium intibus L.	H scap	Cosmop	Sp
Cirsium creticum (Lam.) D'Urv. subsp. *creticum*	H bienn	NE-Medit	Sp, Sr
Cota tinctoria (L.) Gay	H bienn	Centro-Europ.-Pontica	Sp
Crepis setosa Haller fil.	T scap	Euro-Medit.-Orient	Sr

	Life form	Chorological type	Distibution
Dittrichia viscosa (L.) Greuter	H scap	Euro-Medit	At
Hypochoeris achyrophorus L.	T scap	Steno-Medit	Sp
Limbarda crithmoides (L.) Dumort.	Ch suffr	SW-Europ.	Sp, Sr
Pulicaria dysenterica (L.) Bernh.	H scap	Euro-Medit	At
Reichardia picroides (L.) Roth	H scap	Steno-Medit	At
Rhagadiolus stellatus (L.) Gaertn.	T scap	Euro-Medit	Sr
Sonchus bulbosus (L.) N. Kilian & Greuter	G bulb	Steno-Medit	Or
Sonchus oleraceus L.	T scap	Eurasiat	Or
Tragopogon dubius Scop.	H bienn	S-Europ.-Caucas	Sr
Trifolium pannonicum subsp. tripolium (L.) Greuter	H bienn	Eurasiat	Sp, Sr
Xanthium strumarium L.	T scap	Cosmop	Sp
Convolvulaceae			
Calystegia sepium (L.) R. Br.	H scand	Paleotemp	Sp, Sr
Calystegia soldanella (L.) Roemer & Schultes	G rhiz	Cosmop	Sp
Cruciferae			
Brassica geniculata (Desf.) Snogerup & B. Snogerup	H scap	Medit.-Macar	Sp, At
Cakile maritima Scop.	T scap	Medit.-Atl	Sp, At, Or
Hymenolobus procumbens (L.) Nutt. subsp. *procumbens*	T scap	Subcosmop	Or
Lepidium draba l.	G rhiz	Medit.-Turan	Or
Malcolmia flexuosa (Sm.) Sm.	T scap	SE-Europ.	At
Matthiola tricuspidata (L.) R. Br.	T scap	Steno-Medit	Sp, At, Or
Rapistrum rugosum (L.) All.	T scap	Euro-Medit	Sp
Sinapis alba L. subsp. *alba*	T scap	E-Medit	Or
Euphorbiaceae			
Euphorbia helioscopia L.	T scap	Cosmop	Or
Euphorbia parallias L.	Ch frut	Euromedit.-Atl	Sp, At
Euphorbia peplis L.	T rept	Euro-Medit	Or
Fumariaceae			
Fumaria kraliki Jordan	T scap	S-Europ.-Sudsib	Or
Gentianaceae			
Centaurium spicatum (L.) Fritsch	T scap	Euro-Medit	Sr
Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch subsp. *tenuiflorum*	T scap	Paleotemp	Sp, Sr, Or
Geraniaceae			
Erodium ciconium (L.) L'Hér.	T scap	Euro-Medit.-Pontico	Or
Geranium molle subsp. *brutium* (Gasparr.) Graebner	H scap	NE-Medit	Or
Geranium dissectum L.	T scap	Subcosmop	Or
Geranium rotundifolium L.	T scap	Paleotemp	Sr
Haloracaceae			
Myriophyllum spicatum L.	Hyd	Subcosmop.-Temper	Sr
Labiatae			
Lycopus europaeus L.	H scap	Paleotemp	Sp
Marrubium peregrinum L	H scap	SE-Europ.	At
Satureja vulgaris subsp. *arundana* (Boiss.) Greuter & Burdet	H scap	Circumbor	Sp
Vitex agnus-castus L.	P caesp	Steno-Medit.-Turan	Sp
Leguminosae			
Lotus corniculatus L.	H scap	Paleotemp	Sr, At
Lotus cytisoides L.	Ch suffr	Steno-Medit	At, Or

	Life form	Chorological type	Distibution
Lotus palustris Willd.	H scap	Steno-Medit	Sp
Medicago arabica (L.) Hudson	T scap	Euro-Medit	Sr
Medicago littoralis Loisel	T scap	Euro-Medit	Sp, At Or
Medicago marina L.	Ch rept	Euro-Medit	At
Medicago polymorpha L.	T scap	Euro-Medit	Sr
Medicago scutellata (L.) Miller	T scap	Euro-Medit	Or
Melilotus indicus (L.) All.	T scap	Medit.-Turan	Sp, Sr, At, Or
Melilotus segetalis (Brot.) Ser.	T scap	S-Medit	At
Trifolium angustifolium L.	T scap	Euro-Medit	Sp
Trifolium campestre Schreber	T scap	W-Paleotemp	Sp
Trifolium fragiferum L.	H rept	Paleotemp	Sr
Trifolium ligusticum Loisel.	T scap	Steno-Medit	Or
Trifolium scabrum L.	T rept	Euro-Medit	Sp
Vicia sativa subsp. *nigra* (L.) Ehrh.	T scap	Medit.-Turan	Or
Vicia villosa Roth subsp. *villosa*	T scap	Euro-Medit	At
Linaceae			
Linum bienne Miller	H bienn	Euromedit.-Subatl	Sp
Orobanchaceae			
Parentucellia viscosa (L.) Caruel	T scap	Medit.-Atl	At
Papaveraceae			
Papaver rhoeas L.	T scap	E-Medit	Or
Plantaginaceae			
Linaria micrantha (Cav.) Hoffmanns & Link	T scap	Steno-Medit	Or
Plantago coronopus L. subsp. *coronopus*	H scap	Euro-Medit	Sp, Sr, At, Or
Plantago crassifolia Forsskål	H ros	Steno-Medit	Sr
Plantago lagopus L.	T scap	Steno-Medit	Or
Plantago lanceolata L.	H ros	Eurasiat	Sp
Veronica anagallis-aquatica L.	H scap	Cosmop	Sp
Veronica anagalloides Guss.	T scap	Euro-Medit	Sr
Platanaceae			
Platanus orientalis L.	P scap	SE-Europ.	Sp
Plumbaginaceae			
Limonium bellidifolium (Gouan) Dumort	H ros	Medit.-Turan	Sp, Sr, At, Or
Limonium graecum (Poiret) Rech. fil.	Ch suffr	Steno-Medit.-Centrooccid	Sp, Or
Limonium gmelinii (Willd.) O. Kuntze	H ros	Steno-Medit	Sp
Limonium narbonense Miller	H ros	Euro-Medit	Sr, At
Limonium sinuatum (L.) Miller	H scap	S-Medit	At
Limonium virgatum (Willd.) Fourr.	H ros	Euro-Medit	Sr
Polygonaceae			
Persicaria maculosa S.F. Gray	T scap	Subcosmop	Sp
Polygonum arenarium Waldst. & Kit.	T rept	SE-Europ.-Centroas	Sp
Rumex conglomeratus Murray	H scap	Eurasiat	Sp, At
Rumex patientia L.	H scap	E-Europ.-Turan	Sp
Primulaceae			
Anagallis arvensis L.	T rept	Euro-Medit	Or
Samolus valerandi L.	H scap	Subcosmop	Sr
Ranunculaceae			
Nigella damascena L.	T scap	Euro-Medit	Sr
Ranunculus muricatus L.	T scap	Euro-Medit	Or
Rubiaceae			
Galium aparine L.	T scap	Eurasiat	Or

	Life form	Chorological type	Distibution
Galium spurium L.	T scap	Eurasiat	At
Salicaceae			
Salix alba L.	P scap	Paleotemp	Sp
Salix fragilis L.	P caesp	Eurosib	Sp
Tamaricaceae			
Tamarix parviflora DC.	P caesp	E-Medit	Sp
Tamarix tetrandra Pallas ex M. Bieb.	P caesp	Medit.-Turan	Sp
Tamarix sp.	P caesp		Sr
Umbelliferae			
Apium graveolens L.	H scap	Paleotemp	Sr
Apium nodiflorum (L.) Lag.	H scap	Euro-Medit	Sr
Bupleurum tenuissimum L.	T scap	Euro-Medit	Sr
Crithmum maritimum L.	Ch suffr	Euro-Medit	Sp, At
Daucus carota L.	H bienn	Paleotemp	Sp, At
Daucus guttatus Sibth. & Sm.	T scap	E-Medit	Sp, Sr
Eryngium maritimum L.	G rhiz	Medit.-Atl	Sp, At
Malabaila aurea (Sibth. & Sm.) Boiss.	H scap	E-Steno-Medit	Sp
Oenanthe silaifolia M. Bieb.	H scap	Medit.-Atl	At
Smyrnium rotundifolium Miller	H bienn	S-Medit	At
Torilis nodosa (L.) Gaertner	T scap	Euro-Medit.-Turan	Sr, At, Or
Urticaceae			
Parietaria cretica L.	T rept	Steno-Medit.-Orient	At
Angiospermae - Monocotyledones			
Cyperaceae			
Bolboschoenus maritimus (L.) Palla	Hyd	Euro-Medit	Sp, Sr, At
Carex distans L.	H caesp	Euro-Medit	Sp, At
Carex divisa Hudson	G rhiz	Euro-Medit	Sr, At, Or
Carex extensa Good.	H caesp	Medit.-Atl	Sp, Sr
Carex hispida Willd.	G rhiz	Steno-Medit	Sr, At, Or
Carex pendula Hudson	H caesp	Eurasiat	Sp
Carex spicata Hudson	H caesp	Eurasiat	Sp
Cyperus glaber L.	T scap	Paleotemp	Sp
Cyperus laevigatus subsp. *distachyos* (All.) Maire & Weiller	G rhiz	Subcosmop	Sr
Cyperus longus L.	G rhiz	Paleotemp	Sp
Scirpus cernuus Vahl	T scap	Subcosmop	Or
Scirpoides holoschoenus (L.) Soják	G rhiz	Euro-Medit	Sp
Scirpus lacustris subsp. *tabernaemontani* (C.C. Gmelin) Syme	Hyd	Eurosib	Sr
Gramineae			
Aegilops triuncialis L.	T scap	Euro-Medit	Sp
Aeluropus littoralis (Gouan) Parl.	G rhiz	N-Medit.-Turan	Sp, Sr, At, Or
Alopecuros myosuroides Hudson	T scap	Paleotemp	At
Anisantha diandra (Roth) Tutin ex Tzvelev	T scap	Euro-Medit	Sp, Or
Anisantha madritensis subsp. *delilei* (Boiss.) Bracchi, Banfi & Galasso	T scap	Euro-Medit	Sr, Or
Anisantha rubens (L.) Nevski	T scap	S-Medit.-Turan	At
Avena barbata Pott ex Link subsp. *barbata*	T scap	Euro-Medit.-Turan	Sp, Sr, At, Or
Avena sterilis subsp. *ludoviciana* (Durieu) Gillet & MaMagne	T scap	Euro-Medit	Or

	Life form	Chorological type	Distibution
Brachypodium sylvaticum (Hudson) P. Beauv. subsp. *sylvaticum*	H caesp	Paleotemp	Sp
Bromus alopecuros Poiret subsp. *alopecuros*	T scap	Steno-Medit	Sr
Bromus hordeaceus L. subsp. *hordeaceus*	T scap	Subcosmop	Sr, At
Bromus intermedius Guss.	T scap	Euro-Medit	At
Bromus lanceolatus Roth	T scap	Paleotemp	Or
Bromus scoparius L.	T scap	Steno-Medit	Sr
Catapodium rigidum (L.) C.E. Hubb.	T scap	Euro-Medit	Sp
Cynodon dactylon (L.) Pers.	G rhiz	Termo-Cosmop	Sp, Sr, Or
Cynosurus echinatus L.	T scap	Euro-Medit	Sp, Sr, Or
Dactylis glomerata L.	H caesp	Paleotemp	Sp, Sr
Elymus elongatus (Host) Runemark subsp. *elongatus*	H caesp	Euro-Medit	Sp
Elymus elongatus subsp. *ponticus* (Podp.) Melderis	H caesp	Euro-Medit	Sp, Sr, Or
Elymus repens (L.) Gould subsp. *repens*	G rhiz	Circumbor	Sp
Elytrigia juncea (L.) Nevski	G rhiz	Euro-Medit	Sp, At
Elytrigia scirpea (C. Presl) Holub	H caesp	E-Medit	Sr, At, Or
Hordeum bulbosum L.	H caesp	Paleosubtrop	Sp
Hordeum geniculatum All.	T scap	Steno-Medit	Sr, At
Hordeum marinum Hudson	T scap	Euro-Medit.-Occid	Sp, Sr, At, Or
Hordeum murinum subsp. *leporinum* (Link) Arcang.	T scap	Euro-Medit	Sr, At, Or
Lagurus ovatus L. subsp. *ovatus*	T scap	Euro-Medit	Sp, Sr, At, Or
Lolium multiflorum Lam.	T scap	Euro-Medit	Or
Lolium rigidum Gaudin subsp. *rigidum*	T scap	Paleosubtrop	Sp, Or
Melica ciliata L. subsp. *ciliata*	H caesp	Euro-Medit.-Turan	Sr, At
Monerma cylindrica (Willd.) W. Greuter	T scap	Euro-Medit	Sr, At
Parapholis filiformis (Roth) C.E. Hubbard	T scap	Medit.-Atl	Or
Parapholis incurva (L.) C.E. Hubbard	T scap	Medit.-Atl	Sp, Sr, At, Or
Parapholis marginata Runemark	T caesp	E-Medit	Sr
Paspalum distichum L.	G rhiz	Subcosmop	Sp
Phalaris minor Retz.	T scap	Paleosubtrop	Sr, Or
Phalaris paradoxa L.	T scap	Steno-Medit	Or
Phragmites australis (Cav.) Trin. ex Steudel	Hyd	Subcosmop	Sp, Sr, At, Or
Piptatherum coerulescens (Desf.) P. Beauv.	H caesp	Steno-Medit	At
Piptatherum miliaceum (L.) Cosson subsp. *miliaceum*	H caesp	Medit.-Turan	Sp, Or
Poa trivialis L. subsp. *trivialis*	H caesp	Eurasiat	Sr, At
Polypogon maritimus Willd. subsp. *maritimus*	T caesp	Steno-Medit.-Macar	Sp, Sr
Polypogon monspeliensis (L.) Desf.	T scap	Paleosubtrop	Sp, Sr, At, Or
Polypogon viridis (Gouan) Breistr.	H caesp	Paleosubtrop	Sp
Puccinellia distans (Jacq.) Parl. subsp. *distans*	H caesp	Paleotemp	Sp, Sr, At
Puccinellia distans subsp. *limosa* (Schur) Jáv.	H caesp	SE-Europ.	Sp
Puccinellia festuciformis (Host) Parl.	H caesp	Steno-Medit	Sp, Sr, At
Rostraria cristata (L.) Tzvelev	T caesp	Paleotemp	Sp, Sr, Or
Tripidium ravennae (L.) H. Scholz	H caesp	Medit.-Turan	Sp
Sphenopus divaricatus (Gouan) Reichenb.	T scap	Medit.-Turan	Or
Sporobolus virginicus (L) Kunth	G rhiz	Subtrop	Sp, At
Vulpia fasciculata (Forskål) Samp.	T caesp	Medit.-Atl	Sp
Iridaceae			

	Life form	Chorological type	Distibution
Morea sisyrinchium (L.) Ker Gawl.	G rhiz	Steno-Medit	Or
Juncaceae			
Juncus acutus L. subsp. *acutus*	H caesp	Euro-Medit	Sp, Sr, At, Or
Juncus articulatus L.	G rhiz	Circumbor	Sp, At
Juncus bufonius L.	T caesp	Cosmop	Sr, At, Or
Juncus gerardi Loisel subsp. *gerardi*	G rhiz	Circumbor	Sr
Juncus heldreichianus Marsson ex Parl.	H caesp	E-Medit	Sr, At
Juncus hybridus Brot.	T caesp	Medit.-Atl	Sp, At
Juncus inflexus L.	H caesp	Paleotemp	At
Juncus littoralis C.A. Mayer	H caesp	Medit.-Turan	At
Juncus maritimus Lam.	G rhiz	Subcosmop	Sp, Sr, Or
Juncus subulatus Forsskål	G rhiz	S-Medit	Sp, Sr, At
Juncaginaceae			
Trigloghin bulbosa subsp. *barrelieri* (Loisel.) Rouy	G bulb	Steno-Medit	Or
Orchidaceae			
Ophrys fusca Link	G bulb	Steno-Medit	Or
Potamogetonaceae			
Potamogeton pectinatus L.	Hyd	Subcosmop	Sr
Potamogeton pusillus L.	Hyd	Subcosmop	Sr
Ruppiaceae			
Ruppia maritima L.	Hyd	Cosmop	Or
Sparganiaceae			
Sparganium erectum subsp. *neglectum* (Beeby) Schinz & Thell.	Hyd	Eurasiat	Sp
Typhaceae			
Typha domingensis (Pers.) Steudel	Hyd	E-Medit	Sp, Sr, At
Typha latifolia L.	Hyd	Cosmop	Sp
Zannichelliaceae			
Althenia filiformis Petit	Hyd	Steno-Medit.-Occid	Or

APPENDIX 2

Complete list of the syntaxa quoted in the text.

Aeluropetum littoralis (Prodan 1939) Şerbănescu 1965
Alkanno tinctoriae-Maresion nanae Rivas Goday ex Rivas Goday & Rivas-Martinez 1963 corr. Díez-Garretas, Asensi & Rivas-Martinez 2001
Ammophiletea Br.-Bl. et Tx. ex Westhoff et al. 1946
Arthrocnemion glauci Rivas-Martínez & Costa 1984
Arthrocnemo glauci-Halocnemetum strobilacei Oberdorfer 1952
Arthrocnemetum glauci Br.-Bl. 1933
Arthrocnemo-Halocnemetum strobilacei Oberdorfer 1952
Bolboschoenetum maritimi Eggler 1933
Cakiletea maritimae Tx. et Preising ex Br.-Bl. et Tx. 1952
Caricetum divisae Br.-Bl. 1931
Cutandietalia maritimae Rivas-Martinez, Díez-Garretas & Asensi in Rivas-Martinez et al. 2002 *Eryngio-Sporoboletum virginici* Géhu et Uslu 1989
Festuco-Puccinellietea Soó 1968
Halimiono-Arthrocnemetum glauci Istanbullouglou 2004
Halocnemetum strobilacei Oberdorfer 1952 em. Géhu 1994
Juncetum acuti Molinier & Talon 1969
Juncetea maritimi R. Tx. et Oberd. 1958
Juncetum maritimi (Rübel 1930) Pignatti 1953
Juncetum maritimo-acuti Horvatić 1934
Juncetum subulato-maritimi Gradstein & Smittenberg 1977
Limonietalia Br.-Bl. & O. de Bolòs 1958
Myriophyllo-Potametum Soó 1943
Nerio-Tamaricetea Br.-Bl. et O. de Bolós 1958
Phragmitetum communis Schmale 1939
Phragmito-Magno-Caricetea Klika in Klika et Novák 1941
Potamo pectinati-Myriophylletum spicati Rivas Goday 1964 corr. Conesa 1990
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