

## PLOPUL SALT MARSHES (TULCEA COUNTY) – AN UNIQUE AREA FOR HALOPHYTES IN ROMANIA

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**Abstract:** The Plopul salt marshes, Tulcea County, developed within the perimeter of Lake Beibugeac, have been identified as having a high concentration of halophytes on a relatively small area of about 100 ha. These have formed vegetal communities that fit within two types of Natura 2000 habitats: 1310 Communities of *Salicornia* and other annuals colonising mud and sand and 1530\* Pannonic salt steppes and salt marshes. Four of the 57 species recorded are rare at national level: *Halocnemum strobilaceum*, *Limonium bellidifolium* subsp. *danubiale*, *Limonium meyeri* and *Salicornia prostrata*. The area currently has a SPA (Special Protection Area) status, but the unique concentration of halophytes, the presence of Natura 2000 habitats and of rare species, also recommend the area for designation as a SCI (Sites of Community Interest).

**Key words:** halophytes, Natura 2000 habitats, Plopul, Romania, *Salicornia*, salt marshes

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### Introduction

During the botanical research study conducted in the southeast of Romania, the vegetation nearby Plopul locality, Tulcea County, captured our attention. Although the Plopul salt marshes are mentioned in the informative materials about the Danube Delta (Gâstescu 2008, Gâstescu & Baboianu 2011), the area has not been treated as one important for plant conservation, but only as a site of avifaunistic protection – ROSPA0052 Lake Beibugeac (Brînzan 2013). Scientific data about the flora and vegetation of these salt marshes has so far only been published once. The presence of the species *Halocnemum strobilaceum* is noted at Plopul (Țupu 2010, Anastasiu 2011). Thus, we aimed to find out what the plant species that populate these salt marshes are, and whether there are any rare plants with conservation value at national and European level. We also investigated the degree of halophilia of the species found on these salt marshes, the correlation between the salt concentration in the soil and the distribution of the species of *Salicornia*, whether any Natura 2000 habitats are present, and if so, which ones.

### Material and methods

**Investigated area.** Plopul salt marshes are located north and north-west of the locality with the same name (Fig. 1), at about 4 km south-west of Murighiol and about

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one km of Lake Sărățuri (Murighiol Salt Marshes), which has been identified as a special area of plant conservation (Sârbu 2007) and included in the Danube Delta Biosphere Reserve. At Plopul, a lake of approximately 900 m length, 700 m width and 2 m maximum depth forms here in spring – Lake Beibugeac. The total area of this lake can vary from year to year depending on the level of rainfall and temperatures during summer (Brînzan 2013). Lake Beibugeac is located along an old route of the fluvial branch Sf. Gheorghe, which once used to reach the north of Lake Razim (Brînzan 2013). The substrate on which vegetation grows here is solonchak of marine type.



Fig. 1. The investigated area, situated N-NW of Plopul locality, in the vicinity of the protected area Danube Delta Biosphere Reserve (red outline) (www.googleearth.com)

**Research methods.** For the inventorying of the flora of the Plopul salt marshes a number of field trips were conducted from July to November, in 2011 and 2012. The species found were collected, herborised and identified. These were deposited in the Herbarium of Botanical Garden from Bucharest (BUC).

The degree of halophilia and hydrophilia was established using several bibliographic sources: Săvulescu (1952-1976), Sanda & Popescu (1998), Ciocârlan (2009), Sârbu et al. (2013).

The nomenclature of the recorded species is according to the Illustrated Flora of Romania (Ciocârlan 2009) and the Plant List ([www.theplantlist.org](http://www.theplantlist.org)).

For each of the inventoried species the degree to which they are threatened was analysed according to international and national documentation (Oltean et al. 1994, Dihoru & Negrean 2009, Bilz et al. 2011).

In order to establish the correlation between the concentration of soil salts and the differentiated distribution of some species of *Salicornia*, soil samples were collected and analysed.

The presence of Natura 2000 habitats was established based on the dominant and characteristic species identified, according to the Interpretation Manual of European Union Habitats Romania (Gafta & Mountford 2008).

### Results and discussion

Out of the 57 species identified on the Plopol salt marshes, a significant percentage (61.40% - 35 taxa) is represented by obligatory or facultative halophytes. This high concentration of halophytes in a relative small area makes this place unique. In the Danube Delta Biosphere Reserve, well known for its salt marshes, there are no areas as rich in halophytes as the Plopol salt marshes. During research conducted between 2009 and 2011, 15 halophyte species were identified on the Histria salt marshes, 20 halophyte species were inventoried on the Sacalin Island, and 27 halophytes were recorded on the Chilia Plain (Câmpul Chiliei) (Anastasiu P., unpubl. data).

The obligatory halophytes (eu-halophyte) identified on the Plopol salt marshes are: *Aeluropus littoralis* (Gouan) Parl. – mesohydrohalophile, *Artemisia santonicum* L. s.l. – xeromesohalophile-mesohalophile, *Aster tripolium* subsp. *pannonicus* (Jacq.) Soó – mesohydro-hydrohalophile, *Atriplex prostrata* Boucher ex DC. – mesohydrohalophile, *Bassia hirsuta* (L.) Asch. – mesohydrohalophile, *Chenopodium chenopodioides* (L.) Aellen – mesohydrohalophile, *Crypsis aculeata* (L.) Aiton – mesohydrohalophile, *Cyperus pannonicus* Jacq. – mesohydrohalophile, *Elymus elongatus* (Host) Runemark – mesophylo-mesohalophile, *Halimione pedunculata* (L.) Aellen – mesohalophile, *Halimione verrucifera* (M.Bieb.) Aellen – mesohalophile, *Halocnemum strobilaceum* (Pall.) M.Bieb. – mesohydrohalophile, *Juncus gerardi* Loisel. – mesohydrohalophile, *Limonium bellidifolium* Dumort. subsp. *danubiale* (Klokov) Roman – mesohydrohalophile, *Limonium meyeri* Kuntze – mesohydrohalophile, *Lotus tenuis* Waldst. & Kit. – mesohydrohalophile, *Puccinellia distans* (Jacq.) Parl. – mesohalophile, *Salicornia dolichostachya* Moss – hydrohalophile, *Salicornia europaea* L. – mesohydrohalophile, *Salicornia prostrata* Pall. – mesohydrohalophile, *Salicornia ramosissima* J.Woods – mesohydrohalophile, *Spergularia marina* (L.) Griseb. – mesohalophile, *Spergularia media* (L.) C.Presl – mesohalophile, *Suaeda confusa* Iljin – mesohydrohalophile, *Suaeda maritima* (L.) Dumort. – mesohydrohalophile, *Taraxacum bessarabicum* (Hornem.) Hand.-Mazz. – mesohydrohalophile, *Trifolium fragiferum* subsp. *bonannii* (C.Presl) Sojak – mesohydrohalophile. All these obligatory halophytes are also found in the Danube Delta Biosphere Reserve, pointing to possible genesis links.

The facultative halophytes (neo-halophytes) from the researched area are: *Bolboschoenus maritimus* (L.) Pall., *Chenopodium glaucum* L., *Cynodon dactylon* (L.) Pers., *Daucus carota* L. subsp. *carota*, *Phragmites australis* (Cav.) Trin. ex Steud., *Potentilla reptans* L., *Rumex palustris* Sm., *Salsola kali* L. subsp. *ruthenica* (Iljin) Soó.

Other 22 species are ruderal or of xerophile meadows, and arrived here from surrounding habitats: *Achillea setacea* Waldst. & Kit., *Amaranthus retroflexus* L., *Arctium lappa* L., *Artemisia vulgaris* L., *Ballota nigra* L. subsp. *nigra*, *Bassia scoparia* (L.) A.J.Scott, *Cichorium intybus* L., *Convolvulus arvensis* L., *Conyza canadensis* (L.) Cronquist, *Eragrostis minor* Host, *Galium humifusum* M.Bieb., *Heliotropium europaeum* L., *Marrubium vulgare* L., *Medicago sativa* L. subsp. *sativa*, *Melilotus alba* Ledeb., *Plantago lanceolata* L., *Plantago major* L. s.l., *Polygonum aviculare* L., *Salvia*



Based on the dominant and characteristic species in the vegetal communities installed on the salt marshes in the vicinity of Plopol locality, we consider that these fall within two types of Natura 2000 habitats: 1310 Communities of *Salicornia* and other annuals colonising mud and sand and 1530\* Pannonic salt steppes and salt marshes.

Habitat 1310 is installed in the lower areas of the site, where seasonal variations of the water level occur. The vegetal communities of this habitat are dominated by species from the Chenopodiaceae family: *Salicornia europaea*, *Bassia hirsuta*, *Suaeda confusa*, *Suaeda maritima*, *Halimione pedunculata*. The communities that belong to habitat 1530\* are installed on the higher areas on the edge of the site, and are dominated by perennial plants such as *Artemisia santonicum*, *Aster tripolium* subsp. *pannonicum*, *Juncus gerardi*, *Cyperus pannonicus*, *Puccinellia distans*, *Halocnemum strobilaceum*, *Aeluropus littoralis*, *Limonium meyeri*, *Taraxacum bessarabicum*, *Trifolium fragiferum* subsp. *bonannii*, *Cynodon dactylon*, *Elymus elongatus*, *Halimione verrucifera*. The conservation status of these habitats is very good, but it is possible that in the future the structure to be affected by fluctuations of the level of water, and by some anthropological activities, given the small distance between the site and the locality.

### Conclusions

The salt marshes at Plopol, Tulcea County, are unique in Romania thanks to the large number of obligatory and facultative halophile species, concentrated on a small area of about 100 ha.

This area is particularly important not only due to the presence of some rare species (*Halocnemum strobilaceum*, *Limonium bellidifolium* subsp. *danubiale*, *Limonium meyeri* and *Salicornia prostrata*), but also due to the presence of two Natura 2000 habitats, out of which one is a conservation priority. Thus, it is necessary that Lake Beibugeac be granted the status of protected natural area, not only for birds, but for habitats and plants, too.

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### References

- Anastasiu, P. (2011). New taxa and chorological data for Danube Delta Flora. *Acta Horti Bot. Bucurest.*, 38, 33-38.
- Bilz, M., Kell, S. P., Maxted, N. & Lansdown, R. V. (2011). *European Red List of Vascular Plants*. Luxembourg: Publications Office of the European Union.
- Brînzan, T. (Red.) (2013). *Catalogul habitatelor, speciilor și siturilor Natura 2000 în România*. București: Exclus Prod.
- Ciocârlan, V. (2009). *Flora Ilustrată a României. Pterydophyta et Spermatophyta*. București: Edit. Ceres.
- Dihoru, G. & Negrean, G. (2009). *Cartea Roșie a plantelor vasculare din România*. București: Edit. Academiei Române.
- Gafta, D. & Mountford, O. (Coord.). (2008). *Manual de interpretare a habitatelor Natura 2000 din România*. Cluj-Napoca: Edit. Risoprint.

- Gâștescu, P. & Baboianu, G. (2011). *Rezervația Biosferei Delta Dunării. Ghidul vizitatorului / Danube Delta Biosphere Reserve. Visitor's Guide*. Suceava: Manifest Suceava.
- Gâștescu, P. (2008). *Danube Delta*. Tulcea: „Danube Delta” Technological Information Center.
- Oltean, M., Negrean, G., Popescu, A., Roman, N., Dihoru, G., Sanda, V. & Mihăilescu, S. (1994). Lista roșie a plantelor superioare din România. In M. Oltean (Coord.), *Studii, sinteze, documentații de ecologie, Acad. Română, Institutul de Biologie*, 1, 1-52.
- Sârbu, A. (Coord.) (2007). *Arii speciale pentru protecția și conservarea plantelor în România*. București: Edit. victorBvictor.
- Sanda, V. & Popescu, A. (1998). Conspectul florei cormofitelor spontane din România. *Acta Horti Bot. Bucurest.*, /1998/, 1-336.
- Săvulescu, T. (Red. princip.) (1952-1976). *Flora României • Flora Romaniae* (Vol. 1-12). București: Edit. Academiei Române.
- Sârbu, I., Ștefan, N. & Oprea, A. (2013). *Plante vasculare din România. Determinator de teren*. București: Edit. victorBvictor.
- The Plant List 2010. *Version 1*. Retrieved October 25, 2012, from: <http://www.theplantlist.org/>
- Țupu, E. (2010). Contributions on chorology of rare plant species from Tulcea Hills (Romania). *Acta Horti Bot. Bucurest.*, 37, 37-43.