PARTICULARITIES OF THE AQUATIC VEGETATION FROM “IRON GATES” NATURA 2000 SITE (BANAT, ROMANIA)

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ABSTRACT

The paper presents the results of investigations on the aquatic vegetation, along the Romanian bank of the Danube River, in the area of Porțile de Fier (“Iron Gates”; Mehedinți and Caraș-Severin counties), a Natura 2000 site. Twenty-three plant communities were identified from Lemneta minoris and Potametea pectinati classes. The survey led to the identification of some newly described phytocoenotaxons in this protected area. All the plant communities in this paper are documented by phytosociologic tables, being accompanied by coenotaxonomic, phytogeographical, ecological and social strategies analysis, in order to assess their conservation status, as the main tool for management decisions.

ZUSAMMENFASSUNG: Die Besonderheiten der Gewässervegetation im Natura 2000-Gebiet „Porțile de Fier/Eisernes Tor”.

Vorliegende Arbeit stellt die Ergebnisse der Untersuchungen betreffend die Gewässervegetation entlang der rumänischen Uferstrecke der Donau im Bereich des Natura 2000-Gebietes „Porțile de Fier/Eisernes Tor” (Verwaltungskreise Mehedinți und Caraș-Severin) vor. Dabei wurden 23 Pflanzengesellschaften der Klassen Lemneta minoris und Potametea pectinati festgestellt. Die Untersuchungen führten zur Identifikation und Beschreibung einiger für dieses Schutzgebiet neuer phytocoenologischer Einheiten. Alle in der Arbeit vorgestellten Pflanzengesellschaften sind mittels pflanzensoziologischer Tabellen dokumentiert und von coenotaxonomischen, pflanzengeographischen, ökologischen sowie sozial-strategischen Analysen begleitet, die der Bewertung des Erhaltungszustandes als wichtigstes Instrument für Management-Entscheidungen dienen.

REZUMAT: Particularitățile vegetației acvatice din situl Natura 2000 „Porțile de Fier” (Banat, România).

Lucrarea prezintă rezultatele investigațiilor efectuate asupra vegetației acvatice de-a lungul malului românesc al Dunării, în zona sitului Natura 2000 Porțile de Fier (jud. Mehedinți și Caraș-Severin). Au fost identificate 23 asociații vegetale aparținând claselor Lemneta minoris și Potamogetonetea (syn. Potametea) pectinati. Studiile au condus la identificarea unor fitocenotaxoni noi pentru aria protejată. Toate asociațiile prezentate în lucrare sunt documentate prin tabele fitosociologice, fiind însoțite și de analize cenotaxonomice, fitogeografice, ecologice și ale strategiilor sociale, în scopul evaluării stării de conservare a acestora, ca principal instrument în luarea deciziilor manageriale.

INTRODUCTION

The complexity of aquatic communities is a result of topographic diversity (Vivian-Smith, 1997), of physical and chemical characteristics of the water and of human influences (Tetelea, 2005; Brönmark and Hansson, 2010).

Species diversity is dependent on habitat structure, the most complex habitats hosting a higher biodiversity (Bell et al., 1991). According to Williams et al. (2003), ponds are responsible for a higher diversity comparing to other aquatic communities, sheltering unique and rare species. Aquatic macrophytes play an important role for nitrogen (Saunders and Kalff, 2001) and detritus retention (Rooke, 1984), during the vegetation season. Moreover, higher structural complexity of habitats provides higher heterogeneity of algae and invertebrates colonization (Dudley, 1988; Melo et al., 2002; Takeda et al., 2003; Thorp et al., 1997).

A complex system of rivers, ponds, ditches, swamps, and flooded areas were formed as a result of the construction of one of the largest hydroelectric power plants in Europe, “Iron Gates” I, on the Danube River, in 1972. Both, the isle of Moldova Veche and Nera Delta are large areas flooded during the spring season. According to Blaustein and Schwartz, 2001 (in Dudley), temporary water host important species for global biodiversity and plays an important role for population dynamics and community structure studies.

The “Porțile de Fier” Natural Park was the subject of many botanical surveys, addressing all the plant communities, a highly diversified area, leading to a floristic inventory of 1,875 vascular plant species: among these 1,748 species, 120 subspecies and six varieties. Also, there have been registered 44 plant communities, framed in two suballiances, 22 alliances, 16 orders, and 13 classes of vegetation (Matacă, 2005). Aquatic and wetlands flora found along the Danube River, in the “Iron Gates” Natural Park, has been studied since the nineteenth century, by Grecescu (1898), Heuffel (1858), but especially in the last century (Borza, 1947-1949; Matacă, 2002; Roman, 1971; Călinescu and Iana, 1964; Raclaru and Alexan, 1972; Ciocârlan et al., 1969; Lițescu et al., 2003; Morariu et al., 1969; Sârbu et al., 2006, 2011; Ștefureac et al., 1971).

As a result of the newly designed navigation system in the “Porțile de Fier” area, the vegetation investigations increased (Matacă, 2002; Ștefureac, 1970; Grigore and Coste, 1978; Raclaru and Alexan, 1973; Resmeriță et al., 1972; Șerbănescu and Sanda, 1970; Csűrös et al., 1968; Dihoru et al., 1973; Păun et al., 1968; Sanda et al., 1968, 1970; Todor et al., 1971).

The purpose of this study is a reappraisal of the previously identified aquatic communities, new plant communities in the area, and the analysis of their structure, primarily to highlight the conservation status of habitats, emphasizing the presence of invasive plant species. It was taken into account the fishermen complaint toward the explosive growth of fixed aquatic vegetation, especially those communities edified by the water chestnut (*Trapa natans*). This species is known as having a wide ecological spectrum, concerning nutrient and heavy metal concentration (Rai and Sinha, 2001), playing an important role in phytoremediation (Srivastava et al., 2014).

The surveys have been conducted mainly in the Natura 2000 site “ROSPA0026 Danube sector – Baziaș-Porțile de Fier”, largely overlapping the “Iron Gates” Natural Park. The above mentioned site has an area of 9,904 ha, and is located on the territory of Caraș-Severin (56%) and Mehedinți (44%) counties (south-western part of Romania), in Continental biogeographical region. The altitude ranges from 28 to 192 m a.s.l. (O. M. 2387/2001; Planul de management al Parcului Natural Porțile de Fier, 2013) (Fig. 1).

Figure 1: Map of the “Porțile de Fier” Natural Park.

Geology of the study area has a mosaic feature. The studied territory is the most picturesque section of the Danube River – the so-called areas “Cazanele Mari” and “Cazanele Mici”. In addition to these, from a geological point of view there is the remarkable suspended synclinal called “Munteana”, the fossiliferous outcrops at Svinița and Bahna, the Permian volcanic neck Trescovăț, and also a variety of karst formations. In some areas, the loess deposits are exposed in the form of slopes, some including a status of nature reserves, for example “Râpa cu Lăstuni” (a nesting place for some species of swifts). The Moldova Veche isle was intended to become into a place to store the mining waste from the MoldaMin Company, which exploited copper in Moldova Nouă, and coal at Cozla, Baia Nouă and Bigăr.

The surveyed territory belongs to the “Iron Gates” Massif (Popp, 1971), which is crossed for 134 km by the Danube River, generating the most spectacular gorge sector in Europe (Călinescu et al., 1955; The Geological Map of Romania). Upon entering Romania, the riverbed is between 7.5 to 17.5 m in depth and has a width of up to 1,500 m. Between Coronini and Liuborajdea, the Danube passes through a limestone sector, the width decreases and reaches 36 m in depth. West of Liubcova, the Danube crosses a granite area, and toward Cozla rapids and transverse currents occur, due to substrate formed by gneisses of Ielova, conglomerates, porphyry and porphyrites. Downstream Cozla, the Danube cuts through another limestone area. The maximum depth is recorded in the “Cazane” area – about 100 m, and the width is 150-200 m. Beyond the “Cazane” area, the riverbed depth decreases and because of the lithology, represented by crystalline schists, rapids and submerged rocks appear.

Based on the calculated values for the period during 1970-2000, average annual temperatures in the “Iron Gates” Natural Park are: at Berzasca 11.4°C, at Orșova 11.6°C, at Svinița 11.5°C; the relative humidity of the air at Orșova is 76% and at Drobeta-Turnu Severin is of 74%. There were two periods recorded with the most rainfall, one in May-June and the second in November-December. At Orșova, the average yearly rainfall is of 586.3 mm, and at Drobeta-Turnu Severin is of 652.4 mm. The prevailing winds at Orșova are from the north-west, and at Drobeta-Turnu Severin those from west and north-west (Matacă, 2005).

From a pedologic point of view, the most widespread zonal soils are clay-illuvial podzolic series, the brown-acid soils, and intrazonal lito-morphic soils. The best soils that are presented in flooded areas are those weakly evolved soils, namely silt and alluvial soils, that vary in texture and evolution. On the high river meadow and lower terrace there is a succession of alluvial soils: sandy silt layered alluvials, the alluvial humiferous soils, and the brown alluvial soils. On alluvial cones and tributaries floodplains, soils are coarse, and in the calcareous skeleton occur branciogs. In some places, alluvial gleic soils and even swamps gleic soils are reported (Matacă, 2005; Glăvan and Geanana, 1972).

MATERIAL AND METHODS

The study of vegetation utilizes a basic coenotaxonomic unit the plant association, characterized into the field by the phytocoenoses (= individuals of association), which were analyzed on the basis of phytocenological relevés. The quantitative indices of abundance-dominance (AD) used are those from the Braun-Blanquet scale (Braun-Blanquet, 1964). Identification of plant associations was based on the characteristic species, taking into account the presence of the dominant species (Cristea, 1991, 1993; Cristea et al., 2004). In order to draw up the coenotaxonomic conspectus, various records have been consulted (Coldea, 1991, 1997; Grigore and Coste, 1978; Morariu and Danciu, 1970; Popescu and Ștefureac, 1976; Raclaru and Alexan, 1973; Șerbănescu and Sanda, 1970; Dihoru et al., 1973; Morariu et al., 1969; Popescu et al., 1997; Sanda et al., 1968, 1980, 1994; Todor et al., 1971), as well as other available European classifications.

The extent of the sampled surface was determined by the size of the phytocoenoses, ranging from 1 m² to 25 m².

Setting the location of the natural habitats were based on the characteristic phytocoenotaxons (associations, alliances, orders), as stated by the Romanian interpretation manual of habitats (Gafta and Mountford, 2008; Doniță et al., 2005, 2006), in accordance with the European Union Habitat Directive 92/43/EEC (***, Manuel d'interprétation des habitats de l'UE).

The vascular flora nomenclature is in accordance with Flora Europaea (Tutin et al., 1964-1980; ***, <http://ww2.bgbm.org/europlusmed/>), and with some Romanian identification field books (Ciocârlan, 2000). We used the nomenclature of the algae suggested by Cărauş (2012). Establishing the values of ecologic and floristic elements indexes were made after various reference publications (e.g. Popescu and Sanda, 1998; Sanda et al., 1983). The social behaviour and the degree of naturalness were analyzed after Borhidi (1995).

The coenotaxonomic classification was performed using the program SYNTAX 5.0 (Podani, 1993), using the UPGMA algorithm and also the Bray Curtis quantitative index.

RESULTS AND DISCUSSION

Twenty-three aquatic vegetal communities were identified in the area, all belonging in two classes, according to the following coenotaxonomic conspectus:

* new recorded associations in the studied area

LEMNETEA O. de Bolós and Masclans 1955

Lemnetalia minoris O. de Bolós and Masclans 1955

Lemnion gibbae R. Tx. and Schwabe-Braun in R. Tx 1974

1. Lemnetum gibbae Miyavaki and J. Tüxen 1960
2. Lemnetum minoris Oberd. ex T. Müller and Görs 1960
3. Lemno-Spirodeletum W. Koch 1954 (syn. Spirodeletum polyrhizae W. Koch 1954)
4. Salvinio-Spirodeletum polyrhizae Slavnič 1956
5. *Lemno-Salvinietum natantis Miyawaki and Tx. 1960
6. *Lemno minoris-Azolletum filiculoides Br.-Bl. 1952

Lemno-Utricularietalia Passarge 1978

Utricularion vulgaris Passarge 1964

7. *Lemno-Utricularietum vulgaris Soó (1928) 1947

Hydrocharietalia Rübel 1933

Hydrocharition morsus-ranae (Passarge 1964) Westhoff and den Held 1969

8. Hydrocharitetum morsus-ranae Van Langendonk 1935
9. Ceratophylletum demersi Corillion 1957

POTAMETEA PECTINATI R. Klika in Klika and Novák 1941

Potametalia pectinati W. Koch 1926

Potamion pectinati (W. Koch 1926) Görs 1977

10. *Potametum lucentis Hueck 1931
11. Myriophyllo-Potametum lucentis Soó 1934
– *vallisnerietosum (syn. Potameto-Vallisnerietum Br.-Bl 1931)
12. *Najadetum marinae Fukarek 1961
13. *Najadetum minoris Ubrizsy 1961
14. *Potametum pectinati (Hueck 1931) Carstensen 1955
15. Potametum pusilli Soó 1927
16. *Elodeetum nuttallii Ciocârlan et al. 1997
17. *Elodeetum canadensis (Pign. 1953) Pass. 1964

Nymphaeion albae Oberd. 1957

18. Nymphoidetum peltatae (All. 1922) Bellot 1951
19. Trapetum natantis Kárpáti 1963
20. Potametum natantis Soó 1927
21. *Potametum perfoliati Miljan 1933

Ranunculion aquatilis Passarge 1964

22. *Ranunculetum (syn. Batrachietum) trichophylli Soó (1927) 1971
23. Potametum nodosi Passarge 1964.

Class Lemnetea O. de Bolós and Masclans 1955 in the “Porțile de Fier” Natural Park is represented by nine plant communities, belonging to three orders and three alliances (Tab. 1).

Table 1: Plant communities from Class Lemnetea O. de Bolós and Masclans 1955.

Relevé no.	1	2	3	4	5	6	7	8	9	10
General coverage (%)	70	90	80	100	100	100	100	90	80	100
Relevé area (m ²)	9	9	4	9	2	1	5	9	1	25
Relevé code	Lmin_70	L_min_39	L_min_48	L_min135	L_gib138	L_gib139	L_Spi150	L_Spi137	L_Spi158	L_Spi163
Lemnion										
<i>Lemna gibba</i>	.	.	.	1	3	3-4	+	.	1	.
<i>Spirodela polyrhiza</i>	+	+-1	+	1	+	2	5	4	2	1-2
Hydrocharition										
<i>Hydrocharis morsus-ranae</i>	.	.	.	.	.	.	.	.	.	.
Utricularion										
<i>Utricularia vulgaris</i>	.	.	.	.	.	.	.	.	.	.
Lemnetalia and Lemnetea										
<i>Azolla filiculoides</i>	.	.	.	.	+	1	.	.	1	+
<i>Lemna minor</i>	4	4-5	4	5	3-4	3	1-2	2-3	3	3-4
<i>Salvinia natans</i>	.	.	.	.	.	.	+	+	+	+
Potamion										
<i>Potamogeton acutifolius</i>	.	.	.	.	.	.	.	.	.	.
<i>Potamogeton acutifolius f. major</i>	.	.	.	.	.	.	.	.	.	.
Potametalia and Potametea										
<i>Najas marina</i>	.	.	.	.	.	.	.	.	.	.
<i>Najas minor</i>	.	.	.	.	.	.	.	.	.	.
<i>Potamogeton nodosus</i>	.	.	.	.	.	.	.	.	.	.
<i>Trapa natans</i>	1	+	.	.	.	.	.	.	.	+
<i>Ceratophyllum demersum</i>	.	.	.	.	.	.	.	.	.	1
<i>Elodea canadensis</i>	.	.	.	.	.	.	.	.	.	.
<i>Myriophyllum spicatum</i>	.	.	.	.	.	.	.	.	.	.
<i>Potamogeton crispus</i>	.	.	.	.	.	.	.	.	.	+
<i>Potamogeton natans</i>	.	.	.	.	.	.	.	.	.	.
<i>Potamogeton pectinatus</i>	1	2	.	.	.	.	.	.	.	.
<i>Potamogeton perfoliatus</i>	.	.	.	.	.	.	.	.	.	+
<i>Potamogeton pusillus</i>	.	.	.	.	.	.	.	.	.	.
<i>Elodea nuttallii</i>	.	.	.	.	.	.	.	.	.	.
Phragmiti-Magnocaricetea										
<i>Alisma plantago-aquatica</i>	.	.	.	.	.	.	.	.	.	.
<i>Schoenoplectus lacustris</i>	.	.	.	.	.	.	.	.	.	.
<i>Paspalum distichum</i>	.	.	.	.	.	.	.	.	.	.
Varyae syntaxa										
<i>Echinochloa crus-galli</i>	.	.	.	.	.	.	.	.	.	.
<i>Cladophora glomerata</i>	.	.	2	.	.	.	.	.	.	+

Table 1 (continued): Plant communities from Class Lemneta O. de Bolós and Masclans 1955.

[illegible]

Table 1 (continued): Plant communities from Class Lemneta O. de Bolós and Masclans 1955.

Relevé no.	21	22	23	24	25	26	27	28	29	30	31
General coverage (%)	60	50	100	100	100	70	85	65	90	90	100
Relevé area (m ²)	8	25	25	25	9	9	9	9	25	9	25
Relevé code	C_dem 153	C_dem 159	C_dem 164	C_dem 169	C_dem 174	C_dem 1	C_dem 8	C_dem 54	C_dem 139	C_dem 141	C_dem 142
Lemnion											
<i>Lemna gibba</i>	1	.	.	.	.	.	.	.	.	.	.
<i>Spirodela polyrrhiza</i>	3-4	.	1-2	+	1-2	.	.	.	+	+	.
Hydrocharition											
<i>Hydrocharis morsus-ranae</i>	+	.	.	.	.	.	.	.	.	.	.
Utricularion											
<i>Utricularia vulgaris</i>	+	.	.	.	.	.	.	.	.	.	.
Lemnetalia and Lemneta											
<i>Azolla filiculoides</i>	.	.	+	+	+.1	.	.	.	.	.	.
<i>Lemna minor</i>	.	.	3-4	1-2	3-4	.	.	.	+	.	+
<i>Salvinia natans</i>	.	.	+	+	+	.	.	.	.	.	.
Potamion											
<i>Potamogeton acutifolius</i>	.	.	1	.	.	.	.	.	.	1-2	+
<i>Potamogeton a. f. major</i>	.	.	1	.	.	.	.	.	.	1-2	+
Potametalia and Potametea											
<i>Najas marina</i>	.	.	.	+	+	.	.	.	+	2	+
<i>Najas minor</i>	.	.	.	.	.	.	.	.	.	1	+
<i>Potamogeton nodosus</i>	.	.	1	.	.	1-2	.	.	.	.	.
<i>Trapa natans</i>	.	.	1	1	+	.	.	.	.	+	1
<i>Ceratophyllum demersum</i>	4	2-3	4	5	4	3	4	4	5	3	4
<i>Elodea canadensis</i>	+	.	.	.	1-2	.	.	.	.	.	2
<i>Myriophyllum spicatum</i>	.	.	.	.	.	.	+	.	.	.	.
<i>Potamogeton crispus</i>	.	.	.	.	+	.	.	.	.	.	.
<i>Potamogeton natans</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Potamogeton pectinatus</i>	.	.	+	.	.	1	.	+	.	.	.
<i>Potamogeton perfoliatus</i>	.	2	+	+	.	2-3	+	.	.	.	.
<i>Potamogeton pusillus</i>	.	.	.	.	.	.	+	+	.	.	.
<i>Elodea nuttallii</i>	.	.	.	+	.	.	.	.	.	.	.
Phragmiti-Magnocaricetea											
<i>Alisma plantago-aquatica</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Schoenoplectus lacustris</i>	.	.	.	.	.	.	.	+	.	.	.
<i>Paspalum distichum</i>	.	.	.	.	.	.	.	.	.	.	.
Varyous syntaxa											
<i>Echinochloa crus-galli</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Cladophora glomerata</i>	.	.	+	+	1	.	.	.	.	.	.

Data and place of relevés: Ass. Lemnetum minoris: **rel. 1-3**, 25.06.2012, Divici Pond, **rel. 4**, 31.07.2012, Calinovăț Island; Ass. Lemnetum gibbae: **rel. 5-6**, 01.08.2012, Calinovăț Island; Ass. Lemno-Spirodeletum: **rel. 7**, 01.08.2012, Nera Pond, **rel. 8**, 03.08.2012, Calinovăț Island, **rel. 9**, 02.08.2012, Nera Pond, **rel. 10**, 03.08.2012, Liborajdea, **rel. 11**, 23.09.2012,

Moldova Veche Island; Ass. *Salvinio-Spirodeletum polyrhizae*, **rel. 12**, 27.06.2012, Nera Pond; Ass. *Lemno-Salvinietum natantis*, **rel. 13**, 24.09.2012, Pojejena, **rel. 14**, 24.09.2012, Orșova, **rel. 15-17**, 23.09.2012, Moldova Veche Island; Ass. *Lemno minoris-Azolletum filiculoides*: **rel. 18**, 25.09.2012, Orșova; Ass. *Lemno-Utriculariteum vulgaris*: **rel. 19**, 31.07.2012, Moldova Veche Island; Ass. *Hydrocharitetum morsus-ranae*: **rel. 20**, 02.08.2012, Nera Pond; Ass. *Ceratophylletum demersi*: **rel. 21**, 02.08.2012, Nera Pond, **rel. 22**, 02.08.2012, Coronini, **rel. 23**, 03.08.2012, Liborajdea, **rel. 24**, 03.08.2012, Dubova, **rel. 25**, 05.08.2012, Orșova, **rel. 26**, 23.06.2012, Slătanicul Mare Valley, **rel. 27**, 23.06.2012, Vodiței Valley, **rel. 28**, 25.06.2012, Belobreșca Pond, **rel. 29**, 01.08.2012, Șușca Pond, **rel. 30-31**, 01.08.2012, Pojejena.

Three plant communities are reported for the first time in this protected area. Class Lemnetae comprises of aquatic vegetation that is short in size, as well as scattered throughout lakes, ponds, and canals. These communities appear as free floating or initially fixed to the substrate, later roots break and become free, being carried by water currents. This is the reason why in the dendrogram (Fig. 4), communities of this class do not form distinct clusters. In the studied area, this vegetation type has a simple coenotic structure, with a well individualized coenotic core, usually represented by at least 50% of the characteristic species for class and the coenotaxonomic component units (in Lemnetae gibbae 100%), the other plant species being characteristic especially for Potametea class, with which is in contact. The vegetation cycle (growing season) is very short, only few weeks.

From a phytogeographical point of view (Fig. 2), the cosmopolitan and Eurasian species are thrive, especially the Mediterranean species, as a result of the climate influence in south-western Romania. In general, the plant communities within this class are poor in species. *Ceratophylletum demersi* is richer in species, moreover it is the most widespread plant community in the area, which is reflected by a greater variety of phytogeographical elements.

Figure 2: Phytogeographical spectrum for the associations of the Lemnetae class.

Figure 3: Ecological spectrum for humidity for the communities of the Lemnanea class.

Among the alien plant species in this class, the more common is *Azolla filiculoides*, on Moldova Veche Isle; along with this species, *Paspalum distichum* is also present.

The **ecological** spectrum shows the extreme characteristics of this habitat, 100% dominated by the hydrophilous plant species (U_6) (Fig. 3). The temperate climate is reflected by the predominance of micro-mesothermal species ($T_{3.3.5}$), and the influence of the Mediterranean climate is evidenced by the presence of the moderately thermophilous species ($T_{4.4.5}$) and thermophilous ones ($T_{5.5.5}$) (Fig. 5). Related to water pH (Fig. 6), the dominant species are those euri-ionics (R_0), as many of the cosmopolitan species are amfitolerant. Of the steno-ionics species, a large proportion is those acid-neutrophilic ($R_{3.3.5}$) or less acid-neutrophilous ($R_{4.4.5}$) ones.

Figure 5: Ecological spectrum for temperature for the communities of the Lemnanea class.

Figure 6: Ecological spectrum for water pH for the communities of the Lemnanea class.

In terms of social behaviour, the natural pioneer species dominate (NP, with a naturalness value of +3), while in the initial stages of the phytocoenogenesis process, with a high reproductive rate, being a species that are tolerant to the extreme environmental conditions, but demanding to nutrient content. Competitive species are well represented (C naturalness value of +5), stress-resistant species, especially into those phytocoenosis better knocked off. If phytocoenoses are more stabilized, there are also stress tolerant species, with a broad ecology (generalist species, G, with a naturalness value of +4) or even specialist species (S, with a naturalness value of +6). The latest are met only in the phytocoenosis of the plant community *Ceratophylletum demersi*, for which the reisthemost diversified spectrum (Fig. 7). Moreover, they have the most complex structure in the Lemnanea class.

Figure 7: Social behaviour for the communities of the Lemnanea class.

[illegible]

Table 2 (continued): Plant communities from Class Potametea Tx. and Prsg. 1942, Alliance Potamogetonion pectinati (W. Koch 1926) Görs 1977.

Relevé no.	1	2	3	4	5	6	7	8	9	10	11
General coverage (%)	9	9	9	9	9	10	9	9	25	6	9
Relevé area (m ²)	95	100	60	65	95	80	100	80	100	70	70
Relevé code	P_luc_59	P_luc_60	P_luc_61	P_lu_61b	P_luc_23	P_luc_12	P_luc_45	MY_Po_81	MY_Po_84	MY_Po_165	MY_Pot_7
<i>Potamogeton acutif. f. major</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Potamogeton trichoides</i>	.	+	.	.	.	.	.	.	.	.	1
Potametalia and Potametea											
<i>Ceratophyllum demersum</i>	.	.	.	+	+	+	1	+	+	.	.
<i>Najas marina</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Najas minor</i>	.	.	1	.	.	.	.	.	.	.	.
<i>Potamogeton nodosus</i>	.	.	.	.	.	.	.	+	+	.	.
<i>Vallisneria spiralis</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Elodea canadensis</i>	.	.	.	.	.	.	.	.	.	.	5
<i>Elodea nuttallii</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Myriophyllum spicatum</i>	1	.	.	1-2	.	.	.	.	.	.	1
<i>Potamogeton crispus</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Potamogeton lucens</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Potamogeton pectinatus</i>	4	4	4	5	.	.	.	1	.	+	.
<i>Potamogeton perfoliatus</i>	.	.	1	.	.	.	2	+	+	+	.
<i>Potamogeton pusillus</i>	.	.	.	+	5	4-5	4	5	4-5	5	.
<i>Ranunculus trichophyllus</i>	.	+1	.	.	.	.	.	.	.	.	.
<i>Trapa natans</i>	.	.	.	.	.	.	.	+	.	+	.
Lemnetea											
<i>Azolla filiculoides</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Lemna minor</i>	.	+	.	.	+	1	.	.	.	.	.
<i>Salvinia natans</i>	.	+	.	.	.	.	.	.	.	.	.
<i>Spirodela polyrhiza</i>	.	+	.	.	+	+	.	.	.	.	.
Phragmiti-Magnocaricetea											
<i>Schoenoplectus lacustris</i>	.	.	.	.	.	.	.	.	.	.	.
Varyae syntaxa											
<i>Chara foetida</i>	+	.	.	.	.	.	.	.	.	.	.
<i>Cladophora glomerata</i>	.	.	.	.	.	2-3	.	.	.	.	3

Table 2 (continued): Plant communities from Class Potametea Tx. and Prsg. 1942, Aliance Potamogetonion pectinati (W. Koch 1926) Görs 1977.

Potamion						
<i>Potamogeton acutifolius</i>	.	.	.	.	.	.
<i>Potamogeton acutifolius</i> f. <i>major</i>	.	.	.	.	.	.
<i>Potamogeton trichoides</i>	+	+	+	.	.	.
Potametalia and Potametea						
<i>Ceratophyllum demersum</i>	+	+	.	2	.	.
<i>Najas marina</i>	+	.	.	+	.	.
<i>Najas minor</i>	.	.	.	+	.	.
<i>Potamogeton nodosus</i>	.	.	1	.	.	.
<i>Vallisneria spiralis</i>	+	+	.	.	.	.
<i>Elodea canadensis</i>	5	5	4	.	.	.
<i>Elodea nuttallii</i>	.	.	.	2	4	5
<i>Myriophyllum spicatum</i>	+	+	.	.	+1	.
<i>Potamogeton crispus</i>	.	.	+	.	+	+
<i>Potamogeton lucens</i>	.	.	.	.	2	.
<i>Potamogeton pectinatus</i>	.	.	.	1-2	.	.
<i>Potamogeton perfoliatus</i>	.	.	.	.	.	2
<i>Potamogeton pusillus</i>	.	.	.	.	1	.
<i>Ranunculus trichophyllus</i>	.	.	.	.	.	.
<i>Trapa natans</i>	+	1-2	3	+	.	.
Lemnetea						
<i>Azolla filiculoides</i>	+	+	.	.	.	.
<i>Lemna minor</i>	+	+	+	+	.	.
<i>Salvinia natans</i>	+	+	2	+	.	.
<i>Spirodela polyrrhiza</i>	.	.	.	+	.	.
Phragmiti-Magnocaricetea						
<i>Schoenoplectus lacustris</i>	.	.	.	.	.	.
Varyae syntaxa						
<i>Chara foetida</i>	.	.	.	.	.	.
<i>Cladophora glomerata</i>	.	.	.	.	.	.

Data and place of relevés: Ass. Potamogetonnetum lucentis Hueck 1931: **rel. 1-2**, 25.06.2012, Șușca Pond, **rel. 3-4**, 25.06.2012, Pojejena Pond, **rel. 5**, 24.06.2012, Sirinia Valley, **rel. 6**, 23.06.2012, Cerna Valley, **rel. 7**, 25.06.2012, Divici Pond; Ass. Myriophyllo-Potamogetonnetum lucentis Soó 1934, **rel. 8-9**, 26.06.2012, Moldova Veche Island, **rel. 10**, 03.08.2012, Liubcova, **rel. 11**, 23.06.2012, Vodiței Valley, **rel. 12**, 31.07.2012, Moldova Veche Island; ass. Myriophyllo-Potamogetonnetum lucentis Soó 1934 sass. vallisnerietosum Coldea et al., 1997, **rel. 13-17**, 02.08.2012, Nera Pond; Ass. Potamogetonnetum pectinati (Hueck 1931) Carstensen 1955, **rel. 18-23**, 25.06.2012, Divici Pond, **rel. 24**, 25.06.2012, Belobreșca Pond, **rel. 25-26**, 24/25.06.2012, Șușca Pond, **rel. 27-28**, 25.06.2012, Calinovăț Isl., **rel. 29, 32**, 26.06.2012/31.07.2012, Moldova Veche Isl., **rel. 30-31**, 27.06.2012, Nera Pond; Ass. Potamogetonnetum pusilli Soó 1927, **rel. 33-34**, 25.06.2012, Belobreșca Pond, **rel. 35-38**, 25.06.2012, Pojejena Pond; Ass. Najadetum marinae Fukarek 1961, **rel. 39**, 03.08.2012, Liubcova, **rel. 40**, 31.07.2012, Moldova Veche Island, **rel. 41**, 02.08.2012, Nera Pond; Ass. Najadetum minoris Ubriszy 1961, **rel. 42**, 01.08.2012, Șușca Pond, **rel. 43**, 02.08.2012, Nera Pond; Ass. Elodeetum canadensis Eggler 1933, **rel. 44**, 03.08.2012, Cozla, **rel. 45-47**, 23.09.2012, Moldova Veche Island; Ass. Elodeetum nuttallii Ciocârlan et al., 1997, **rel. 48**, 01.08.2012, Pojejena, **rel. 49**, 23.06.2012, Cerna Valley, **rel. 50**, 23.06.2012, Vodiței Valley.

Table 3 (continued): Associations from Class Potametea Tx. and Prsg. 1942, Alliance Nymphaeion albae Oberd. 1957.

Relevé no.	1 6	1 7	1 8	1 9	2 0	2 1	2 2	2 3	2 4	2 5	2 6	2 7	2 8	2 9	3 0	3 1
General coverage (%)	9 5	6 0	9 0	6 0	1 0	1 0	1 0	1 0	8 0	6 5	1 0	9 0	1 0	7 0	6 0	8 0
Relevé area (m ²)	9	9	2 5	2 5	2 5	2 5	2 5	2 5	9	2 5	2 5	2 5	9	9	9	9
Relevé code	Trap_58	Trap_63	Trap_136	Trap_140	Trap_162	Trap_170	Trap_171	Trap_172	Trap_192	Pnat131	Pper156	Pper157	Pper22	Pper25	Pper60	Pper25
Potamion																
<i>Potamogeton acutifolius</i>	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
<i>Potamogeton acutifolius</i> f. <i>major</i>	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
<i>Potamogeton trichoides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Potametalia and Potametea																
<i>Nymphoides peltata</i>	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Trapa natans</i>	5	5	5	4	5	5	5	5	+	.	.	.	.	+	+	.
<i>Potamogeton natans</i>	.	.	+	.	.	.	.	.	+	4	.	.	.	.	.	+
<i>Potamogeton perfoliatus</i>	.	+	.	+	.	.	.	.	.	.	4	5	5	5	3- 4	4- 5
<i>Najas marina</i>	.	.	.	+	.	.	.	.	.	1	+	.	.	.	.	.
<i>Potamogeton nodosus</i>	.	.	.	+	.	.	+	.	.	.	.	.	.	.	1- 2	.
<i>Ceratophyllum demersum</i>	+	2	2	2	+	1- 2	1- 2	+	1- 2	.	3	1	1- 2	.	.	.
<i>Elodea canadensis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Myriophyllum spicatum</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Potamogeton crispus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Potamogeton lucens</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Potamogeton pectinatus</i>	+	.	.	+	.	.	.	.	.	.	.	.	2	+	.	+
<i>Potamogeton pusillus</i>	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Elodea nuttallii</i>																
Lemnetea	.	.	.	.	.	+	.	+	.	.	.	.	+	.	.	.
<i>Azolla filiculoides</i>	.	.	.	.	.	+	+	.	+	.	+	+	.	.	.	.
<i>Salvinia natans</i>	.	.	+	.	.	+	+	.	+	.	+	+	.	.	.	.
<i>Lemna minor</i>	+	.	1	.	+	1	.	1	+	.	+	+	.	+	+	.
<i>Lemna gibba</i>	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.
<i>Spirodela polyrhiza</i>	+	.	+	.	+	.	+	+	+	.	+	+	.	.	+	.
Varyae syntaxa																
<i>Chara foetida</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cladophora glomerata</i>	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+

Data and place of relevés: Ass. Nymphoidetum peltatae (All. 1922) Bellot 1951: **rel. 1**, 23.09.2012, Moldova Veche Island; Ass. Trapetum natantis Kárpáti 1963, **rel. 2**, 23.06.2012, Orşova, **rel. 3**, 23.06.2012, Mala Bay, **rel. 4**, 24.06.2012, Dubova Bay, **rel. 5**, 23.06.2012, Grăniceri Valley, **rel. 6-14**, 25.06.2012, Divici Pond, **rel. 15**, 25.06.2012, Belobreşca Pond, **rel. 16** and **19**, 25.06.2012/01.08.2012, Şuşca Pond, **rel. 17**, 25.05.2012, Pojejena Pond, **rel. 18**, 31.07.2012, Calinovăţ Island, **rel. 20**, 03.08.2012, Liborajdea, **rel. 21-22**, 08.04.2012, Dubova, **rel. 23**, 08.04.2012, Eşelniţa, **rel. 24**, 23.09.2012, Moldova Veche Island; Ass. Potamogetonnetum natantis Soó 1927, **rel. 25**, 31.07.2012, Moldova Veche Island; Ass. Potamogetonnetum perfoliati Miljan 1933, **rel. 26-27**, 02.08.2012, Nera Pond, **rel. 28**, 24.06.2012, Tri-Kule, **rel. 29**, 25.06.2012, Divici Pond, **rel. 30-31**, 25.06.2012, Pojejena Pond.

Table 4: Plant communities from Class Potametea R. Tx. and Prsg. 1942, Alliance Ranunculus aquatilis Passarge 1964.

Relevé no.	1	2	3	4	5	6	7	8
General coverage (%)	1	9	9	9	9	9	9	9
Relevé area (m ²)	90	80	90	100	90	80	100	70
Relevé code	Batr_108	P_nod_41	P_nod_42	P_nod_46	P_nod_49	P_nod_69	P_nod_70	P_nod_71
Potamion								
<i>Potamogeton obtus. f. latifrons</i>	.	.	.	.	.	.	.	.
Potametalia and Potametea								
<i>Najas marina</i>	.	.	.	.	.	.	.	.
<i>Potamogeton nodosus</i>	.	4	3-4	3,4	3	3	3	4
<i>Trapa natans</i>	.	+	+1	1	+	.	.	.
<i>Ceratophyllum demersum</i>	.	+	.	.	2	.	.	.
<i>Myriophyllum spicatum</i>	.	.	.	.	.	.	.	.
<i>Potamogeton crispus</i>	.	.	.	.	.	.	.	.
<i>Potamogeton lucens</i>	.	.	.	1-2	.	+	.	.
<i>Potamogeton pectinatus</i>	.	1	2-3	2-3	2	2	2-3	.
<i>Potamogeton perfoliatus</i>	.	.	.	.	.	+	+	+
<i>Potamogeton pusillus</i>	.	.	.	.	.	.	.	+
<i>Ranunculus trichophyllus</i>	5	.	.	.	.	.	.	.
<i>Potamogeton trichoides</i>	.	.	.	.	.	+	.	.
Lemnetea								
<i>Azolla filiculoides</i>	.	.	.	.	.	.	.	.
<i>Salvinia natans</i>	.	.	.	.	.	.	.	.
<i>Lemna minor</i>	+	+	1	+	2	1-2	+	.
<i>Spirodela polyrhiza</i>	+	+	.	.	+	1	.	+
Varyae syntaxa								
<i>Chara foetida</i>	.	.	.	.	.	.	.	.
<i>Cladophora glomerata</i>	.	.	.	.	.	1	1	1
Potamion								
<i>Potamogeton obtus. s f. latifrons</i>	.	.	.	.	.	.	+	.
Potametalia and Potametea								
<i>Najas marina</i>	.	.	.	1-2	.	.	.	.
<i>Potamogeton nodosus</i>	5	3	3	3-4	3	4	2	3-4
<i>Trapa natans</i>	+	.	.	.	.	.	.	.
<i>Ceratophyllum demersum</i>	.	.	.	+	.	.	2	2
<i>Myriophyllum spicatum</i>	.	.	.	.	.	.	.	1
<i>Potamogeton crispus</i>	.	.	.	.	.	.	+	+
<i>Potamogeton lucens</i>	.	.	2	.	1	.	.	.
<i>Potamogeton pectinatus</i>	+1	.	1	+	+	.	.	.
<i>Potamogeton perfoliatus</i>	.	.	.	.	.	.	.	1-2
<i>Potamogeton pusillus</i>	.	2-3	.	.	.	.	.	.
<i>Ranunculus trichophyllus</i>	.	.	.	.	.	.	.	.
<i>Potamogeton trichoides</i>	.	.	.	.	.	.	1	.
Lemnetea								
<i>Azolla filiculoides</i>	.	.	.	.	.	+	.	.
<i>Salvinia natans</i>	.	.	.	.	+	+	+	.
<i>Lemna minor</i>	+	+	.	.	+	2	3	.
<i>Spirodela polyrhiza</i>	+	+	.	.	+	1-2	1-2	.
Varyae syntaxa								
<i>Chara foetida</i>	.	+	.	.	.	.	.	.
<i>Cladophora glomerata</i>	.	.	.	.	.	.	.	.

Data and place of relevés of table 4: Ass. *Ranunculetum* (*Batrachietum*) *trichophylli* Soó (1927) 1971: rel. 1, 27.06.2012, Nera Pond; Ass. *Potamogetonietum nodosi* Passarge 1964, rel. 2-4, 25.06.2012, Divici Pond, rel. 5, 25.06.2012, Belobreșca Pond; rel. 6 and 13, 25.06.2012/31.07.2012, Pojejena Pond, rel. 7-11, 25.06.2012, Calinovăț Island, rel. 12, 31.07.2012, Moldova Veche Island, rel. 14, 02.08.2012, Coronini, rel. 15, 02.08.2012.

Class *Potametea pectinati* R. Tx. and Prsg. 1942 includes submerged aquatic vegetation or with floating leaves, fixed on substrate, which develop in standing, year-around waters. The vegetation is dominated by perennial species, with communities that tolerate a wide range of water depths. Unless the water levels dry up completely, some species survive periods of low water levels.

One order, three alliances and 14 plant communities (eight associations and one subassociation are newly identified in this protected area) were identified in the “Porțile de Fier” Natural Park (Tabs. 2, 3 and 4).

Over 60% of the component species belong to the coenotic core, which comprises a decent fraction of these communities in the area, as a consequence of the stable water conditions. This aspect is reflected by distinct clusters in our comparative analysis (Fig. 4).

Figure 8: Phytogeographic spectrum for the communities of the Potamogetonetea class.

From a phytogeographical point of view (Fig. 8), the cosmopolitan, circumpolar and the Eurasian species are well represented (especially the Mediterranean ones). Compared with the phytocoenosis of Lemnetea class, the phytogeographical spectrum is more diversified here, as a consequence of a stronger stability of these phytocoenosis. The circumpolar species are present in most communities, benefiting from lower thermal amplitudes of the water. The adventitious species are: *Elodea nuttallii*, *E. canadensis*, *Vallisneria spiralis*, and *Azolla filiculoides*, the first three species exhibit invasive behavior in the studied area. Communities of *Elodea nuttallii* replace those of *E. canadensis*, and also other plant communities edified by indigenous species. Only few communities are devoid of invasive species, e.g. *Potametum pectinati* (occurs more frequently at the fringes of ponds along the Danube River, where the water current is faster), *Potametum pusilli*, *Potametum natantis* and *Ranunculetum* (*Batrachietum*) *trichophylli*. The last two communities are rare in the area.

Figure 9: Ecological spectrum for humidity for the communities of the Potamogetonetea class.

Figure 10: Ecological spectrum for temperature for the communities of the Potamogetonetea class.

The **ecological** spectra, related to humidity (Fig. 9) and temperature (Fig. 10) are similar to those of the Lemnetaea class, prevailing hydrophilous (U_6) and the micro-mesothermal species ($T_{3-3.5}$); with a good occurrence of the moderate thermophilous species ($T_{4-4.5}$) and thermophilous ($T_{5-5.5}$) as a result of Mediterranean climate. Compared to water pH, among the steno-ionic species, the dominant are the weak acid-neutrophilous species ($R_{4-4.5}$), followed by acid-neutrophilous ($R_{3-3.5}$). The euri-ionic species (R_0), show a permanent disturbance of the habitat (Fig. 11).

Figure 11: Ecological spectrum for water pH for the communities of the Potamogetonetea class.

In terms of **social behaviour**, the competitive species dominate (C with a naturalness value of +5), being stress-resistant species, are more present in a cohesive phytocoenosis. Natural pioneers are well represented (NP, with a naturalness value of +3), especially by those plant communities located in areas with strong currents (Potamogetonetea lucentis) or by the recently installed (Najadetea marinae). In the case of stabilized phytocoenoses, stress-tolerant plant species are also present, with a broad ecology (generalist G, with a naturalness value of +4). The presence of species with limited ecology (S, with a naturalness value of +6), in almost all plant communities is noteworthy, which indicates a constant, stable feature of phytocoenosis, a harmonized structure of the aquatic habitats with extreme conditions, a structure that was accomplished over time (Fig. 12). *Potamogetonetea natantis* and *Ranunculetea trichophylli* plant communities are exceptions, seldom appear in the investigated area. The plant communities of *Ranunculion aquatilis* (aquatic vegetation developed in shallow waters, smoothly flowing and sometimes temporarily) are in competition with large aquatic macrophytes, which is a reason why they are becoming fewer and fewer in southeastern Europe (<http://www.sci.muni.cz/botany/vegsci/vegetace.php?lang=en&typ=VBD>).

The characteristic species of this alliance is *Ranunculus trichophyllus*. It was identified in a single phytocoenosis only, in the mini delta of Nera, and only in June, during the flooding period. Two alien invasive species, *Elodea canadensis* and *E. nuttallii*, were recorded (Borhidi, 1995), but according to other references, *Vallisneria spiralis* is also an invasive plant species in Europe (Săvulescu, 1952-1976).

Figure 12: Social behaviour spectrum for the associations of the Potamogetonetea class.

Anthropogenic impact on natural habitats

Based on phytosociologic relevés and field investigations, there have been identified the following three types of natural habitats, namely: **3150** – Natural eutrophic lakes with vegetation of Magnopotamion or Hydrocharition, **3160** – Natural dystrophic lakes and ponds, and **3260** – Water courses lowland to mountain level, with vegetation from Ranunculus fluitantis and Callitriche-Batrachion. The habitat 3160 is the most widespread in the area, especially represented by Trapaetea natantis plant communities, which cover large areas of the ponds, shallow waters and small bays. The massive development of this plant community is detrimental to other submerged or floating communities, up until September, when the area covered by this habitat is halved, as long as the dominant species begins to decompose. This situation, led to some difficulties during summer time, water crafts are slowed in their movement along the ponds; furthermore, this plant community slows the development of the fish fauna because of the low amount of oxygen in the water; on the other hand, it has a positive effect on birds, giving them peace, bringing environmental services by water denitrification (Tall et al., 2011), especially considering, where the terrain includes croplands.

These habitats host protected or threatened plant species, including those on the red lists, like: *Azolla filiculoides* (Dihoru and Negrean, 2009), *Potamogeton trichoides* (Oltean et al., 1994), *Salvinia natans* (Bern Convention, 1979; Dihoru and Negrean, 2009), *Elodea canadensis* (Boşcaiu et al., 1994), *Najas marina* (Boşcaiu et al., 1994) (in our opinion, it is a mistake to include in a red list/red book, those species which are aliens in a certain region, e.g. *Azolla filiculoides* or *Elodea canadensis* in Europe).

The plant communities of these habitats are dominated by natural pioneer species (especially floating species) and competitive species (mostly submerged species), as a result of habitat disturbance through seasonal water fluctuation. According to Zohary and Ostrovsky (2011), increasing water level affects the habitat diversity, species richness and abundance and favours the income and proliferation of allochthonous generalists, with negative response in species richness. Some of the alien species have an invasive feature in natural habitats. *Elodea canadensis*, *Vallisneria spiralis*, and especially *Elodea nuttallii*, which eliminate other plants, represent a real problem. On the other hand, *Vallisneria spiralis* grows abundantly in Nera Pond, taking out the communities edified by *Najas marina* and *Najas minor*.

A permanent anthropogenic pressure is exerted on aquatic and swamp habitats from the “Porțile de Fier” Natural Park. The development of tourism, as an alternative to the economic downturn in the studied area, is reflected by a growing number of buildings (as hotels, holiday cottages, pontoon bridges, etc.), but mostly by leasing the banks of the Danube River to private persons or companies. All these lead to a decrease of the cover of spontaneous riparian vegetation and water eutrophication. In addition, each year, the Danube River and its tributaries, bring a significant amount of waste, the most affected area in this regard being the Nera Delta. This area is grazed by sheep, while the isle of Moldova Veche is grazed by horses, thus leading to a higher eutrophication. The answer of plant communities toward eutrophication is obvious through a higher representation of euri-ionic plant species.

CONCLUSIONS

The aquatic vegetation of the “Porțile de Fier” Natural Park has a mosaic-type appearance, mainly determined by the speed of water flow, and by the topography of the studied area. Thus, all the identified associations are concentrated in the area of Divici, Belobreșca, Șușca, Pojejena, and Nera ponds, the golfs between Orșova and Dubova, and associated ponds and bays of the island of Calinovăț and Moldova Nouă. Most of the plant communities have been recorded in the area of the Moldova Nouă Isle and Nera Pond, which require a special attention, as part of the integrated management of the Natura 2000 sites: “ROSPA0026 Cursul Dunării – Baziaș-Porțile de Fier” and “ROSCI0206 Porțile de Fier”.

As a result of this study, eleven plant associations, and a sub-association, are newly-identified in the investigated area. The presence of all of these plant communities could be a consequence of vegetation succession after the construction of the dam. An increase of wealth of the aquatic communities involves diversification of the algal and invertebrate fauna components, as some authors have already concluded (Dudley, 1988; Melo et al., 2002; Takeda et al., 2003; Thorp et al., 1997). The structure of these plant communities is influenced by the flow regime, level fluctuation and nutrient concentration in the water.

While developing the management plan should take into account the surveillance of the spreading of invasive plants (especially *Elodea canadensis*, *Elodea nuttallii* and *Valisneria spiralis*) and a mechanical removal of them. On the other hand, opening up corridors through the aquatic vegetation and allowing a controlled eco-tourism, with small speed boats, is an occupational alternative in this area sought by tourists, while the mines were closed and fishing is strongly restricted in the area of the “Porțile de Fier” Natural Park.

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Figure 12: Aquatic communities' dendrogram (UPGMA, Bray Curtis Index).

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