THE GRADATION OF MACROVEGETATION IN THE AREA OF THE SOMOVA-PARCHES AQUATIC

A. Popescu[1*], C.D. Ibanescu[1], I. Vasilean[1]

[1]"Dunarea de Jos" University of Galati, Galati, Romania

Abstract

The macrovegetation is a permanent, but not exclusive, component of the waterside area, fixed on the substrate by strong roots or rhizomes that, in most cases, cross the water column coming into contact with the atmosphere.

For all categories of aquatic vegetation, the development in an excessive way leads to a deficit of oxygen in the warm months, at dawn. Oxygen varied between 8.32 mg/l end 8.68 mg/l.

Our study was carried out in Tulcea County in July-August 2020 and July-August 2021. In this case study, the gradation of macrovegetation in space according to water depth is presented. The plant species were identified in the area of the Somova-Parches Aquatic Complex. In the Somova-Parcheș Aquatic Complex, the reed covers large areas and plays an important role as a biological filter as well as protecting the banks.

Key words: *macrovegetation, gradation, reed, plant species, aquatic complex*

INTRODUCTION

The Danube brings to Ceatal Chilia a volume of water of about 204.5 km³/year, which represents a multi-annual influx of 6300 m³/s, of which only 5% enters the lake complexes. In the lake complexes, the depths vary between -0.5 and -3 m. One of the vital conditions of the wetland, with a variety of ecosystems and representative biodiversity, is the water circulation system (Driga B.-V., 2004).

The following types of aquatic plants are found in the Danube Delta:

- floating plants that float freely on the surface of the water or in the water mass;
- plants fixed to the substrate but with floating leaves;
- submerged plants attached to the substrate that are completely covered by water, (Torok, 2001).

The persistence of these forms of growth in the different aquatic ecosystems of the delta is largely conditioned by the fluctuations of the hydrological regime. As the water depth increases, the emerged macrophytes are progressively reduced, then those with floating leaves and finally the submerged ones.

Macrovegetation fulfills many functions in aquatic ecosystems. One of the important functions performed is the absorption of dissolved nutrients (N and P) from the water. Macrovegetation indirectly influences nutrient cycling, especially N cycling by influencing denitrifying bacteria found on macrophyte roots and shoots (Hallin Sara et al., 2015). This favors the sedimentation of suspended solids (Zhu et al., 2015), prevents erosion by stabilizing the soil (Horppila et al., 2013).

The complexity of the habitat offered by the macrovegetation increases both the biodiversity of ichthyofauna and invertebrates (Thomaz et al., 2008).

MATERIAL AND METHOD

THE STUDY AREA

Somova - Parcheș lake complex is located in the pre-delta area of the Danube Delta Biosphere Reserve (DDBR), is located in the western part of the DDBR, near the border between Romania and Ukraine.

The total surface of the lake-complex is 9,170 ha, out of which 2,025 ha are covered by waters and is an important aquatic area for

*Corresponding author: Adina.popescu@ugal.ro
The manuscript was received: 01.10.2022
Accepted for publication: 25.03.2023

biodiversity (lakes, channels) (Torek Z., 2006, Burada A. et al., 2016).

The hydrographic unit Somova - Parcheș, located upstream from Tulcea county, is under the direct influence of the Danube river, which supplies the complex's ponds and ponds with high water.

The Somova - Parcheș lake complex includes the following waters: Gorgonel, Rotundu, Gâsca, Telincea, Parcheș, Morun, Ciorciovata, Babele, Peticu, Somova, Somova backwater, Câșla (protection area for freshwater species) (figure 1).

Fig. 1 The lake complex Somova - Parcheș (in red the access roads to the lakes)

WORK METHODOLOGY

In the Somova-Parches lake complex, field investigations were organized both in July-August 2020 and in July-August 2021. The duration of the investigations was 8 hours every day (between 9:00 and 16:00). To identify the types of habitat in which the macrovegetation included in our study grows and develops, we used the "Manual for the interpretation of Natura 2000 habitats from Romania", (Gafta et al., 2008) and "Habitateles in Romania", (Doniță et al., 2005). The vegetation study consisted of extensive transect surveys.

RESULTS AND DISCUSSIONS

Due to the hydromorphological conditions, this complex presents a great diversity of habitats, which makes the biodiversity similar to that of the Delta, being considered a mini-delta (table 1 and figure 2).

Concerning the complex habitats, they are dominated by floodable reed, upstream, lakes with large areas and active exchange of water, downstream lakes with low exchange of water and covered partially by floating vegetation. On the Danube banks are areas with willows (Gâștescu et al., 2008).

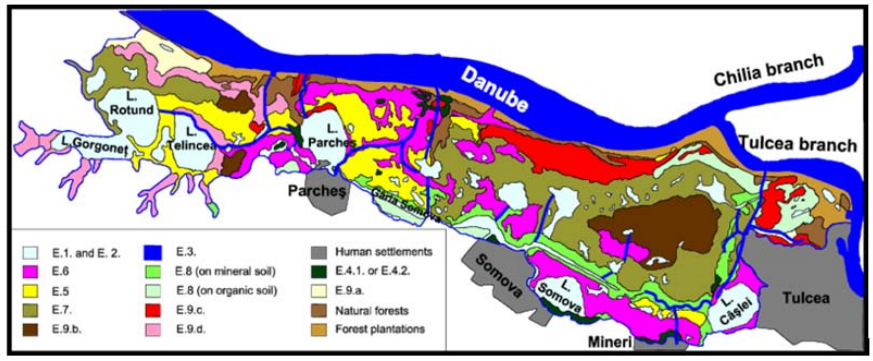


Fig. 2 The main habitat types and their spatial distribution (Torek, 2006)

Table 1 Main habitat types and the surface covered by them in Somova-Parches lake-complex (Torek, 2006)

Table content – Arial, 8		
Habitat code	Habitat type	Surface of of Habitat (ha)
E.1	big lakes	1770
E.2.	small lakes, pools and other shallow open waters	200
E.3	channels and canals	350
E.4.1.	floating aquatic vegetation in isolated sites	100
E.4.2.	floating aquatic vegetation nearby human settlements	50
E.5.	rare, floating reed-beds	700
E.6.	compact, floating reed-beds	800
E.7.	rare, floating reed-beds with trees	1400
E.8.	areas with reedmace (Typha sp.), either on mineral or organic soil	700
E.9.	forested areas	950
E.9.a.	pastures	250
E.9.b.	compact, floating reed-beds with trees	700
E.9.c	reed on mineral soil	750
E.9.d.	thick reed-cover with trees	450

A significant wealth of species characterizes habitat types 3150 (Natural eutrophic lakes with Magnopotamion or Hydrocharition vegetation) and 3160 (Dystrophic lakes and ponds) respectively, habitats that can be considered representative of the Somova-Parcheș aquatic complex.

Habitat 3150 includes lakes, ponds, ponds, gulches, closed arms with a depth varying between 0.4 - 2.5 m, in which the water is clearer or more cloudy but always eutrophic and rich in dissolved bases (pH =7). Habitat 3160 includes water bodies with stagnant or smoothly flowing water, slightly deep water (0.5–2 m), with a low content of nutrients and a neutral or often alkaline reaction (pH = 7.5–8).

Habitat 3150 is represented by various hydrophytic and hygrophytic plants and is generally stratified into four levels. Habitat 3160 is represented by Danube communities with *Potamogeton perfoliatus*, *P. gramineus*, *P. lucens*, *Elodea canadensis* and *Najas marina.*

Floating plants are represented by: *Lemna minor*, *Spirodela polyrrhiza*, *Hydrocharis morsus-ranae*, *Nymphoides peltata, Salvinia natans.*

Submerged plants are represented by: *Utricularia vulgaris, Ceratophyllum demersum, Potamogeton pectinatus, Potamogeton perfoliatus, Aldrovanda vesiculosa.*

Emergent plants with floating leaves are represented by: *Trapa natas, Nuphar lutea, Nymphaea alba.*

Emergent plants with aerial leaves are represented by: *Sagittaria sagitifolia, Butomus umbellatus, Menta aquatica, Thelypteris palustris, Typha latifolia, Phragmites australis.*

Habitat 3160 is represented by Danube communities with *Nymphaea alba, Trapa natans, Nuphar luteum and Potamogeton natans.*

The floating layer is made up of *Nymphaea alba, Trapa natans, Nymphoides peltata, Potamogeton natans*.

Aquatic vegetation is generally stratified in four levels: 1) floating plants; 2) fixed, anchored or floating submerged plants, 3) emergent plants rooted and with leaves floating on the surface of the water, 4) emergent plants, often amphibious.

Vegetal associations characteristic of habitat 3150 are: Alliance Potamogetonion pectinati W. Koch 1926 Görs 1977: Potamogetonetum lucentis Hueck 1931,

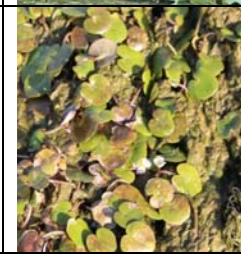
Potamogetonetum perfoliati Koch 1926, Potamogetonetum graminei (Koch 1926) Passarge 1964 em. Görs 1977, Elodeetum canadensis Eggler 1933, Potamo-Ceratophylletum submersi Pop 1962.

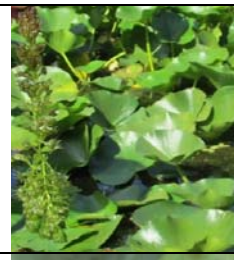
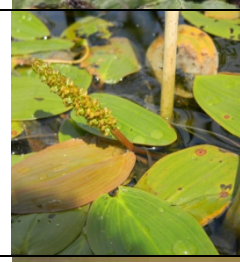
Vegetal associations characteristic of habitat 3160 are: Myriophyllo verticillati – Nupharetum luteae W. Koch 1926, Nymphaeetum albae Vollmar 1947, Nymphoidetum peltatae (Allorge 1922) Bellot 1951, Trapetum natantis V. Kárpati 1963, Potametum. natantis Soó 1927.

Among the internationally protected species are two relatively common plants in the Somova-Parches aquatic complex, namely *Salvia natans* and *Trapa natans*. These species have optimal development conditions in deltaic ponds and lakes, but as we move towards Western Europe, they become increasingly rare, overgrowing in some isolated wetlands (Torek Z., 2001).

The most common plants aquatic and marshland in the Somova-Parches lake. complex can be found in table 2.

Table 2 Aquatic and marsh plants from the Somova-Parches aquatic complex

No.	Taxon name	Original photos	No.	Taxon name	Original photos
1	*Phragmites australis* (Cav.) Steud		4	*Butomus umbellatus* L.	
2	*Typha latifolia* L.		5	*Sagittaria sagittifolia* L	
3	*Schoenoplectus lacustris* (L.) Pallas		6	*Thelypteris palustris* Schott	
7	*Nymphoides peltata* (S. G. Gmel.) O. Kuntze		13	*Hydrocharis morsus-ranae* L.	

8	*Aldrovanda vesiculosa* L		14	*Ceratophyllum demersum L.*	
9	*Nymphaea alba* L		15	*Elodea canadensis* Michx.	
10	*Nuphar lutea* (L.) Sibth. et Sm.		16	*Myriophyllum spicatum L.*	
11	*Trapa natans* L.		17	*Utricularia vulgaris* L	
12	Potamogeton natans L.		18	*Salvinia natans (L.) All.*	
19	Potamogeton perfoliatus L.		20	*Potamogeton pectinatus* L.	

For all categories of aquatic vegetation, the development in an excessive way leads to a deficit of oxygen in the warm months, at dawn. Table 3 shows the values of oxygen soluble in water, depending on the water temperature, in the absence of aquatic vegetation.

In the Somova-Parches aquatic complex, oxygen varied between 8.32 mg/l and 8.68 mg/l during the study period.

Table 3. Variation of O2 solubility in water, depending on water temperature

Water temperature °C	The solubility of oxygen mg/l
12	10,99
14	10,54
16	10,13
18	9,74
20	9,39
22	9,06
24	8,78
26	8,48
28	8,22
30	7,98

$N\text{-}NO_3^-$ varied between 1.7 and 3.7 mgl^{-1} in July 2020 and between 2.4 and 4.5 mgl^{-1} in July 2021.
$N\text{-}NO_2^-$ varied between 0.06 and 0.07 mgl^{-1} in July 2020 and between 0.06 and 0.11 mgl^{-1} in July 2021.
$N\text{-}NH_4^+$ varied between 0.02 and 0.05 mgl^{-1} in July 2020 and between 0.07 and 0.09 mgl^{-1} in July 2021.
$P\text{-}PO_4^{3-}$ varied between 0.06 and 0.1 mgl^{-1} in July 2020 and between 0.04 and 0.2 mgl^{-1} in July 2021.

In this sense, some plant species are N-sensitive (*Elodea canadensis, Myriophyllum spicatum*), and others N-tolerant (*Ceratophyllum demersum, Potamogeton pectinatus*).

When water transparency is reduced, only certain species (*Ceratophyllum demersum*, *Potamogeton perfoliatus*, *P. pectinatus*) that have a high content of assimilatory pigments can develop (Sârbu et al., 1999).

CONCLUSIONS

Aquatic plants (Macrovegetations) are primary producers and form the basis of many biological food webs. They have significant effects on soil chemistry and light levels, slow water flow, trap pollutants and trap sediment.

Although they can cause the covering of lakes, macrophytes have a great functional importance in the process of self-purification of water bodies and the regulation of biological processes.

Aquatic plant communities, for the most part, prevent the water from "blooming" and, in addition, serve as a breeding and fattening place for many phytophilous fish.

Macrophytes form the biotope for various groups of hydrobionts and fulfill the role of substrate for periphyton.

They change the physico-chemical parameters of the environment in the process of photosynthesis, absorb and eliminate biogenic elements and organic substances dissolved in water, transport them from underwater deposits to the water layer, concentrate microelements in cells and tissues.

Habitats that can be considered representative for the Somova-Parcheș aquatic complex are 3150 and 3160.

ACKNOWLEDGEMENTS

Acknowledgments to the project "Revision of the management plan and the DDBRA regulation", contract no. 253/2019, POIM / 178 / 4.1 / 123322.

The authors are grateful for the technical support offered by the Grant POSCCE ID 1815, cod SMIS 48745 (www.moras.ugal.ro).

REFERENCES

1. Burada, A., Teodorof, L., Ionascu, A., Topa, M. C., Georgescu, L. P., Tudor, I.-M., Ibram O., Tudor M. (2016). Temporal trends and evolution of heavy metals concentrations in Somova-Parches aquatic complex – last area of the Danube floodplain, Journal of Environmental Protection and Ecology, No 3, p. 864–873.
2. Doniță N., Popescu A., Păucă-Comănescu M., Mihăilescu S., Biriș I.A. (2005). Habitats in Romania. Bucharest: Silvic Technical Publishing House.
3. Driga B.V. (2004). The Danube Delta. Water circulation system. Institute of Geography of

the Romanian Academy, Cluj Napoca: Casa Carții de Sciință Publishing House.
4. Gâștescu P., Știucă R. (2008). Danube Delta – a Biosphere Reserve. Ed. CD PRESS, Romania.
5. Gafta D. et Mountford O. (eds.). (2008). The interpretation manual of Natura 2000 habitats in Romania. Cluj-Napoca. Risoprint Publishing House.
6. Horppila, Jukka; Kaitaranta, Joni; Joensuu, Laura; Nurminen, Leena (2013). Influence of emergent macrophyte (Phragmites australis) density on water turbulence and erosion of organic-rich sediments. Journal of Hydrodynamics, Vol. 25 (2), p. 288–293.
7. Sârbu A., Cristofor S., Vădineanu A., Florescu C. et Smarandache D. (1999). Dynamics of the content of assimilatory pigments for the main macrophyte species in the Danube Delta, Scientific Annals of the Danube Delta Institute, Vol 3, p. 279-289.
8. Thomaz, Sidinei M.; Dibble, Eric D.; Evangelista, Luiz R.; Higuti, Janet; Bini, Luis M. (2008). Influence of aquatic macrophyte habitat complexity on invertebrate abundance and richness in tropical lagoons. Freshwater biology, Vol. 53(2), p. 358-367.
9. Torok Z. (2001). Aquatic-plants-from-the-Danube-Delta, AVES Publishing House
10. Zhu, M.Y., Zhu, G.W., Nurminen, L., Wu, T.F., Deng, J.M., Zhang, Y.L., Qin, B.Q. & Ventela, A.M. (2015). Influence of macrophytes on sediment resuspension and effect of associated nutrients in a shallow and large lake (Taihu Lake, China). Journal PLOS ONE, 10 (6).