

## THE STUDY OF ZOOPLANKTON COMMUNITY DIVERSITY IN ZAGHEN RESTORED WETLAND

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**Key words:** zooplankton, trophic status, diversity, eutrophication, restored wetland.

### INTRODUCTION

The zooplankton, through its structure and functions, have a fundamental character in the significance of an aquatic ecosystem, taxonomic groups of zooplankton plays a key role in the energy and matter transfer, providing them survival and auto-regulation (Jeppesen E. 2011, Tudor M. et al, 2015).

Inclusion of the zooplankton in the aquatic ecosystems assessment studies, can offer a clear image of their ecological status, due to its important role in the trophic food webs, because it act as primary consumer of the algae, detritus and bacteria, but also the main source of food for secondary consumers such as invertebrates and small sized planktivorous fish.

The Zaghen wetland is under the influence of the conversions works from the 1960-1970 years, which were aimed to damming the Danube floodplain, in order to return in the agricultural circuite the lands below the Danube river.

The normal hydrological regime that was tributary to the Danube river, became unfunctional due to damming works of Tulcea – Nufaru area, the agricultural use of lands was abandoned after 1990, due to salinization and low productivity of soils.

The project was not finished however, the effects of damming works and antropogenic impact, were disastrous for the habitats of Zaghen wetland.

During the period of 05.04.2012-07.04.2015, it was implemented the project „ *The ecological reconstructions of Polder Zaghen, from Border Danube Delta Biosphere Reserve Romania/ Ucraina SMIS –NSRF 36 276*”

The ecological objective it was renaturing the wetland, to restore the essentials functions of wet ecosystems, protect species and preserve biodiversity. In technical terms the solution it was to restore the hydrological regime characteristic for flooded areas and reconstruction of specific habitats.

The present study was undertaken through a period of four months from June 2017 to September 2017, to provide data relating to the ecological status of several biological, and physico-chemical quality components, in accordance with Water Framework Directive.

### MATERIALS AND METHODS

Zaghen wetland is located in the eastern part of Tulcea, delimitedated by the Tulcea branch of the Danube river, and DJ222C Tulcea-Malcoci road, in the Tulcea Malcoci Nufaru area, which was a former floodplain of the Danube river.

Lake Zaghen, is a floodplain lake with an area of 180 ha and a volume of 937.000 mc ([www.primaria-tulcea.ro](http://www.primaria-tulcea.ro)).

Zooplankton samples were collected from lake Zaghen, at monthly intervals from June to September 2017, totally were collected a number of fifteen samples of zooplankton.

The sampling method and procedure, were performed according to zooplankton collection and processing techniques, those are very important as they may have influence on the obtained qualitative and quantitative data.

The physico-chemical parameters, such us temperature, dissolved oxygen (O<sub>2</sub>), dissolved oxygen saturation (O<sub>2</sub>%), turbidity, electroconductivity, total dissolved solids (TDS), pH, have been measured using a multiparameter, water transparency and depth were measured also, monthly for each sampling point.

This parameters of water quality, are very important because play a significant role in dynamics of abundance and diversity of zooplankton community.

For each analyzed month, zooplankton samples were taken from four sampling points, september being an exception, in this month were collected samples from three sampling points, due to abundance of aquatic vegetation (Fig. 1).

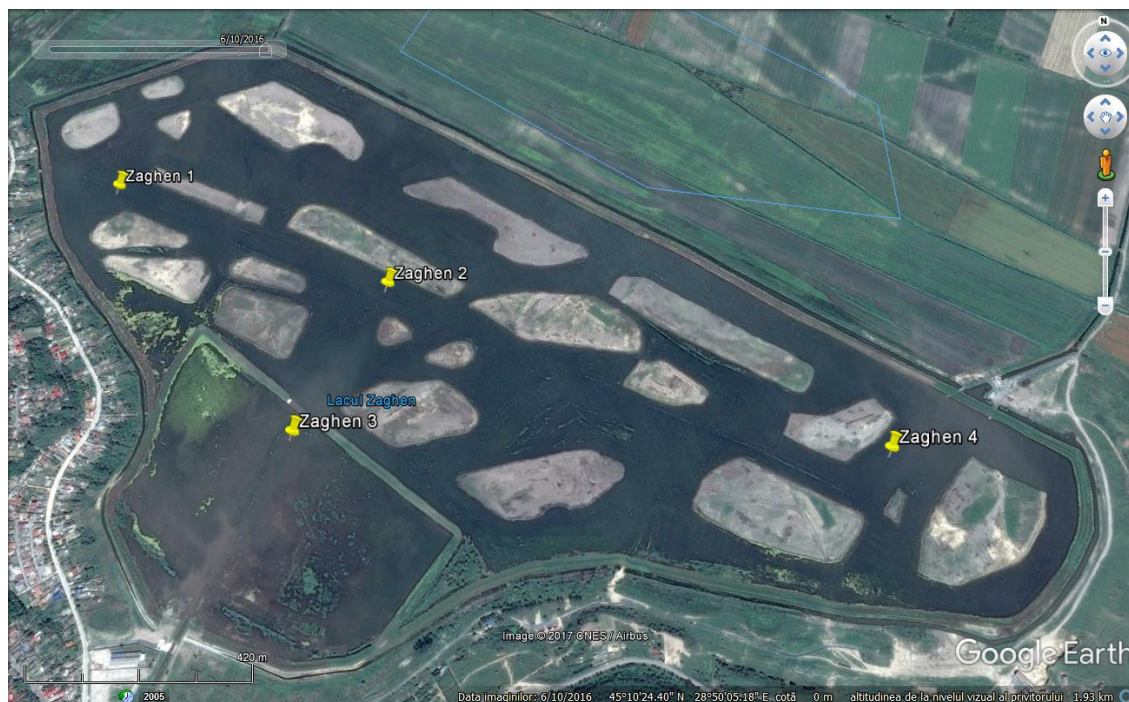


Fig. 1. Zaghen wetland and sampling points

The determinations were performed according to the methods described by (American Public Health Association [APHA], 1989) and (Tudor I-M, et al. 2015). Zooplankton samples were collected by filtering 30 L of water, through a plankton net with mesh size of 55  $\mu\text{m}$ , zooplankton concentrate thus obtained, was transferred into 100 ml containers and preserved with 96 ° alchool, before to be transported into laboratory.

In the laboratory samples were again concentrated by slow sedimentation method for at least two weeks, after the supernatant was removed by siphoning to obtain 30-50 ml concentrate sample.

The zooplankton from concentrate samples was analyzed qualitatively and quantitatively under the microscope by extracting sub-samples of 1 ml, and transferring them to a counting cell, the organisms observed in the microscopic field were counted and taxonomically identified using keys to species identification. These steps have been repeated five times, five sub – samples for 1 ml , for each sample were determined and counted.

## RESULTS AND DISCUSSION

In this study, have been analyzed the dynamic of monthly changes in structure, abundance and diversity of zooplankton species from Zaghen lake.

Zooplankton community of Zaghen lake, is composed by rotifers, copepods, cladocerans and *Chironomidae* larvae.

In percentage, the composition of zooplankton during the study period revealed that the Copepoda was the highest abundance group, represent 65% of the total zooplankton community recorded in lake Zaghen, followed by Rotifera Group (14%) , Diptera Order (13%), and Cladocera Group (8%) (Fig.2).

During the study period, totally 85 species of zooplankton were recorded, belonging to Rotifera, (56 species), Copepoda (15 species) and of Cladocera (14 species) .

For the measurement of physico-chemical parameters was used a multiparameter, (pH, dissolved O, temperature) were taken at each sampling time zooplankton. It can be seen that for July at stations 3 (decantor station) and 4 (pumping station) the depth of water is small due to the low depths and the water temperature is high (Table 1). With regard to transparency, at the same time of year in the Danube Delta lakes studied by us, the depth of water is equal to transparency. Dissolved oxygen has values ranging from 5.33 to 8.47 (minimum 3-5 mg/L for hydrobionic life). Ph (6,5-8 natural water) is between 8,5 and 9,1 - increased alkalinity in the summer months due to the intensification of the photosynthesis process by which the plants consume all CO<sub>2</sub> free of water

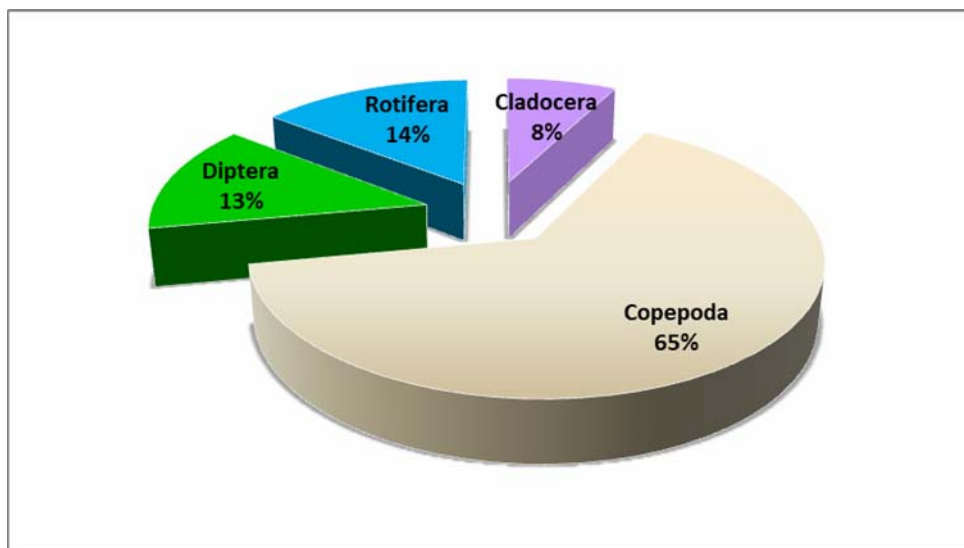


Fig. 2. Main zooplankton taxonomic groups from Zaghen lake in the studied period.

Table 1. Physical and chemical variable measurements in station sampling

Station	pH	O <sub>2</sub>	O <sub>2</sub> %	EC	Turbidity	Temperature	Depth	Transparency
		mg/l	%	μS/cm	FNU	°C	cm	cm
14.06.2017								
1	10	4,6	55,5	1785	1,4	22,49	200	100
2	9,9	4,8	52,1	1812	9	22,61	220	100
3	9,3	8,7	110	1848	122	26,94	60	20
4	9,9	8,3	104	1847	19,1	25,52	180	100
27.07.2017								
1	8,9	5,3	66,9	1829	18,3	26,6	240	80
2	9,1	5,7	72,5	1822	27,1	26,06	220	60
3	8,8	8,4	98,8	1833	176	28,19	20	10
4	8,6	6,5	83,2	1884	11	27,63	100	80
28.08.2017								
1							220	70
2							220	50
3							60	20
4							210	60
28.09.2017								
1	9,2	5	51,1	2054	20,1	16,49	180	80
2	8,9	5	51,1	2055	21,6	16,3	110	60
4	8,8	5,6	55,9	2077	27,3	16,52	80	60

The abundances of zooplankton were higher in August and September, this can be linked to favourable temperatures and availability of abundant food, Copepoda Group has the highest abundances in all analyzed months (Fig 3).

The maximum total zooplanktonic abundance was recorded in September 2017 (286 ind/L) and the minimum in June 2017 (139 ind/L) - average of all sampling stations.

Rotifers were the most rich species group, thus show the highest diversity at all sampling stations

compared to the other two groups, taking into account the selectivity of planktivorous fish for the high quality biomass food source and the preferences for the large individuals from the zooplankton community.

Regarding the Copepoda and Cladocera groups, the number of recorded species was lower this providing once again the rate of higher size selective predatorism of larger individuals (Fig. 4.).

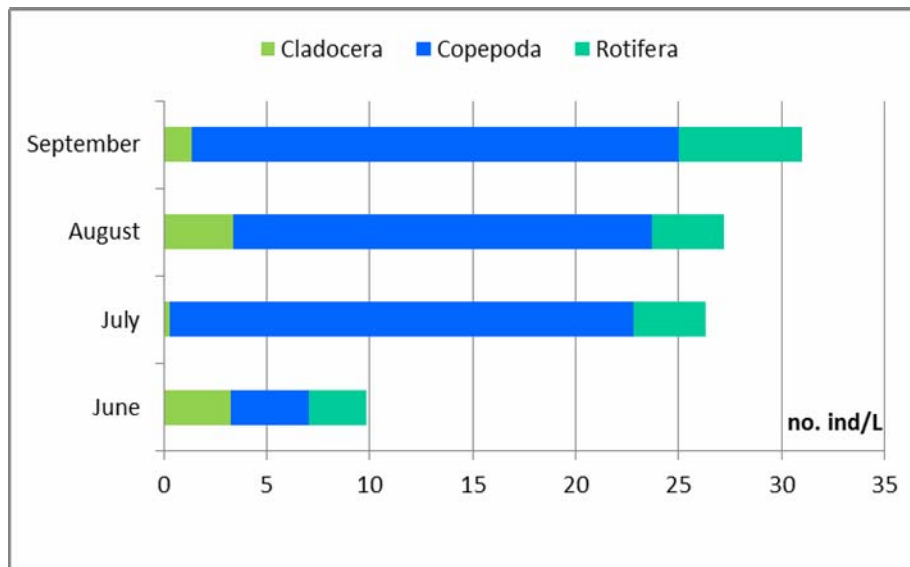


Fig. 3. Distribution of zooplankton abundances of taxonomic groups in the studied period

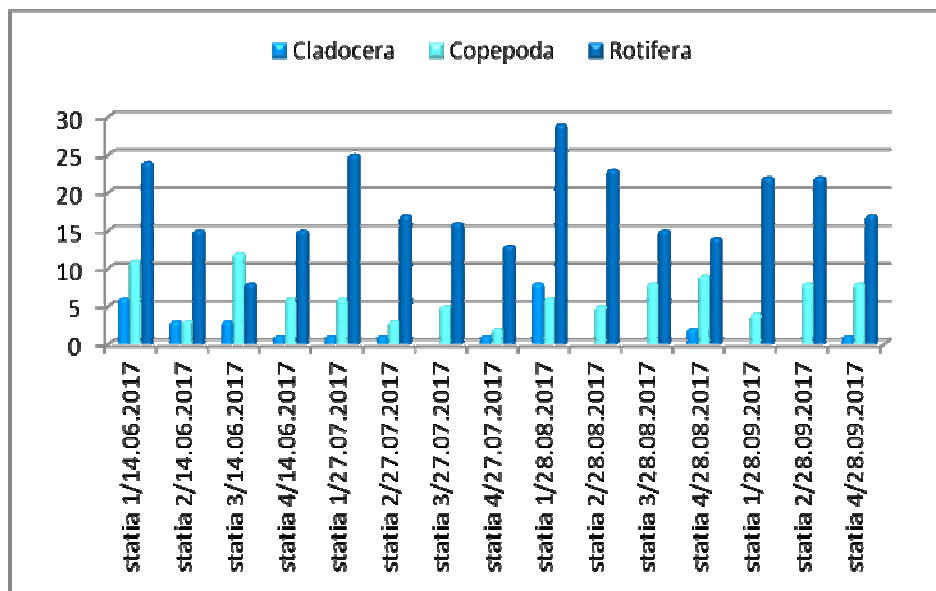


Fig. 4. Number of zooplankton species in all sampling stations

The highest abundance levels were represented by the particularly species of *Brachionidae* family, good indicators of trophic, such as: *Brachionus calyciflorus pala* (16,63 ind/L) *Polyarthra vulgaris* (11,70 ind/L), *Pompholyx sulcata* (10,74 ind/L), *Brachionus forficula* (9,38 ind/L), *Keratella tecta* (7,53 ind/L), *Brachionus angularis bidens* (7,16 ind/L), *Anuraeopsis fissa* (7,14 ind/L) (Fig. 5.)

From the group of copepods, predators species, the highest abundance was represented by small size planktonic crustaceans, especially in the

stages of nauplies and copepodides Nauplii dominated the copepods count (76,99 ind/L) and copepodides occupied the second order of abundance (17,67 ind/L), while cyclopoids like: *Megacyclops viridis* (2,67 ind/L), *Macrocyclus fuscus* (2,05 ind/L) and *Macrocyclus albidus* (2,02 ind/L), were the most abundant species (Fig. 6).

Cladocerans are filtrators species, the most abundant species observed were *Scapholeberis mucronata* (16,3 ind/L), *Chydorus sphaericus* (8,78 ind/L), *Simocephalus vetulus* (5,6 ind/L) and *Macrothrix laticornis* (5,54 ind/L), (Fig. 7.).

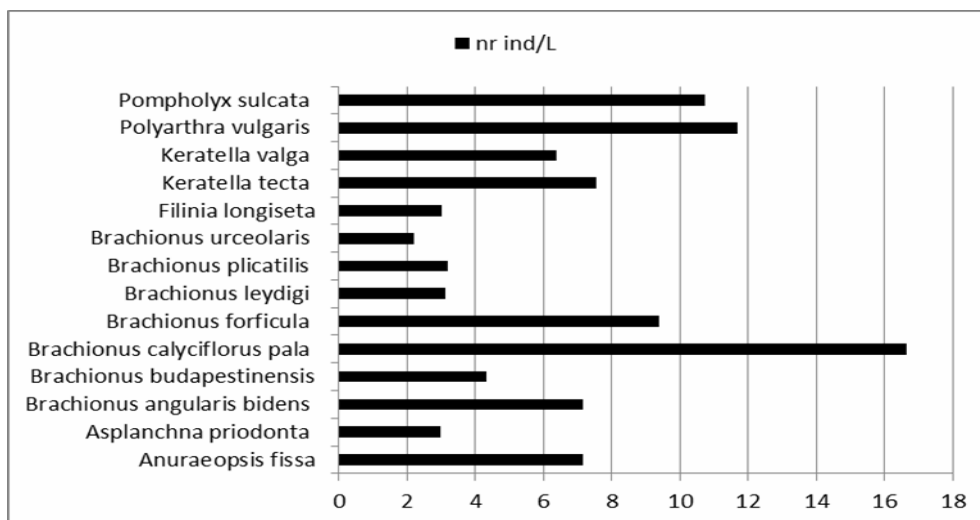


Fig. 5. Distribution of abundances of Rotifera from Zaghen lake in the studied period

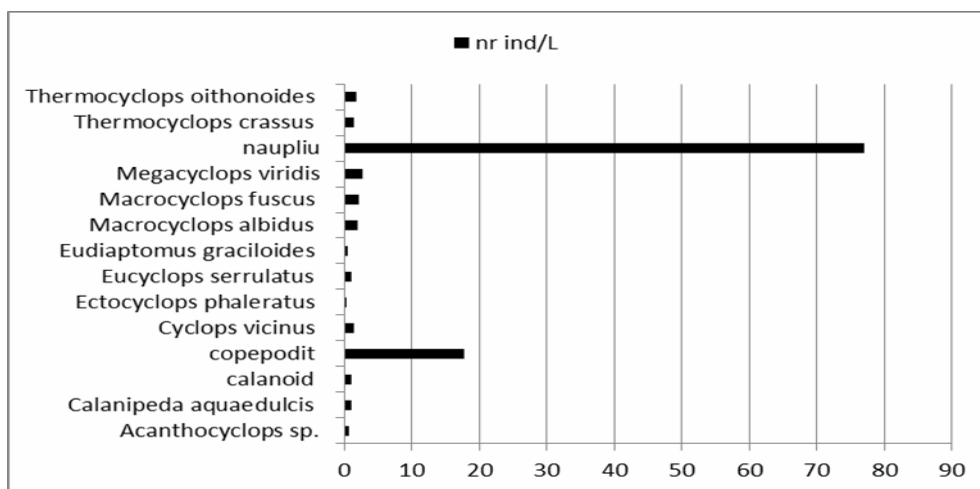


Fig. 6. Distribution of abundances of Copepoda from Zaghen lake in the studied period

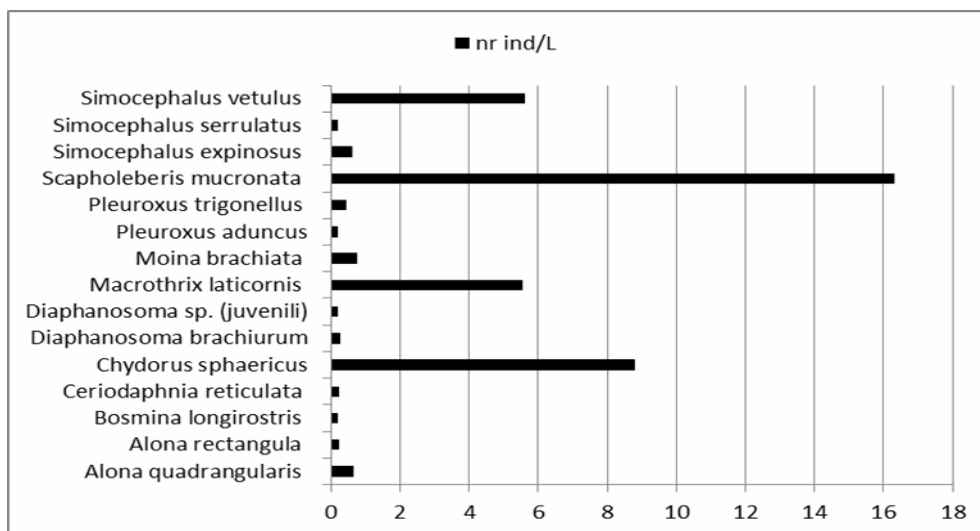


Fig. 7. Distribution of abundances of Cladocera from Zaghen lake in the studied period

## CONCLUSIONS

During the studied period, June 2017 – September 2017, 15 zooplankton samples were collected from lake Zaghen.

The monthly changes in zooplankton structure, abundance and specific diversity have been studied.

The qualitative analysis of zooplankton in lake Zaghen revealed the presence of three taxonomic groups: the Rotifera Group, the Copepoda Group, the Cladocera Group, as well as the representatives of the Diptera Order - the *Chironomidae* larvae.

The rotifers are more diversified and predominant in the water mass, while in contrast copepods and cladocerans were less diversified, in terms of specific abundance the Copepoda Group have the highest abundance through nauplies and copepodites stages.

Zooplanktonic numeric abundance in lake Zaghen it was represented by: Copepoda Group with 65%, Rotifera Group with 14% , representatives of the Diptera Order, *Chironomidae* larvae with 13 % , and Cladocera Group with 8%. The specific diversity was due to the presence of 85 species of zooplankton including: 56 species in the Rotifera Group, 15 Copepoda Group and 14 Cladocera Group.

## ABSTRACT

The Zooplankton species richness found in Zaghen wetland area, located in the eastern part of Tulcea, were studied in four stations, during June to September 2017. The present investigation reveals 85 taxa of zooplankton which include rotifera, showing highest diversity of 56 taxa followed by that of copepoda with 15 taxa, cladocera with 14 taxa and *Chironomidae* larvae (Diptera). This study was necessary to evaluate the ecological status of the Zaghen reservoir after restoring the functions as they are important in nutritive level and evaluating as well as ameliorating pollution status and thus used for determining the health of an aquatic ecosystem.

Zaghen wetland aims to restore functions of wet ecosystems lost as a result of anthropogenic activities carried out in the 1970s and aimed at expanding Romania's agricultural area to the detriment of natural ecosystems. During the 2012 to 2015, a rehabilitation flood regime was carried out.

This study was to implement the conservation of biological diversity, natural habitat, wild flora and fauna species in this wetland.

## REFERENCES

1. CLESCERI L. S., GREENBERG A. E., TRUSSELL R. R., 1989 - *Standard methods for the examination of water and waste water* (17 th ed.), Washington, APHA American Public Health Association, 1989. 10:94, 1193 pp.;

2. JEPPESEN E., NÖGES P., DAVIDSON T.A., HABERMAN J., NÖGES T., BLANK K., LAURIDSEN T.L., SODERGAARD, SAYER C., LAUGASTE R., JOHANSSON L.S., BJERRING R., AMSINCK S.L., 2011 - Zooplankton as indicators in lakes: a scientific-based plea for including zooplankton in the ecological quality assessment of lakes according to the European Water Framework Directive (WFD). *Hydrobiologia*. (663), 1.;
3. TUDOR I.-M., 2005 - The diversity of zooplankton in two restored wetlands in the Danube Delta.” Anthropogenic influence on wetlands biodiversity and sustainable management of wetlands; Warsaw Agricultural University Press; ISBN 83-7244-658-X pg.135-145;
4. TUDOR I.-M., IBRAM, O., TOROK L., COVALIOV S., DOROFTEI M., TUDOR M., NĂSTASE A., NĂVODARU I., 2015 - Metode de monitorizare a indicatorilor biologici în ecosistemele acvatice ale Deltei Dunării. Cap. 3. pp 95-123. In Tudor I.-M. (ed.), Ghid metodologic de monitorizare a factorilor hidromorfologici, chimici și biologici pentru apele de suprafață din Rezervația Biosferei Delta Dunării, 143 pag. ISBN 978-606-93721-8-0, Editura Centrul de Informare Tehnologică Delta Dunării, Tulcea, România;
5. TUDOR M., TUDOR I.-M., IBRAM O., TEODOROF L., NASTASE C., DEAK G., 2015 - *Analysis of biological indicators related to the surface water quality in Danube Delta Biosphere Reserve*, Journal of Environmental Protection and Ecology (JEPE), vol. 16 (2), ISSN 1311-5065;
6. \*\*\* Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy). OJL 327, 1, (2000).
7. \*\*\* [www.primaria-tulcea.ro](http://www.primaria-tulcea.ro); Reconstrucția ecologică în polderul Zaghen din Rezervația Biosferei Transfrontaliere Delta Dunării, Raportul privind impactul asupra mediului

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