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PRESENT STATE OF TROPHIC PARAMETERS OF THE MAIN LAKES FROM SIRET AND PRUTH WATERSHEDS

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Abstract

In the Siret and Prut river basins, wich are overlapping historical province of Moldova, the artificial lakes dominate over natural ones. Some ponds are historically recorded during Ştefan cel Mare princehood 1457-1504 (Dracşani). This study examines and highlights the role that these lakes have in the present economic activity of local communities and reveals the current degree of pollution after the industrialization.The highest density of lakes is specific for the northern part of Moldavian Plateau (Botoşani and Iaşi counties). In the mountain area were analyzed lakes with a high degree of complexity and natural dam lakes (Roşu, Crucii). Salt lakes were avoided because the physicochemical characteristics are quite different and can not be used in the water supply system. The majority of the lakes, depending on the nutrient content, belongs to the eutrophic and hipertrophic category, and from the biological point of view are oligotrophic, mesotrophic or eutrophic. All artificial lakes have complex functions, even if are ponds or hydropower complexes.

Keywords: genetic type, lakes, Moldova, pollution, water quality.

1. INTRODUCTION

Geographycal literature on lake water quality is relatively poor. This field of research was a predilection for biologists. In the last 10 years the limnogeographical school of Iaşi initiated a series of complex studies on water basins and wetlands of Siret and Prut river basins (Romanescu, 2006, 2009; Romanescu and Romanescu, 2008; Romanescu et al., 2005, 2008, 2009, 2010, b,c,d).

To detail the studies conducted in the lakes situated in Romania was consulted a large body of Romanian, European and American domain literature, from which have been extracted the most important directions and ideas to be reported to the local realities: Bates et al., 2003; Dinu, 2004; Dinu et al., 2002, 2005; Dinu and Radu, 2004; Dodds and Cole, 2007; Dussart and Defaye, 1995; Gastescu, 1971; Hakausson, 2002; Harding and Smith, 1974; I.N.M.H., 2006; Sallenare and Cowley, 2004; Stebe and Krauter, 1982; Török and Dinu, 2006; Vadineanu et al., 1998; Van Dam et al., 1994.

This study targeted analisys of lake water quality from Siret and Prut river basins and their use in the context of market economy. Expeditionary field analyses took into account the evidence of the quality parameters according to nutrients and in biologically terms.

2. REGIONAL SETTING

Siret and Prut river basins are located in the eastern part of Romania and overlap historical province known by name Moldova (Figure.1). Both rivers spring from the territory of Ukraine and flows in to the Danube near the Galați town. Siret and Prut rivers are the most important hydrographic artery of Romania and they are the main source of water from county like: Suceava, Botoşani, Neamț, Iaşi, Bacău, Vaslui, Vrancea and Galați.

3. METHODOLOGY

There are 3,450 lakes in Romania, with a cumulated surface of 2,620 km^2, covering 1.1 % of the total surface of Romania. Unfortunately, most of the lakes are human made, and the natural lakes, apart of being few their surface is insignificant (Gastescu, 1971; Romanescu, 2006). The seasonal campaign during 4 years (2005, 2006, 2007, and 2008) had as a main purpose the complex characterization of lacustrine waters quality, by interpreting the results of the field measurements, with reference to the their classification in quality classes. A complex measurement set was used for the measurement of the physico-chemical

parameters, and at the same time, samples of phytoplankton specific to the lacustrine waters were taken. The trophicity of the lacustrine waters required the characterization of several physico-chemical and biological indicators, determining and favouring its evolution: pH, CCO-Cr, CC=-Mn, CBO_5, total mineral nitrogen, total phosphorous, temperature, dissolved oxygen, transparency, nutrients, structure of aquatic biota (value of phytoplankton biomass, percentile value V90 % of the plankton biomass, coli form bacteria) etc. The physico-chemical parameters were interpreted at the Hydrology Laboratory of the Faculty of Geography and Geology, University "Alexandru Ioan Cuza" of Iasi, and the biological parameters were interpreted by the Natural Sciences Museum in Tulcea. As some data for few of the lakes mentioned above were missing from our analysis, they could be taken from the Water Headquarters in Bucharest or from the regional hydrologic offices (I.N.M.H., 2006). The data we obtained were reported to Order 1146/2002 in five quality classes, and the classification of the lakes was established by using the percentile system V (90 %).

Figure 1. Geographical location of the Siret and Prut river basin in Romania

4. RESULTS AND DISCUSSIONS

The lakes of Siret and Prut river basins have a natural and anthropogenic genesis. Most anthropogenic lakes are located in the north-eastern part of Moldova, in the Prut river basin, and are from ponds category. In the Siret river basin dominate the lakes with a complex character, especially those located in mountains area. The plateau lakes are widespread in Bârlad river basin and have the first destination flood mitigation or water supplies to urban and rural localities.

The complex analysis of the lakes was done on river basins: Siret (Bucecea, Rogojesti, Galbeni, Dragomirna, Calimanesti, Izvorul Muntelui, Bâtca Doamnei, Poiana Uzului, Tungujei, Puscasi, Cazanesti, Solesti, Cuibul Vulturilor, Râpa Albastra, Jirlau, Amara, Balta Alba, Siriu, Cândesti, Lala, Rosu, Rediu); Prut (Cal Alb, Stânca-Costesti, Mileanca, Negreni, Dracsani, Catamaresti, Halceni, Tansa, Pârcovaci, Podul Iloaiei, Ciric, Gorban) (Figure 2).

The geographical location of the lakes, in distinct landform units (mountains, hills, and plains) creates different environment for the manifestation of the trophicity (Table 1). The largest water acumulation have a complex character and are located in the mountains area (except for accumulation Stânca-Costeşti which holds second place in Romania in size and volume of water after Porțile de Fier I lake). Lakes that are located on small rivers are designed to mitigate flooding or are used for irrigation or fish farming (Dragomirna, Bahlui, Tutova, Valea Bolului etc.).

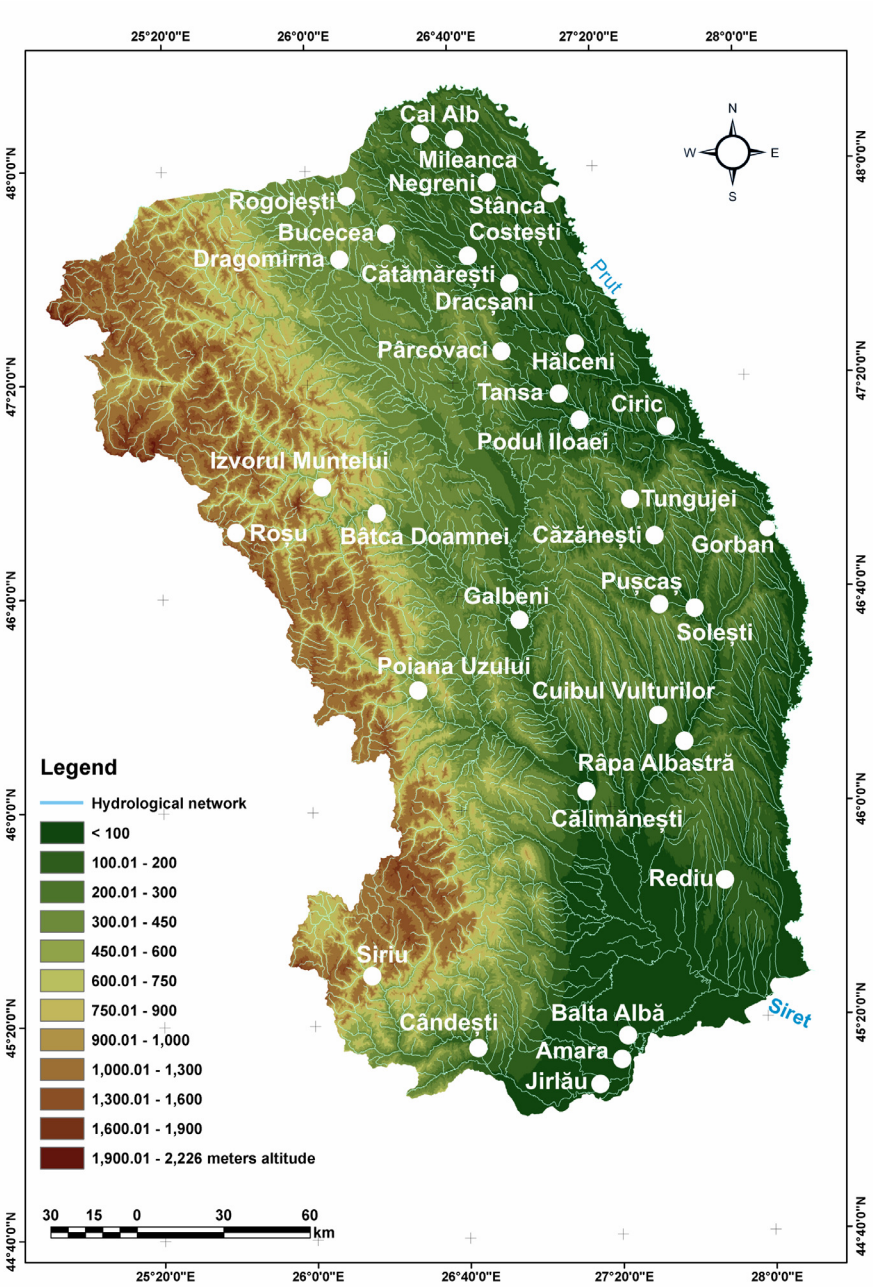

Figure 2. Geographical position of the lacustrine basins analyzed in Siret and Prut river basins

Table 1. Morphometric characteristics and trophicity of the lakes in Siret and Pruth watersheds (partially according to I.M.H. Bucharest, 2006)

Lake	Genetic type	Water course	Usage	Volume millions m^3	Surface ha	Maximum depth	Water quality (category)	
							Nutrients (total nitrogen, total phosphorous)	Biology
Siret river basin								
Bucecea	Human made	Siret	Complex	24.5	475	-	M-E	O
Rogojesti	Human made	Siret	Complex	48.4	800	9	M-E	O
Galbeni	Human made	Siret	Complex	71.0	1123	-	E-H	E-H
Dragomirna	Human made	Dragomirna	Water supply	17.0	106	-	M-E	M
Calimanesti	Human made	Siret	Energy	44.3	-	-	E-H	O
Izvorul Muntelui	Human made	Bistrita	Complex	1230.0	3000	90	M	M
Bâtca Doamnei	Human made	Bistrita	Energy	10.0	235	16	E	O
Poiana Uzului	Human made	Uz	Water supply	90.0	335	75	E-H	M

Tungujei	Human made	Sacovat	Complex	25.0	-	-	E	UO
Puscasi	Human made	Racova	Complex	20.7	-	-	H	O
Cazanesti	Human made	Stavnic	Complex	20.6	-	-	H	O
Solesti	Human made	Vasluiet	Complex	47.0	-	-	H	O
Cuibul Vulturilor	Human made	Tutova	Complex	54.6	1150	-	E-H	O
Râpa Albastra	Human made	Simila	Complex	25.8		-	H	UO
Jirlau	Liman	Valea Boului	Fishing	5.6	900	-	H	M
Amara	Liman	Buzoel	Fishing	3.6	600	3,0	H	M
Balta Alba	Liman	Boldul	Therapeutic	5.1	1012	4	H	M
Siriu	Human made	Buzau	Complex	158.0	360	-	E	O
Cândesti	Human made	Buzau	Complex	4.4	-	-	E-H	M
Rosu	Natural barrage	Bicajel	Tourism		13	7.5	M-E	UO
Rediu	Human made	-	-	-	-	-	E	M
Prut River basin								
Cal Alb	Human made	Baseu	Complex	11.9	-	-	H	E
Stânca-Costesti	Human made	Prut	Complex	1400.0	140000	-	H	O
Mileanca	Human made	Podriga	Complex	9.5	-	-	H	E
Negreni	Human made	Baseu	Complex	19.8	304	-	M	O
Dracsani	Human made	Sitna	Complex	9.5	574	-	H	E
Catamaresti	Human made	Sitna	Fishing	14.0	-	-	H	M
Halceni	Human made	Miletin	Water supply	49.5	-	-	E-H	O
Tansa	Human made	Bahlui	Complex	33.0	360	7	E-H	UO
Pârcovaci	Human made	Bahlui	Water supply	5.5	-	-	M-E	UO
Podul Iloaiei	Human made	Bahluiet	Fishing	-	-	-	E	E
Ciric	Human made	-	Complex	-	-	-	E	E
Gorban	Floodplain	-	-	-	-	1,4	E	E

***H - hypertrophic; E - eutrophic; M - mesotrophic; O - oligotrophic; UO - ultraoligotrophic.**

Water trophicity depending on the amount of nutrients is relatively different in the two basins. In the Siret river basin 21 lakes were analyzed and in the Prut river bazin, 12 lakes. For Siret stands out 6 eutrophic-hypertrophic lakes and other 6 hypertrophic. In the Prut river basin were distinguished 6 hypertrophic lakes and 3 eutrophic. Trophicity depending on the biomass of phytoplankton is an important indicator of biological pollution. In the Siret river basin dominates 9 oligotrophic lakes and 8 mesotrophic (Table 3). For Prut dominates 6 eutrophic lakes and 3 oligotrophic. Most of the water from Siret and Prut river basins belongs to the economic water category and are used in this way. Usually, the ponds are fish farms and the lakes with complex character have as a main role the flood capture. Large lakes (except pond Dracşani) also produce significant quantities of electricity: Izvorul Muntelui, Stânca Costeşti, Bâtca Doamnei etc.

Table 2. Lacustrine waters trophicity according to the nutrients value

River basin	Total nr. of lakes	Trophicity degree															
		UO		O		O-M		M		M-E		E		E-H		H	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Siret	21	-	-	-	-	-	-	1	4,76	4	19,04	4	19,04	6	28,57	6	28,57
Prut	12	-	-	-	-	-	-	-	-	1	8.33	3	25.00	2	16.66	6	50.00

***H - hypertrophic; E - eutrophic; M - mesotrophic; O - oligotrophic; UO - ultraoligotrophic.**

Table 3 Trophicity of lake waters according to the phytoplankton biomass value

River basin	Total no of lakes	Trophicity degree															
		UO		O		O-M		M		M-E		E		E-H		H	
		Nr.	%	Nr.	%	Nr.	%	Nr.	%	Nr.	%	Nr.	%	Nr.	%	Nr.	%
Siret	21	3	14,28	9	42,86	-	-	8	38,10	-	-	-	-	1	4,76	-	-
Prut	12	2	16.66	3	25.00	-	-	1	8.33	-	-	6	50.00	-	-	-	-

***H-hypertrophic; E-eutrophic; M-mesotrophic; O-oligotrophic; UO-ultraoligotrophic.**

Genetically, the natural lakes analyzed are: river liman (Jirlău, Amara, Balta Albă), natural dam lake (Roşu) or left meander (Gorban). These lakes have just an natural landscape role and are an important tourist attractions (Roşu).

CONCLUSIONS

The number of the lakes in Romania is relatively great, but their area is often reduced. The most numerous lakes are human made, situated mainly in the northern Moldova and Transylvania. The most important analysed lakes were limited within the river basins. In the present study the salty lakes in the salt massifs were not analysed as they present different characteristics and they are used only therapeutically. The trophicity degree is given by 5 main qualifications (hypertrophic, eutrophic, mesotrophic, oligotrophic, ultraoligotrophic) and separates the lakes on the territory of Romania according to the landform units and climate. Trophicity can be also influenced by the nature of rocks. According to the value of the nutrients, most of the lakes are included in the mesotrophic, mesoeutrophic, eutrophic, eutro-hypertrophic and hypertrophic categories. The lakes with the best trophicity are used for fishing as well.

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