QUALITY CONDITIONS IN SURFACE WATERS

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Abstract

In this paper we propose to observe water quality in the basin Barlad. Water quality in the basin varies Barlad as required by the Law 310/2004 amending and supplementing the Water Law 107/1996 which took over the provisions in the Water Framework Directive 60/2000/EC. Author studying the evolution of the basin parameters Barlad, under the monitoring, river pollution and the impact on Barlad.

Key words : surface waters, pollution monitoring sections, surface water quality

Surface water have the ability to dilute and disperse contaminants and natural self-purification capacity. Barlad River, left tributary of the Siret River has a catchment area of 7220 km^2. Barlad basin is situated in the southern part of the Moldavian Plateau (fig. 1). Length of main river course under the supervision Barlad in terms of water quality is 207 km, the main tributaries are: Sacovat, Durduc, Rebricea, Vaslui, Crasna, Racova, Similia, Pereschiv, Zeletin and Berheci.

Barlad river was monitored at 4 monitoring sections: Ienei Valley, Crasna, Criveşti (upstream Tutova) and Umbrăreşti.(NRAW, 2000).

Location river

Barlad river, is a major river artery, a major tributary of the Siret on the left. Barlad River runs between 46 º and 14 'latitude N and longitude 27 º 40' E.

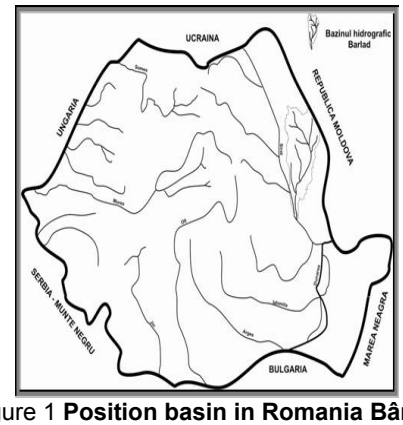

Figure 1 **Position basin in Romania Bârlad**

MATERIAL AND METHOD

Investigation

National water monitoring system has two types of monitoring, as required by the Law 310/2004 amending and completing Law 107/1996 which took over the provisions of Water Framework Directive in the field of water 60/2000/CE and other EU Directives (WFR, 2000) Thus, we conducted a surveillance monitoring role given to assess the status of all water bodies within the watershed, and an operational monitoring (integrated surveillance monitoring) for water bodies they may fail to meet the objectives of water protection.

Thus, taking into consideration the risks for the aquatic ecosystem and for the human health, it asserts the monitoring of dangerous and priorities the dangerous substances in all subsystems and investigation environments (Giurma, 2000).

In this classification of water quality, appropriate benchmarks correspond to II quality class which is to be achieved levels nationally and regionally in a long term strategy (NARW,2008)

According to this programme, samples are taken annually with a sampling frequency ranging from 6 to 12 annual samples (NARW, 2008).

The variables measured include determination of basic variabiles (e.g pH, conductivity, water temperature), organic pollution indicators (e.g dissolved oxygen, BOD), nutrients and suspended solids. To establish the quality state of the water (one of the five classes), the evaluation took into consideration both aspects: chemical and ecological. The categorization of the control section on different quality classes has been done according to the MO 161 (2006) which approves the „Normative for the classification of surface water quality in order to establish the ecological status of water corps" (WFR, 2000).

RESULTS AND DISCUSSIONS

Control sections of the Basin Barlad

IENEI VALLEY SECTION

This section located at 1.4 km from the source is the first river Barlad, the reference section. The numbers of physico – chemical and

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biological assays depends an each type of assessments between January-December.

Table 1

Inventory of analysis types for Barlad River monitoring in Ienei Valley Section

Type of assays		Number of assays per year
Physico – chemical		6/12
biological	-phytoplankton	3
	-zoobentos	2

Ecological status of rivers:

- *Biological quality elements:*

For Ienei valley section biological analysis has been made with a quarterly frequency both for the phytoplankton indicator and the macrozoobentos indicators.

The average density of the organism was 90 organisms/m^2,and the saprobe indicator had an average value of 2.17, therefore the *Ienei valley Section belonged to the II quality class.*

Phytoplankton is dominated by species of diatoms: Navicula gracilis, floculossa Tabellaria, Synedra acoustic, cryptocephala Navicula, Pinnularia viridis, sigmoid Nitzschia. Minimum density of phytoplankton was recorded in March 135 000 organisms/m^2 and a maximum of 230,000 in organisms / m^2 in September. Saprobity index is 1.90 set by phytoplankton in the framing section as class II (β-mezosaprobă area).

This section is framed in terms of biological quality class II(NARW, 2008).

- *Physico-chemical quality elements*

In the area of monitoring river water is pure water Barlad located in quality class II system after oxygen and salinity. Exemplified by the following values of the arithmetic mean (table 2).

Table 2

Values of water quality indicators in Ienei Valley Section

Water quality indicator	Value
BOD_5 - (mg/l)	2,82
CCO - Mn - (mg/l)	5,7
CCO - Cr - (mg/l)	14,43
$N\text{-}NH_4$ - (mg/l)	0,09
Residue - (mg/l)	612,5
Chlorides (mg/l)	21,5
Sulphate (mg/l)	99,7

CRASNA SECTION

Table 3

Inventory of analysis types for Barlad River monitoring in Crasna Section

Type of assays		Number of assays per year
Physico – chemical		6/12
biological	-phytoplankton	3
	-zoobentos	3

For Crasna Section the numbers of assays depending by the physico – chemical and biological indicators between January-December are show in the table 3.

Ecological status of rivers:

• *Biological quality elements:*

For confluence upstream section Crasna biological samples were taken three times the frequency / year for phytoplankton and macrozoobentos indicators. The structure is composed of inorganic material banks fine low slope on the right side, left side ranging sediment consists of sand. Speed is dominated by small and water turbidity is high. Zoobentosul investigated in May, July and September was composed of species: Chironomus plumosus, Dicrotendipes nervosus, Orthocladius thienemanni (dipterous), Gammarus fossarum (crustaceans), Helobdella stagnalis, Erpobdella octoculata (hirudin) pellucidula Hydropsyche (Trichoptera), Calopteryx splendens (Sighisoara), Phys acute Lymnaea stagnalis (Mollusca). Average annual index has the value 2.63 saprobity quality class III. Density is the average of 131 organisms/m^2. Phytoplankton is diverse and rich in species of diatoms: Navicula gracilis, Navicula cryptocephala, Synedra acoustic and euglenofite: Euglena variabilis, acoustic Euglena, Euglena geniculate, Euglena Caudata. Annual average index is 2.25 saprobity framing section quality class II (the β - mezosaproba). Average phytoplankton density is 260,000 organisms /m^2.

Globally, according to the biolocical evaluation the Crasna Section belonged to the III qualitative class.

• *Physico-chemical quality elements*

In the area of monitoring river water is located Barlad grade IV quality after nutrient regime. Exemplified by the following values of the arithmetic mean:

Table 4

Values of water quality indicators have conflicting section Crasna

Water quality indicator	Value
BOD - mg/l)	6.25
COD - Mn (mg/l)	13.88
COD - Cr (mg/l)	34.6
$N\text{-}NH_4$ (mg/l)	6.125
phosphorus total (mg/l)	1.311
Residue (mg/l)	846.5
Chlorides (mg/l)	56.5
Sulfates(mg/l)	210.7
Cooper(µg/l)	49.43

Source: Data were obtained from the National Agency of Romanian Water (NARW Prut)

CRIVEŞTI SECTION (UPSTREAM TUTOVA)

Table 5

Inventory of analysis types for Barlad River monitoring in *Criveşti* Section *(upstream Tutova)*

Type of assays		Number of assays per year
Physico – chemical		6/12
biological	-phytoplankton	3
	-zoobentos	3

Ecological status of rivers:

• *Biological quality elements:*

For section Criveşti biological samples were taken with the frequency 3 times/year for phytoplankton and macrozoobentos indicators.

The structure is composed of inorganic material banks fine, low slope, the sediment consists of sand. Water velocity is low and turbidity is high. The average density is 110 organisms/m^2 and saprobity index of 2.40 falls in the quality section in III class.

Taxonomic phytoplankton is represented by: euglenofite (*Euglena variabilis, Euglena acoustic*) cianofite (*Aphanizomenon flos-aquae*), criptofite (*Cryptomonas marssonii*), diatom (*Navicula gracilis, Synedra acoustic*) and chlorophylls (*Crucigenia fenestrated*). The density of phytoplankton had an average numeric of 381 667 organisms / m^2, the saprobe indicator had an average value of 2.07 –quality class II.

Globally, according to the biolocical evaluation the Crivesti Section belonged to the III qualitative class.

• *Physico-chemical quality elements*

In the area of monitoring river water is located Barlad quality IV class after nutrient regime. Exemplified by the following values of the arithmetic mean:

Table 6

Values of water quality indicators in Criveşti (upstream Tutova) Section

Water quality indicator	Value
BOD(mg/L)	7.59
CCO-Mn(mg/L)	15.38
CCO-Cr(mg/L)	34.98
N-NH_4 (mg/L)	2.981
Phosphorus (mg/L)	0.976
R_{fix}(mg/L)	777.5
Sulfates(mg/L)	175.4
Chlorides (mg/L)	54.9
Cooper(µg/L)	87.5
Nikel(µg/L)	176.19
Phenols(µg/L)	2.44

Data were obtained from the National Agency of Romanian Water (NARW Prut).

BARLAD - UMBRĂREŞTI SECTION

Table 7

Inventory of analysis types for Barlad river monitoring in Barlad – Umbraresti Section

Type of assays		Number of assays per year
Physico – chemical		6/12
biological	-phytoplankton	1
	-zoobentos	3

Ecological status of rivers:

• *Biological quality* elements*:*

For Umbraresti section biological samples were taken with frequency 3 times / year for phytoplankton and macrozoobentos indicators, and in November was analyzed fitobentos indicator.

The structure is composed of inorganic material banks fine low slope. Speed is low and water turbidity is very high. Saprobity index annual average was 2.67 – quality class III.

In quantitative terms, the density was 1.9375 million microfitobentosul organisms/ m^2. Saprobity index annual average was 2.22 – quality class II.

Phytoplankton density reached the highest value in June (1.932 million organisms/ m^2) and lowest in March (1.025 million organisms/ m^2) and saprobity index annual average value of 2.21 corresponds to quality class II. Global Section is classified in biological quality class II.

Table 8

Values of water quality indicators in Barlad – Umbraresti Section

Water quality indicator	Value
BOD(mg /l)	6.82
COD – Mn (mg /l)	18.33
COD – Cr (mg /l)	37.74
N-NH4 (mg /l)	1.375
Total Phosphorus (mg /l)	0.734
Residue (mg /l)	709.5
Sulphates (mg/l)	100.3
Chlorides (mg/l)	61.5
Nickel (µg/l)	27
Phenols(µg/l)	3.78

Data were obtained from the National Agency of Romanian Water (NARW Prut). The data were processed in the of Hydrotechnical, Geodesy and Environmental Engineering Iasi.

• *Physico-chemical quality elements*

In the area of monitoring river water is located Barlad quality class III after oxygen regime, nutrient and salinity. Exemplified by the following values of the arithmetic mean:

The general principle of classification of ecological status has been for the five groups of indicators - the regime of oxygen, nutrients, mineralization, specific toxic pollutants of natural origin and other relevant chemical indicators, by evaluating the weighted effect of all indicators, based on the arithmetic mean.

Surface water of the river sections Barlad depending on the length of the river over a length of 207 km in terms of biological indicators fall into Class II (168 km) and class III (39 Km) - (table 10). In River basin Barlad in 2008, according to the physico-chemical indicators of surface water is within quality class II-IV (table 11)

Barlad River surface water is characterized as "good" in terms of ecological status and chemical status assessment (table 12).

Table 9

The limit of quantification and indicators of river sections Bârlad

River/ Section	N- NO_2	LQ The limit of quantification	P-PO_4	LQ The limit of quantification
Barlad –upstream lenei valley	0.011	0.002	0.037	0.01
Barlad – upstream Crasna	0.030	0.002	0.073	0.01
Barlad - Crivesti	0.023	0.002	0.746	0.01
Barlad - Umbraresti	0.042	0.002	-	

Data were obtained from the National Agency of Romanian Water (NARW Prut)

Table 10

Two characteristic length of river sections in 2008 compared to quality im registered with biological indicators

River	The section of river		Length (km) of which				
		Total	Quality class				
			I	II	III	IV	V
Catchment Barlad							
Barlad	Source - Berheci river	207		168			
	Berheci river – Siret river				39		
	TOTAL			168	39		

Data were obtained from the National Agency of Romanian Water (NARW Prut)

Table 11

Classification of control sections according to quality classes for the Barlad River in 2008 (Ecological and Chimical state)

No	River	Section	Monitoring S	Type of the monitoring program	Ecological state						Chemical state		
					Oxygen regime	Nutrients	Salinity	Other indicators	General Class – Physico-chemical indicators	Physico-chimical indicators that determine the quality	General class- The saprobe indicators	Dangerous substances (Metals and composite – dissolved, organic micro - pollutants)	
BARLAD													
1	Barlad	*Upstream lenei valley*	S	IH,R	I	I	II	-	II	Residue, chlorides	II	N (MG: Ni, Cu)	Bad
2		upstream Crasna	S	O,IH	III	IV	III	III	IV	NH_4, P	II	N (MG: Ni, Cu)	Bad
3		Upstream Tutova	S	O,IH	III	IV	III	II	IV	BOD, CCOMn, NH_4, P	II	N (MG: Ni, Pb, Cu)	Bad
4		Umbrăresti	S	O,IH,EI ONET, TNMN	III	III	III	II	III	BOD, CCOMn, CCOCr	III	N (MG: Ni, Cu, Se)	Bad

Table 12

Distribution of surface water bodies (rivers) as assessed ecological status and chemical status in 2009

No.	Bazinul hidrografic	No total body water	Distribution of water bodies as ecological status assessment										Distribution of water bodies as assessed by chemical status			
			Very good		good		Moderat		Poor		Bad		Good		Poor	
			No body	%	No body	%	No body	%	No body	%	No body	%	No body	%	No body	%
1	PRUT	130	0	0	120	92,3	10	7,7	0	0	0	0	130	100	0	0
2	BARLAD	91	0	0	81	89,0	10	11,0	0	0	0	0	91	100	0	0
3	SIRET	17	0	0	16	94,1	1	5,9	0	0	0	0	17	100	0	0
TOTAL		238	0	0	217	91,2	21	8,8	0	0	0	0	238	100	0	0

ICIM developed the methodology on the assessment of ecological status of surface water. The observations were made in 2007, 2008, 2009 in ABA Prut- Barlad –National Agency of Romanian Waters, measurements were made in each section of the River.

CONCLUSIONS

Analysis of water quality surveillance in sections and their inclusion in the five quality classes is the first result characterizing the quality of river sections of these sections. Barlad River was monitored by four sections: Ienei Valley (reference section), upstream Crasna, upstream Criveşti, Umbraresti. Thus the river Barlad can establish four sections of river with physico qualities - different water chemistry, depending on water quality and drinking water monitoring sections, sources of pollution in the area and influence the quality of major tributaries.

The section source - Negreşti

It has a length of 40 km and is located in Class II as demonstrated by quality recorded in Ienei Valley Section.

Negreşti Section the confluences of Vaslui river

This section with a length of 49 km is corresponds to the III quality class, quality found in Barlad – Vaslui Section outlet. In this section act as sources of pollution with wastewater treatment plant operation and also damaged the city Negresti of localities in the area.

Vaslui Section the confluences of Berheci river

It has a length of 79 km and is classified as class IV of quality due to physico-chemical and biological sections have registred upstream Crasna and Criveşti.

This part of the river is polluted by Vaslui receiver insufficiently treated wastewater treatment plant to the city of Vaslui and direct discharges of wastewater from the town of Vaslui, and intake of pollutants from the city treatment plant Barlad.

Berheci River Section the confluence with the River Siret

It has a length of 39 km and is located in quality III class confirmed by Umbraresti section. The quality of this section is due to influence of it's main tributary water quality of this sector (Berheci river which fall in quality II class).

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