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SURFACE WATER QUALITY-STUDY CASE RIVER GALDA

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Abstract

Due to the rapid development of the industry and also the settlements along the rivers, their waters reach wastes and even toxic elements that affect water quality characteristics. Pollution from industry is done at all levels: chemically, physically and biologically, thus affecting the normal development of flora and fauna. Changing water quality is achieved by altering the pH, temperature, water turbidity, but also enriching with organic materials content, thereby reducing the amount of oxygen in water, that favors the overgrowth of algae communities, resulting in eutrophication banks. The proposed research theme enroll in scientific concerns of international and national quality control and protection of surface waters against pollution and provides a comprehensive characterization of water quality of River Galda. To better highlight the influence of industry on the river Galda, his course was divided into four sectors from its source to its mouth, each sector comprising settlements developed along the watercourse and one food industry factory, except the first sector, that includes source of the river and a portion without settlements or other pollution sources. This section, first sector, provides information on the quality of river Galda water without the influence of anthropogenically induced pollution and is used as a reference section. To establish the water quality were used physical analyzes, chemical evaluation was done by determining the main parameters of the oxygen regime, parameters concerning nutrients and main ions existing in water. Evaluation of water quality in terms of biological and microbiological study was carried out by community diatoms in Phytobenthos and establishing ecological status of water on saprobic system, and the micro-biologically analyzed colonies of coliform bacteria , E. coli, Enterococci and NTG. As a result of analyzes was performed in framing quality classes stipulated in legislation of each sector analyzed and also established the ecological status of water in each sector, thus achieving a comprehensive evaluation of river water quality Galda, and evolution pollution from the source to the mouth, according to the sources of pollution.

Key words: *diatoms, pollution, River Galda,water quality*

INTRODUCTION

Water is an important element for the existence of life and human community development. The fact that the first life forms arose in the aquatic environment, the first human settlements were established near rivers and streams, to have the water needed for drinking and needs household, that water is the place where all metabolic processes, the tissues and organs of all living creatures contain water in big proportion proves the role of primary importance in the development and maintenance of the water in life and in development of human community over time. (M. Popa, 2013)

Whatever the use, water must meet certain quality because the existence and development of human society are entirely dependent on this precious resource. Due to rapid development of humanity in socio-economic field, the types of waste discharged into water courses become more diverse: agricultural fertilizers, pesticides, detergents, heavy metals, cyanide, radioactive substances, industrial chemicals, organic matter, etc.. Many of these substances can be harmful or toxic for organisms that lives in the biosphere, and these substances induce the degradation of surface water quality.(Banu A, 2001)

The research theme proposed is part of a broad spectrum of importance, addressing the growing problem of surface water pollution. This research theme investigate the water quality of the river Galda in terms of physical and chemical parameters, represented by the parameters of the oxygen regime, nutrients, parameters on salinity, temperature and

acidification, and toxic pollutants of natural origin; hydro-biological phytobenthos and micro-biological analysis represented by the amount of viruses and bacteria contained in the water.

MATERIALS AND METHODS

The study was made in November 2013, so the results will reflect the specific meteorological and hydrological conditions of that period.

River is studied Galda River , located in Alba County , and is a major right tributary of the river Mureș. Galda river has its source in the tip Negrileasa Mogosului at an altitude of 1364 m , located Trascău mountains. The river has a length of 39 km and a total area of 253 km^2 , crossing along its course mainly limestone relief .

This river was chosen because along its course are formed numerous settlements and factories in the food industry. The appearance of these anthropogenic formations on river banks have a strong impact on water quality parameters affecting quality by the waste water discharged into the river, by waste thrown into the water or deposited on the riverbanks, or spills of toxic substances such as chemicals used in agriculture. The study area is part of the Action Plan for the protection of waters against pollution caused by nitrates from agricultural sources, according to Order 743 of December 12, 2008.

Characterisation of river water in terms of quality investigation was made using data from four control sections , located along the watercourse. The first sector is the control sector, that includes the upper river and its source, the second area is the middle course of the river crossing localities with population more than 200 people in this sector was build a food factory. The third sector is the lower course of the river, that cross localities with a population of about 1,800 inhabitants and also in this sector is a major industry food factory. The fourth sector, and last, is the lower course of the river that crosses localities with more than 2,800 inhabitants, this sector includes the mouth of the river, and also a food factory in it. Sections aim to highlight critical points regarding water quality, that are located downstream of the major sources of pollution , thus providing information on the impact on river water Galda . (Truța, 2014)

River Galda waters quality characterization was performed by evaluating three factors: water, particles matter and living organisms. Water quality and particle matter as settled by physical and chemical water quality perspective while living organisms and phytobenthos layer analysis was performed by existing microorganisms in water. The analysed parameters, that are representative for the study was conducted in framing appropriate grade using the worst case , based on the results obtained.

Sampling:

Water sampling was done according to Stas 6324, to insure that samples are representative , thus eliminating the possibility of errors in the analysis.

Sampling for analysis of physical and chemical parameters is performed in sterile polyethylene bottles with a capacity of 2 liters fitted with a stopper . Taking water samples for analysis phytobenthos,and micro-biological parameters is done in sterile glass bottle, hermetically sealed. In order to achieve Phytobenthos analysis samples were collected by scraping the substrate immersed in the river for at least 4 week. Handling and preparation of samples were performed according to PGL- 13.

The physical and chemical analysis of water in the study were: thermal regime and acidification, oxygen, nutrients, salinity, toxic substances of natural origin. Other physical and chemical parameters analyzed are: turbidity, color, odor, total dissolved substances, conductivity, total alkalinity, total acidity and total hardness of water.

These determinations were made by potentiometric methods, analytical and instrumental methods and also volumetric methods. Setting class of chemical quality of water is done using worst scenario.

At the time of sampling was determined "in situ" water temperature using an electronic thermometer stem, color and odor of water were determined organoleptically.

The system parameters of the oxygen regime: dissolved oxygen, BOD5 were determined in the laboratory using the Winckler method , and

COD-Mn has been determined by titration with potassium permanganate.
Nutrients class parameters were determined by spectrophotometric methods to achieve analysis using Spectroquant NOVA 60 (SQ) SQ specific kits .
Salinity class parameters were determined by complexometric titration using complexone III EDTA solution 0,01 M and murexide indicator. Using the volumetric titration with EDTA complexone III was also determined and water hardness. Acidity and alkalinity of the water was determined by titration with NaOH 0.1 N and HCl 0.1 N solution.
Parameters in natural toxic pollutants, were determined by X-ray fluorescence spectrometry using EDXRF Quant'X ARL spectrophotometer (Thermo Scientific, USA).
The turbidity of the water was determined using a HI88713. Total dissolved substances, conductivity and pH were determined by means of the multi Hanna HI station 4522 .
Assessment of the ecological status of the river Galda was achieved by Pantle-Buck method . Phytobenthos study was performed using a microscope Optec B.03 at 1000x magnification. The analysis consisted of identifying and counting species prevalent category of benthic algae using saprobic system developed Marsson Kolkwitz, and after that was done the assessing of ecological status of the river and corroborating the results obtained with the values of the physical, chemical and micro-biological water to be placed in class quality.
Analysis of microbiological parameters was performed by standardized and approved methods. Determination of the total number of bacteria was done according to SR EN ISO 6222/2004. Detection and conting of Escherichia coli and Coliform bacteria was performed according to EN ISO 9308-1/2004, SR EN ISO 788-2/2002. Identification and counting of Enterococcus was performed by membrane filtration method according to SR ISO 21528-1/2 2004.

RESULTS AND DISCUSSIONS

By applying the methods presented, were determined the relevant parameters for establish river water quality Galda, to assess ecological status and classification in an appropriate quality class of each sector in the study. Classification in quality class was done according to the laws in vigor and the maximum limits for the parameters considered in each class quality (Table 1).

Table 1. Maximum limits and quality class for physical and chemical parameters

Quality parameter	U.M	Quality class				
		I	II	III	IV	V
Thermal and acidification						
Temperature	°C	not standardized				
pH		6,5-8,5				
Oxygen						
Dizolved oxygen	mg O_2/l	12-14	10-9	5-4	5-1	0
BOD_5	mg O_2/l	3	5	7	29	20,01
COD-Mn	mg O_2/l	5	10	20	50	50,01
Nutrients						
Ammonium	mg N/l	0,4	0,8	1,2	3,2	3,20
Nitrite	mg N/l	0,01	0,03	0,06	0,3	0,30
Nitrate	mg N/l	1	3	5,6	11,2	11,20
Salinity						
Calcium	mg/l	50	100	200	300	300,1
Magnesium	mg/l	12	50	100	200	200,1
Toxic pollutants of natural origin						
Zinc	µg/l	100	200	500	1000	1000,1
Iron	µg/l	0,3	0,5	1	2	2,01
Copper	µg/l	20	30	50	100	100,1

Framing saprobic and ecological status assessment is performed using the Pantle-Buck method (Table 2):

Table 2. Pantle-Buck method for establish ecological status

Saprobic index	Saprobic zone	Contamination	Quality status	Ecological status
1,8	o o-b	absence low	I	Very good
2,3	b	moderate	II	Good
2,7	b-a	moderate to critical	III	Stisfy
3,2	a	strong	IV	Moderate
>3,3	a-p p	strong to very strong very strong	V	Very bad

NOTE: *) o= oligosaprobic; o-b= oligo-beta-mesosaprobic; b= beta-mezosaprobic; b-a= beta-meso-alpha saprobic; a= alpha-mezosaprobic; a-p= alpha-polisaprobic; p= polisaprobic

In terms of micro-biological parameters analyzed values are relate to the Directive 76/160/EEC as river water taken in the study is classified as bathing water, according to this Directive (Table 3), we have the maximum

allowable concentrations for the parameters analyzed.

Table 3. Maximum allowable concentration for microbiological parameters

Total coliform bacteria/ 100 ml	E.coli/ 100 ml	Enterococcus/ 100 ml	NTG/ ml
500	100	100	>500

Values of the parameters analyzed in each sector of the river have been reported in those maximum permissible values, under the legislation in vigor, in order to classify the water quality of the river and to establish its ecological status.

Sector 1

After analyzing the physical and chemical parameters were obtained normal values, but also values exceeding limit, according to Norm 161/2006. In Table 4 are the results of water quality assessment of the main elements taken from the one of the river, as stated above norm.

Table 4. "Elements and quality standards chemical and physicochemical water" from the norm 161/2006- Sector 1

Quality parameter	U.M.	Sector 1
Thermal and acidification		
Temperature	°C	-1
pH		7,67
Oxygen		
Dizolved oxygen	$mgO_{2/l}$	12,16
BOD_5	$mgO_{2/l}$	1,15
COD-Mn	$mgO_{2/l}$	18,64
Degree of oxygen saturation	%	80,85
Nutrients		
Ammonium	mgN/l	<0,01
Nitrite	mgN/l	<0,008
Nitrate	mgN/l	0,35
Salinity		
Calcium	mg/l	48,09
Magnesium	mg/l	65,11
Quality class according physical and chemical analzis: II		

From the view of the thermal and acidification, and oxygen, water analysis can be framed in clean water quality class I. Nutrients values are reduced for ammonium and nitrates, but nitrites value is slightly higher due to discharges of manure and waste water directly into the river, or storage of garbage in the river bed. For the parameters from the nutrients class, the first section of river Galda classify in Class I chemical quality of the water.

Quality class II for the river, is printed by salinity parameters. There is a slight high content of calcium and magnesium ions, due to limestone substrate of the river.

In addition to the parameters specified in Norm 161/2006, we have conducted a series of analyzes that are relevant to the study addressed. The values obtained from the determination of these parameters are shown in Table 5.

Table 5. Other parameters relevant for the study - Sector 1

Quality parameter	U.M	Sector 1
Turbidity	NTU	2,39
Color		no color
TDS	ppm	133,3
Conductivity	µS	267,1
Total alkalinity	mg-ech/dm^3	109,8
Total acidity	mg-ech/l	0,4
Total hardness	degrees of hardnesse/ dm^3	7,39

The conductivity is below the maximum permissible value, and is directly proportional to the total concentration of the substances dissolved in the water.
Water alkalinity is due both hydroxides, the carbonates and the bicarbonates. The analysis shows that water is considered medium hard water.
The analysis sample of Phytobenthos for the first sector, were identified following taxa: *Achnanthes lanceolata, Achnanthes inutissima, Coconeis pidicului, Cymbella affinis, Cymbella cestatii, Cymbella lanceolata, Cymbella ventricosa diatomite vulgar, Fragilaria vaucheriae, Fragilaria virescens, Gomphonema angustatum, Gompgonema olivaceum, Melosira varians, meridional circulation, the radiant Navicula, Navicula rynchocephala, Nitzschia dissipated, Nitzschia linearis, Rhoicosphaenia slut, Surilella ovalis, Tabellaria flocculosa*. In total were identified a total of 21 taxa, totaling 500 individuals. Relative frequency, absolute frequency and saprobic index of each species is shown in Table 6.

Table 6. Phytobentos analyses results-Sector 1

Taxa	Sapr. zone	p	Frecv. rel. %
Achnanthes lanceolata	b	8	1,60
Achnanthes minutissima	o-b	40	8,00
Coconeis pediculus	b	9	1,80
Cymbella affinis	o-b	11	2,20
Cymbella cestatii	o	12	2,40
Cymbella lanceolata	b	13	2,60
Cymbella ventricosa	o-b	9	1,80
Diatoma vulgare	b-a	27	5,40
Fragilaria vaucheriae	b	1	0,20
Fragilaria virescens	o	20	4,00
Gomphonema angustatum	o	24	4,80
Gomphonema olivaceum	b	130	26,00
Melosira varians	b	2	0,40
Meridion circulare	o	52	10,40
Navicula radiosa	o-b	70	14,00
Navicula rynchocephala	a	10	2,00
Nitzschia dissipata	o-b	26	5,20
Nitzschia linearis	o-b	8	1,60
Rhoicosphaenia curvata	b	10	2,00
Surilella ovalis	b	8	1,60
Tabellaria flocculosa	o	10	2,00
Saprobic zone oligosaprobic	Saprobic index 1,64		Quality class: I

Following the completion of microscopic analysis and related calculations are found ecological state of river water very good in the first sector, which can fit in the oligosapropbic zone as saprobity index calculated.

At the microbiological analysis were identified Coliforms bacteria, Enterococcus, E. coli and Total bacteria within normal limits, classifying this regard, the first sector of the river Galda quality class I . The values obtained from the microbiological analysis are presented in Figure 1.

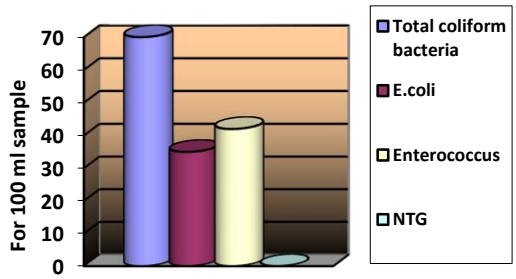

Figure 1. Micro-biological analysis results-Sector 1

These results fit body water in quality class I, with the absence of contamination. It follows therefore that the sector is a sector of reference, with no anthropogenic sources of contamination. Regime in the optimum for normal development of aquatic flora and fauna.

Sector 2

Following the completion of analyzes for water collected from the second sector were obtained the following results for physical and chemical parameters (Table 7).

Table 7. "Elements and quality standards chemical and physicochemical water" from the norm 161/2006- Sector 2

Quality parameter	U.M.	Sector 2
Thermal and acidification		
Temperature	°C	0,1
pH		8,03
Oxygen		
Dizolved oxygen	$mgO_{2/l}$	9,06
BOD_5	$mgO_{2/l}$	6,41
COD-Mn	$mgO_{2/l}$	30,02
Degree of oxygen saturation	%	62,05
Nutrients		
Ammonium	mgN/l	<0,01
Nitrite	mgN/l	<0,008
Nitrate	mgN/l	0,75
Salinity		
Calcium	mg/l	56,112
Magnesium	mg/l	65,115
Pollutants of natural origin		
Zinc	µg/l	1,5
Quality class according physical and chemical analzis: III		

The analysis (Table 7) shows that anthropogenic activities taking place on the banks of river affect water quality, and causes a contamination with organic material, hence a low percentage of oxygen dissolved in water. All chemical parameters corroborated fit Sector 2 of river Galda in quality class III, with pollution levels moderate to polluted environment.

In considering other relevant parameters for the study, reveals a higher conductivity due to existing suspensions in water. These suspensions reveals discharges of wastewater and disposal of various wastes in the river bed. The results are presented in Table 9:

Table 8. Other parameters relevant for the study-Sector 2

Quality parameter	U.M	Sector 2
Turbidity	NTU	1,98
Color		no color
TDS	ppm	176,7
Conductivity	µS	335,1
Total alkalinity	mg-ech/dm^3	91,8
Total acidity	mg-ech/l	0,4
Total hardness	degrees of hardness/ dm^3	8,16

After analyzing the sample of Phytobenthos were identified 20 taxas (Table 9).

Table 9. Phytobentos analyses results-Sector 2

Taxa	Sapr. zone	p	Frecv. rel. %
Achnanthes minutissima	o-b	42	8,40
Amphora ovalis	a	7	1,40
Coconeis pediculus	b	6	1,20
Cymbella affinis	o-b	36	7,20
Cymbella lanceolata	b	3	0,60
Cymbella silesiaca	b-a	4	0,80
Cymbella ventricosa	o-b	19	3,80
Diatoma vulgare	b-a	91	18,20
Fragilaria capucina	b-o	15	3,00
Gomphonema olivaceum	b	21	4,20
Melosira varians	b	4	0,80
Meridion circulare	o	48	9,60
Navicula cuspidata	b-a	98	19,60
Nitzschia dissipata	o-b	43	8,60
Nitzschia palea	a	2	0,40
Nitzschia pseudofonticola	o-b	8	1,60
Rhoicosphaenia curvata	b	17	3,40
Surilella ovate	b	13	2,60
Synedra ulna	b	9	1,80
Tabellaria flocculosa	o	14	2,80
Saprobic zone oligo-beta-mezosaprobe	**Saprobic index 1,90**		**Quality class: I**

After analyzing the sample of Phytobenthos and make the calculations related, was remarked a slight change in water quality from the first sector. This change in water quality is due to arrive in river water discharges from anthropogenic activities, such as industrial and household developed along the watercourse. The species identified in this sector are included in the oligo-beta-mezosaprobic zone with a low contamination with organic material. Ecological status of water in this sector is good for slightly contaminated. Phytobenthos species identified in river water result in a higher consumption of oxygen, which leads to the reduction of oxygen saturation in water and dissolved oxygen content of these. In this sector is affected flora and fauna due to the reduction in oxygen.

Regarding microbiological parameters there was an increase of bacteria in the water (Figure 2).

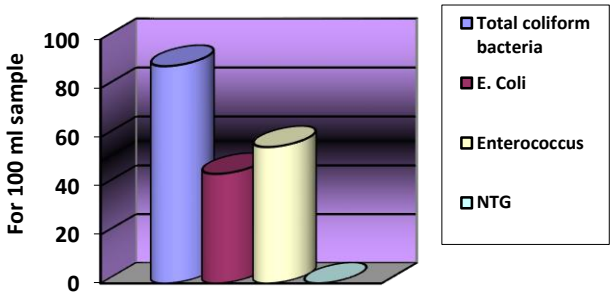

Figure 2. Micro-biological analysis results-Sector 2

Increased levels are due to manure, the food industry factory but also dejection from houses reached in river water.

The results can fit the overall quality of the water sector in Quality class III. Industrial activity in this area and the villages mark the water quality. Quality parameters have values not very much changed from control sector parameters, except the oxygen regyme that have a decrease in the concentration of oxygen in the water, due to the benthos development . This is caused by manure reached the water, including blood from the slaughterhouse in the area, or manure from stables and latrines.

Normal development of existing fish and aquatic fauna may be affected due to reduced oxygen concentration, causing imbalances in the ecosystem.

Sector 3

Sector 3 illustrates even better the influence of anthropogenic activities. Water quality parameters analyzed in this sector are seriously affected, and water quality degradation affects both the environment and local population.

From the analysis of physical and chemical parameters shown a lower quality class due to the degradation of all indicators, illustrated in Table 10.

Table 10. "Elements and quality standards chemical and physicochemical water" from the norm 161/2006- Sector 3

Quality parameter	U.M.	Sector 3
Thermal and acidification		
Temperature	°C	0,1
pH		8,45
Oxygen		
Dizolved oxigen	$mgO_{2/l}$	9
BOD_5	$mgO_{2/l}$	8,64
COD-Mn	$mgO_{2/l}$	16,432
Degree of oxygen saturation	%	61,643
Nutrients		
Ammonium	mgN/l	<0,01
Nitrite	mgN/l	<0,008
Nitrate	mgN/l	2,57
Salinity		
Calcium	mg/l	56,112
Magnesium	mg/l	68,790
Pollutants of natural origin		
Zinc	µg/l	22
Iron	µg/l	4,9
Copper	µg/l	1,3
Quality class according physical and chemical analzis: V		

The main problems identified in this sector are low oxygen content in water, slightly higher values of nitrates and high concentration of iron. For the first two serious problems identified as the main cause is the manure from the food industry factory situated on the river bank, and also the use of chemical fertilizers in agriculture. The existence of iron at so high concentrations in water is due to ferrous metals deposits formed in riverbed due nomads installed here.

The other relevant parameters are normal. There is only a slight increase in conductivity due to the suspension dissolved in water, as is showen in the Table 11.

Table 11. Other parameters relevant for the study-Sector 3

Quality parameter	U.M	Sector 3
Turbidity	NTU	1,59
Color		white
TDS	ppm	176,1
Conductivity	µS	352,2
Total alkalinity	mg-ech/dm^3	79,3
Total acidity	mg-ech/l	0,5
Total hardness	degrees of hardness/ dm^3	8,45

From the analysis regarding substation shown a high load of the body water with organic matter. In the sample were identified at microscopically analyze a total of 18 taxa, totaling 500 individuals (Table 12).

Table 12. Phytobentos analyses results-Sector 3

Taxa	Sapr. zone	p	Frecv. rel. %
Achnanthes minutissima	o-b	16	3,20
Amphora ovalis	a	18	3,60
Coconeis pediculus	b	14	2,80
Cymbella affinis	o-b	42	8,40
Cymbella ventricosa	o-b	36	7,20
Diatoma tenue	a	9	1,80
Diatoma vulgare	b-a	53	10,60
Fragilaria capucina	b-o	23	4,60
Gomphonema olivaceum	b	53	10,60
Melosira varians	b	16	3,20
Meridion circulare	o	14	2,80
Navicula cryptocephala	a	15	3,00
Navicula cuspidata	b-a	66	13,20
Nitzschia capitellata	a	54	10,80
Nitzschia palea	a	9	1,80
Surilella angusta	b-a	8	1,60
Surilella ovata	b	27	5,40
Synedra ulna	b	27	5,40
Saprobic zone beta-mezosaprobe	**Saprobic index 2,22**		**Quality class: II**

As a result of analysis phytobenthos and associated calculations we find a dominance of species mezosaprobic and the alpha-beta-alpha-mezosaprobic. This is because of the organic matter in water from anthropogenic activity performed in the area. Identified taxa are characteristic for waters with a moderate to pronounced contamination. Due to excessive algal growth, the of water self purification process is slowed, thus decreasing the concentration of oxygen in water, which causes eutrophication banks.

The result of analysis of microbiological parameters reveals a total increase of bacteria in the water. This is due to the accumulated manure and sewage plant in the villages crossed the river. Also the values of other parameters studied a slight increase, as is show in the Figure 3.

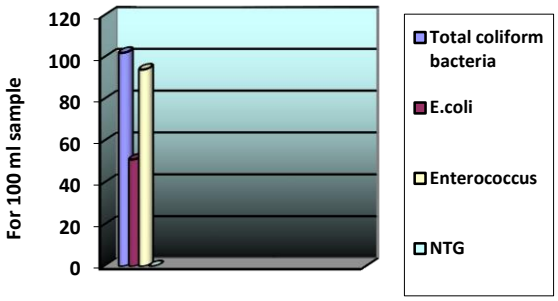

Figure 3. Micro-biological analysis results-Sector 3

After examining the results obtained for the parameters in this sector 3 can be seen how much is influencing the number of inhabitants of a town, the water quality parameters. Anthropogenic activity has left its mark on all the characteristics of water, physical, chemical, hydro-biological and micro-biological. Due to low oxygen content in the water, increase the algal community development, which in time, if there is no intervention will lead to eutrophication banks. Compared to the first sector, in this section is a noticeable degradation in the quality of water, so we can fit it in quality class V, in terms of the combination of the parameters analyzed. Water quality Class V is heavily polluted, and includes waters whose features are modified.

Sector 4

This is the most affected sector due to population abundance installed on the river banks, and also because of the small distance between the two factories placed on the land near river. Water quality is affected because waste water from the two food industry factories and from homes in the area. Physical and chemical parameters recorded sharp declines compared to other sectors (Table 13).

This sector is included in the National plan on the protection of waters against pollution caused by nitrates from agricultural sources, in accordance with Directive 91/676/EEC, due to high levels of nitrates concentration in water and soil.

Oxygen regime shows that river water is heavily contaminated with organic material that consumes oxygen in the water, resulting in 100% biochemical oxygen consumption.

Table 13. "Elements and quality standards chemical and physicochemical water" from the norm 161/2006-Sector 4

Quality parameter	U.M.	Sector 4
Thermal and acidification		
Temperature	°C	1
pH		8,08
Oxygen		
Dizolved oxigen	$mgO_{2/l}$	5,12
BOD_5	$mgO_{2/l}$	5,12
COD-Mn	$mgO_{2/l}$	32,548
Degree of oxygen saturation	%	35,955
Nutrients		
Ammonium	mgN/l	<0,01
Nitrite	mgN/l	<0,008
Nitrate	mgN/l	5,1
Salinity		
Calcium	mg/l	66,132
Magnesium	mg/l	95,4
Pollutants of natural origin		
Zinc	µg/l	5,6
Quality class according physical and chemical analzis: V		

In Table 14 are presented the remaining important parameters.

Table 14. Other parameters relevant for the study-Sector 4

Quality parameter	U.M	Sector 4
Turbidity	NTU	2,6
Color		no color
TDS	ppm	233,5
Conductivity	µS	467,2
Total alkalinity	mg-ech/dm^3	103,7
Total acidity	mg-ech/l	0,3
Total hardness	degrees of hardness/ dm^3	11,14

From investigating these parameters shows that water has a high content of calcium and magnesium due to water contamination with chemicals and dissolution of these salts from the substrate of the river, which print high water hardness. The dissolved material causes a high conductivity of water in this section.

The analysis phytobenthos observe a predominance of the alpha-mezosaprobic species, which indicates critical water pollution. Microscopic study were identified 23 taxa, totaling 500 individuals. The results of the microscopic study are showed in the Table 15.

Table 15. Phytobentos analyses results-Sector 4

Taxa	Sapr. zone	p	Frecv. rel. %
Achnanthes minutissima	o-b	36	3
Amphora ovalis	a	5	2
Coconeis pediculus	b	20	2
Cymbella affinis	o-b	28	3
Cymbella silesiaca	b-a	7	2
Cymbella ventricosa	o-b	15	3
Diatoma vulgare	b-a	65	4
Fragilaria capucina	b-o	10	3
Fragilaria pygmaea	a	7	2
Gomphonema olivaceum	b	17	3
Gomphonema parvulum	p	21	3
Gomphonema truncatum	b	5	2
Navicula cinta	a	10	2
Navicula cryptocephala	a	13	2
Navicula cuspidata	b-a	87	4
Nitzschia capitellata	a	58	4
Nitzschia dissipata	o-b	29	3
Nitzschia palea	a	2	1
Nitzschia pseudofonticola	o-b	2	2
Surilella angusta	b-a	10	2
Surilella ovata	b	13	2
Synedra ulna	b	11	3
Tabellaria flocculosa	o	11	2
Saprobic zone beta-mezo-alfa-saprobe	**Saprobic index 2,32**		**Quality class: III**

From analyzing phytobenthos appears that water has a high impurity whose value tends to critical. This is mainly due to waste and manure that reach in river Galda waters. These hydro-biological results combined with oxygen regime bring out a critical contamination of river water by throwing animal wastes or other wastes in water. In this way oxygen level decreases with materials putrefaction. Once the oxygen level drop is seriously affected both flora and aquatic fauna and hold back the photosynthesis processes and gas traffic. When sampling was taken I noticed a sharp eutrophication banks. Due to poor water quality, the environment was affected by the disappearance of fish and plants, by degradation of the landscape, and by affecting human health.

In Figure 4 are the concentrations of microbiological parameters.

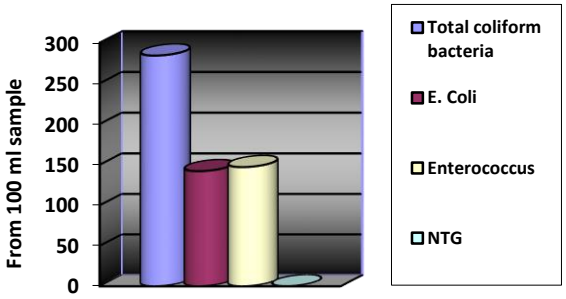

Figure 4. Micro-biological analysis results-Sector 4

Due to this high concentration of bacteria and organic matter in the water, health of the population suffers.

CONCLUSIONS

Today, the concern for the effects of water pollution has increased. Also the effects on aquatic organisms, aquatic biocenosis stability, and on human health represent a global concern.

Analysis of the quality of aquatic systems has proved to be absolutely necessary for both human health and for the smooth running of processes in the natural environment.

Following the survey we concluded:

- Surface water pollution is a serious problem and we have to apply remedial actions, for change the water status from qualitatively weak;
- The largest sources of pollution were found to be of human settlement;
- River Galda face with organic pollution due to agricultural activity carried out in the area, but also because manure and waste waters from food factories;
- Over the river from its source to its mouth can be seen that as the number of residents increases, this increase is reflected in the environment by increasing the number of waste that end up in the river bed;
- In the lower areas of the river, oxygen regime proved to be quite poor because of high organic matter reached the water. This can lead to disruption of the entire aquatic ecosystem, or cause the extinction of some fish species;

- The most polluted areas are the sectors 3 and 4 located in the lower reaches of the river, as is shown in Figure 5. In this area there were higher values for some indicators due to the raised number of population in this river area;

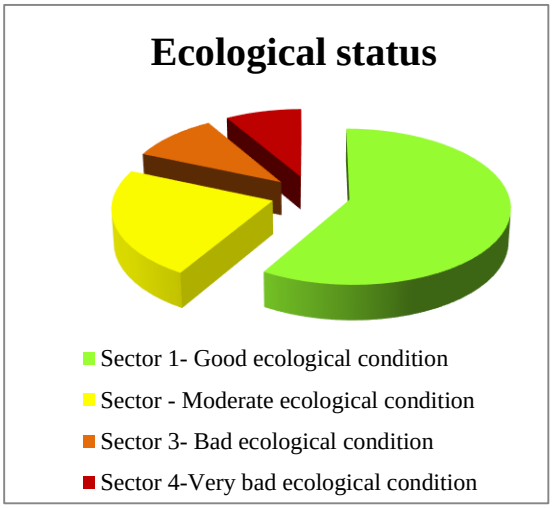

Figure 5. Ecological status of river Galda

- To reduce pollution in this area is necessary to inform people, and especially to educate them for sustainable development, to learn preserve the environment in the best condition possible;
- This pollution does not only affect the environment but also affects tourism and the economy. Due to riverbed degradation remained ruin some camps and camping areas, and nature monuments were buried in garbage.
- Ecological status of the river is heavily degraded over the course of the spring to the confluence with river Mures;
- Both physical parameters, chemical, hydro-biological and microbiological show that have been registrated seriously changes from one sector to another one;
- Chemical and ecological status of the river is degraded due to human activity in the area, if it would stop the pollution, water would regenerate and river banks would again be a tourist attraction because of its beauty and authenticity area.

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