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Estimation of quality of water of river drino (albania) based on analysis of diatoma

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Key words: Diatoms, Bio-indicator species, Drino river, Gjirokastër, Albania.

Abstract

The main objective of this paper is to investigate the genera of diatoms, which were identified in the Drino river in the period 2011-2012 in the Gjirokastër region. A classification of the quality of the water through the bio-indicator diatoms was also carried out. The study area included 5 sampling sites along the Drino River. In total, 116 taxa of diatoms within 33 different genera were found.. There were 59 bio-indicator species. Detailed floristic analysis of the diatoms' flora has not been conducted before in theserivers. The presence of polysaprobic species in the Drino river, such as, *Gomphonema parvulum, G.olivaceum, Nitzschia palea,* is a clear indication of the pollution of waters coming from a varietyof source. According to the bio-indicator saprobic species investigated the waters in the Drino rive isclassified as II class of bonity, respectively as mesosaprob. Based on this estimation and on the use of the Drinos river waters by the local residents, the physical-chemical and microbiological study of these waters in the future is of great interest.

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Introduction

Water is a prerequisite for life and a key factor in virtually all human economic activities. Freshwater rivers are crucial sources of water and it is necessary to study, protect, and improve their ecological status (Zalewski, 2000).Self-purification of water bodies depends on marine life of which algae serve as the primary producers and form the basis of the food chain. In addition to this, algae diversity is a clear indicator of the ecological and hygienic (health) status of the river as well as of the self-purification capabilities (Janauer and Dokulil, 2006). Our approach is based on the bio-indication of algal habitats, which includes not only the biodiversity but also the density of each bio-indicator species. The assessment of aquatic ecosystems is based on algal indicators which are widely used (WFD, 2000), in particular, the assessment of water quality based on the saprobity indicator, obtained from the analysis of algal communities, (Sumita, 1986; Watanabe *et al.*, 1986), but their capabilities are not yet fully understood.

Albania is a country rich in waters, which being near urban centres are under constant risk of being polluted by household and industrial waste. These waters are rich in diatoms many species of which serve as bio-indicators due to their capabilities.

The study of diatoms and the monitoring of the water quality in the main rivers which traverse the coastal lowlands of the Albanian stretch of shoreline of the Adriatic Sea using diatoms has been conducted, (Miho *et al.*, 2006).As regards the Drino river, which is located in the south of Albania and empties into the Vjose river, there are no data concerning the diversity of diatoms, the assessment of water quality and the classification of its waters because of the fact that it is not included in the areas which are equipped with monitoring stations.The river originates in the northwestern part of the Ioannina, in Greece then flows through urban areas. For this reason during the last decades, it has turned into a large reservoir of various pollutants. Consequently, various considerable modifications in the hydro-chemical composition of the water and of the algae community are taking place. Periphytic diatoms are an excellent indicator of the ecological condition of rivers and streams, due to their ability to react fast to changes in nutrient concentration. Rivers abound with diatoms which are primary producers and are found in all habitats (Round, 1991). The aim of this study is to identify the diatoms found in the Drinos river waters, which creates a data basis that will enable the determination of the water pollution level on the basis of the presence of diatoms.

Material and methods

The samples were collected from 5 sampling sites along the Drino river during the four seasons: spring 2011, summer 2011, autumn 2012 and winter 2012. Water samples were collected in 500 ml glass bottles, 10 cm beneath the water surface, using standard methods (Hindak, 1978). Conductivity, pH, salts, TDS (Total Dissolved Salts), were measured on site using portable instruments (HACH), O_2 was measured with portable instruments, such as, oxygenometer (Hana Instrument) and nutrients (N, P, Si) were analyzed by standard methods (DEV, 1981). Epilithon was brushed from the stones using a toothbrush and the upper layer of epipelon was drawn up via a vacuum suction system and then pipetted (Sladeckova, 1962). Epiphyton was sampled from the substrate and placed in the plastic bottles.The diatoms were examined using a Leica microscope, with a digital camera Fujifilm, which photographed the algae directly from the sample.

Diatoms cleaning

Cleaning of diatoms' frustules and the preparation of slides and their determination was done according to standard methods (Krammer andLange-Bertalot, 1986-2001). Diatoms' identification was done according to the keys: *Bacillariophyta*: (KramerandLange-Bertalot, 1986, 1988, 1991a, 1991b).

Study area and sampling sites

Sampling sites are located in:

1. Near Hormovë village, located about 20 km from Gjirokastra city.
2. Near Andon Poci village, located about 12 km from Gjirokastra city.
3. The River Bridge which stands at the entrance to the town of Gjirokaster, it is highly polluted due to human activity.
4. The Bridge of Kordhoca and
5. Near Glina village.

The Drino river is a tributary of the Vjosa river with a length of 84.6 km, and with a catchment area of 1324 km^2. Many streams, such as, Sotira, Suha, Nimsa and Kardhiq empty into the Drino river.

Many villages, such as, Glina, Suha, Libohova, Lunxheria, Lazarati, Humelica, Kardhiqi, Hormova, the villages of the Dropulli commune, and the town of Gjirokaster are located along the Drino valley (Fig.1).

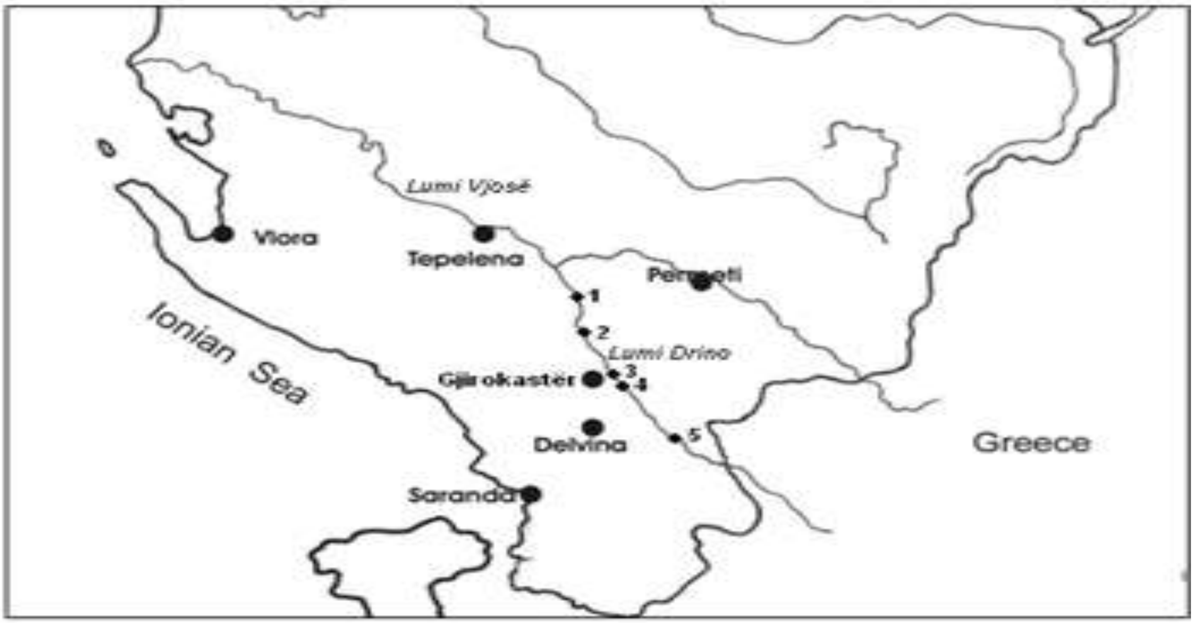

Fig. 1. Study area and sampling stations in river Drino (1-Hormove, 2-Andon Poci, 3-River Bridge in Gjirokaster city, 4- Kordhoca Bridge, 5- Glina Bridge).

Results and discussion

A total of 116 species of diatoms were identified from the quantitative analysis of the samples taken during the four seasons (spring, summer, autumn and winter) (Table 5).

We They are presented according to the seasons in which they were identified: spring 2011, 66 species (Table 1); summer 2011, 91 species (Table 2); winter 2012, 60 species (Table 5) and autumn 2012, 69 species (Table 4). During spring 66 species were identified within 24 genera, where 6 species within the genera *Navicula* and *Gomphonema* were dominant, followed by 5 species within the genera *Cocconeis* and *Nitzchia,* 4 species within the genus *Surirella* and 3, 2 or 1 species within the other genera.

The highest number of algae was identified on site 1 during spring (table 1), with 53 species, followed by the third site with 40 species, the second site with 37 species, fifth site with 34 species and fourth site with 28 species.There were 39 bio-indicator species, where 18 species within the genus betamesosaprob were dominant, followed by 9 species within the genus alphamesosaprob, 6 species within the genus oligo-betamesosaprob, 4 species within the genus beta-alphamesosaprob and 2 species within the genus oligosaprob.91 species within 30 genera were identified during summer, where 18 species within the *Nitzchia* genus were dominant, followed by 13 species within the genus *Navicula,* 7 species within the genus *Surirella* and 6 species within the genus *Gomphonema*; 4, 3, 2, and 1 species within their respective genera were also identified.

Table 1. Determined diatoma in river Drino during the spring season 2011.

Nr. N66	Total number of diatoma	Level of Saprobity	Localities 1	2	3	4	5
1	*Achnanthes hungarica (Grunow) Grunow*	o	1		1		
2	*Amphora lybica Ehrenberg*	β		1		1	1
3	*A. normani Rabenhorst*	o	1		1		
4	*Aneumastus stroesei (Ostrup) Mann*			1	1		1
5	*Cocconeis pediculus Ehrenberg*	o- β	1				
6	*C. placentula Ehrenberg*	β	1	1			
7	*C.placentula var.lineata (Ehrenberg) Cleve*		3	1	5	3	
8	*Caloneis amphisbaena (Cleve)*	β - α	1				1
9	*Cymbela austriaca (Grunow)*	β	3	1	1		
10	*C. affinis Kützing*	o- β	5	5	3		1
11	*C.ventricosaKützing*	β	1		1		1
12	*C.minuta Hilse et Rabenhorst*		1				
13	*C. naviculiformis (Auerswald) Cleve*	β	3	1	3		1
14	*Craticula cuspidata (Kützing) Mann*		3	3		1	
15	*Cymatopleura solea (Brébisson) W.Smith*	β - α		3	1		1
16	*Diatoma elongatum var.tenuis (C. Agardh) Van Heurck*	α	1		1		1
17	*D. moniliforme Kützing*		1	1			
18	*D. vulgare Bory*	β	3	1	1		1
19	*Epithemia addnata (Kützing) Brébisson*		1				3
20	*Fragilaria capucina Desmazières*	o- β	3	1			
21	*F. ulna (Nitzsch) Lange-Bertalot*		3	1	1		1
22	*Gomphonema carolinense Hagelstein*				1		1
23	*G.grovei M.Schmidt*		1		1	1	
24	*G.micropus* Kützing			1	1		
25	*G.minutum (C.Agardh)*				1	1	1
26	*G.olivaceum (Hornemann) Brebisson*	β	5		4		
27	*Gyrosigma acuminatum (Kützing) Rabenhorst*	β				1	
28	*G. scalproides (Rabenhorst) Cleve*		1		1		1
29	*Hantzschia amphioxys (Ehrenberg) Grunow*	α	1				1
30	*Luticola geoppertiana (Bleish) Mann*		3	3	1		
31	*L.mutica (Kützing) D.G.Mann*		3	1		1	3
32	*Melosira varians Agardh*	β	1	3		3	
33	*Navicula cryptocephala Kützing*	α	3	1	5	1	1
34	*N.gracilis Ehrenberg*	β - α		1			3
35	*N.exigua Muller*	β	3		5		
36	*N. lanceolata (Agardh) Ehrenberg*		1	1		1	
37	*N. radiosa Kützing*	o- β	1			3	
38	*N. rhynchocephala Kützing*	α	1	1			3
39	*N. viridula (Kützing) Ehrenberg*	α	5		5	1	1
40	*Nitzschia. acicularis (Kützing) W. Sm.*	α	3		1		1
41	*N.acula Hantzsch in Rabenhorst*	α	1	1		3	
42	*N.capitellata Hustedt*		3	3	1	1	
43	*N.closterium (Ehrenberg) W.Sm.*			3		1	1
44	*N.constricta (Kützing) Ralfs*		1	1	1	1	
45	*N.gracilis (Hatzsch)*			3	1		
46	*N.hungarica (Grunow)*	α	5		3	5	
47	*N. fonticola Grunow*	o- β	1	1	3	5	
48	*N. levidensis (W.Smith) Grunow*		3			1	1
49	*N. litoralis Grunow*			1		1	
50	*N.palea (Kützing) W.Smith*	α	1		1		1
51	*N.paleaceae (Grunow)*		3	1	1		
52	*N. recta Hantzsch*	β -α	1	1			1
53	*N.stagnorum (Rabenhorst)*	β	1	1		3	
54	*N. sigmoidea (Nitzsch) W.Smith*	β			1	1	1
55	*N.termalis var. Minor (Hisle)*		1			1	1

56	*N.vermicularis (Grunow)*	β	1		3	3	
57	*Pinnularia microstauron var. Brebisonii (Kützing) Mayer*	β	1		1		
58	*P.viridiformis (Nitzsch) Ehrenberg*		1		1		1
59	*Rhoicosphaenia curvata (Grunow)*	β	1	1	1		
60	*Stauroneis anceps Ehrenberg*	β	3	3	1	5	1
61	*Surirella ovata Kützing*	o- β	5				1
62	*S.linearis W.Smith*	β	1	1	3	1	
63	*S. robusta Ehrenberg*		3				1
64	*Synedra acus Hustedt*		1	1		1	1
65	*S. nana Meister*				1		1
66	*S. ulna Kützing*	β	5	1	5		1
	Total number of species per locality		53	37	40	28	34

The highest number of algae during summer (table 2) was found on sites 1, 3, 4 with 51 species, followed by site 5 with 40 species, site 2 with 39 species. There were 43 bio-indicator species, where 11 species within the genus betamesosaprob were dominant, followed by 10 species within the genus oligo-betamesosaprob, 9 species within the genus oligosaprob, 6 species within the genus alphamesosaprob, 2 species within the genus xeno-saprob, 1 species within the genus alpha-betamesosaprob, 1 species within the genus xeno-oligosaprob and 1 species within the genus oligo-xenosaprob.

Table 2. Determined diatoma in the river Drino during summer season 2011.

			LOCALITIES				
Nr.	Total number of diatoma	Level of Saprobity	1	2	3	4	5
91							
1	*Achnanthes hungarica (Grunow) Grunow*	o	1		1		
2	*A. coarctata (Brébisson) Grunow*	x	1	1			1
3	*Achnanthidium minutissimum (Kützing)Czarneck*		1		1	1	
4	*Amphora lybica Ehrenberg*		1	1			1
5	*A. normani Rabenhorst*	o	1		3	3	
6	*Aneumastus stroesei (Ostrup) Mann*			1			
7	*Cocconeis pediculus Ehrenberg*	o- β		1		3	1
8	*C. placentula Ehrenberg*	β	3				1
9	*C. placentula var. lineata (Ehrenberg) Cleve*		3	1	5	3	
10	*Craticula accomoda (Hustedt) Mann*	o- β	1			3	
11	*C. cuspidata (Kützing) Mann*	o			3	1	1
12	*Cyclotella ocellata Pantocsek*			1		1	
13	*Cymatopleura solea (Brébisson) W.Smith*	β			1	1	
14	*Cymbella affinis Kützing*	o- β	3		3	3	1
15	*C. helvetica Kützing*	o	3	1	3	3	1
16	*C. minuta Hilse ex Rabenhorst*		1		3		
17	*C. naviculiformis (Auerswald) Cleve*	β	3	1	3		1
18	*Diatoma ehrenbergii Kützing*		3	1	5	3	
19	*D. moniliforme Kützing*				3		1
20	*D. vulgaris Bory*	β		1	3	3	
21	*Epithemia adnata (Kützing) Brébisson*				3		1
22	*Fragilaria capucina Desmazières*	o- β	3	1			
23	*F. ulna (Nitzsch) Lange-Bertalot*				1		1
24	*F. ulna complex oxyrhynchus Lange-Bertalot*		1			1	
25	*Frustulia vulgaris (Thwaites) De Toni*	o	1	1	1		1
26	*Gomphonema carolinense Hagelstein*				1		1
27	*G.grovei M.Schmidt*		1		1	1	
28	*G. micropus* Kützing			1	1		
29	*G. minutum (C.Agardh) C.Agardh*				1	1	1
30	*G. olivaceum (Hornemann) Brébisson*	β	1		1	1	
31	*G. parvulum (Kützing) Kützing*	β	1	1			1
32	*Gyrosigma acuminatum (Kützing)Rabenhorst*	β	1		1		

33	*G. attenuatum (Kützing) Rabenhorst*	β	1		1	1	
34	*G. scalproides (Rabenhorst) Cleve*				1	1	
35	*Hantzschia amphioxys (Ehrenberg) Grunow*	α	1	1			1
36	*Hippodonta capitata(Ehrenberg)Lange-Bertalot*					1	
37	*Luticola goeppertiana (Bleish) Mann*		1			1	1
38	*L. mutica (Kützing) D.G. Mann*				1		1
39	*Melosira varians Agardh*	β	1		1	1	
40	*Meridion circulare (Grev.) C. Agardh*	o	1		1		1
41	*Navicula capitatoradiata Germain*			1		1	1
42	*N. cryptotenella Lange-Bertalot*				3	3	
43	*N. cryptocephala Kützing*	α	3	3		1	1
44	*N. lanceolata (Agardh) Ehrenberg*		3		3	3	
45	*N. radiosa Kützing*	o- β		1		3	1
46	*N. recens (Lange-Bertalot) Lange-Bertalot*	o- β	1	3	3	1	
47	*N. rhynchocephala Kützing*	α			3		
48	*N. species aff radisafallax Lange-Bertalot*		1				1
49	*N. tripunctata (O.F.Müller) Bory*		3			3	1
50	*N. trivialis Lange-Bertalot*		3		3		
51	*N. tuscula Ehrenberg*	o- β		1		1	1
52	*N. viridula (Kützing) Ehrenberg*	α		1	5	3	
53	*N. viridula var.rostellata (Kützing) Cleve*		3		3		
54	*Nitzschia acula Hantzsch in Rabenhorst*			1			1
55	*N. acicularis (Kützing) W. Sm.*			1		1	
56	*N. capitellata Hustedt*		3		3		
57	*N. closterium (Ehrenberg) W.Smit*			3		1	1
58	*N. constricta (Kützing) Ralfs*		1			3	
59	*N. commutata Grunow*				1	1	
60	*N. dissipata (Kützing) Grunow*	o- β	1	1	3	3	
61	*N. elegantula Grunow in Van Heurck*			1	1	3	1
62	*N. eglei Lange-Bertalot*			1			1
63	*N. filiformis (W. Sm.) Van Heurck*	α -β			1	1	
64	*N. fonticola Grunow*	o- β	1	1	3		1
65	*N. levidensis (W.Smith) Grunow*		3				
66	*N. litoralis Gruow*			1		1	
67	*N. linearis (Agardh) W.Smith*	o- β	1				1
68	*N. palea (Kützing) W.Smith*	α		1		3	
69	*N. pusilla Grunow*					1	1
70	*N. recta Hantzsch*	β -α	1		3		
71	*N. sigmoidea (Nitzsch) W.Smith*	β		3		3	
72	*Pinnularia microstauron (Ehrenberg) Cleve*	o-x	3	1			1
73	*P.microstauron var. brebisonii (Kützing)Mayer*	x	3	1			
74	*Planothidium ellipticum (Cleve) Round*		3	1			
75	*P. lanceolatum (Brébisson) Round*		3				1
76	*Reimeria sinuata (Greg.) Kociolek & Stoermer*			1		3	
77	*Rhoicosphaenia abbreviata (Agardh)Lange-Bertalot*	x-o	1		1	1	
78	*Sellaphora pupula (Kützing) Mjereschowsky*	α			3	1	
79	*S. pupula fo. rostrata (Hustedt) Bukhtiyarova*		1		3		
80	*Stauroneis smithii Grunow*	x-o	1			1	1
81	*S.anceps Ehrenberg*		1		1		
82	*Surirella angusta Kützing*	o		1			1
83	*S. brebissonii var. kuetzingii Krammer &Lange-Bertalot*			1		3	
84	*S. linearis W.Smith*	β			3	3	1
85	*S. minuta Brébisson in Kützing*	o	1		3	3	
86	*S.ovalis Brébisson*	o	1		1		1
87	*S.patella Kützing*			1	1		
88	*S.robusta Ehrenberg*				1	1	
89	*Synedra acus Hustedt*		1	1		1	1
90	*S.nana Meister*				1		
91	*S.ulna Kützing*		1			1	1
	Total number of species per locality		51	39	51	51	40

During autumn 69 species were identified within 29 genera, where 12 species within the genus *Nitzchia* were dominant, followed by 9 species within the genus *Navicula*, 4 species within the genus *Surirella*, and 3, 2, 1 species were identified within the other genera.The highest number of algae during autumn was found (table 3) on site 1 with 42 species, site 2 with 38 species, site 4 with 36 species, site 5 with 35 species, site 3 with 30 species. There were 34 bio-indicator species, where 9 species within the genus oligosaprob and genus betamesosaprob were dominant, followed by 7 species within the genus oligo-betamesosaprob, 4 species within the alphamesosaprob, 3 species within the xeno-oligosaprob, 1 species within the genus xeno-saprob and genus beta-alphamesosaprob.60 species within 24 genera were identified during winter, where 6 species within the genus *Navicula* were dominant, followed by 5 species within the genus *Nitzchia*, 5 species within the genus *Cocconeis,* 4 species within the genus *Surirella*, 3, 2, 1 species were identified within the other genera.

Table 3. Determined diatom in the river Drino during autumn season 2012.

Nr. 69	Total number of diatoma	Level of Saprobity	LOCALITIES 1	2	3	4	5
1	*Achnanthes hungarica (Grunow) Grunow*	o	1		1		
2	*A. coarctata (Brébisson) Grunow*	o	1	1			1
3	*Achnanthidium minutissimum (Kützing) Czarneck*		1			1	
4	*Amphora lybica Ehrenberg*		1	1			1
5	*A. normani Rabenhorst*	o	1		1	3	
6	*Aneumastus stroesei (Ostrup) Mann*			1			
7	*Cocconeis pediculus Ehrenberg*	o- β		1		3	1
8	*C. placentula Ehrenberg*	β	3				1
9	*Craticula accomoda (Hustedt) Mann*	o- β	1			3	
10	*C. cuspidata (Kützing) Mann*	o			1	1	1
11	*Cyclotella ocellata Pantocsek*			1		1	
12	*Cymatopleura solea (Brébisson) W.Smith*	β			1	1	
13	*Cymbella affinis Kützing*	o- β	3		3	3	1
14	*C. helvetica Kützing*	o	3	1	1	1	1
15	*C. naviculiformis (Auerswald) Cleve*	β	3	1	3		1
16	*Diatoma ehrenbergii Kützing*		3	1		3	
17	*D. moniliforme Kützing*				3		1
18	*D. vulgaris Bory*	β		1	3	3	
19	*Epithemia adnata (Kützing) Brébisson*				3		1
20	*Fragilaria ulna (Nitzsch) Lange-Bertalot*				1		1
21	*Frustulia vulgaris (Thwaites) De Toni*	o	1	1	1		1
22	*Gomphonema carolinense Hagelstein*			1	1		1
23	*G.grovei M.Schmidt*		1			1	
24	*G. parvulum (Kützing) Kützing*	β	1	1			1
25	*Gyrosigma acuminatum (Kützing) Rabenhorst*	β	1		1		
26	*G. attenuatum (Kützing) Rabenhorst*	β	1			1	
27	*G. scalproides (Rabenhorst) Cleve*				1	1	
28	*Hantzschia amphioxys (Ehrenberg) Grunow*	α	1	1			1
29	*Luticola goeppertiana (Bleish) Mann*		1			1	1
30	*Melosira varians Agardh*	β	1	1	1	1	
31	*Meridion circulare (Grev.) C. Agardh*	o	1		1		1
32	*Navicula capitatoradiata Germain*			1		1	1
33	*N. cryptocephala Kützing*	α	3	3		1	1
34	*N. lanceolata (Agardh) Ehrenberg*		3			3	
35	*N. radiosa Kützing*	o- β		1		3	1
36	*N. rhynchocephala Kützing*	α			3		

37	*N. tripunctata (O.F.Müller) Bory*		3	1		3	1
38	*N. trivialis Lange-Bertalot*		3		3		
39	*N. viridula (Kützing) Ehrenberg*	α		1		3	
40	*N. viridula var.rostellata (Kützing) Cleve*		3		3		
41	*Nitzschia acula Hantzsch in Rabenhorst*			1			1
42	*N. acicularis (Kützing) W. Sm.*			1		1	
43	*N. commutata Grunow*				1	1	
44	*N. dissipata (Kützing) Grunow*	o- β	1	1	3	3	1
45	*N. elegantula Grunow in Van Heurck*			1		3	1
46	*N. eglei Lange-Bertalot*			1			1
47	*N. fonticola Grunow*	o- β	1	1	3		1
48	*N. levidensis (W.Smith) Grunow*		3				
49	*N. litoralis Grunow*			1		1	
50	*N. linearis (Agardh) W.Smith*	o- β	1	1			1
51	*N. recta Hantzsch*	β -α	1		3		
52	*N. sigmoidea (Nitzsch) W.Smith*	β		3		3	
53	*Pinnularia microstauron (Ehrenberg) Cleve*	o-x	3	1			1
54	*P.microstauron var. Brebisonii (Kützing) Mayer*	x	3	1			
55	*Planothidium ellipticum (Cleve) Round*		3	1			
56	*P. lanceolatum (Brébisson) Round*		3				1
57	*Reimeria sinuata (Greg.) Kociolek & Stoermer*			1		3	
58	*Rhoicosphaenia abbreviata (Agardh) Lange-Bertalot*	x-o	1		1	1	
59	*Sellaphora pupula (Kützing) Mjereschowsky*	α		1	3	1	
60	*S. pupula fo. rostrata (Hustedt) Bukhtiyarova*		1				
61	*Stauroneis smithii Grunow*	x-o	1	1		1	1
62	*S. anceps Ehrenberg*		1		1		
63	*Surirella angusta Kützing*	o		1			1
64	*S. brebissonii var. kuetzingii Krammer & Lange-Bertalot*			1		3	
65	*S. ovalis Brébisson*	o	1		1		1
66	*S. robusta Ehrenberg*				1	1	
67	*Synedra acus Hustedt*		1	1		1	1
68	*S. nana Meister*			1	1		
69	*S. ulna Kützing*		1			1	1
	Total number of species per locality		42	38	30	36	35

The highest number of algae during winter (table 4) was identified on site 2 with 27 species, site 1 with 26 species, site 4 with 25 species, site 3 with 18 species, site 5 with 15 species.There were 21 bio-indicator species, where 9 species within the genus betamesosaprob were dominant, followed by 5 species within the genus oligosaprob, 4 species within the genus oligo-betamesosaprob, 2 species within the genus alphamesosaprob, 1 species within the genus beta-alphamesosaprob.

Table 4. Determined diatom in the river Drino during winter season 2012.

			LOCALITIES				
Nr. 60	Total number of diatoma	Level of Saprobity	1	2	3	4	5
1	*Achnanthes hungarica (Grunow)*	o	1				
2	*A.clevei var.clevei Grunow*		1			1	
3	*A.ventralis (Krasske) Lange-Bertalot*		1	1	1		1
4	*Amphora lybica Ehrenberg*		1	3		3	
5	*A. normani Rabenhorst*	o		1		1	1
6	*Cocconeis pediculus Ehrenberg*	o- β	3	3		3	
7	*C. placentula Ehrenberg*	β	3	5		1	

8	*C.placentula var.lineata (Ehrenberg) Cleve*		3		1		1
9	*Craticula accomoda (Hustedt) Mann*			1		1	
10	*Centronella reichelti (Voigt)*		1			1	
11	*Cyclotella ocellata Pantocsek*			1	1		
12	*Cymatopleura solea (Brébisson) W.Smith*	β- α	1	1		1	
13	*Cymbella affinis Kützing*	o- β	5	3		3	
14	*C. helvetica Kützing*		1	1			1
15	*Diatoma ehrenbergii Kützing*		3	1		1	
16	*D. moniliforme Kützing*		1	3	1	1	
17	*D. vulgaris Bory*	β	3	3		3	
18	*Epithemia adnata (Kützing) Brébisson*		1			1	
19	*F. ulna (Nitzsch) Lange-Bertalot*		1	3		1	
20	*F.ulna complex oxyrhynchus Lange-Bertalot*			1	1		
21	*Frustulia vulgaris (Thwaites) De Toni*	o	1			1	1
22	*Gomphonema microporus* Kützing		1	1			
23	*G.minutum (C.Agardh)*		1	3		1	
24	*G.olivaceum (Hornemann) Brebisson*	β	1	1		1	
25	*G.longiceps var.subclavatum Grunow*		1			1	
26	*G.parvaulum var.exlissimum Grunow*		1				1
27	*G.tenue Fricke*		1	1	1		
28	*Gyrosigma acuminatum (Kützing)*	β	1	1		1	
29	*G. attenuatum (Kützing) Rabenhorst*	β	1	1	1	1	
30	*G. scalproides (Rabenhorst) Cleve*		1	1			
31	*Hantzschia amphioxys (Ehrenberg) Grunow*	α	1	1		1	
32	*H.elongata (Hantzch) Grunow*					1	
33	*Luticola goeppertiana (Bleish) Mann*		1		1	1	1
34	*Melosira varians Agardh*	β	1			1	
35	*Meridion circulare (Grev.) C. Agardh*	o	1	1		1	
36	*Navicula cryptotenella Lange-Bertalot*			3	1	3	
37	*N. lanceolata (Agardh) Ehrenberg*		3	5		3	
38	*N. radiosa Kützing*	o- β	3	3	1		1
39	*N. tripunctata (O.F.Müller) Bory*		3	1		3	1
40	*N. trivialis Lange-Bertalot*		1			3	
41	*N. viridula var.rostellata (Kützing) Cleve*		3	3			1
42	*Nitzschia acula Hantzsch in Rabenhorst*	α	3	3	1	3	
43	*N.capitellata Hustedt*			3		3	
44	*N.constricta (Kützing)*		3	3		3	
45	*N. dissipata (Kützing) Grunow*	o- β	1		1	3	
46	*N.exilis Kützing*			1			1
47	*Pinnularia microstauron (Ehrenberg) Cleve*	o			1	1	
48	*P.microstauron var. Brebisonii (Kützing) Mayer*		3	3	1	3	
49	*Planothidium ellipticum (Cleve) Round*					1	
50	*P. lanceolatum (Brébisson) Round*		1	3		1	
51	*Reimeria sinuata (Greg.) Kociolek & Stoermer*		3			3	1
52	*Rhoicosphaenia abbreviata (Agardh)Lange-Bertalot*	β	1	1	1	1	
53	*Sellaphora pupula (Kützing)*		3	3		1	
54	*S. pupula fo. rostrata (Hustedt) Bukhtiyarova*		1		1	1	1
55	*Stauroneis smithii Grunow*			1		1	1
56	*Surirella angusta Kützing*	β	3	3		3	
57	*S. brebissonii var. kuetzingii Krammer*			3	1	3	
58	*S.linearis W.Smith*		1				1
59	*S.minuta Brébisson in Kützing*			1		1	
60	*Synedra ulna (Nitzsch) Ehrenberg*	β	3	5	1	3	
	Total number of species per locality	21	47	42	18	46	16

Benthic algal communities are usually rich species and therefore provide a lot of information which is ideal for the monitoring of the environment because of their relatively short life cycle, allowing for a rapid response to environmental changes. At the same time they also reveal the cumulative effect that the environmental changes has had over a longer time period (Janauer and Dokulil, 2006). Because of this, bio-indicator algae are included in the EC-Water Framework Directive (WFD, 2000) for the assessment and monitoring of water quality. The complete database includes taxa of 116 diatoms, but only 21 diatoms species within 15 genera are found in all seasons (Table 2).

Table 5. Determined diatom in the river Drino during four season: spring, summer, autumn and winter.

			Season			
Nr.	Total number of diatoma	Level of Saprobity	spring	summer	autumn	winter
1	*Achnanthes hungarica (Grunow) Grunow*	o	+	+	+	+
2	*A.clevei var.clevei Grunow*					+
3	*A. coarctata (Brébisson) Grunow*	x		+	+	
4	*A.ventralis (Krasske) Lange-Bertalot*					+
5	*Achnanthidium minutissimum (Kützing) Czarneck*			+	+	
6	*Amphora lybica Ehrenberg*	β	+	+	+	+
7	*A. normani Rabenhorst*	o	+	+	+	+
8	*Aneumastus stroesei (Ostrup) Mann*		+	+	+	
9	*Caloneis amphisbaena (Cleve*	β - α	+			
10	*Cocconeis pediculus Ehrenberg*	o- β	+	+	+	+
11	*C. placentula Ehrenberg*	β	+	+	+	+
12	*C.placentula var.lineata (Ehrenberg) Cleve*	β	+	+		+
13	*Craticula accomoda (Hustedt) Mann*	o- β		+	+	+
14	*C. cuspidata (Kützing) Mann*	o	+	+	+	
15	*Centronella reichelti (Voigt)*					+
16	*Cyclotella ocellata Pantocsek*			+	+	+
17	*Cymatopleura solea (Brébisson) W.Smith*	β - α	+	+	+	+
18	*Cymbella affinis Kützing*	o- β	+	+	+	+
19	*C. austriaca (Grunow)*	β	+			
20	*C. helvetica Kützing*	o		+	+	+
21	*C.minuta Hilse ex Rabenhorst*		+	+		
22	*C. naviculiformis (Auerswald) Cleve*	β	+	+	+	
23	*C.ventricosa Kützing*	β	+			
24	*Diatoma elongatum var.tenuis (C. Agardh) Van Heurck*	α	+			
25	*D. ehrenbergii Kützing*			+	+	+
26	*D. moniliforme Kützing*		+	+	+	+
27	*D. vulgaris Bory*	β	+	+	+	+
28	*Epithemia adnata (Kützing) Brébisson*		+	+	+	+
29	*Fragilaria capucina Desmazières*	o- β	+	+		
30	*F. ulna (Nitzsch) Lange-Bertalot*		+	+	+	+
31	*F.ulna complex oxyrhynchus Lange-Bertalot*			+		+
32	*Frustulia vulgaris (Thwaites) De Toni*	o		+	+	+
33	*Gomphonema carolinense Hagelstein*		+	+	+	
34	*G.grovei M.Schmidt*		+	+	+	
35	*G.microporus* Kützing					+
36	*G.minutum (C.Agardh)*		+	+		+
37	*G.olivaceum Hornemann) Brebisson*	β	+	+		+
38	*G.longiceps var.subclavatum Grunow*					+
39	*G.parvulum (Kützing) Kützing*	β		+	+	
40	*G.parvaulum var.exlissimum Grunow*					+
41	*G.pseudoaugur Lange-Bertalot*		+	+		
42	*G.tenue Fricke*					+
43	*Gyrosigma acuminatum (Kützing) Rabenhorst*	β	+	+	+	+
44	*G. attenuatum (Kützing) Rabenhorst*	β		+	+	+
45	*G. scalproides (Rabenhorst) Cleve*		+	+	+	+
46	*Hantzschia amphioxys (Ehrenberg) Grunow*	α	+	+	+	+
47	*H.elongata (Hantzch) Grunow*					+
48	*Hippodonta capitata (Ehrenberg) Lange-Bertalot*			+		
49	*Luticola geoppertiana (Bleish) Mann*		+	+	+	+
50	*L.mutica (Kützing) D.G.Mann*		+	+		
51	*Melosira varians Agardh*	β	+	+	+	+
52	*Meridion circulare (Grev.) C. Agardh*	o		+	+	+
53	*Navicula capitatoradiata Germain*			+	+	
54	*N. cryptocephala Kützing*	α	+	+	+	
55	*N.cryptotenella Lange-Bertalot*			+		+

56	*N.exigua (Muller)*	β	+			
57	*N. lanceolata (Agardh) Ehrenberg*		+	+	+	+
58	*N.gracilis Ehrenberg*	β - α	+			
59	*N. radiosa Kützing*	o- β	+	+	+	+
60	*N.recens (Lange-Bertalot)*			+		
61	*N. rhynchocephala Kützing*	α	+	+	+	
62	*N. recens Lange- Bertalot*			+		
63	*N. tripunctata (O.F.Müller) Bory*			+	+	+
64	*N. trivialis Lange-Bertalot*			+	+	+
65	*N.tuscula Ehrenberg*	o- β		+		
66	*N. viridula (Kützing) Ehrenberg*	α	+	+	+	
67	*N. viridula var.rostellata(Kützing) Cleve*			+	+	+
68	*Nitzschia acula Hantzsch in Rabenhorst*	α	+	+	+	+
69	*N. acicularis (Kützing) W. Sm.*	α	+	+	+	
70	*N.capitellata Hustedt*		+	+		+
71	*N.closterium (Ehrenberg) W.Sm.*		+	+		
72	*N. commutata Grunow*			+	+	
73	*N.constricta (Kützing) Ralfs*		+	+		+
74	*N. dissipata (Kützing) Grunow*	o- β		+	+	+
75	*N. elegantula Grunow in Van Heurck*			+	+	
76	*N. eglei Lange-Bertalot*			+	+	
77	*N.exilis Kützing*					+
78	*N.filiformis (W.Sm.) Van Heurck*	α -β		+		
79	*N. fonticola Grunow*	o- β	+	+	+	
80	*N.gracilis Hantzsch*		+			
81	*N.hungarica (Grunow)*	α	+			
82	*N. levidensis (W.Smith) Grunow*		+	+	+	
83	*N. litoralis Grunow*		+	+	+	
84	*N. linearis (Agardh) W.Smith*	o- β		+	+	
85	*N.palea (Kützing) W.Smith*	α	+	+		
86	*N.paleaceae Grunow*		+			
87	*N.pusilla Grunow*			+		
88	*N. recta Hantzsch*	β -α	+	+	+	
89	*N. sigmoidea (Nitzsch) W.Smith*	β	+	+	+	
90	*N.stagnorum (Rabenhorst)*	β	+			
91	*N.termalis var.minor (Hisle)*		+			
92	*N.umbonata (Ehrenberg) Lange-Bertalot*					
93	*N.vermicularis (Grunow)*	β	+			
94	*Pinnularia microstauron (Ehrenberg) Cleve*	β	+	+	+	+
95	*P.microstauron var. brebisonii (Kützing) Mayer*	o-x		+	+	+
96	*P.viridiformis (Nitzsch) Ehrenberg*		+			
97	*Planothidium ellipticum (Cleve) Round*			+	+	+
98	*P. lanceolatum (Brébisson) Round*			+	+	+
99	*Reimeria sinuata (Greg.) Kociolek & Stoermer*			+	+	+
100	*Rhoicosphaenia abbreviata (Agardh) Lange-Bertalot*	β		+	+	+
101	*R.curvata Grunow*	β	+			
102	*Sellaphora pupula (Kützing) Mjereschowsky*	α		+	+	+
103	*S. pupula fo. rostrata (Hustedt) Bukhtiyarova*			+	+	+
104	*Stauroneis smithii Grunow*	x-o		+	+	+
105	*S. anceps Ehrenberg*	β	+	+	+	
106	*Surirella angusta Kützing*	β		+	+	+
107	*S. brebissonii var. kuetzingii Krammer & Lange-Bertalot*			+	+	+
108	*S.linearis W.Smith*	β	+	+		+
109	*S.minuta Brébisson in Kützing*	o		+		+
110	*S. ovalis Brébisson*	o		+	+	
111	*S.ovata Kützing*	o- β	+			
112	*S.patella Kützing*			+		
113	*S. robusta Ehrenberg*		+	+	+	
114	*Synedra acus Hustedt*		+	+	+	
115	*S. nana Meister*		+	+	+	
116	*S. ulna Kützing*	β	+	+	+	=
	Total number of species per season		66	91	69	60

The most common species were *Cocconeis placentula var. lineata, Nitzschia acula ,Gomphonema parvulum, Rhoicosphenia abbreviata, Naviculales lanceolata, Nitzschia dissipata, Naviculales radiosa* and *Naviculales gregaria*. These diatoms are known as cosmopolitan, widely distributed in inland waters, and considered as indicators of eutrophic conditions (Van Dam *et al*., 1994).In this study were analyzed the 'ecological' species which are responsible for the total amount of Phosphorus (TP), which is, a response to the presence of other species as well. The biological species usually have symmetrical unimodal distribution (concentrated in a single site) along the environmental gradient (Whittaker, 1967), at least those which are unaffected by the gradient factor at the source.

In our study during the period 2011-2012 were identified 116 species of diatoms within 36 genera; 26 species within the genus *Nitzschia* were dominant, while the other genera are represented with a smaller number of species; 15 species within the genus *Navicula*, 10 species within the genus *Gomphonema*, 8 species within the genus *Surirella*, 6 species within the genus *Cymbella*.Out of 116 identified species, 59 are bio-indicator species which belong to the xenosaprobic till alphamesosaprobic level of saprobity. 23 species belong to the Betamesosaprobic level, and dominate the other level of saprobity. The other levels of saprobity have the lowest number of bio indicator species, such as, oligo-betamesosaprobic and alpha- mesosaprobic level of saprobity have 10 species, oligosaprobic level of saprobity has 8 species, beta-alphamesosaprobic level of saprobity has 5 species, xeno-oligosaprobic level of saprobity has 2 species, xenosaprobic level of saprobity has 1 species.

Conclusion

During the study period (2011-2012) were identified 116 algae species of plankton and periphyton within 36 genera. 26 species within the genus *Nitzschia* were the most dominant, followed by 15 species within the genus *Navicula*, 10 species within the genus *Gomphonema*, 8 species within the genus *Surirella*, 6 species within the genus *Cymbella*, 4 species within the genus *Achnanthes*, *Cocconeis,Fragilaria*, *Gyrosigma*, *Pinularia* and*Synedra* were identified as having 3 taxa, whereas the other genera were identified with one or two species.. Furthermore, there is a high diversity of diatoms in each season. There are 59 bio-indicator species. The betamesosaprobic bio-indicator (20 bio-indicator species) were dominant. 11 species which belong to oligo-betamesaprob (o- β) level of saprobity were found, followed by alfamesosaprob bio-indicator (10 species), oligosaprob bio-indicator (9 species), beta-alfamesosaprob bio-indicator (4 species) and alfa–betamesosaprob bio-indicator (1 species).

The presence of bio-indicator diatoms shows that the Drinos river water pollution level is considerable. This water pollution is caused by urban residues. Appreciating the uses of this river water for different needs and in order to get more thorough results, its physical-chemical and microbiological study is necessary.We No bio-indicator species which belong to polisaprob (ρ) level of saprobity were not found.According to the bioindicators species, investigate waters classified in second-II-class of bonity respectively at beta-mesosaprob level.

References

DEV. 1981. Deutsche Einheitsverfahren zur Wasser, Abwasser und Schlamm-Untersuchung.Wiley-VCH, Weinheim. Physikalische, chemische, biologische und bakteriologische Verfahren. Auflage **1,** 3-86.

Hindak F. 1978b. The genus Lagerheimia Chod. and Lager Hinda´k, F., 1978b. The genus Lagerheimia Chod. and Lager heimia-like unicells in the genus Scenedesmus Meyen (Chlorophyceae). Biologia **33,** 795–808

Janauer G, Dokulil M. 2006. Mactophytes and algae in running waters.), England. Biological monitoring of rivers **2**, 127-214.

Krammer K, Lange-Bertalot H. 1986-2001. Suesswasserflora von Mitteleuropa. Fischer, Stuttgart. **2/1**: p. 876; **2/2**: p. 596; **2/3**: p. 576; **(2/4)**: p. 437.

Krammer K, Lange-Bertalot H. 1986: Bacillariophyceae, 1. Naviculaceae. In: Ettil, H., Gerloff, J., Heynig, H., Mollenhuer, D. (eds), Süsswasserflora von Mitteleuropa, Gustav Fischer Verlag. Jena. **2, 1**, 1–876.

Krammer K, Lange-Bertalot H. 1988. Bacillariophyceae, 2. Bacillariaceae, Epithemiaceae, Surirellaceae. In: Ettil, H.,Gerloff,, J.,Heynig, H.,Mollenhuer, D. (eds), Süsswasserflora von Mitteleuropa, Fischer Verlag. Stuttgart **2, 2**, 1–596.

Krammer K, Lange-Bertalot H. 1991a: Bacillariophyceae, 3. Centrales Fragilariaceae, Eunotiaceae. In: Ettil, H., Gerloff, J., Heynig, H., Mollenhuer, D. (eds), Süsswasserflora von Mitteleuropa, Gustav Fischer Verlag. Stuttgart, **2, 3**, 1–576.

Krammer K, Lange-Bertalot H. 1991b: Bacillariophyceae, 4. Achnanthaceae. Kritische Ergänzungen zu Navicula (Lineolatae) und Gomphonema. In: Ettil, H., Gerloff, J., Heynig, H., Mollenhuer, D. (eds), Süsswasserflora von Mitteleuropa, Gustav Fischer Verlag. Stuttgart **2, 4**, 1–437.

Miho A, Çullaj A, Lazo V, Hasko A, Kupe L, Schanz F, Brandl H, Bachofen R. 2006. Assessment of water quality of some Albanian rivers using diatom-based monitoring. Albanian Journal of Natural and Technical Sciences (AJNTS) (Academy of Sciences, Tirana, Albania) Nr. **19(20),** 94-105.

Round FE. 1991. Diatoms in river water- monitoring studies. Journal of Applied Phycologica **3,** 129–145.

Sladeckova A. 1962. Limnological investigation methods for the periphyton (Awfwuch) community. Wiley-VCH, Weinheim. Botanical Review **28,** 286-350.

Sumita M. 1986. A numerical water quality assessment of rivers in Hokuriku District using epilithic diatom assemblage in riverbed as a biological indicator (II). The values of RPId in surveyed rivers. –
Diatom, Japan J. Diatomology **2,** 9-18.

Van Dam H, Mertens A, Simkeldon I. 1994. Acoded cheklist and ecological indicator values of fresh water diatoms from the Nehterlands Neth,I. Ag. Ecol. **8(1),** 117-133.

Watanabe T, Asai K, Houki A. 1986. Numerical estimation to organic pollution of flowing water by using the epilithic diatom assemblage – Diatom Assemblage Index (DAI). – Sci. Total Environmental **55,** 209-218.

WFD. 2000. Directive 2000/60/EC of the European Parliament and of the Council establishing aframework for community action in the field of water policy. – Official J. Eur. Communities L327, Brussels, Belgium: 1-72. Whittaker, R. H., 1967. Gradient analysis of vegetation. Biological Reviews **49,** 207–264.

Zalewski M. 2000. Ecohydrology – the scientific background to use ecosystem properties as management tools towards sustainability of water resources. Ecological Engineering **165,** 1-8.