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P 1. A STUDY OF DIATOM DISTRIBUTION AND BIODEIVERSITY IN FRESH WATER OF VJOSA RIVER

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ABSTRACT: During the NASRI project we realized a several field trips on Vjosa river from October 2021 to July 2023. In this paper we will present diatom species which were collected in May 2021. Samples were collected as periphyton upper the stones or in Chladophora sp., from representative station in: Mifol (Vlore), Poçem (Mallakaster), Memaliaj, Tre urat, Sajmola (Kelcyre), Dragot and Vjosa in Kelcyra (near the source of black water). In total we have collected seven samples. Together with its tributaries, the Vjosa provides a dynamic, near-natural ecosystem, at the same time, the Vjosa represents a unique chance for European river science to assess the ecology of wild rivers. The assessment of the biological and ecological conditions of the river waters is an important factor in the protection of the biodiversity of species in the Vjosa river. Were identify 100 diatom species where two belong centric diatom and others belong pennate diatoms. Based on presence of diatoms in sampling sites, more widespread diatoms were: Brachysira neoexilis Large Bertalot, Cocconeis pediculus Ehrenberg, Cocconeis placentula var. lineata (Ehrenberg) Van Heurck, Cymbella minuta, Diatoma moniliformis Kützing, Gomphonema pumilum Grunow, Cocconeis placentula var. placentula etc. Some of diatom's species were found rarely which included: Diatoma tenuis, Encyonema silesiacum, Fragilaria capucina, Fragilaria tenera Lange-Bertalot, Gomphonema olivaceum (Hornemann), Nitzschia dissipata, etc. In some samples we have collected green algae like as Chladophora sp. Also, diatoms used as long-term indicators of the ecological status of freshwater.

Keywords: Vjosa River, Biodiversity, Diatoms, Floristic Data

1. INTRODUCTION

The Vjosa and its main tributaries flow freely for more than 400 km, from the Pindus Mountain Range in Greece to the Adriatic coast in Albania. The Vjosa Wild River National Park proclaimed in 2022, is a National Park categorised under IUCN's Protected Area Management Category II. The main aim of the park is to preserve the natural biodiversity and ecological structure, facilitate environmental processes, and encourage education and recreation. The use of technical terms has been kept to a minimum and when necessary, they have been defined clearly and spelled out in full when first mentioned. The river and its environs constitute significant ecosystems of biodiversity, harbouring over 1,100 animal species such as 13 globally threatened animal species and two plant species evaluated by IUCN. Biological monitoring has several advantages compared to chemical monitoring, as it summarizes biota data over a wider timescale and area of pollution. This has been highlighted by Calow & Petts (1994) and John (2002). Diatom communities serve as a popular tool for assessing past and present environmental conditions and are frequently used in studies pertaining to water quality. Biomonitoring techniques, which have been established for 100 years (Kolkwitz & Marsson, 1908), have been employed in freshwaters to reveal the impact of various sources of pollution. Vjosa presents an exceptional opportunity for European river science to evaluate the ecology of natural rivers. The appraisal of biological and ecological conditions in the river is imperative for preserving biodiversity of species in the Vjosa river. For biological monitoring, we referred to the Water Framework Directive (WFD: European Union 2000, Foster et al. 2001, Kelly M. 2013). The WFD monitors the ecological

state of water bodies. The distribution of diatoms is highly correlated with temperature, light intensity, aquatic physical-chemical characteristics, and seasonal variations. The influence from organic or inorganic matter is reflected by distribution of diatoms community. The dominant diatom taxa belong a pennate species in all samples.

The aim of this study is the assessment of the species composition of microscopic algae (diatoms) as indicators for evaluating water quality according to EU directives. The measurement of diatom population variance across sampling sites is assessed through the computation of various number of species to dominance and water ecology.

2. MATERIAL AND METHODS

2.1. Site sampling

This study presents the species of diatoms that were collected in May 2021 from seven sampling locations. The sampling locations include: Mifol (Vlore), Poçem (Mallakaster), Memaliaj, Tre urat on the Albanian-Greek border, Sajmola (Kelcyre), Dragoti, and Këlcyra near the source of "Black Water" (refer to Table 1).

Table 1: Sampling sites with their coordinates in Vjosa river

May-22	
Sampling sites	**Coordinates**
Ura e Mifolit (Vlorë)	40°38'02.8"N 19°27'40.5"E
Poçem (Mallakastër)	40°31'41.3"N 19°43'41.5"E
Memaliaj	40°21'05.2"N 19°58'06.8"E
Sajmola	40°17'44.3"N 20°06'29.9"E
Tre Urat (Përmet)	40°04'20.0"N 20°35'19.8"E
Kelcyre	40°30'56237.N 20°182'6817E
Dragot	40°29'23368"N 20°07'88.407E

2.2. Biological investigation

Our research aims to investigate diatom communities through microscopic analysis. The suspensions produced during the experiment were collected in small bottles and preserved in 4% formaldehyde for safekeeping, as previously outlined in research by Prygiell and Coste (1993), Kelly and Whitton (1995), and Lund et al. (1958). Diatom frustules were purified by boiling in H_2O_2cc (EN13946:2003). Species composition data was obtained by counting approximately 500 valves per slide using 100 oil immersion views. This method produced a 95% confidence level. Additionally, we consulted previous studies by Prygiell & Coste, 1993. The identification and enumeration of microscopic algae were conducted using an optical microscope that was equipped with a 100x objective lens. Abbreviations of technical terms will be explained upon first use. Diatoms were recognized employing recognized literature sources (Cleve – Euler 1955; Pascher 1976; Krammer & Bertalot 1996-2001, Algabase, 2020).

3. RESULTS AND DISCUSSION

In the seven stations of Vjosa river, we found about 75 species of diatoms from our collected samples (Tab. 2). Diatoms are crucial microscopic algae and reflect the current environmental conditions at the sampling site. Their identification at a species level is possible via microscopy and serves as a reliable metric while assessing water eutrophication (Hall et al., 1999). Centric diatoms have a low relative abundance. The water quality is reflective of this relative abundance. The most dominant species in all samples was classified as a pennate diatom. The most widespread diatoms belong to the *Cocconeis genus, particularly Cocconeis placentula var. lineata*, which is present at all sampling station, as well as *Cymbella affinis, Gomphonema olivaceum, Navicula cryptotenella, Diatoma hyemalis, Diatoma moniliformis,* and *Achnanthes exilis.* The station of Sajmola-Kelcyre yielded the greatest diatom abundance, with the most prevalent species being *Cymbella affinis* with 240 shells in Sajmola in Kelcyra and 105 shell at Tre urat, but the low number of frustules were identified in Pocem, Mifol and Memaliaj.

We are encountering a similar situation with the *Gomphonema olivaceum var. olivaceum*; approximately 250 frustules were counted in Sajmola while only 110 in Kelcyra station. *Diatoma messodon* has approximately 475 frustules in the Sajmola station, while *Diatoma hyemalis* has about 222 frustules in the same station. According to our analysis, the Sajmola and Kelcyre stations displayed the highest diatom counts (Table 2), with the foremost species being *Cymbella affinis, Gomphonema olivaceum var. olivaceum, Diatoma messodon, Diatoma hyemalis*, and others. In contrast, Mifol had the least species diversity, while Sajmola-Kelcyre, Dragot, and Tre Urat displayed a high number of species. The undisturbed hydrological regime along the entire Vjosa River and its tributaries is an essential component for supporting the diverse range of rare, endangered and endemic species in the Vjosa River Valley. This valley contains notable biological and ecological features and landscapes that house habitats for plants and animals as well as areas of geodiversity (IUCN, 2021-011). These locations possess also significant spiritual, scientific, educational, recreational, or tourism value.

Table 2: Distribution of diatoms in the Vjosa river stations, May 2022

Table of species	Mifol (Vlore)	Pocem (Mallakaster)	Memaliaj	Dragot	Sajmola\Kelcyre	Kelcyre	Tre urat
Time of sampling	May, 2022						
Name of species	Nr	Nr	Nr	Nr	Nr	Nr	Nr
Centric							
Cyclotella ocellata Pantocsek				3			
Melosira varians Agardh		+					
Pennate							
Achnanthes biasolettiana GRUNOW	1						
Achnanthes exilis Kützing	24			94		1	185
Achnanthes bryophila J.B.Petersen					5		
Achnanthidium eutrophilum (Lange-Bertalot)						3	
Amphora pediculus (Kützing) Grunow		25					
Asterionella formosa Hassall							1
Cocconeis pediculus Ehrenberg	4	22					45
Cocconeis placentula Ehrenberg agg.	3						
Cocconeis placentula var. lineata (Ehrenberg) Van Heurck	14	240	50	130	85		215
Cocconeis placentula var. euglypta (Ehrenberg) Grunow				8			
Cocconeis placentula var. placentula		27					
Cymbopleura cf. diminuta						5	
Cymatopleura solea (Brebisson) W.Smith	1						
Cymbella affinis Kützing agg.	9	1	7	98	240	240	105
Cymbella alpina Grunow					6		
Cymbella hungarica (Grunow) Pantocsek	1						
Cymbella minuta Hilse, 1862					22		
Cymbella tumida Brebisson	2						
Cymbella tumidula Grunow	3				15	5	
Cymbella tumidula var. lancettula Krammer							4
Cymbella silesiaca Bleisch	1					8	

Table of species	Mifol (Vlore)	Pocem (Mallakaster)	Memaliaj	Dragot	Sajmola\Kelcyre	Kelcyre	Tre urat
Time of sampling	May, 2022						
Name of species	Nr	Nr	Nr	Nr	Nr	Nr	Nr
Denticula thermalis Kützing	4						
Denticula subtilis Grunow							20
Diatoma ehrenbergii Kützing					13		
Diatoma mesodon Ehrenberg Kützing			3		475		
Diatoma moniliformis Kützing	1		2		45	5	73
Diatoma hyemalis (Roth) Heiberg					222		
Diatoma vulgaris Bory gr.	1	1		2			
Diatoma vulgaris morphotyp distorta					16		
Encyonema silesiacum				5			
Encyonema ventricosum	1			5	11	5	
Eunotia bilunaris Ehrenberg	1						
Fragilaria berelinensis Hustedt			1				3
Fragilaria biceps					1		
Fragilaria capucina var. mesolepta (Rabenh.)					2		
Fragilaria ulna (Nitzsch.) Lange-Bertalot var. ulna	3				2	1	
Fragilaria acus (Kützing) Lange-Bertalot	1						
Fragilaria tenera Lange -Bertalot	1				2		4
Gomphonema angustum Agarth				18	10	5	14
Gomphonema minutum (Agardh) Agardh agg.	5	2	35				10
Gomphonema minutum var.minutum			25	75			10
Gomphonema affine Kützing	1						
Gomphonema clavatum Ehr.	4		5		17		
Gomphonema stauroneiforme Grunow			5	19			22
Gomphonema species cf.pumilum				10			
Gomphonema pumilum var. elegans					27		
Gomphonema pumilum Grunow	6	1	8	42			52
Gomphonema truncatum Ehrenberg					7		
Gomphonema tergestinum Grunow	1					2	
Gomphonema vibrio Ehrenberg	19						
Gomphonema ventricosum Gregory				92			
Gomphonema olivaceum (Hornemann)				40		10	
Gomphonema olivaceum var. minutissimum Hustedt				105	80	52	
Gomphonema olivaceum var. olivaceum				65	250	110	50
Gomphoneis transylvanica (Pantocsek) Krammer					15		
Gyrosigma wansbeckii (Donkin) Cleve						1	
Meridion circulaire (Grewille) Agardh	5				2		
Navicula clementis Grunow	2						

Table of species	Mifol (Vlore)	Pocem (Mallakaster)	Memaliaj	Dragot	Sajmola\Kelcyre	Kelcyre	Tre urat
Time of sampling	May, 2022						
Name of species	Nr	Nr	Nr	Nr	Nr	Nr	Nr
Navicula cryptotenella Lange-Bertalot	4			5	37		
Navicula cryptotenelloides Lange-Bertalot		4					
Navicula dealpina Lange-Bertalot					4		
Navicula molestiformis Hustedt					17		
Navicula incertata Lange-Bertalot					5		
Navicula tripunctata (O. F. Müller) Bory	1						
Nitzschia diversa Hustedt	1						
Nitzschia monochorum L-B				4			
Nitzschia palea Kutzing					1		
Nitzschia dissipata (Kützing) Grunow var.dissipata	2						
Nitzschia vermicularis Kutzing	3						
Rhoicosphaenia abbreviata (Agardh) Lange-Bertalot				7		2	3
Rhopalodia gibba (Ehrenberg) O.Müller						1	

4. CONCLUSSION

In this study, a large number of diatoms were found collected in seven different stations. Most species are pennate, and a very limited number are centric. The most dominant species are: *Cocconeis placentula var. lineata, Cymbella affinis Kützing agg. Diatoma mesodon*. The relative abundance is reflected in the water quality. Monitoring of River waters, including here even their biological monitoring, can help to reach more accurate conclusions on water quality, so that possible risks to the living and human health are prevented. Historical impacts sources to biodiversity in Vjosa are from; agriculture, urban pollution Industrial pollution (especially from coal mining in Memaliaj), tourism activities ect. Biological and ecological conditions of the river waters is an important factor in the protection of the biodiversity of species.

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