CHARACTERIZATION OF PHYTOPLANKTON COMMUNITIES ON THE DANUBE SECTOR KM 169 - KM 197 IN 2021

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Abstract

The objective of this paper was to analyze the phytoplankton communities on the Danube sector km 169 - km 197 in 2021. Phytoplankton samples were performed monthly. For the study of phytoplankton, the water was collected in glass bottles with a volume of 300 ml, from the surface horizon of the water (0 m). After the collection of samples were preserved with Lugol's fixative and sodium acetate (Utermöhl), in the following proportion 0.15 - 0.25 ml solution per 100 ml/sample. Following the study on the characterization of phytoplankton in the studied area, a diversity of variations of phytoplankton communities were found. From the analyzes performed during the research period, we observe the dominance of diatoms, followed by chlorophylls and cyanophytes. Regarding the species found in the analyzed samples, between April and September of 2021, the following conclusions were drawn: in the presence of diatoms (Bacillariophyceae), there are species characteristic of the river such as Synedra acus, Nitzschia palea, and Melosira granulata, which are identifiable each month.

Key words: phytoplankton biomass, density, algae communities, Danube River

INTRODUCTION

For Romanian and foreign researchers the Danube river represents the preferred object for various studies of hydrological, hydrochemical, biological nature in order to sustainably and responsibly exploit the living aquatic resources in this aquatic ecosystem.

The Danube River, the second largest river in Europe in length and discharge of water, is one of the most important inland waterways of Europe, crossing the continent from west to east over a length of 2860 km. In Romania, the Danube stretches 1075 km. Our country holds approximately 31% of the total catchment area of the Danube [3]

Other uses of the Danube River are: drinking water sources in many locations, irrigation, fisheries, hydroelectric power production, industrial uses, tourism, and recreation [1].

Planktonic algae form communities of plant organisms with a fundamental role in the structure and physiology of aquatic ecosystems and are also an important source of food for consumers in the ecosystem [5]

Sharmin Akter et al. [6] highlights that phytoplanktons are integral components of freshwater wetlands which significantly contribute to the succession and dynamics of fish.

In his study, [7] mentioned that the analysis and study of phytoplankton is of interest because it is the most important group in the whole algal flora, for the circuit of organic matter from primary to final production.

Parameters such as phytoplankton biomass assessment, together with the estimation of the numerical density of the algal groups entering the phytoplankton composition and of the diversity of algal

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The manuscript was received: 10.10.2021
Accepted for publication: 02.11.2021

populations, are essential elements in assessing the ecological status of surface waters [8].

According to their studies,[9], phytoplankton is responsive to excessive supplies of inorganic nutrients and may also enhance water quality for humans in rivers affected by agricultural or industrial uses.

Because in the aquatic environment algae and macrophyte aquatic plants (together with heterotrophic organisms) support the entire food chain, being responsible for global fish production it is important to establish the presence or absence of indicator species, but also their number and weight in relation to other species.

This study aims to analyze the phytoplankton communities on the Danube sector km 169 - km 197 from April to September 2021.

MATERIALS AND METHODS

The phytoplankton samples were collected monthly, during April – September 2021. The Danube area of Brăila falls between the villages Smârdan and Gropeni (km 169-197). This area makes part from sector two of Danube River km 155 (confluence of Siret River) – km 227 (Călmăţui River) including the Vâlciu Arm (Figure.1). This area from the river represents an important route for migrating fish species and places of spawning by pontic shad but also a navigation route linking the Danube river and the sea.

The samples were collected in glass bottles with a volume of 300 ml, from the surface water horizon (0 m) to be analyzed in the hydrobiology laboratory of the Research and Development Institute for Aquatic Ecology, Fisheries, and Aquaculture – Galați.

After the prelevance of probes, these were preserved with Lugol fixative and sodium acetate (Utermöhl), in the following ratio 0.15 - 0.25 ml solution per 100 ml/sample.

Quantitative analysis of phytoplankton in the studied area involved the determination of two quantitative parameters, algal density (exp/l) and algal biomass (g/l).

The microscopic preparation was made by placing a drop of algal concentrate on a slide, then covering it with a slide. Algae species have been examined under the (40X) lens of the OxionEuromex microscope with a Ccmex3.0MP camera consulting the determinants in force and other reference materials.

The biomass was determined based on morphometric measurement of phytoplankton units. A list of all species was necessary and a consent agreement for the definition of cell relative geometric forms in order to calculate cell volume with the same geometric transformation for each taxon as described in detail.

To determine the numerical density of algae, the unit density of each tax was calculated first and then the density of all the taxa were summed together to provide total density

The temperature and level water values recorded in the studied area were collected by the authors on the site *Lower Danube River Administration, Galați.*

Fig. 1 Sampling location during April-September 2021

RESULTS AND DISCUSSIONS

The water temperature and levels of the Danube river directly influence the development of phytoplankton and all the aquatic organism.

Water temperature affects phytoplankton both directly, by impacting its physiology and metabolic rates, as well as indirectly, by impacting its aquatic growth environment and other members of its community [10].

According to the graphs (figure 2), it can be seen that in July the highest temperatures were registered but also the highest concentration of chlorophylls (figure 4).

Water-level plays a key role in determining environmental conditions, such as nutrient concentrations and light availability, and also biological variability, such as phytoplankton taxonomic and functional communities [4].

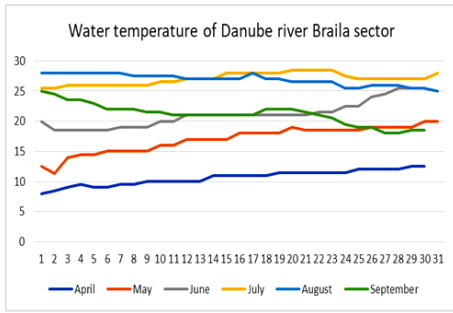

Fig. 2 Evolution of daily water temperature during April-September 2021

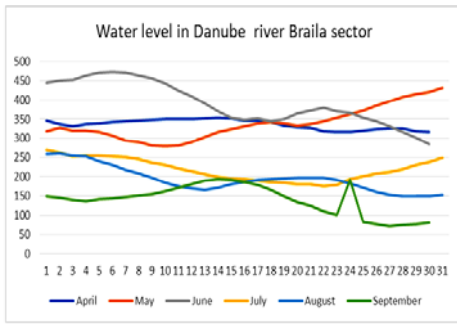

Fig. 3 Evolution of daily water levels during April-September 2021

Following the processing of phytoplankton samples in the studied area, the following objectives were achieved: the numerical density of each taxonomic group, expressed in thousands of exp./l, and the biomass of each population, expressed in g/l.

Analysis of water samples it was found that the structure of phytoplankton communities was made up of representatives of the following taxonomic groups: Chlorophyta, Cyanophyta and Bacillariophyta.

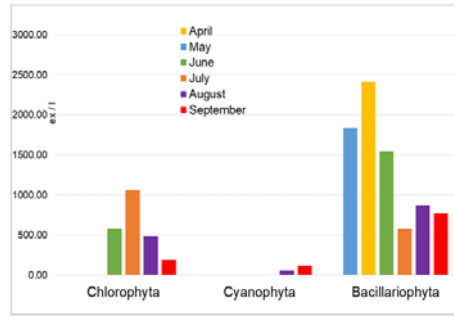

Fig. 4 Evolution of phytoplankton density during April-September 2021

Regarding the species found in the analyzed samples, between April and September of 2021, the following conclusions were drawn: in the presence of diatoms (Bacillariophyceae), there are species characteristic of the river such as *Synedra acus*, *Nitzschia palea,* and *Melosira granulata*, which are identifiable each month [2]

The month in which different species of diatoms were present in the largest share is April, on the opposite side, with the lowest share are the results in July.

The presence of green algae (Chlorophyta) is high in July. Species such as: *Ankistrodesmus falcatus*, *Cymbella lanceolata*, *Pediastrum duplex*, *Ulothrix sp*. were identified in June, July, and August. In September, green algae have the lowest share of the species present in the analyzed samples being *Actinastrum hantzschii*.

In the case of blue-green algae, the species *Oscillatoria planktonica* was found only in the samples collected in August. The share of blue-green algae in the studied area has increased significantly since September, when the species *Microcystis aeruginosa* was identified in the analyzed samples.

Analyzing the numerical density of the species, we observe an increased development of phytoplankton in the spring period, more precisely in April, when the diatoms reach an average density of 2414.25 thousand exp./l (fig. 4).

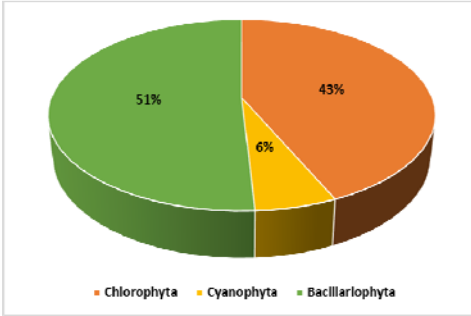

Fig. 5 The share of algal biomass between April and September 2021

Diatoms had a quantitative share in April (51%) and chlorophylls had maximum values in July (43%). Cyanophytes had a share of 6%, the highest value being recorded in September (fig. 5.)

CONCLUSIONS

Following the study on the characterization of phytoplankton in the studied area, a diversity of variations of phytoplankton communities was established. Therefore, phytoplankton comprises heterogeneous elements, which belong to several ecological categories, resulting in a mosaic with a significant number of taxonomic units.

From the point of view of the qualitative structure, it is found that in the Danube, diatoms predominate throughout the studied period.

From the analyzes performed during the research period, we observe the dominance of diatoms, followed by chlorophylls and cyanophytes.

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From the researches carried out on the investigated sector, there is a well-seasoned dynamics of the structural-functional parameters of phytoplankton: the maximum values of the herd and of the biomass being registered in the spring period, and the minimum ones in the autumn period.

ACKNOWLEDGEMENTS

The authors would like to thank the Ministry of Agriculture and Rural Development of România for financially supporting this research under budget code ADER 13.1.2

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