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Summary

The diversity of diatom communities and their use in water quality assessment for the Upper Wisłoka River and selected tributaries (Lower Beskid, Magura National Park)

The aim of the study was to document the diatom flora, and to determine the structure and dynamics of diatom communities, in the headwaters of the Wisłoka River and selected tributaries, within the Magura National Park and its protective buffer zone. Different types of substratum and different sampling seasons were examined in the study. In addition, due to the specificity of the area studied (Chapter 2), it was conjectured that the study waters could be the habitat of taxa with diverse ecological preferences that are rare or new to science. Using the high bio-indicative potential of diatoms, the ecological status of the study waters was assessed using classification systems and diatom water quality indices. An attempt was also made to determine factors that could affect the differentiation of diatom communities, and to indicate possible sources of pollution and threats to the aquatic environment.

The research was conducted in six survey seasons in 2013–2014, at 16 sampling localities on the Wisłoka River and selected tributaries. In total 126 epilithic and epiphytic diatom samples were collected.

The physico-chemical parameters of the waters of the Magura National Park indicated a high water quality. Changes in the values of water parameters at each sampling locality and in each season were mainly the result of natural processes and progressive re-naturalization of former pastoral and agricultural areas, including an increase in afforestation.

The rivers and streams were characterized by a large diversity of species of diatoms: in total, 581 taxa were recorded at all sampling locations (500 taxa in the Wisłoka River and 472 in its tributaries). 20 taxa were recorded as new to Polish diatom flora, of which two taxa (*Frustulia pumilio* and *Pinnularia graciloides* var. *triundulata*) were known so far only from *locus typicus*. In addition, 70 endangered and rare taxa on the Polish Red List of Algae were also found. At most sampling locations the most frequent taxa, and with the highest degree of stability, were *Achnantheidium pyrenaicum* and *A. minutissimum*. In epilithic assemblages, *Achnantheidium thienemannii*, *Cymbella parva*, *Diatoma moniliformis*, *Encyonopsis subminuta*, *Gomphonema olivacem*, *G. pumilum* and *Amphora inariensis* occurred frequently, while in moss communities, typical epiphytic taxa, with a large share of *Cocconeis* ssp. and *Meridion circulare*, and such species as *Gomphonema pumilum*,

Planothidium lanceolatum and *Psammothidium grischunum*. These species also showed a high degree of stability, and the majority were absolutely stable species. Diatom assemblages in most sampling localities were dominated by taxa with a broad spectrum of ecological tolerance to trophic conditions, preferring β -mesosaprobic and oligosaprobic waters. Regarding pH, the predominant taxa were those with alkaline or near-neutral pH, occurring mainly in strictly aquatic habitats.

The statistical analyses identified four main groups of diatom communities, the differentiation of which probably resulted from natural processes, including the watercourse order (size) and substratum type. The results of the research and statistical analyses showed that the main factors affecting the structure of diatom communities were fluctuations in the water level, degree of shading, water temperature and detritus deposits in the headwaters, which could affect differences in trophic and nutrient concentrations. The assessment of the ecological status of the watercourses studied, using diatom indices, showed that waters of the Magura National Park and its protective buffer zone mostly have a good or very good ecological status. The most reliable results were obtained by means of SPI and IO indices. The degree of anthropogenic impact on the waters of the area studied seems to be inconsiderable. No factors were found that posed a significant threat for the water ecosystems of the Magura National Park. The reservoir on the Wisłoka River, in Krempna village – probably due to its low capacity and frequent emptying – does not noticeably affect the chemistry of the waters studied, or the ecological structure of diatom communities. However, an increase was observed in species diversity at the site below the reservoir.

Based on the available literature data, it was concluded that diatom assemblages in the streams studied showed a high degree of similarity in terms of species composition, dominance structure and ecological preferences, compared to communities in other unpolluted streams and springs in the Carpathians Mts. (including the Tatra and Bieszczady Mts. and other range of Beskids Mts.). It seems that the diatom communities in the studied streams exhibit a high degree of naturalness and can be considered as reference communities for small flysch rivers and streams.

This research is the first scientific study of algae from the area of the Magura National Park, and the first comprehensive study from the Lower Beskid. The obtained results on the diversity, species composition and identification of taxa that are rare and new to Poland are of importance in assessing the conservation value of the area, valorisation of resources and strategies for the protection of waters and habitats.