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Water age – a major factor controlling phytoplankton community structure in a reconnected dynamic floodplain (Danube, Regelsbrunn, Austria)

Michael SCHAGERL*, Irene DROZDOWSKI[1)], David G. ANGELER[2)], Thomas HEIN[3)] and Stefan PREINER[3)]

University of Vienna, Department of Marine Biology, Althanstraße 14, A-1090 Vienna, Austria
[1)]Biosphärenpark Wienerwald Management GmbH, Deutschwaldstraße 15/b, A-3002 Purkersdorf, Austria
[2)]Swedish University of Agricultural Sciences, Dep. of Aquatic Sciences and Assessment, Box 7050, S-750 07 Uppsala, Sweden
[3)]Inter-Universitary Cluster for Water Research, Carl Kupelwieser-Promenade 5, A-3293 Lunz/See, Austria and University of Natural Resources and Applied Life Sciences, Vienna, A-1180 Vienna, Austria
e-mail corresponding author: michael.schagerl@univie.ac.at

ABSTRACT

*The study was carried out during four years that span a gradient in hydrological connectivity between the Danube and its side-arm system at Regelsbrunn (Austria). We evaluated the influences of distinct periods of hydrological connectivity on the phytoplankton community structure itself, but also interferences with biotic processes (including community succession, competition and zooplankton grazing) that may take place within the constraints set by the hydrological disturbance regime. Algal biomass was highly related to the hydrological regime: lowest amounts were detected either during flood events or at long-lasting periods of isolation; on the other hand intermediate connection led to maximum concentrations. During floods and throughout the cold season, Bacillariophyceae were dominating the algal community. Summer and elongated periods of isolation favoured Chlorophyta. Cryptophyta occurred in early autumn after two months disconnection from the main channel, Dinophyta and Cyanoprokaryota were only of minor importance. Multivariate statistical analyses showed that water age was the primary determinant of phytoplankton community structure in the side-arm system. Cluster analyses revealed 7 groups that were characterized by 169 indicator taxa. Groups were dominated by Bacillariophyceae (*Nitzschia*,* Navicula*,* Cymbella*,* Fragilaria *and* Diatoma*), while species belonging to the Chloro-, Eugleno- and Dinophyta were less abundant. Non-metric Multidimensional Scaling was used for a comparison of community similarity between the main channel and the side-arm system. During high connectivity temporal trends of phytoplankton similarity in the side-arm tracked closely the community patterns of the Danube which indicated a major influence of the main channel on phytoplankton community structure. During low connectivity the temporal trends of the communities from both sampling stations were less coupled. A Canonical Correspondence Analysis explained 89.7% of the variance of the species-environment relation. Water age, particulate inorganic matter and dissolved inorganic nitrogen compounds were strongly coinciding with the first axis, whereas particulate nitrogen was mainly related to the second axis. A phytoplankton succession model was developed for the side-arm system. This model emphasizes increased phytoplankton community similarity during high connectivity and short isolation periods and a site-specific community development during low connectivity between the Danube and the side-arm. During prolonged isolation, seasonality gained importance in structuring the plankton community. Biotic interaction (intraguild competition and zooplankton grazing) played an important role in the shifts between successional stages, suggesting that these effects should not be neglected in ecological studies of disturbance-dependent floodplain ecosystems.*

Key words: hydrology, connectivity, phytoplankton community, floodplain, river