Influence of temperature and water flow on the annual abundance of macrophyte communities in the Rhône and Garonne Rivers

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Abstract

In large rivers, temporal evolution of macrophyte communities is directly under the influence of the environmental parameter annual cycle (temperature, water flow, nutrients, etc.). Yet, the specific interactions between abiotic factors and macrophyte abundance and diversity are still overlooked. Floristic and environmental monitoring were performed on several stations and years on the Rhône (i.e., 2010-2017) and Garonne (i.e., 2012-2017) rivers to determine the key environmental factors triggering the annual growth, abundance and diversity of the macrophyte community. The results showed that higher water temperature and lower flow conditions during the earlier growing season in the spring were the best environmental metrics inducing the highest abundance of macrophytes during the summer. In contrast, lower temperature and high flow conditions in the spring would limit the maximum growth of macrophyte during the summer. For instance, accumulated water temperature over 15∘C in the spring in the Rhône River was the best metric correlated with the maximum annual abundance of macrophytes in the summer and especially that of invasive alien species. For example, *Elodea nuttallii* was always collected on lower flow stations but also on the warmest years. Water flow was also an important factor, as flood events in the spring were able to limit and partially prevent the growth of macrophytes in the summer. However, discharges are often artificialized in large rivers, then the impact on vegetation is quite biased. On all studied stations, the macrophytes species occurrence drops in 2013, which has been demonstrated as the coldest and wettest year over the studied period. This study demonstrates the influence of some environmental parameters on the macrophyte abundance but also highlights the need for long-term monitoring data to determine the spatial and temporal evolution of macrophyte communities related to environmental changes.

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