Dike fields connectivity and diversity: a complex functioning on the Rhone River

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Abstract

The relation between hydrological connectivity and species diversity appears to be strong in natural habitats. Several ecological concepts revealed this marked link, such as the Intermediate Disturbance Hypothesis (IDH), a nonequilibrium model used to describe the relationship between disturbance and species diversity. The IDH has been supported by several studies which highlight that highest species diversity is maintained by intermediate levels of disturbance. However, can this hypothesis likewise be validated for artificial systems? Large European rivers were severely impacted by human activities, especially to promote navigation. We therefore tested the link between hydrological connectivity and diversity in these anthroposystems. During the 19th century, submersible dikes were built in the main channel of the Rhone River (France) delimiting dike fields. These could represent engineered backwaters, present a hydrological connectivity gradient and, hence could be used to test the IDH in an artificial context. We studied environmental and biological variables in 12 dike fields with different connectivity level in two locations of the lower Rhone, "Péage de Roussillon" and "Arles". Our study reveals a high ecological variability among dike fields. Variations of abiotic factors, biodiversity, and functional diversity are strongly linked to the hydrological connectivity gradient. A higher diversity is observed in dike field with intermediate connectivity level compared to isolated or permanently connected dike fields. In these artificial systems, first results are in agreement with the IDH. Interaction between hydrological connectivity and diversity appears to well describe anthroposystems functioning and must be taken into account in rehabilitation of modified large rivers.

Keywords: Rhone River, Hydrological Connectivity, Diversity, Intermediate Disturbance Hypothesis, Dike Fields

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