Testing predictions of changes in the abundance and community structure of benthic invertebrates and fish after flow restoration in a large river (French Rhône)

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ABSTRACT

Effective environmental management needs models that reliably predict quantitative ecological changes as a function of restoration effort (e.g. cost) and meet expectations of stakeholders. Given that principal threats to large rivers are linked to human-caused modifications of discharge and morphology of channels and floodplains, we started to search for corresponding restoration tools in the 1980s. Following a decision of the French government in 1997, water managers, local authorities and the "Compagnie Nationale du Rhône" financed a scientific program to develop, test and subsequently use predictive models to assess the restoration (particularly minimum flow increases and reconnections of floodplain channels with the main channel) of eight regulated reaches of the French Rhône River. Focusing on various degrees of discharge increases in the bypassed main river channel, we synthesize the insights gained over recent decades of research during which four river reaches (total length 47 km) were restored since 1999. The Rhône restoration led to more lotic and diverse aquatic communities. When reliable pre-restoration data are available and the minimum flow increase is substantial, simple habitat models can be used to predict quantitative ecological changes in the abundance of individual species or the structural (i.e. taxonomic) or functional (i.e. biological traits) characteristics of invertebrate and fish communities as a function of restoration effort. The project illustrates the need to reliably quantify changes of ecologically relevant hydraulic conditions in studies of physical river restoration and shows the effort required for a powerful assessment of restoration effects.