

[The effect of river restoration on fish, macroinvertebrates and aquatic macrophytes: a meta-analysis \(Kail et al. 2015\) \[1\]](#)

An increasing number of rivers have been restored over the past decades and several studies investigated the effect on biota. The published monitoring results have already been summarized in narrative reviews but there are few quantitative reviews and a comprehensive meta-analysis on different organism groups and factors influencing restoration effect is missing. We compiled monitoring results and information on catchment, river and project characteristics from peer-reviewed literature and unpublished databases to (i) quantify the effect of restoration measures on fish, macroinvertebrates and macrophytes, and (ii) identify predictors which influence restoration effect.

Results indicated significant effects of restoration on all three organism groups, especially of widening projects on macrophyte richness/diversity, instream measures on fish and macroinvertebrates, and higher effects on abundance/biomass compared to richness/diversity. Restoration effect was most strongly affected by agricultural land use, river width and project age. Effects were smaller but restoration generally still increased richness/diversity and abundance/biomass in agricultural catchments. Since land use is a proxy for different pressures, the underlying causal relationships have to be investigated in more detail. Project age was the most important factor but had non-linear and even negative effects on restoration outcome, indicating that restoration effects may vanish over time. The meta-analysis indicated that river managers in general can expect an increase of richness/diversity and abundance/biomass of all three organism groups investigated, especially of macrophytes in widening projects and of fish and macroinvertebrates if instream measures are applied.

However, variability was high, stressing the need for adaptive management approaches. Furthermore, the large but non-linear and different (even negative) effects of project age stressed the need for long-time monitoring to better understand the trajectories of change caused by restoration measures and to identify sustainable measures. The meta-analysis was restricted to metrics commonly reported in literature and future studies would greatly benefit from authorities and scientists reporting original monitoring data, which would allow to use functional metrics to investigate the effect of restoration measures and to infer causal relationships.

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