

# Quantifying river fragmentation from local to continental scales: data management and modelling toolbox

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## Abstract

Restoring river connectivity is a global conservation priority but quantifying river fragmentation has proved difficult due to the paucity of good barrier records, duplicate entries, and other sources of biases. Here we present some tools to help overcome some of these challenges and illustrate their application with case studies drawn across different spatial scales. We begin by proposing a classification of artificial instream barriers that harmonises disparate barrier types into six functional types, and present a binary classification key for ease of use. We then introduce a method for excluding duplicate barrier records that retains most genuine barriers and illustrate its practical use. Sampling bias is a pervasive problem in barrier inventories and we show how to detect and correct for it via bootstrapping of data obtained from standardised field surveys, ad-hoc records provided by citizens, and modelling. Finally, we show how to assess fragmentation when barriers cannot be aligned with the river network, and how to estimate barrier impacts from barrier height and when information on barrier passability or permeability is not known. Collectively, our toolbox will help generate more realistic estimates of river fragmentation and help inform more efficient restoration of river connectivity.

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