**ABSTRACT** Identifying drivers of fish abundance in running water is challenged by high variation in physical conditions at both large and local spatial scales. Several fish species perform migrations upstream and downstream, covering gradients in climatic and geographic factors. Moreover, streams typically encompass highly diverse adjacent habitats, where environmental conditions, such as water velocity, depth, and substrate type, vary within short spatial ranges. Among the local-scale factors affecting fish abundance, the occurrence of woody debris has been reproted to boost salmonid fish population growth. However, what species benefit from woody debris and to what extent relative to other drivers, and what factors influence woody debris local quantity is not clear yet, which limits our ability to use woody debris as an effective restoration measure.

We analysed time series data collected between 1993 and 2016 from 3653 rivers (total of ca 7000 sampling sites) all over Sweden to investigate 1) the relative importance of large-scale and local factors for the abundance of three key freshwater fish species: salmon (Salmon salar), trout (S. trutta), and sculpin fish (Cottus spp.), 2) whether local abundance of woody debris has beneficial effects on these three species, and 3) the drivers of woody debris persistence.

We found that large-scale factors such as annual mean air temperature and altitude mainly explained Cottus abundance (negative effects), while local stream width was the strongest predictor of trout and salmon abundance, with negative and positive effects, respectively. Trout abundance also decreased with local stream depth and abundance of burbot, a predatory species, while it increased with mean air temperature. Woody debris appeared to benefit trout abundance, but not salmon or Cottus spp.. The abundance of woody debris strongly decreased with stream width, but also depended, albeit to a lesser extent, on stream bed slope, forest age and cover, altitude, and mean air temperature. Our study suggests that the weight of large- and local-scale factors on fish abundances in streams varies strongly with species, and that effectiveness of woody debris as a restoration measure depends on both the targeted species and local environmental conditions.