Testing the effects of fine sediment on community structures of hyporheic macroinvertebrates

(河床飽和間隙域の無脊椎動物群集構造へ細粒土砂が及ぼす影響の検証)

Graduate School of Environmental Science，Hokkaido University

Division of Environmental Development Science
MO ZHENGWEI

Abstract

Hyporheic zone plays a vital role in maintaining the functioning of river ecosystems by providing critical ecological services, but how fine sediment associated with background environmental conditions affects hyporheic macro-invertebrate remains still unclear. Two different experiments were conducted to test separately the effects of fine sediment and the interactive effects of fine sediment and background environmental variables (mainly in nutrients such as nitrate and phosphate, as well as invertebrate community) on hyporheic macro-invertebrate community structures in five rivers in Hokkaido, Japan. The first experiment was performed by establishing colonization traps at three sites in two rivers to examine correlations between fine sediment and macro-invertebrates. The second experiment was performed by manipulating the level of fine sediment at seven sites in five rivers to examine causal relationships among fine sediment and community structure responses.

In the first experiment, high amount of fine sediment deposition was positively associated with high abundance of the most hyporheic macro-invertebrate taxa except Chironomidae. Organic matter was observed positively correlated with fine sediment in hyporheic zone, indicating indirect positive effects of increased food availability as a partial mechanism. In the second experiment, the interactive effects of fine sediment and concentration of background nutrients on the macro-invertebrate (e.g., total, Chironomidae, and Oligochaeta abundance) responses to the sediment additions differed greatly among rivers. Strong positive effects of fine sediment were observed only in sites or samples where sediment tolerant taxa such as Caenidae and Oligochaeta were common. Also, the strongest negative effects of fine sediment were observed for sites where Ephemeroptera dominated. Overall, this study demonstrated fine sediment as a vital driver that alters the structure of hyporheic macro-invertebrate community, and background environmental conditions and macro-invertebrate community as important determinants of the effect sizes and directions.