

Associations of stream water acidity and other environmental factors with the spatial distribution of Brown Trout in a mesoscale boreal stream network

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Boreal stream networks are embedded in a mosaic of wetlands and lakes interspersed in the forest landscape. This mosaic results in complex and dynamic water chemistry that varies depending on stream size, catchment characteristics, season and flow. Spatiotemporal variations in stream acidity are however frequently predictable based on spatial patterns in the terrestrial watershed, and acidity has been found to limit the spatial distribution of brown trout (*Salmo trutta*) in some Scandinavian streams. This study compares the distribution of brown trout with stream acidity and other environmental factors using 47 sites distributed throughout the Krycklan stream network, a 67 km² boreal catchment in northern Sweden. We tested whether local factors (stream water chemistry and stream site physical habitat from field surveys) or large-scale factors (whole-catchment characteristics derived from a GIS) were more closely correlated with the spatial distribution of brown trout as determined by electrofishing survey.

Brown trout exhibited a threshold response to pH, and were not observed at any sites which had pH <5.0 during the spring flood episode, matching published toxicity thresholds. However, brown trout distributions were patchy even in less acidic regions of the stream network, suggesting other consequential environmental factors. This was primarily due to an association of brown trout with streams containing alluvial sediments, coupled to a lack of brown trout in areas with fine sorted sediment substrate, in spite of high pH. A multivariate redundancy analysis (RDA) model including only significant large-scale whole-catchment characteristics was able to explain 43% of the variation in brown trout young and adult densities, while models with local site characteristics alone and stream chemistry alone explained only 33% and 25%, respectively. However, much of the strong correlation between large-scale catchment characteristics and trout distributions was likely due to inter-correlations between large-scale characteristics and local site physical/chemical character, which in turn have direct ecological significance for brown trout. The substrate type and physical habitat appeared to play a primary role in controlling brown trout distributions in this stream network, with acidity placing an additional restriction. Variation in physical habitat may explain the lack of brown trout in many well-buffered surface waters in Scandinavia.

KEY WORDS: alluvial sediments, salmonids, stream networks, multiple scales, boreal Sweden