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On habitat complexity in streams derived from an analysis of tracer data

J. R. Manson[1] , S. G. Wallis[2], A. Radecki-Pawlik[3], K. Plesinski[4], P. Zinke[5]

[1] Stockton University, New Jersey, USA. email: russell.manson@stockton.edu
[2] Heriot-Watt University, Edinburgh, Scotland. email: s.g.wallis@hw.ac.uk
[3] Cracow University of Technology, Krakow, Poland. email: rmradeck@cyf-kr.edu.pl
[4] University of Agriculture in Krakow, Krakow, Poland. email: karol.plesinski@urk.edu.pl
[5] Norwegian University of Science and Technology, Trondheim, Norway. email: peggy.zinke@ntnu.no

ABSTRACT

The habitat complexity of streams contributes to their biotic diversity and to their overall stream metabolism. Habitat complexity is manifest in several ways. Here we are interested specifically in physical complexity inherent in geomorphologic structures and non-uniform bed substrate at multiple spatial scales; essentially, we are considering the numerous pockets and interstices in the stream caused by both abiotic (stones, pebbles and rocks) and biotic (macro-phytes, organic debris) material. This paper explores the relationship between the dispersive fraction parameter of the Aggregated Dead Zone Model (as a surrogate for physical habitat complexity) and flow rate for streams. Results were obtained by fitting the model to a set of tracer data from several streams in Norway, the United Kingdom and Poland. The results show that while there was no apparent correlation between the dispersive fraction and flow rate, the variance in possible values for the dispersive fraction increases with decreasing flow rate. These results suggest possible estimates of this parameter but crucially also suggest uncertainties to be ascribed along with this estimate. They also suggest that as streams decrease in size the variance in physical habitat complexity increases.

Data from 51 tracer studies were used in the current study. The data comes from three countries (U.K., Norway and Poland) and are summarized in Table 1 below which shows the ranges of flow rates and stream widths. As seen from Table 1, the streams are small (largest width is 10.5 m) and the largest flow rate is about 3 m^3s^{-1}.

Figure 1 shows the dispersive fraction computed for all tracer studies plotted against flow rate. It shows no clear relationship but there is greater variance in dispersive fraction values in the smaller streams, i.e. there is a large scatter in the data particularly at flows < 0.2 m^3s^{-1}. We postulate that this large variance is due to the influence of wide variations in the channel geomorphology having great influence on the dispersive fraction in low flow regimes; at larger flows such variations in geomorphological detail would tend to be “drowned” out. To further explore this, we have separated the results (albeit arbitrarily) into those for flows less and greater than 1 m^3s^{-1}.

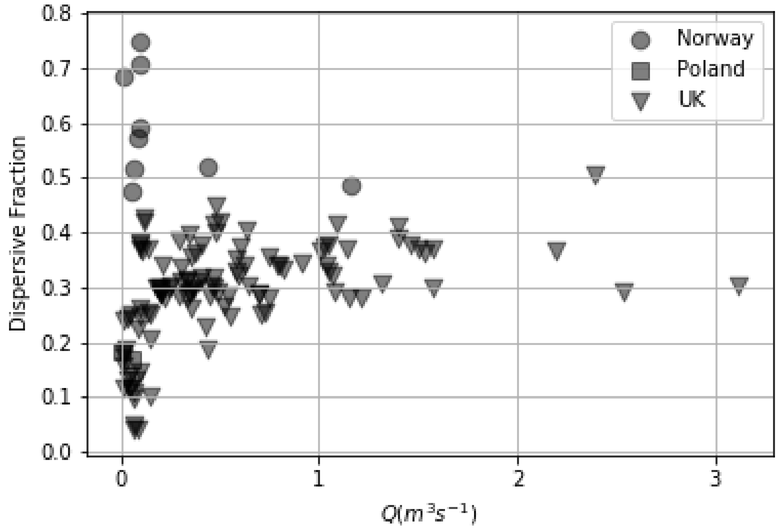

Fig 1. Dispersive fraction versus flow rate.