Are Surface Flow Type Mesohabitats Biologically Distinct?

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Background

Traditionally river ecologists have focused on the microhabitat scale, fluvial geomorphologists the mesohabitat scale. Legislation operates at the macroscale. Recently the biological realism of some widely-used techniques (PHABSIM) has been questioned (Booker *et al.*, 2006). Surface Flow Types (SFT) are the standard hydraulic descriptor in the River Habitat Survey (Environment Agency, 2003), although their biological significance is unknown. This study examines the physical andbiological relevance of mesohabitats defined by SFT.

Method

Multiple mesohabitat surveys of several lowland English rivers were completed, mesohabitats were defined by SFT (figure 1). Depth, velocity, substrate and other data were collected from each mesohabitat. Benthic macroinvertebrates (MI) were collected from representative mesohabitats together with further depth, velocity and substrate data from each MI sample point (microhabitat).

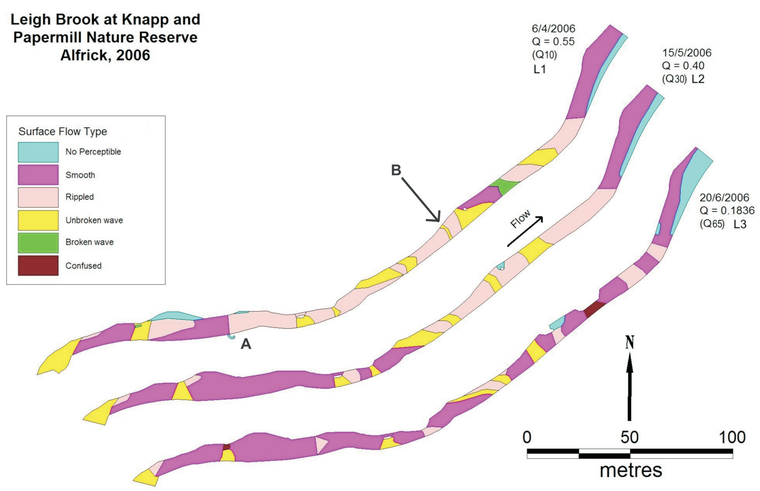

Figure 1. Habitat types from three surveys of the same reach of Leigh Brook, Worcestershire, UK. 'A' shows a small backwater inundated only high discharge and 'B' a bed controlled area of unbroken wave.

Results

Analysis showed there are statistically significant differences between depth and velocity (table 1) and substrate and embeddedness of fine material across five SFT mesohabitats.

Table 1. Results from Mann-Whitney *U* test analysis of depth and velocity data from five surface flow type habitats. (Significant: P = <0.05, Not Significant: P = >0.05).

Depth	No Perceptible	Smooth	Rippled	Unbroken wave
No Perceptible (NP)				
Smooth (SM)	Significant			
Rippled (RP)	Significant	Significant		
Unbroken wave (UW)	Significant	Significant	Significant	
Upwelling (UP)	Significant	Significant	Significant	Significant
Velocity	No Perceptible	Smooth	Rippled	Unbroken wave
No Perceptible (NP)				
Smooth (SM)	Significant			
Rippled (RP)	Significant	Significant		
Unbroken wave (UW)	Significant	Significant	Significant	
Upwelling (UP)	Significant	Not Significant	Not Significant	Significant

HydroSignature analysis (Le Coarer, 2005) identified clusters of SFT mesohabitat by depth/velocity class (figure 2). No Perceptible mesohabitats cluster in slow/deep cells (left) and unbroken wave mesohabitats in faster/shallower areas (upper right). There is a strong probability of correctly identifying depth/velocity classes associated with SFTs, NP (90%), UW (73%) and UP (78%) whilst for SM (44%) and RP (33%) depth/velocity classes are less reliably identified.

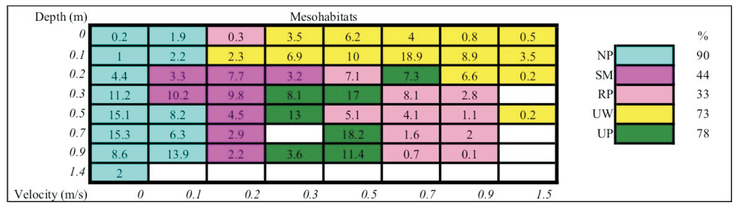

Figure 2. Distribution of depth and velocity classes by surface flow type from mesohabitat data based on HydroSignature analysis.

Using depth/velocity data from MI sample points, a preference matrix was constructed for each MI family group (figure 3). The red cell shows the cell containing the mean depth/velocity from all sites, the deep orange represents the 25th - 75th percentile range and the light orange the observed maximum/minimum range. LIFE score velocity classes are shown for comparison. Similar matrices can be derived from substrate and embeddedness data.

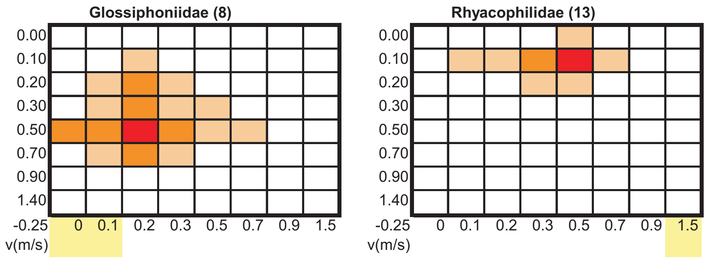

Figure 3. Depth and velocity matrices for Glossipjhoniidae and Rhyacophillidae. LIFE flow groups shown in yellow in the x-axis

Conclusion

- Mesohabitats defined by SFT have statistically distinct physical characteristics and appear capable of consistent identification.
- Macroinvertebrates have depth/velocity and substrate/embeddedness preferences.
- Therefore, SFT mesohabitats may provide a way of mapping rivers at the macroscale whilst retaining biological relevance.

References

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