Headwater streams in the EU Water Framework Directive: Evidence-based decision support to select streams for river basin management plans

Headwater streams are important contributors to aquatic biodiversity and may counteract negative impacts of anthropogenic stress on downstream reaches. In Denmark, the first river basin management plan (RBMP) included streams of all size categories, most being b2.5m wide (headwater streams). Currently, however, it is intensely debated whether the small size and low slopes, typical of Danish streams, in combination with degraded habitat conditions obstruct their ability to fulfill the ecological quality objectives required by the EU Water Framework Directive (WFD). The purpose of this study was to provide an analytically based framework for guiding the selection of headwater streams for RBMP. Specifically, the following hypotheses were addressed: i) stream slope, width, planform, and general physical habitat quality can act as criteria for selecting streams for the next generation of RBMPs, and ii) probability-based thresholds for reaching good ecological status can be established for some or all of these criteria, thus creating a sound, scientifically based, and clear selection process. The hypotheses were tested using monitoring data on Danish streams from the period 2004–2015. Significant linear relationships were obtained between the ecological quality ratio assessed by applying the Danish Stream Fauna Index (DSFIEQR) and stream slope, width, sinuosity, and DHI. The obtained models were used to produce pressure response curves describing the probability of achieving good ecological status along gradients in these parameters. Next, threshold values for slope, width, sinuosity, and DHI were identified for selected probabilities of achieving minimum good ecological status. The obtained results can support managers and policy makers in prioritizing headwater streams for the 3rd RBMP. The approach applied is broadly applicable and can, for instance, help prioritization of restoration and conservation efforts in different types of ecosystems where the biota can be significantly linked to separate and quantifiable environmental characteristics.

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Contributors: Baattrup-Pedersen, A., Larsen, S. E., Andersen, D. K., Jepsen, N., Nielsen, J., Rasmussen, J.
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