Groundwater influence in hyporheic zones: a key control on site selection for Atlantic salmon spawning in a braided river system?

1. INTRODUCTION

Over the past 30 years the numbers of Atlantic salmon (Salmo salar) spawning in Scottish headwater streams has declined. Conservation measures to protect this species have focused on preserving the integrity of their upland spawning sites. Disruptions exist between predicted available spawning habitat derived from suites of hydraulic or sedimentary variables and those favoured by spawning salmon. These differences may be due to the physicochemical characteristics of the hyporheic zone within the spawning gravel.

2. OBJECTIVES

To identify the sources and flowpaths of waters entering a highland braided system and to separate reaches into channel types based on their physiochemical characteristics.

3. STUDY SITE

The Glen Feshie Braids, the biggest braided river system in the UK (Figure1).

4. METHODOLOGY

During Summer 2005 - Spring 2006 intensive hydrochemical surveys of the braided system were carried out using natural tracers; trace metals, dissolved oxygen (DO) and Gran alkalinity, giving rise to high levels of spatio-temporal variation in hyporheic water quality within spawning gravels.

5. RESULTS

Five main channel types were recognised: main river channels, side channels, hillslope tributary streams, mixed alluvial and groundwater (Figure 6).

6. CONCLUSIONS

Different types of groundwater-surface water exchange occurs across the 5 channel types of the Glen Feshie Braids producing high levels of spatio-temporal variation in hyporheic water quality within spawning gravels.

7. FUTURE WORK

•Repeat redd counts across the braids during spawning season
•Excavation of a number of redds to examine juvenile survival.
•Implantation of egg chambers equipment with water quality measuring devices into the hyporheic zone of known groundwater dominated spawning sites.

Figure 1: The Feshie Braids

Figure 2: Spawning Atlantic salmon (G. V. Ryckevorsel)

Figure 3: Location of Feshie Braids

Figure 4: Mapping channel types

Figure 5: Illustration of hyporheic water sampling equipment

Figure 6: Channel types in Feshie Braids

Figure 7: An example of two hydrochemical surveys which show temperature, DO and Gran Alkalinity variability to be high across the braids

Figure 8: Key spawning sites

Table: Summary of spawning site characteristics

Figure 9: Distribution of spawning Atlantic salmon

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Figure 10: Distribution of spawning Atlantic salmon

Table: Summary of spawning site characteristics

Figure 11: Distribution of spawning Atlantic salmon

Table: Summary of spawning site characteristics

Figure 12: Distribution of spawning Atlantic salmon

Table: Summary of spawning site characteristics

Figure 13: Distribution of spawning Atlantic salmon

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