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Do groundwater - surface water exchange patterns in the floodplain channels of a braided river affect spawning site selection by Atlantic salmon?

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In many Scottish headwater streams the number of Atlantic salmon *Salmo salar L.*, returning to spawn remains worryingly low, despite ongoing fisheries and habitat management programs. Understanding the processes which affect habitat quality is vital to underpin the management of this important species. There has been much progress in recent years in understanding the role and importance of groundwater - surface water interactions in Atlantic salmon spawning streams: Much of this has focused on the role of hyporheic water quality in determining embryo performance and there remains a relative paucity of studies that have examined the influence of GW- SW interactions on spawning site selection by female salmon. Sites with suitable hydraulic and sedimentary characteristics are often underutilized and sometimes completely avoided by spawners and this may be due the physiochemical characteristics associated with groundwater discharge through the hyporheic zone.

The River Feshie, Cairngorm mountains, Scotland, contains some of the largest areas of braided channels and floodplains within the UK, and is an important spring salmon spawning tributary of the River Spey. The hydrological and hydrochemical dynamics of the river's braided channel-floodplain system are strongly influenced by the complex processes of groundwater and surface water exchange, evident over a range of spatial and temporal scales. This gives rise to a diversity of channel and floodplain habitats which underpin the ecological quality and integrity of the system. This novel

study, the first of its type in the UK, investigates the role of groundwater - surface water interactions on site selection by Atlantic salmon spawning in the Feshie braids. During the 2005 and 2006 spawning seasons, intensive surveys of dissolved oxygen, alkalinity, temperature and trace metals were undertaken under high and low flow conditions in the surface waters of the floodplain reaches. More intense hyporheic water quality sampling and continuous temperature monitoring took place in the second spawning season. Using GIS, these data were related to the locations utilized by spawning fish surveyed on a daily basis in each year.

Results indicated that dynamic and spatially distributed patterns of groundwater – surface water exchange were occurring across the channel floodplain system during the two spawning seasons. A range of different channel types could be differentiated on the basis of contrasting surface and hyporheic water quality characteristics. These included main river, side, hillslope-tributary, groundwater spring-fed and mixed source channels. Although most channels contained good hydraulic and sedimentary conditions, spawning was concentrated in those locations which displayed strong chemical signatures of groundwater. In both years over 80% of spawning occurred along three main floodplain channels where groundwater contributions to the surface water were high and where in some locations the hyporheic zone was characterised by upwelling groundwater at depth. This study suggests that GW-SW interactions may play an important role in determining site selection by spawning Atlantic salmon and sea trout.