SEASONAL EFFECTS AND INTERACTION OF STREAM DISCHARGE AND WATER TEMPERATURE ON THE EMIGRATION PROBABILITY OF JUVENILE SALMONIDS FROM DIFFERENT MESOHABITATS IN A NATURAL STREAM

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River regulation, and hydropeaking in particular, may cause rapid flow fluctuations in rivers. Juvenile stream salmonids are well known to exhibit habitat preferences with respect to water velocity and depth. Such preferences implicate that the spatial distribution of stream salmonids, at the population level, follow a general pattern dictated by the flow conditions. However, it is not well understood when the possible redistribution of fish occurs in relation to fluctuating flow levels (e.g threshold levels). Furthermore, the swimming capability and metabolism of fish are directly related to water temperature and therefore, it is likely that flow fluctuations effect the distribution of stream fish differently across seasons and mesohabitats. In this study, we followed 141 juvenile Atlantic salmon (*Salmo salar* L.) and 20 brown trout (*S. trutta* L.) individually tagged with Passive Integrated Transponder tags during a period from August 2008 to June 2009 in order *i*) to understand the causal relationship between the interaction of discharge, water temperature and the emigration of non-smolt juvenile salmonids and *ii*) to differentiate the probability of emigration between different mesohabitats at different times of a year in a highly seasonal environment. The fish were tagged within a 150-m long wadable study reach (River Sokna, central Norway) and the study section was enclosed from both ends with two 'flat-bed' stationary PIT antennae (approx. 10 m wide), which recorded the date and time of fish emigration. The stationary PIT data were supplemented by active tracking surveys in which the distribution of tagged fish within the whole studied reach was revealed and the mesohabitats occupied by them could be identified. Active tracking surveys were temporally adjusted such that a survey was carried out before and after high discharge event during autumn and spring seasons (a total 11 surveys) so that also the within-study site variability in mesohabitat use by individual fish could be analysed. Classification of in-stream heterogeneity was conducted on every tracking occasion using a hydro-morphological unit (HMU)

classification system and discharge and water temperature were continuously monitored within-site throughout the study. Further, mapping of substrate was carried out throughout the whole reach so that any substrate-mediated processes in terms of emigration could be detected. In addition, PIT tagged rocks were placed in the stream in order to monitor substrata stability and the possible links to mesohabitats where emigration occurs. Although changes in discharge caused large changes in in-stream heterogeneity and temporal exclusions of some mesohabitat types, the physical changes did not automatically translate either into changes in spatial distribution of fish within-site or fish emigration out of the study site emphasizing the complex nature between the preferred fish habitat and environmental conditions. A preliminary logistic regression model between the emigration probability, stream discharge and temperature revealed that neither environmental factor alone explained the emigration patterns. Indeed, it was observed during the most intense emigration period in autumn (late Sept. – Oct), that the “to-be” emigrants were not displaced in a single episodic event, but showed nocturnal exploratory behaviour for a period of multiple days prior to eventual emigration. That is, many of the tagged fish that eventually emigrated started to move every night between at least the stationary antennae situated 100 m apart, but presumably returned into their original mesohabitat during the daytime until emigration from the study site rather than choosing a different mesohabitat within site. Therefore, the final logistic regression model explaining the emigration probability will include variables exploring the variability in the environmental conditions (e.g. mean daily CV calculated across weekly periods for discharge and temperature, and their interaction). Ice covered time of the winter was recognized as a period of very low emigration. Eventually, the mesohabitat-based emigration model will be applied on a river-wide scale in a case-study to be able to show population wide estimates of fluctuations in fish densities between different river reaches.