EGU21-10384
https://doi.org/10.5194/egusphere-egu21-10384
EGU General Assembly 2021

Adult Atlantic salmon (Salmo salar) spawning migration and behaviour in the lower Skienselva

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Atlantic salmon swim upstream from the North sea through Frierfjorden to spawn in the Skien watershed, the third largest in Norway. There are two hydroelectric power plants in the lower reaches of the Skienselva: Klosterfoss and Skotfoss. Salmon caught swimming up the fish ladder at the downstream power plant (Klosterfoss) were tagged, released, and at the downstream power plant tracked from the beginning of the upstream migration to the end of the spawning period in the entire anadromous watershed. Salmon spent unequal amounts of time at the four spawning areas in the main river and a tributary between Klosterfoss and Skotfoss. Salmon spent less time at the larger spawning site, Vadrette, compared to the smaller Fossum and Grøtsund spawning sites. 26% of tagged salmon which swam upstream to the Skotfoss hydroelectric power plant ascended the fish ladder. Further, 16% of all salmon ascended the fish ladder at Skotfoss and continued to upstream spawning sites, indicating that they were homing to sites in the upper watershed. This is much smaller than the what is expected based on the fry populations in the rivers of the Skien watershed, which are augmented by yearly stocking in some of the rivers. Salmon which ascended the Klosterfoss ladder relatively early, swam upstream to Skotfoss more quickly than salmon that arrived relatively late at the Klosterfoss ladder. Short and repeated movements upstream to Skotfoss, and downstream to areas in the Farelva, and back again to Skotfoss were observed in the majority of tagged salmon that approached Skotfoss. The “yo-yo” migration of salmon in the Farelva is for the most part unexplained, but the movement costs the salmon valuable energy before and during the spawning season and may have negative consequences. Overall, these results indicate that salmon find the entrance to the fish ladder and do not remain stuck at the tunnel outlet, but most do not successfully ascend it. This could be the result of poor ladder construction, too low flow from the ladder, low survival of fry from upstream of Skotfoss reducing the number of salmon that are homing to upstream spawning areas, or that not all salmon which approach Skotfoss are homing to areas above the ladder. The possibility exists that salmon which will eventually spawn in areas downstream of the ladder engage in searching behavior near the fish ladder. If efforts to restore the populations in the upper watershed are to continue, issues salmon have with ascending the Skotfoss fish ladder must be addressed first.