Seasonal shifts in diel vertical migration (DVM) and activity patterns of burbot *Lota lota* in a large hydropower reservoir: Implications for entrainment risk

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Abstract

To minimise the impacts of hydropower on burbot *Lota lota*, we must first understand more about the basic ecology of this species. A key step in this process is the ability to predict burbot seasonal and diel depth distributions. While a number of horizontal movement studies suggest burbot are most active during the winter and spend the summer in a quiescent state, few fine-scale vertical distribution studies exist corroborating these behaviours. Diel vertical migration (DVM) is a depth distribution strategy common amongst freshwater organisms and has been described in juvenile burbot, however evidence describing this migration in adult burbot is scarce and the function of this behaviour in burbot is unknown. Explanations for the function of DVMs in other freshwater fishes include thermal or foraging habitat optimization and predation/completion avoidance. In this study we utilized a continuous monitoring telemetry array to model the seasonal and diel depth distribution and thermal habitat use of 30 burbot over 360 days. We found burbot exhibited a clear DVM and nocturnal activity pattern through most of the year, except during their pre-spawning/spawning period (Nov-Jan), when DVM ceased and high night-time activity rates continued through the day. Burbot in our study system did not enter a quiescent state during the summer, and while they remained inactive during the day in summer, night-time activity rates were not different from the rest of the year. Burbot DVM continued during periods when no thermal advantage was available and DVM was more pronounced among larger individuals, which together suggests that thermal optimization and competition/predation avoidance were not the sole drivers of this behaviour. Given the high night-time vertical activity rates, we hypothesise that burbot DVM may be driven by the need to optimise foraging opportunity.