Hydropeaking effects on two cyprinid fish species, barbel and nase, under experimental conditions emphasizing larval stranding

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ABSTRACT: Hydropeaking, characterized by fluctuating river flows, is considered one of the most significant impacts on riverine biota downstream of hydropower plants. Many studies have, therefore, investigated how various taxa are affected by artificial flow fluctuations. However, cyprinid fish received little attention in hydropeaking studies so far, and extensive knowledge gaps remain of this highly diverse fish family. Therefore, we aim to assess the effects of artificial flow reductions on two European cyprinid indicator species, the common barbel (*Barbus barbus* L.) and the common nase (*Chondrostoma nasus* L.).

We conducted mesocosm experiments (2.25×2 m) under semi-natural conditions with early developmental stages (body length <2 cm) at an outdoor research facility (http://hydropeaking.boku.ac.at), simulating different hydropeaking scenarios with varying down-ramping rates during daylight conditions and at night time. At each trial, we stocked 100 individuals from one species at peak flow (80 $L.s^{-1}$). After 15 min. of acclimation, the flow rate was automatically lowered to constant low flow conditions (10 $L.s^{-1}$) with variable ramping rates , ranging from 0.3 to 3.0 $cm.min^{-1}$. As a response parameter, we quantified larvae stranded on the flat and gently sloped bank mimicking typical riparian habitats preferred by cyprinids.

Our results show distinct diurnal patterns for both species, with higher stranding rates at night than during the day for all experimental scenarios. Additionally, the data reveal differences among the tested down-ramping rates and indicate interactions between these ramping rates and the time of day. Differences in stranding between nase and barbel may be associated with differences in the water temperature – related to their inherently different timing of emergence from the sediments in late spring and early summer, respectively – and ecological factors. The study outcomes will benefit the discussions on species-specific mitigation actions by providing evidence on the effects of rapid flow down-ramping on early cyprinid stages.