

Fish pass Steffstep – a solution for disconnected rivers?

Potential application and efficiency of a new fish pass type



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Abstract

Fish are migrating organisms, which need free flowing rivers to live in. However, nowadays rivers are highly fragmented due to human intervention. Barriers, weirs and falls are gradually getting removed. Reducing the negative impacts of these man-made obstacles requires significant resources and time. To enable a fish migration in due time, the new modular fish pass type Steffstep was developed. In this master thesis a prototype of such a Steffstep was evaluated with respect to its efficiency and potential application for Switzerland. In order to quantify the fish migration, 672 fishes were marked with PIT-tags (PIT = passive integrated transponder). Additionally, a video camera and a fish trap were installed at the fish pass. The focus on the research lay on the target species brown trout (*Salmo trutta* resident form) and minnow (*Phoxinus phoxinus*).

The results show, that the attraction efficiency of the Steffstep prototype for the target species was rather low (brown trout 28 %, minnow 12 %). The passage efficiency of the brown trout was sufficient (65 %), whereas the minnows were not able to pass the facility (0 %). This result matches with other field studies, where minnows also did not use fish pass facilities. For the brown trout a size selection was observed: fish smaller than 211 mm (median) had a lower passage efficiency (47 %) than bigger ones (80 %), though both had almost the same attraction efficiency. Therefore, improvements to the flow velocity within the fish pass for small fishes, as well as optimizations to increase the attraction efficiency for all fishes are strongly recommended. Overall, the low attraction efficiency resulted in a rather low total efficiency in comparison to conventional vertical-slot fish passes or block ramps. However, these facilities focus on other functionalities than Steffstep. The fish preferably migrated during an increased discharge. No correlation between day time or water temperature and the fish migration was observed. The bigger fish were ascending the fish pass slightly faster than the smaller ones. Some brown trout were using the fish pass more than once (n = 13). The fish were slightly faster at the second and third run than they were at the first run. Additionally, ten of the ascending fish were recorded using the fish pass even downstream.

The potential application of Steffstep is high at rivers with a mean annual discharge of up to 10 m³/s, where suitable fish habitats are fragmented through an obstacle that will not to be rebuilt within the next few years. The amount of suitable sites is roughly estimated to be in the order of a few thousands in Switzerland. The research illustrated that the efficiency of this prototype for brown trout is almost sufficient. Continuing investigation is recommended for efficiency monitoring of other species as well as for a systematic approach to determine locations, where this fish pass would be useful.